MAGIC BEAN: THE QUESTS THAT BROUGHT
SOY INTO AMERICAN FARMING, DIET AND CULTURE

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ABSTRACT OF THE DISSERTATION

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In 1900, the soybean was a nonentity in American farming. By 2000, 87 million metric tons were grown each year and soy was the country's most valuable agricultural export. A less concrete but perhaps more telling difference was the soybean's increased presence in American culture: in 1900, a small number of Asian immigrants, adventuresome farmers, and agricultural researchers thought about soybeans on a regular basis. By 2000, that number had expanded to include chemical, nutritional and medical researchers; commodities traders; lobbyists; vegetarians and millions more buying tofu or soy health-foods; sufferers of soybean allergies; and countless others. Magic Bean charts the diverse paths of the soybean into American farming, diet and culture over the course of the twentieth century. These pathways were enmeshed in systems of knowledge and cultural transfer that themselves underwent enormous transformations in that time: immigrant networks, missionary enterprises, agricultural science, laboratory chemistry, commodities markets, spiritual pilgrimages, and marketing techniques. In tracking the career of the soybean in America, Magic Bean takes a broadly ecological approach that highlights the interconnections between the environment, science and culture, while never losing sight of the aspirations of individuals whose quests drove the process forward.

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Introduction: A Century of Soybeans

The story of the soybean in the United States is the story of a highly successful commodity. Over the course of a century, its career followed the mythical American trajectory from obscurity to prominence. In quantitative terms alone, it was an impressive rise. Nobody knows how much U.S. land was planted in soybeans in 1900, because nobody was keeping track at the time, but it may have been as high as 50,000 acres. One hundred years later, the number was upwards of 70 million acres, more than a thousand-fold increase and an acreage second only to that devoted to corn. To put it another way, the area expanded from 78 square miles, roughly two townships, to just under 122,000 square miles, an area slightly larger than New Mexico, the fifth largest state.[1] One might also cite its raw economic value: $12 billion paid to farmers for the nearly 3 billion bushels they harvested, and this a dip from almost $18 billion in 1996, when prices were higher. And this was before the initial buyers – exporters and crushers, who processed the beans into oil and residual meal, as well as tofu makers and other food manufacturers – added any value. Exports alone of beans, oil and meal brought in on the order of $7 billion, making it by far the nation's largest agricultural export; much of this went to China, with which the U.S. otherwise ran a trade deficit but which had fallen to fourth place among soybean producing countries. In fact, the U.S. was now the world's leading producer of the crop, producing almost double that of the runner-up, Brazil.[2] Something exotic at the outset of the 1900s, the soybean was now a thoroughly American crop and had been for decades.

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[1] American Soybean Association (ASA), "Soy Stats 2001," http://www.soystats.com/2001/..

[2] Steven T. Sonka, Karen L. Bender and Donna K. Fisher, "Economics and Marketing," in *Soybeans: Improvement, Production, and Uses*, Third Edition, H. Rogers Boerma and James E. Specht, eds. (Madison, WI: American Society of Agronomy, 2004), 922-924.

The story of the soybean in the United States is also a case study of commodification. The soybean was widely used in Asia, and certain soy products were objects of regional and global trade, but soybeans were not the commodity that they would become in America. A commodity, in business terms, is a bulk good, typically grown in or removed from the soil for the purpose of exchange, which is not readily distinguished by source. Rather, the separate outputs of producers join a collective pool that is, in turn, sorted into grades, with prices determined by the supply of and demand for each grade.[3] As early plant explorers in China noted, on the other hand, soybeans were primarily grown and consumed by farmers who saved their seeds year after year, resulting in a baffling array of local soybean varieties. Likewise, in their earliest uses by American farmers, soybeans stayed on the farm in the form of green fertilizer or animal feed, typically in a manner that used the whole plant. Beans were harvested mainly for seed. By the mid-1920s, however, use of soybeans as oilseeds became more widespread and, its botanical classification as a legume notwithstanding, the soybean became a grain. In 1925, the federal government accordingly established grades for soybeans. By the early 1930s, farmers harvested more soybeans for grain than for seed, and the Chicago Board of Trade consummated their status as a commodity by first trading them as a cash grain, with rules modeled on those for corn, and then in the futures market. The establishment of futures trading in particular marked the maturation of the soybean market as the Board overcame fears that it was too small to avoid being cornered. By the early 1950s, futures trading was underway as well for the soybean's two primary products, oil and meal.

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[3] See William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W.W. Norton & Co., 1991), 112-116, for a famously evocative description of the genesis of commodity wheat, as something removed from sacks that identified individual farmers in order to become a veritable river of grain.

Although these milestones heralded the soybean's arrival as a commodity, however, they do not capture the underlying process of commodification. It is important to note, first of all, that this process did not begin in the private sector, but rather within the U.S. Department of Agriculture. Arguably at its creation in the Civil War era, and certainly by the turn of the century, the USDA's central goal was to increase the incomes of American farmers by establishing new applications for their produce, whether that meant discovering new marketable uses for existing crops or introducing new crops. Other public institutions, including land-grant colleges and agricultural experiment stations, joined in this mission. By 1900, the USDA's newly founded Office of Foreign Seed and Plant Introduction sponsored international expeditions with the intent of establishing new industries through the introduction of new crops; soybeans were not an initial focus, but soon became prominent among the imported crops. Various offices of the USDA's Bureau of Plant Industry, including Forage Crop Investigations, which employed William J. Morse, collaborated with experiment stations to test them at locations throughout the nation. And it is in fact Morse's work that offers the best opportunity to grasp how the early stages of commodification worked.

This is best glimpsed through a chart he published in 1918 mapping the uses of the soybean. This kind of diagram, which one might call a utilization tree, would in fact recur in many publications throughout the century. In this early example, it is important to note that as a picture of the actual uses of soybeans in America at the time, it was largely fantasy. One might cynically dismiss it as a promotional tool designed to make soybeans seem more valuable than they were by misleadingly showcasing a host of untried products with uncertain market potential. On the other hand, one might consider it a productive fiction. Having charted a full range of soybean products and their potential uses, Morse pushed simultaneously to make as many of them as possible into viable commodities. He tested different varieties to determine their suitability for various uses: high-oil beans for pressing, low-fiber beans for home cooking. He explored different techniques for producing the various products, and tried to drum up interest among possible manufacturers, as well as the general public. Ultimately, pressing soybeans for oil and meal would be the path to achieving exchange value for farmers and processors. In the meantime, however, Morse and others pushed ahead on all fronts. This process of mapping possibilities, and then working to see which ones fly, is a reason that commodification – a relentless quest for exchange value through the development of use value – is such a powerful force.

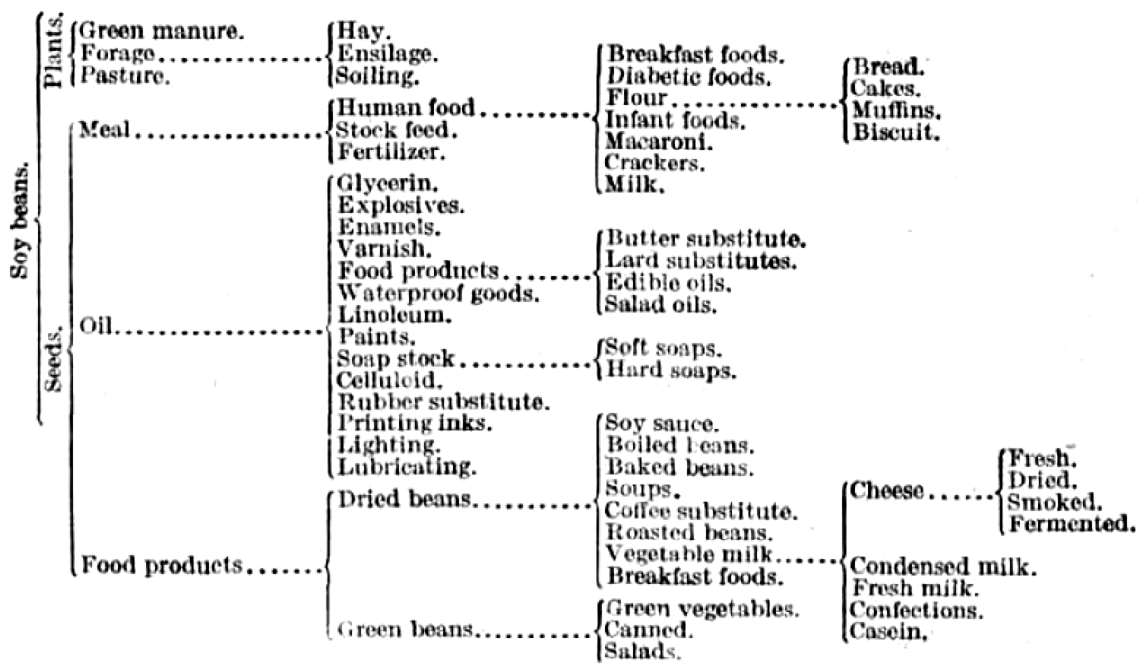

FIG. 2.—Diagram showing the various ways in which the plants and seeds of soy beans are utilized.

Fig. 1: "Diagram showing the various ways in which the plants and seeds of soy beans are utilized." U.S. Department of Agriculture, Bureau of Plant Industry, *The Soy Bean: Its Uses and Culture,* by W.J. Morse, Farmers' Bulletin 973 (Washington, D.C.: Government Printing Office, 1918), 5.

Another thing to note about Morse's chart, and another aspect of the commodification of a material substance like soybeans, is its branching structure. In Morse's presentation, the brackets can actually represent two different meanings: alternative uses, on the one hand, and simultaneous uses on the other. It is an emphasis on the latter that provided the key to unlocking the commodity value of soybeans. To separate out its constituent substances – oil and meal – enhanced the value of the soybean.

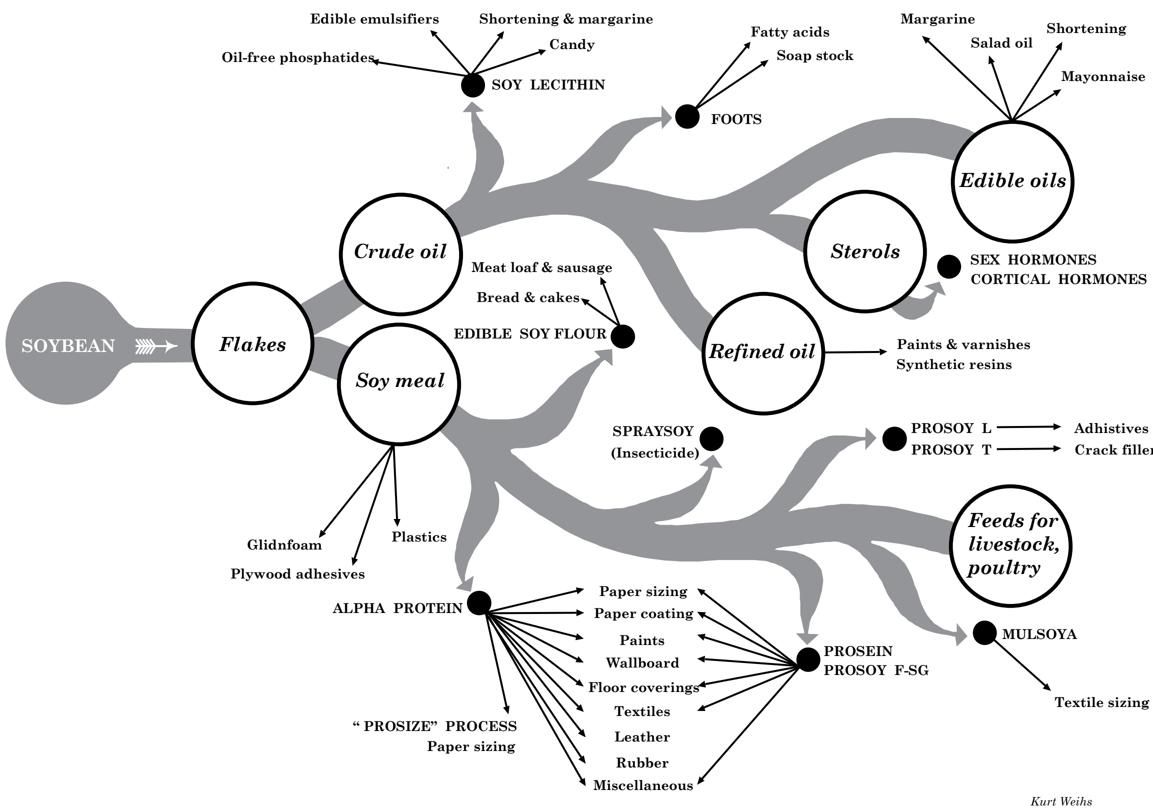

Fig. 2: Glidden soybean utilization tree. "The House that Joyce Built," *Fortune,* May 1949, 97.

This aspect is presented more clearly in an evolution of the utilization tree that appeared in a 1949 article on the Glidden Company. The diagram elegantly illustrates the division of the soybean into specialized fractions which can be utilized simultaneously (Fig. 2). The alternative uses of each fraction are indicated by smaller arrows. In general, the more numerous the specialized fractions that can be separated out from the same bushel of soybeans, the higher its overall value; and, indeed, one trend over the course of the century was the utilization of smaller and smaller fractions of the soybean. By 1949, most soybeans grown in the Corn Belt were divided into oil and meal. Increasingly, this was done through solvent extraction, which separated the oil from the meal more thoroughly than previous methods. Refineries further separated out lecithin from the oil, a heretofore gummy waste substance that had found value as an emulsifier; from the remaining oil, Glidden's Percy Julian had discovered how to separate out sterols to use in the production of synthetic hormones. Likewise, on the meal side, Glidden extracted various grades of protein before using the residue as animal feed. Because Glidden was a processor, the illustration begins with the beans, not the plants, but even harvesting now followed this principle of enhanced value through clean separation: combines, the predominant harvesters in the Midwest, thoroughly removed the beans while leaving the rest of the plant behind as field litter, thus returning more fertility to the soil.

A variation of the utilization tree, which first appeared in the 1950s, maps in a precise way the contribution of various fractions of the soybean to its farm-level value (Fig. 3). By this time, the Chicago Board of Trade has established futures markets for soybean oil and meal, in addition to soybeans themselves, making the soybean the only commodity with futures markets for its primary products. Collectively, this was known as the "soy complex." These markets allowed the soybean's exchange value itself to be progressively subdivided into fractions with varying risk profiles. Hedging strategies located low-risk fractions that represented the profit due to the middleman who stored or processed beans, leaving high-risk fractions – which represented the vagaries of what were now world markets – to the speculators in search of potentially lucrative gambling opportunities. In the postwar era, soybeans were the most free-market of crops, with a price determined by commodities exchanges rather than federal price supports, and thus provided the best opportunities for high-flying traders. Even from the standpoint of farmers, whose choices to plant other crops were often constrained by government acreage limits, soybeans were the unregulated crop they could divert their unused acres to, as it was considered a soil builder, thus providing an outlet for farmers' entrepreneurial energies. The government maintained a role in creating the value of the soybean, however, as indicated in a small way in Fig. 3 by the box for the P.L. 480 (or Food for Peace) program. More importantly, the government still played a major role in varietal development.

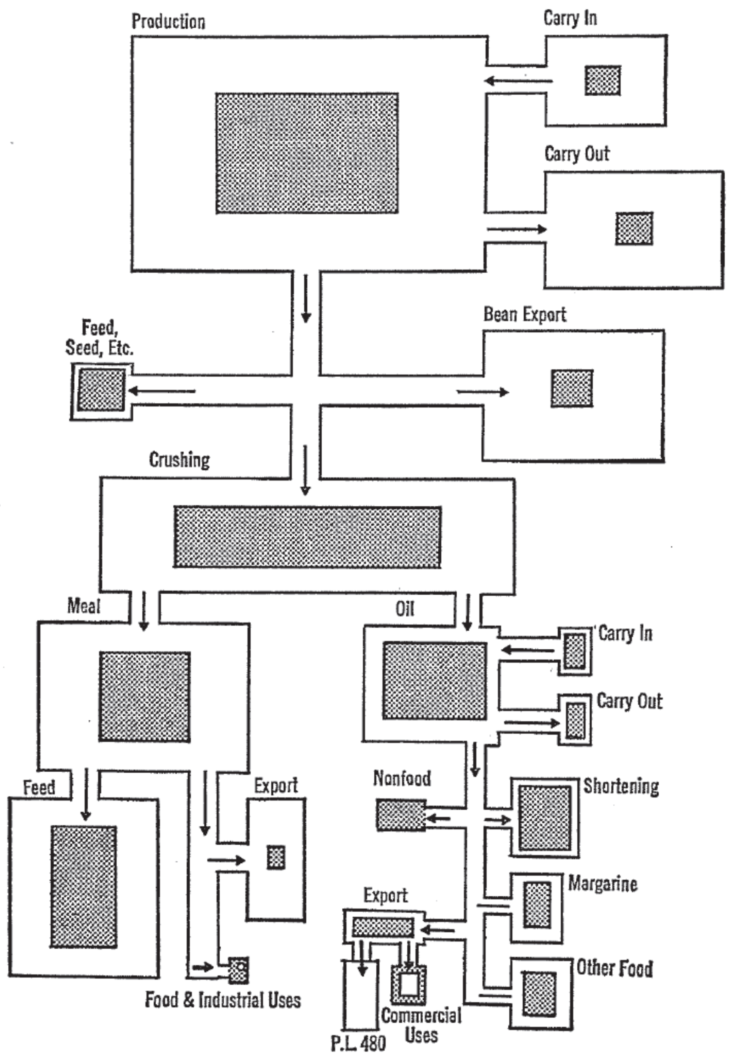

Fig. 3: "Contribution of various market outlets to farm-level value of soybeans, on an average crop-year basis for 1949-49 (shaded rectangles) and 1967-69 (white rectangles)." James P. Houck, Mary E. Ryan and Abraham Subotnik, *Soybeans and Their Products: Markets, Models, and Policy,* (Minneapolis: University of Minnesota Press, 1972), 37.

This study thus emphasizes the creative power of the commodification, the outcome of a collaboration between the private and public sectors. This emphasis follows the path of environmental historians such as Cronon, whose *Nature's Metropolis* explores the landscape-altering effects of commodity flows, as well as historians of science and technology such as Henry Petroski, whose *Evolution of Useful Things*, while never using the term "commodification" itself, shows how inventors create variations on basic forms to better suit them to highly specific uses. When the market exists, these forms might proliferate, as a baffling variety of dinner forks did in the late nineteenth-century during the heyday of elaborate dining.[4] Likewise, in the case of stuff, small fractions proliferate, each modified to perform highly specialized roles.

There is also, of course, a dark side to commodification, one explored in a longstanding way by Marxist writers, as well as by environmental writers influenced by Marxist thought. In Marxist formulations, violence underlies the commodity form: exchange value is the ransom paid for a use value that is, in the first instance, expropriated from users. See Jack Kloppenburg's *First the Seed*, for an account of the "primitive accumulation" involved in developing seeds – notably hybrid corn – that short circuit a farmer's ability to simply save and plant seed from a previous crop.[5] The violence involved in the creation of commodities is usually far from abstract, however. As described in such works as Sidney Mintz's *Sweetness and Power*, a cheap source of energy for the working class of the industrializing world was premised on the use of expropriated land and enslaved labor.[6] Historians of the environment and agriculture also point to the simplification of natural ecologies that farming entails: a regimentation of the landscape that falls in line with the regimentation of labor. Because of the distance that commodities travel from their source, all of this is rather easily masked by the

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[4] Henry Petroski, The Evolution of Useful Things (New York: Alfred A. Knopf, 1992; Vintage Books Edition, New York: Vintage Books, 1994).

[5] Jack Ralph Kloppenburg, Jr., First the Seed: The Political Economy of Plant Biotechnology (Cambridge: Cambridge University Press, 1988; Second Edition, Madison: University of Wisconsin Press, 2004).

[6] Sidney W. Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (New York: Penguin Books, 1985).

images of natural bounty used by marketers to sell their products to the ultimate consumers.[7]

The story of the soybean's growth as a commodity in the U.S. is in part a story of displacement, but one that lacks the direct violence of the history of sugar. By the time the soybean arrived, it mainly displaced other crops on land already expropriated from Native Americans and simplified into monocultural farming systems centered on corn or cotton; although as it spread further north, it displaced mixed dairy systems that typically used deeper-rooted legumes. It did play a significant role in the displacement of Southern tenant farmers, as mechanized farming both of cotton and soybeans transformed the region's labor system during and after the Depression and Second World War. But it was more an enabler than a direct cause of displacement: once southern farmers had mechanized, soybeans became a viable option. The use of the names of Confederate generals to label varieties for the South, however, does point to an underlying violence, one that was not visible to the ultimate consumers.

More broadly, displacement is a central process in the life of commodities. The goal of producers seeking natural resources is to have substitutable options to choose from. One aspect missing from both the Morse and Glidden utilization trees, in fact, are the other products competing to perform each use. As a green manure or forage crop, for instance, the soybean competed with clover and alfalfa in the North, cowpeas in the South; as a whole-bean food, it competed with cowpeas and peanuts; as a "semi-drying" oil, it competed with cottonseed and palm oil for edible purposes, linseed oil for paint and other industrial purposes; as a protein meal, it competed with cottonseed, peanut and fish

[7] See Steven Stoll, *The Fruits of Natural Advantage: Making the Industrial Countryside in California* (Berkeley: University of California Press, 1998) and Jackson Lears, *Fables of Abundance: A Cultural History of Advertising in America* (New York: Basic Books, 1994).

meal; its sterols competed with those of the wild Mexican yam; and soy milk, needless to say, competed with milk. This competition occurred at all levels, for instance in the USDA Office of Forage Crop itself, where the soybean competed with clover, alfalfa and other crops for institutional resources – and even vied for Morse's time and attention with cowpeas, velvet beans, adzuki beans, and kudzu.

Soybeans fought each of these competitions separately, but victory anywhere helped to achieve victory everywhere, as increased production of soybeans for any reason made them – and their various byproducts – cheaper. As the century progressed, the soy complex gained momentum, and even gained government support to sustain the value of its different fractions, as a glut in one would undermine the overall farm-level value of the crop, a central concern for the still-potent farm lobby.

The growth of the nation's soy crop did have ecological impacts, which were part of the discussion surrounding the soybean from the beginning. Early interest in them as a legume focused on their contribution of nitrogen, and thus fertility, to the soil. They were extolled by the heirs of the nineteenth-century soil improvement movement – source of the incipient twentieth-century organic farming movement – for helping nurture a rich humus that was the yardstick of a land's health, something that commercial manures only undermined. The virtue of soybeans, in this case, presumed their participation in a specific farming regime: diversified, with an emphasis on livestock, in which soybeans and other legumes were planted as green manure or forage. Part of the difficulty in establishing *the* ecological implications of the soybean is that it can participate in numerous forms of agriculture.

By the middle of the twentieth century, for example, the debate turned to soybeans' erosive effect as a row crop, hastening the disappearance of topsoil to which they made only a negligible net contribution of nitrogen in any case. The contrast, emphasized by butter interests fighting to maintain taxes on margarine, was between soybeans and perennial, deep-rooted legumes such as clover that provided fodder and forage in diversified dairy farming. Concerns about erosion led to gentler tillage methods, ultimately abetted by herbicides that selectively attacked weeds without harming genetically modified soybeans, leading in turn to a new round of accusations of dangerous ecological impacts.

Ecological concerns have often encompassed human health as well. In addition to worries about phytoestrogens – reasonable worries about their role in promoting cancer in women, less reasonable ones about their role in effeminizing boys – fears have centered on technological transformations of soybean oil. Partial hydrogenation created dangerous trans fats, now outlawed in New York City, while the removal of off tastes in refined oil – variously described as "fishy" or "painty" – was achieved by removing what were ultimately considered beneficial omega-6 fatty acids.

As central as commodification was to the progress of the soybean in America, however, it did not enter and spread entirely in a commodified form. In *Privileged Goods*, Jack P. Manno argues that all goods and services fall on a spectrum of low to high "commodity potential": "Goods with low commodity potential are less alienable (more communal), less mobile (attached to local ecosystems or local culture), less marketable (being communal and attached), and less standardizable."[8] By this definition,

[8] Jack P. Manno, *Priviliged Goods: Commoditization and Its Impact on Environment and Society* (New York: Lewis Publishers, 2000), 59.

tofu and other Asian soy foods – while often sold by small shopkeepers – had low commodity potential in the early part of the century, being bound up in the cultural traditions of small communities as they established themselves in a new land. Adventist products, predicated on religiously prescribed dietary habits, fell on the low end as well.

The movement of soybeans within the Asian-American community was what some cultural geographers have called demic diffusion,[9] whereby a cultural practice is carried along by a group as it migrates, rather than being adopted by new groups. Driven by the need to preserve some sense of home in new and alien environments – as illustrated by the case of Tsuru Yamauchi, Japanese picture bride turned tofu maker in Honolulu – Asian groups moving into U.S. territory tenaciously reproduced soy-based foodways, as indicated in particular by the immediate presence of tofu (soybean curd) in new locales. Of the primary Asian soy foods, shoyu (or soy sauce) might be imported from the homeland, miso (fermented soybean paste) to a lesser extent – but perishable tofu had to be produced fresh in each settlement, indicating the presence of local expertise and equipment (which, not insignificantly, included heavy grinding stones), as well as, somewhat mysteriously, the availability of beans.

In the case of Japanese-Americans, the beans seemed always to travel with the people: even the earliest Japanese who set foot in California, shipwrecks rescued by an American vessel, were able to provide soybeans as a gift to a visiting horticulturalist, who subsequently planted them in Illinois. Later generations likely planted soybeans along the edges of the truck gardens for which they were well known, duplicating a widespread

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[9] Linda Stone and Paul F. Lurquin, *Genes, Culture, and Human Evolution* (Malden, MA: Blackwell Publishing, 2007), 197.

practice of Japan, but these beans were not observed by outsiders and have left no trace in the historical record; tofu itself was scarcely noticed.

At the core of Japanese tofu making were the small traditional shops within the close-knit communities that formed the spine of Japanese-American settlement on the west coast. But the tenacity of tradition carried tofu, miso and even shoyu into the internment camps of World War II – where the arid physical environment was hostile, and bureaucratic approval was necessary for what had previously been conducted by small-scale entrepreneurs – and beyond, to cities in the Midwest where some internees, given the opportunity to leave the camps, settled. Following the war, tofu makers returned to the west coast as communities reconsolidated; a new generation expanded and modernized. But for decades, there was no crossover into mainstream American food, as there often is with ethnic foods, and as there was with Chinese food. Even in the case of Chinese food, which crossed over with chop suey at the turn of the twentieth century, soy foods – with the partial exception of soy sauce – did not become popular among non-Asians. Asian communities, especially Chinatowns, were significant footholds for traditional soy foods, and were on occasion important resources for other Americans suddenly interested in adopting them – briefly during World War II and on a more sustained basis beginning in the 1960s.

If the Asian-American project was cultural preservation and adaptation, the Seventh Day Adventists project was one of substitution – that is, finding alternatives to the meat that constituted a large part of the American diet. Vegetarians in varying degrees from the 1860s, when their founding prophet, Ellen G. White, received visions of a nutritional doctrine that excluded meat, their impact on the American diet was rooted in the sanitariums they founded. Their flagship, the Battle Creek Sanitarium, was operated by John H. Kellogg, who invented granola and corn flakes, and who popularized peanut butter; he also created fake meats out of wheat gluten and peanuts. Kellogg's was too independent and forceful a personality to contain within a church, and he eventually went his own way, taking the San with him. Others Adventists, Harry W. Miller among them, followed and improved upon Kellogg's example and established sanitariums at home and abroad, as well as a system of academies and colleges. All offered a vegetarian menu, providing a key institutional basis for food innovations. The broader Adventist community, including White herself, often wavered in their vegetarianism, but the institutional centers were far stricter; at the same time, they needed foods that appealed to non-vegetarian sanitarium guests and young students.

Adventist food manufacturers established to supply these institutions would become mainstays in the American health-foods market, an otherwise diffuse constellation of Theosophists, Physical Culturists, Naturopaths and miscellaneous nutritional sectarians. Often dismissed as faddists – and, indeed, many dietary systems were short-lived, as even their originators moved on to new revelations – these groups shared a commitment to vitalism, the belief in a life force separate from and irreducible to mere chemical processes. The digestive process, which converted dead food into living tissue, and which was both the ultimate source of vital force and a potential drain on it, was often a central concern to vitalists. While embracing science in varying degrees – in particular, when new discoveries of such things as vitamins proved that prior scientific conceptions of food and digestion had been impoverished – the impulse driving vitalism was, at its core, religious. When discussing vital force, its adherents slipped easily into the language of spirit and soul; physical health mirrored moral integrity, and both could be undermined by indulgence in the wrong foods. The overall Adventist project, moreover, was premised on the existence of a God whose providence supplied the full range of foods in Eden without the need to resort to animal flesh; there was faith that, for those who sought them, wholly satisfying and nutritionally superior substitutes could be found. The Adventists stand as a reminder that food choice – and taboos – has often been bound up in religion, in part because omnivorous humans require ideology as a substitute for instinct, in part because the assimilation of food into the body indeed remains wondrous. But their experience also points to the difficulty of their project: even when buttressed by religious devotion, and rarely otherwise, wholesale dietary substitution is difficult to achieve.

As a providential substitute, the soybean entered Adventist awareness from both east and west. Beginning at the turn of the twentieth century, Adventist missionaries to Japan and China discovered tofu and other traditional soy foods and began introducing them during the 1920s to the denomination's schools and sanitariums. At the same time, soy flour had found use in Europe in low-starch diets for sufferers of diabetes, a disease whose basis in diet gave it a prominent place in the thinking of vitalists such as J.H. Kellogg. Adventist soy foods largely failed to appeal, however, to those who were not committed or debilitated. In this context, soy milk was an interesting case. While the injunction against dairy products was never as clear as that against meat – in fact, Adventists were rarely vegan – in some ways it had better prospects for widespread adoption. Many non-Adventists – including Henry Ford – argued that dairy milk was unsanitary, while at the same time forming a basis of western superiority: while threatening to health, it could not simply be dispensed with. Soy milk not only had the possibility of sanitary production – that is, the elimination of the harmful microbes of decay – to recommend it, but greater value as a substrate for the beneficial microbes of fermentation; at least, this was what Kellogg argued in his promotion of *acidophilus*-soured soy milk. The Adventist who made the greatest attempt to made soy milk a perfect substitute for dairy milk, or at least to eliminate all of the various beany flavors that offended western tastes, was Harry Miller. Even as he met with some success, however, he was able to establish only a foothold beyond the traditional health-food market: formula for infants allergic to dairy (and not yet set in their tastes). As it happened, soy milk produced according to his method had its breakout instead in postwar Asia, where it became a popular soft drink that would in turn colonize America only decades later, when certain key attitudes towards milk had shifted.

Both the Asian-American and Adventist soy products were low on the commodity spectrum largely because culture and belief systems constrained the marketability more broadly. Another group, which emerged within the counterculture of the 1960s, took an explicit stance against the commodification of American life, and their use of the soybean reflected this. The "Soytopians" instead striving for holism, which envisioned wellbeing as the connection to some greater whole rather than as the sum of discrete use values.

In part, this entailed putting the soybean back together, fermenting whole beans, for example, into tempeh. Tofu, which became the iconic soy food of the 1970s, presents a more complicated example: it is not a "whole food" by any means, as its production removes first the soybean fiber (*okara)* and then the whey as it curdles and presses the resulting milk into cakes; the soybean as traditionally used in Asia thus had its own utilization tree. The result, moreover, displayed a more modernist than hippie esthetic: tofu is white, uniform in texture, typically rectangular in form, a Platonic solid, rather than brown and variegated, signifiers of earthy authenticity. To Buddhist-inspired vegetarians of the Bay Area who went on to promote soy foods – Stephen Gaskin and William Shurtleff – it was flesh without violence, or “meat without the bone,” as Asians were supposed to have said. As with the Adventists, it enabled peaceful coexistence with the other creatures of Eden. And its appeal lay in its mode of production as much as in its physical properties: Shurtleff in particular sought a sense of wholeness through participation in a spiritually rich craft tradition. There has also been an enduring perception that Asian soy foods, refined by such traditions over hundreds of years, nurtured holistic bodily health more effectively than the isolated soybean products used in processed foods, including the soy burgers, dairy desserts and energy bars that were an outcome of the countercultural soybean movement as it fed the ongoing process of commodification. Even some of the harshest critics of the soy industry and its veil of health-food virtue agree with soybean promoters such as Shurtleff that the traditional foods, in particular the fermented ones, are healthier.[10] As it happened, however, the counterculture effort to decommodify life produced powerful images that were useful in selling a new generation of soy foods.

Magic Bean ends in 1980, as this interplay between the projects of holism and commodification begins in earnest, but it is a moment when soybeans has entered all of the cultural streams that would carry it deep into the American landscape, diet and culture. The Adventist stream would become a trickle, as many of the colleges and

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[10] See Kaayla Daniel, “The Good Old Soys – Soybeans with Culture,” 47-62, in *The Whole Soy Story: The Dark Side of America’s Favorite Health Food* (Washington, D.C.: New Trends Publishing, 2005).

sanitariums shut their doors and the food companies become divisions of giant food corporations. The Asian-American stream would swell as would the tide of immigration and a growing appreciation of diverse Asian foods by other populations. The countercultural stream would become part of Big Organic, and the soybean improvement stream – the mainstream soybean industry with its lobbying arm in Washington – would continue developing markets for soybean products, aided in part by the reputation for health of soy foods. At the same time, by the turn of the century, there was a backlash occurring in the new information ecology of the internet and, as is perhaps typical of that ecology, gaining fervent followers even as public opinion, measured more generally, grew more favorable to soy foods.

The result of all of these developments was that, by 2000, the soybean loomed much larger in American life than it had one hundred years earlier. Farmers on more than 300,000 farms grew soybeans, although farmers were so much smaller a proportion of the population in 2000 than in 1900 that this absolute increase did not necessarily represent a big leap in overall awareness.[11] Beyond farmers, however, the American agriculture industry had grown more variegated. Crop and food science research had burgeoned from the nucleus in place in 1900 at agricultural colleges, and many professors had based their careers on the soybean; one comprehensive monograph on the soybean published in 2004 listed almost fifty contributors from almost twenty universities.[12] There were technologists at private companies as well: chemists and food engineers, developing and refining inputs for feed and food manufacturers, as well as the genetic engineers who developed Monsanto's famous Roundup Ready soybeans. Big agribusiness depended on

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[11] Soybean Factsheet

[12] Boerma and Specht.

big finance: soybean futures, first introduced in 1936, were among the most popular contracts traded on the Chicago Board of Trade, drawing in speculators to trade with the hedgers actually engaged in the soybean industry. Policymakers in Washington were obligated to consider soybeans when writing Farm Bills and were prodded by lobbyists representing growers through the American Soybean Association or processors through the National Oilseed (formerly Soybean) Processers Association.

As for average consumers, more than five percent of Americans were of Asian descent, many of them preparing traditional soy foods, which were consumed more widely as well due to increasing interest in ethnic cuisines. With sushi, Americans ate edamame, and by 2000, tofu was a $225 million business nationwide. These foods were overshadowed by sales of nontraditional soy foods such as soymilk, now available in the refrigerated sections of supermarkets, meat alternatives and energy bars – all in all, totaling $2.5 billion in sales.[13] Starbucks, itself already known for its ubiquity, offered various soy latté drinks by 2000. (And by 2006, a third of Americans would report consuming a soy food or beverage at least once a month.)[14] Much of this consumption was driven by health concerns, as more Americans reduced meat in their diet and as some populations – older women and the so-called lactose intolerant – sought soy milk for specific benefits.

At the same time, there was an incipient backlash. Although soy allergies occurs in fewer than one percent of children – the group where the allergy is most prevalent – the presence of soy in processed foods, and thus of warnings on packaging, brought the

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[13] Soyfoods Association of North America (SANA), "Sales by Product Type, 1996-2011," http://www.soyfoods.org/wp-content/uploads/SANA-sales-data-1996-2011-for-web.pdf.
[14] SANA, "Soy Information: Sales and Trends," http://www.soyfoods.org/soy-information/sales-and-trends.

problem to the attention of a wider population. Along with concerns about genetically modified crops, there were stranger fears as well: in the early 2000s, the same phytoestrogens that recommended soy products to menopausal women were blamed by some for lowering male sperm counts, effeminizing men or even making boys gay.[15] There may have been subterranean psychological linkages here to stereotypes of Asians and hippies, tofu-eaters both, along with a growing realization that soy was everywhere in U.S. food. Indeed, long before the soybean entered in a major way into Americans' awareness, it was increasingly incorporated in amounts into their bodies: 80 percent of the edible fats and oils consumed by Americans in 2000, for instance, came from the soybean.[16]

By the end of the twentieth century, then, most Americans were aware of the soybean, many had an opinion about it, and some devoted a large part of their working hours thinking about it; and whether they thought about it or not, they almost certainly ate it in one form or another. What had been exotic one hundred years earlier was now everywhere and everyday. *Magic Bean* attempts to chart this course through the interplay of commodification with the foodways embedded in American cultural practices that, in many instances, only gradually gave way.

[15] WorldNetDaily, "Commentary: Soy Is Making Kids 'Gay,'" Published 12/12/2006, http://www.wnd.com/2006/12/39253/.
[16] ASA, 28, http://www.soystats.com/2001/page_28.htm.

Chapter 1: Crossings

Three streams carried soybeans into the United States during the first half of the twentieth century: Asian immigrants, primarily from China and Japan, who took their soy foods with them wherever they settled and managed to adapt them to areas where initially no soybeans grew; members of the Seventh-Day Adventist Church, who more than other vegetarians and health-food enthusiasts in the early part of the century sought to create novel foods to demonstrate that the taste and nutrition of meat and milk could be achieved without the use of animal products; and a wide-ranging network of researchers, farm extension agents, progressive farmers, rural reformers and businesspeople who believed that improving America's crops was the key to national prosperity. The story of soybeans at the turn of the century is less about how they traveled through these channels – which they indeed had begun to do in a small way decades earlier – than it is about how these channels were forged and widened. In all cases, this involved individuals traveling between continents separated by ocean, a feat that was easier to accomplish than ever before but which was still lengthy and arduous. And in all cases, these channels were shaped by America's strategies as it embarked on its pursuit of empire. These strategies varied from the direct acquisition of colonies in the wake of the Spanish-American War, to the encouragement of American missionary work in China in the wake of the Boxer Rebellion, to the insistence on an Open Door policy that used imperial power to ensure free trade, a contest America felt confident of winning. In some ways complementary, in some ways alternative approaches to global power, these strategies all helped open channels through which soybeans could eventually cross over into America in force.

The Picture Bride: Tsuru Yamauchi

When she first arrived in Hawaii in 1910, 20-year-old Tsuru Yamauchi (formerly Kamigawa) spent three tense days at the Immigration Bureau waiting for the arrival of a husband she knew only from a photograph. Her parents had been strict, warning her about boys and keeping her home when the sun went down, so the prospect of leaving with a man made her tremble so badly that the two other picture brides waiting at the Bureau held on to her shaking legs and comforted her. It was a relief, however, from the seasickness of the 15-day voyage from Yokohama on the *Mongolia*: she had been unable to eat rice or even drink tea, and spent the days sleeping below decks in a swing made of thick cloth. In an interview conducted 70 years later, she revealed that the sight of a ship still made her feel weak. When Yamauchi-*san* arrived and took her to the cane fields of Waipahu, where he worked on a plantation, she felt a different kind of sickness, a deep homesickness: "You couldn't see anything but cane and some mountains. I felt lost without my parents and sisters. Here you couldn't see anything, no view, no landscape, just fields and hills. Ah, such a place. The sun was already going down. I thought, 'Is Hawaii a place like this?'"[1]

The hard work confronting an immigrant such as Yamauchi – aside from the backbreaking work in the cane fields – was to create something familiar in such an overwhelmingly alien environment. Food was an important element of this: when, after the voyage, she was served a meat and vegetable dish at the Immigration Bureau, she remarked with surprise, "Oh, they have *konbu* (seaweed) in Hawaii, too." But as a cultural memento, food presents special challenges: unlike more durable household

[1] Tsuru Yamauchi, interview by Michiko Kodama, ed. Marie Hara, trans. Sandra Iha and Robin Fukijawa, in *Uchinanchu: A History of Okinawans in Hawaii* (Honolulu: Ethnic Studies Oral History Project, Ethnic Studies Program, University of Hawaii, 1981), 488-489.

goods, it is continuously consumed. To eat familiar foods, even occasionally, is a logistical feat, especially when the primary ingredient is not a crop native to the new land. But even in the remote cane fields of Hawaii, Yamauchi and her family would manage to find a food that she had eaten growing up in Okinawa: tofu, the pressed curds of soybean milk.

For Yamauchi, tofu would always be linked to memories of childhood poverty. She was of a samurai lineage whose ancestors had been forced to leave Japan for Okinawa. Her father was well-educated, but with a growing number of children, her parents found themselves in straightened circumstances and moved from the capital city, Shuri, to a provincial town, Itoman, where they had friends. Her father continued to speak to his children in the more refined language of Shuri. ("Shuri speech has too much apologizing," Yamauchi would recall. "Itoman people don't apologize as much.") But never having worked before, her parents learned to sew, making *awase* (lined kimonos) and *baori* (coats) in the winter and *bitori-mon* (unlined clothing) in the summer.[2] For food, the family was at times dependent on the charity of others. Fishermen would give them fish, and their next-door neighbors, who owned a tofu shop, sometimes called them over to "get some of the burned bottom part" – a reference, most likely, to the deep-fried tofu, or agé, customarily prepared by the wives of tofu makers – and "even that tasted good when there wasn't any food."[3]

As one of the older daughters, Tsuru helped her parents during busy times and took care of her siblings at other times, despite her desire to attend school: once, she tagged along with her younger sisters, carrying a smaller sibling on her back, not thinking that

[2] Ibid., 491.
[3] Ibid., 492.

the baby would get hungry. Unable to attend school, she directed her ambitions to making extra money for herself and her family: she tended a field where she grew vegetables and hay, which she learned to weave into mats, a skill she taught her father.

She learned to make tofu when she was thirteen or fourteen, grinding the beans by hand early in the morning and using it to make a kettleful of the bean curd. She would peddle it on the streets of Itoman, selling it to friends, perhaps earning one yen. She purchased soybeans from farmers who ventured into town from the surrounding countryside and sold it cheap: a "big heap would be about 20 *sen.*" A side benefit of the tofu business was that "You never waste *tofu*. . . . [E]ven if the *tofu* turned sour, you could eat all of it."[4] Tofu was good business in part because Okinawans ate it regularly, more frequently than in Japan proper even though they were not vegetarians (the other distinctive feature of the Okinawan diet, reflecting the influence of China, being pork consumption). As a result, Okinawans suffered less from protein deficiencies, despite the island's economic backwardness.[5]

Yamauchi found out that she was to go to Hawaii when she had her picture taken, to be exchanged with the parents of prospective husbands. Shokin Yamauchi, her future husband, was already working in the cane fields of Waipahu. She was sent to live with his family in the country village of Kanegusuku, where, to legalize the marriage, her name was entered in the Yamauchi family register. Her parents felt that it would be good for her to get accustomed to his family. She made tofu, helped to grow sweet potatoes, and cooked for the field workers, all of which she characterized as "light work."[6]

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[4] Ibid., 492.
[5] Naomiche Ishige, *The History and Culture of Japanese Food* (London: Kegan Paul, 2001), 138-39.
[6] Yamauchi Oral History, 490.

The light work of making traditional tofu involved waking before dawn to grind soybeans that had soaked overnight into a purée (*gô*) between hand-turned granite millstones. These stones, once common in Japanese households, were about 13 inches in diameter by 4 to 5 inches thick, weighed around 50 pounds each, and were grooved on their grinding surfaces; a short metal rod held them together during use.[7] Yamauchi, alone or with assistance, would have ladled the soybeans through a hole in the upper stone and turned it by its vertical wooden handle. The gô sluiced out from between the stones, which rested on a platform above a catch barrel. She cooked the gô in a wide-mouthed iron pot over a wood fire, perhaps sprinkling it with rice bran and stirring it with a wooden paddle to keep the foam down, then poured it into a cloth sack that she then set on a rack above another catch barrel; she pressed out the soymilk using a millstone and her own body weight. She repeatedly stirred the contents of the sack with hot water, twisted it back up, and pressed out additional milk, until what remained was a fibrous substance called okara.[8] She poured the milk into the iron pot – thoroughly scrubbed to remove any traces of gô, the oil of which would have interfered with curdling – and brought it to a boil.

After raking the wood and coals out from under the pot to allow it to cool, she added *nigari*, diluted with water, as a curdling agent. Nigari, consisting mainly of magnesium chloride, was produced by collecting the liquid that dripped from sacks of damp sea salt.[9] She may have stirred the milk rapidly with a paddle to form a whirlpool, pouring the nigari from a foot above the surface of the milk to ensure it would reach the bottom of the

[7] William Shurtleff and Akiko Aoyagi, *The Book of Tofu: Protein Source of the Future...Now! Volume I* (Berkeley, CA: Ten Speed Press, 1983), 278.
[8] This was the custom in Japan, at least; Yamauchi later recalled that Okinawans squeezed out the okara without having first boiled the gô. Tsuru Yamauchi Oral History, 504.
[9] Shurtleff and Aoyagi, *Tofu,* 284.

pot. After all turbulence had ceased, she poured more onto the milk's surface, then covered the pot and waited for the milk to curdle. She stirred in nigari until clouds of white curds floated in the whey, a pale yellow liquid that she ladled from the pot before putting the curds into a wooden, cloth-lined rectangular pressing box perhaps a foot-square by 5 inches deep. She placed the box on a rack above the catch barrel, placed a weight on the lid, and waited as, over the course of an hour, the remaining whey flowed through the holes in the bottom and sides of the box. The process of transforming gô into tofu required roughly two hours.[10]

The resulting product was farmhouse tofu: beige, bearing the texture of course cloth and "so firm that it could be tied into a package with rice-straw rope and carried over long distances without breaking apart."[11] This variety was at the bottom of the hierarchy of Japanese tofu, a food originally brought from China sometime between the eighth and twelfth centuries by Zen monks, who began serving it at temple restaurants to the population at large.[12] It gradually diffused from temple to town, where it was sold in shops, and from town to countryside. Farmhouse tofu retained the closest resemblance to Chinese tofu, while the tofu of Japanese towns and cities became whiter and more delicate, less redolent of wood smoke and course cloth, up to the smooth "silken" tofu at the top of the hierarchy.[13] Late in the twentieth century, however, when farmhouse production had given way to village tofu shops, farmhouse tofu became a venerated memory.[14]

[10] Ibid., 71, 286.
[11] Ibid., 271.
[12] Ibid., 93; Ishige, 76.
[13] Shurtleff and Aoyagi, *Tofu,* 94; Barbara E. Thornbury, "Fare of the Country: A Feast of Tofu in Tokyo and Kyoto," *New York Times*, 11 June 1989, XX6.
[14] Shurtleff and Aoyagi, *Tofu,* 275.

Yamauchi lived with her in-laws for a year, then prepared quickly for her trip to Hawaii: "I didn't need so much time, because I just took along my usual clothes, no special crested wedding kimono." She traveled to Yokohama – where she was examined for hookworm and eye disease – and boarded the *Mongolia*. The boat fare, she later recalled, was very cheap.[15]

Yamauchi arrived at the tail-end of a migration from the Japanese to the Hawaiian archipelago that extended back over three decades. The movement of people had begun slowly, as Japan's modernizing Meiji government was concerned that uncontrolled emigration would hurt its international image, as it perceived it had China's. Under pressure from a heavily taxed peasantry eager to earn remittances overseas, Japan allowed workers to venture to the labor-hungry sugar plantations of Hawaii in a process overseen by the government. In the period 1886-1894, 30,000 Japanese made the journey, most returning home after their three-year labor contract expired; only 877, fewer than the number that died in the cane fields, opted to emigrate to the U.S. mainland when the three years was up, as they were free to do under agreements between the U.S. and Hawaii.[16] Much as cane workers redirected the course of water through irrigation ditches using hoes, two wars decisively altered the flow of human migration – and as the movement of people shifted, bringing them in large numbers to new lands, so did the movement of the food they ate and the ingredients they needed for that food.

The Sino-Japanese War (1894-95) compelled the hard-pressed, if ultimately victorious, Japanese government to shift management of Hawaiian migration to private

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[15] Yamauchi Oral History, 493.

[16] Alan Takeo Moriyama, *Imingaisha: Japanese Emigration Companies and Hawaii, 1894-1908* (Honolulu: University of Hawaii Press, 1985), 29.

companies ("imingaisha") which were aggressive in recruiting labor for sugar plantations. The Spanish-American War (1898), marking America's emergence as an imperial power, created political momentum that same year to annex Hawaii, strategically located and already tied to the U.S. through numerous business interests. When American federal law took effect in 1900, the existing labor contracts – a form of indentured servitude – would become null and void. This only spurred Hawaiian planters to press compliant imingaisha to increase their recruitment: 30,000 Japanese entered Hawaii in 1898-99 alone, over 150,000 between 1894 and 1908.[17]

Once in Hawaii, this growing Japanese population was accessible to labor recruiters from California, where farmers offered higher wages and, as the U.S. Commissioner of Labor put it as late as 1906, better working conditions "than on the large plantations of Hawaii where the traditions of penal contract days have not disappeared."[18] With the end of contract labor in 1900, the trickle to the mainland became a flood: nearly 35,000 people from 1902 through 1906,[19] making up a substantial portion of the 72,000 Japanese who lived in the contiguous U.S. in 1910.[20] Though modest in comparison to the influx of immigrants into the U.S. from Europe, the Japanese migration sparked a movement on the west coast to extend the Chinese exclusion law to other Asians.

The departure of so many Japanese from Hawaii in turn left a vacuum on the sugar plantations, which the imingaisha scrambled to fill by expanding recruitment in areas

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[17] Ibid., 51. That Chinese exclusion would also become law in Hawaii was less consequential: planters, under pressure from residents of Hawaii's cities, who resented the burgeoning Chinese population, had shifted their recruitment to Japan precisely to avoid hiring additional workers form China.
[18] Ibid., 134.
[19] Ibid., 133.
[20] Roger Daniels, *Asian America: Chinese and Japanese in the United States since 1850* (Seattle, WA: University of Washington Press, 1988), 115. The number was 6,000 in 1894.

they had previously ignored, Okinawa in particular.[21] Okinawa was part of an island chain to the south of Japan that, as an independent kingdom, had alternately come under the sway of Chinese and Japanese cultural and political influences until decisively incorporated as a Japanese prefecture at the end of the nineteenth century. Largely bypassed by Meiji reforms, but favored by typhoons, Okinawa struggled with overpopulation and famines, as well as the burden of new taxes which funded industrial growth in mainland Japan.[22] A small group of Okinawans emigrated in the late 1890s – enduring sweltering 10-hour days cutting sugarcane and loading it onto train cars under the watchful eye of the "luna," or overseer, who swung a rope in the air and whipped anyone who appeared to be lazy or disobedient[23] – but emigration did not begin in earnest until after 1903: 1,200 workers arrived in 1905, 4,500 in 1906.

Okinawans, who had grown sugarcane as a major crop on their home island, remained on the plantations longer than other Japanese. The planters theorized that they were better suited to tropical labor, given a similar climate back home.[24] When Japan voluntarily curtailed the emigration of male laborers to Hawaii and the mainland U.S. as part of the 1907 Gentlemen's Agreement – brokered by Theodore Roosevelt to prevent the San Francisco School Board from consigning Japanese students to segregated schools reserved for the Chinese – wives (including picture brides), children and parents were still permitted to join their husbands, fathers and sons. The Period of Summoning

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[21] Moriyama, 135.
[22] Ibid., 3.
[23] Yukiko Kimura, "Social-Historical Background of the Okinawans in Hawaii," in *Uchinanchu: A History of Okinawans in Hawaii* (Honolulu: Ethnic Studies Oral History Project, Ethnic Studies Program, University of Hawaii, 1981), 55.
[24] Ibid., 57.

Families ("Yobiyose Jidai"*)* began.[25] In the case of Okinawans in Hawaii, this peaked in 1912 with the arrival of 1,700 yobiyose immigrants. By 1911, there were more than 10,000 Okinawans living in Hawaii,[26] Yamauchi among them.

Wherever the Japanese settled in America, fresh tofu was – it seems – immediately available. This was not a simple matter: general merchants could import soy sauce ("shoyu") and fermented bean paste ("miso"), both used as seasonings, but fresh tofu had to be made locally and daily.[27] Its production required heavy granite millstones and a reliable source of soybeans. In Japanese towns, it was made by specialized craftspeople. (Even in villages, there was specialization: during the busy summer months, one woman typically collected soybeans from villagers and made tofu for all during festival periods.)[28] Despite a plentiful supply of fish, the other protein source favored by the Japanese, even the smallest rural communities on the west coast supported a tofu shop.

The first Japanese tofu in America, at least according to recollections recorded in 1930, may have been produced in the mid-1890s by the wife of a Sacramento food importer – but, as the author of this claim demurred, "there are many who claim to be the first."[29] A tofu shop still in business in the 1990s may have been founded as early as 1903 in New York City, one of the few east coast cities to see significant Japanese

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[25] Ibid., 58.

[26] Moriyama, 135.

[27] On the other hand, the Japanese did import freeze-dried tofu, which was light-weight and kept for up to a year. The process for making it had been discovered in the seventeenth century. Ishige, 237; B.R. Hart, San Francisco, to C.L. Alsberg, Chief, Bureau of Chemistry, Washington, D.C., 22 May 1917, Record Group 88, Records of the Food and Drug Administration, Subgroup: Records of the Bureau of Chemistry 1877-1943, Series: World War I Project File 1917-19, National Archives II, College Park, MD. (henceforth "Bureau of Chemistry.")

[28] Shurtleff and Aoyagi, *Tofu,* 275.

[29] William Shurtleff and Akiko Aoyagi, *How Japanese and Japanese-Americans Brought Soyfoods to the United States and the Hawaiian Islands - A History (1851-2011): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 18.

immigration during this period.[30] The earliest listings in an annual business directory published by *Nichi Bei Shimbun (“Japanese American News”)*, out of San Francisco, also indicated that tofu shops first appeared in urban areas, where the earliest Japanese immigrants, like the Chinese, had settled. The 1905 directory listed six shops: two in Los Angeles, one in San Francisco, one in Sacramento, one in San Jose, and one in Isleton.

By this time, however, the nature of Japanese immigrants had changed: they were predominately rural in origin, they more often came by way of the Hawaiian sugarcane fields, and they settled in the countryside to provide skilled labor in the intensive cultivation of specialty crops, particularly berries. Increasingly, they provided this labor for themselves, buying or leasing enough farms that the Japanese and Korean Exclusion League sounded the alarm in 1907 that, for instance, “[w]ithin the last three or four years they have gained complete control of the country around Fresno and they are virtually the dictators and arbiters in all matters pertaining to the cultivation and harvesting of the raisin crop.” One of the League’s chief objections was to Japanese insularity: “There is no business for the white merchant because the Japanese patronizes his own countrymen.”[31] The Japanese businesses in these areas undoubtedly included tofu shops, although many escaped detection – including any such shop in Fresno – by *Nichi Bei Shimbun* until 1909.

Before this, the tofu-shop listings in the annual directories had grown slowly: from six in 1905 to eight in 1906, including two in Seattle. The 1908 directory listed fourteen, four of which were in L.A. Suddenly in 1909, twenty-nine appeared, moreover in such places as Alameda, Armona, Dinuba, Oxnard, Reedley, Santa Barbara, Selma, and

[30] Shurtleff and Aoyagi, *Japanese and Japanese-Americans*, 18.
[31] *Japanese Immigration, Occupations, Wages, Etc.: Compiled from U.S. Government Reports and Reports of California Bureau of Labor Statistics* (San Francisco: Japanese and Korean Exclusion League, 1907), 11.

Tulare. This was also the year that *Nichi Bei Shimbun* assisted the California Bureau of Labor Statistics, which had been allotted $10,000 by the legislature to compile a comprehensive report on the state's Japanese population. Nine "special agents" of the Bureau, all white, traveled to every Japanese community in California with surveys printed in English and Japanese, a high percentage of which were dutifully mailed back.[32] The resulting "MacKenzie Report," named after John D. MacKenzie, the Commissioner of Labor Statistics, praised the Japanese in California and their contribution to the state's agriculture, declaring that they were vital to specialty crops that required intensive and careful hand labor. The Report, distributed in advance to the press, was lambasted in newspapers for concluding, as the Fresno *Republican* interpreted it, that "California cannot raise both fruit and American civilization, and as the fruit is the more important, we must sacrifice the civilization."[33] The California Senate, which had commissioned the Report, passed a resolution unanimously condemning it for having "misrepresented the wishes of the people of this commonwealth,"[34] and the Report was never officially printed. In the meantime, however, *Nichi Bei Shimbun* had gained access to the surveys, which aided them in finding tofu makers.

In subsequent years, *Nichi Bei Shimbun* conducted business censuses of its own which encompassed neighboring states as well as California. Its 1910 census located 42 tofu makers (although its directory listed only twenty shops), and in subsequent years the number typically ranged between forty and fifty, one shop for every 2,300 Japanese

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[32] Shurtleff and Aoyagi, *Japanese and Japanese-Americans*, 51.
[33] Chester H. Rowell, "Editorial Comment from Fresno Republican: A Calamity." (Fresno, CA) *Republican*, 30 May 1910; quoted in Eliot Mears, *Resident Orientals on the American Pacific Coast* (Chicago: University of Chicago, 1928; reprint New York: Arno Press, 1978), 446-448.
[34] James Augustin Brown, *The Japanese Crisis* (New York: Frederick A. Stokes, c1916).

people in America.[35] Tofu was now being produced in Colorado, Utah, Idaho and Wyoming, as well as in Washington State and Oregon.[36] These were modest businesses, typically with sales of between $500 and $1,000 per year, although one producer in Stockton, California, pulled in $4,000 and two in Los Angeles jointly earned $15,000.[37] Most were owned by men, who dominated the tofu craft in the towns of Japan, although the 1913 census indicated that at least one shop was owned solely by a woman, suggesting that experience making farmhouse tofu could provide an entry into the business in America.[38] There was high turnover – only about a third of the shops listed over the years appeared in more than one directory – but certain locations were favored, with some addresses appearing in different years under as many as six names. Tofu shops were sometimes adjuncts to other businesses, usually food import companies but also, in a number of cases, public baths, presumably because both enterprises used hot water.[39]

The factors that supported tofu production in America – the Japanese community's self-sufficiency and determination to maintain traditions, as well as the business's flexibility and low capital requirements – made it practically invisible to the broader population. One Portland shop appeared in a city directory, for instance, but solely as a public bath. Tofu was not even brandished in invectives against the "coolie" diet, first directed at the Chinese and later at all Asian groups. A famous 1879 statement by James

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[35] By comparison, in 1965 Japan, before the thorough-going modernization of tofu production, there was one tofu shop for every 2,000 Japanese. Soyinfo Center, "History of Tofu: A Chapter from the Unpublished Manuscript, *History of Soybeans and Soyfoods: 1100 B.C. to the 1980s* by William Shurtleff and Akiko Aoyagi," 3, last modified 2007, www.soyinfocenter.com/HSS/tofu3.php.
[36] Shurtleff and Aoyagi, *Japanese and Japanese-Americans*, 78.
[37] Ibid., 74.
[38] Ibid., 67.
[39] Ibid., 48, 77, 117.

Blaine, that "you cannot work a man who must have beef and bread alongside a man who can live on rice," provided the key image for the 1902 American Federation of Labor pamphlet, *Meat vs. Rice*.[40] An 1899 U.S. Department of Agriculture pamphlet describing the uses of soybeans in Japan pointed out, "The statement is frequently made that the Japanese live almost exclusively upon rice, eating little or no meat. It is not, however, generally known that the deficiency of protein in the rice is made up by the consumption of large quantities of shoyu, miso, or other soy-bean products."[41] An invidious contrast between tofu and meat would not, at his juncture, come into play.

Soybeans themselves were undoubtedly also part of the landscape of Hawaii and California, but were even less visible. Contemporary reports about Japanese truck farming did not mention soybeans. The Department of Agriculture did not track their cultivation or uses in California or Hawaii, although agricultural experiment stations in both regions grew several varieties. But tofu production required beans. Some were imported, the *Nichi Bei Shimbun* noting in 1914 that the total value of soybeans arriving in San Francisco was $27,867.[42] Some likely grew in gardens or among fruit and vegetable crops. The 1909 *Nichi Bei Shimbun* directory valued the 1900 U.S. soybean crop at over $7 million, and the California crop at over $1 million, but without mentioning what portion was grown for use in Japanese food.[43]

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[40] Samuel Gompers and Herman Gutstadt, *Meat vs. Rice: American Manhood against Asiatic Coolieism: Which Shall Survive?* (American Federation of Labor, 1902; reprint, as Senate Document 137, Washington, D.C.: Government Printing Office, 1902; reprint, with Introduction and Appendices, San Francisco: Asiatic Exclusion League, 1908), 22, 30.

[41] Department of Agriculture, *The Soy Bean as a Forage Crop*, by Thomas A. Williams, with an appendix on "Soy Beans as Food for Man" by C.F. Langworthy, Farmers' Bulletin No. 58 (Washington, D.C.: U.S. Government Printing Office, 1899), 23.

[42] Shurtleff and Aoyagi, *Japanese and Japanese-Americans*, 77, 70. The earliest ad by merchants selling soybeans, among other products, did not appear until 1918, however. Ibid., 82.

[43] Ibid., 39

As with tofu, soybeans simply appeared wherever the Japanese landed. In 1851, the first Japanese to set foot in California – the crew of a coastal vessel discovered drifting in the open ocean by a New England ship headed for San Francisco – carried with them soybeans viable as seed, perhaps a part of the provisions they had managed to salvage from their floundering boat. Dr. Benjamin Franklin Edwards, of Alton, Illinois, paid them a visit – two years before the Perry Expedition, they were something of a sensation – and received from them a gift of "Japan peas" which he then planted in Illinois (marking the earliest recorded presence of soybeans in that state) and passed on to other amateur horticulturalists in Ohio and Massachusetts.[44] Thus soybeans crossed the cultural divide. The same cannot be said for tofu fifty years later, which accompanied the Japanese as they adapted old traditions to new lands but did not pass from them to the broader population.

When Tsuru Yamauchi arrived in Hawaii in 1910, tofu was already there, although the earliest listing for a tofu shop in Hawaii would appear only years later in the 1923 Honolulu City Directory. She later recalled that the people who made the tofu she purchased "carried it by foot from Waipahu," the town nearest the sprawling cane fields.[45] It was probably not made by a craftsman, but by an Okinawan wife much like herself, selling tofu as one of numerous side businesses. As another woman recounted years later, "For fifteen years I made tofu. Every morning I got up at two o'clock to start making it. I also raised pigs . . . In the afternoon, I washed clothes for single men in the

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[44] "The Japan Pea, " *Moore's Rural New Yorker* 4:7 (Feb. 12, 1853), 54; quoted in William Shurtleff and Akiko Aoyagi, *Bibliography of the Soybean Plant: Nomenclature, Physiology, Morphology, Botany, Taxonomy, and Wild Soybeans* (Lafayette, CA: Soyfoods Center, 1992), 52; first cited by Theodore Hymowitz, "Introduction of the Soybean to Illinois," *Economic Botany* 41:1 (Jan. 1987), 28-32.
[45] Yamauchi Oral History, 494

camp. I also learned dressmaking and tailoring. . . . I wanted to make enough money to send our children to schools."[46]

Yamauchi and her growing family ate tofu only once during most weeks, perhaps twice one week out of the month. She considered this a deprivation, of a piece with other hardships. She and her husband slept on a futon in a partitioned cottage, set in the middle of the canefields, which they shared with other workers: "If you looked around at the walls, you would see lime on unplaned wood with open knotholes . . . If you went out you would see how everything was just stuck right in the red dirt."[47] The red dirt clung to clothing, which she scrubbed, soaked and boiled in the community bathhouse. She worked variously in the fields – using a hoe to weed or to repair the ditches that carried water to the cane, always under the watchful eye of the luna (now without a whip) – and as a cook for the camp, preparing rice and udon noodles early in the morning. She also grew radishes at the edge of the canefield, which she pickled in miso and included in the workers' bentos for lunch.[48] When the cane did poorly, and money was scarce, they bought food at the plantation store on credit. They ate salted salmon and bread without butter.

Tofu might help recreate a sense of home, but it was insufficient. Impoverished as Okinawa was, Yamauchi promised herself that she would return there in ten years: "Ten years at the most. That's how lonely I was then." [49]

[46] Kimura, 66
[47] Yamauchi Oral History, 489
[48] Ibid., 496
[49] Ibid., 489-490

The Missionary: Harry W. Miller

On the leg from Vancouver, British Columbia, to Victoria¸ Harry W. Miller and his fellow medical missionaries on the *Empress of India* felt confident that they would be good sailors, as they did not feel the least bit sick. Then, sometime after they had gone to bed, they hit the open ocean. The two male missionaries, who shared a cabin, were too ill to check on the state of their wives and two nurses. For thirteen days, Miller could barely eat, drink or walk; urged to get fresh air, he managed to crawl up a gangway and lie plastered to a deck chair. As he stood up again on terra firma in Yokohama, it seemed to Miller that the buildings swayed and bucked. Even as he recovered, he vowed to himself that, once in China, he would stay there: "Never will I cross the ocean again [and] expose myself to such a fortnight of terrible sickness."[50]

The next stop after Yokohama was Kobe, where they spent an evening with a couple who had been their classmates at the American Medical Missionary College and who were hungry for news from home. The wife in turn prepared for the group, still half-starved from their seasick passage, a sumptuous feast of Japanese dishes, including one that particularly caught Miller's attention: a "nice roast" made from tofu. It reminded Miller of an egg soufflé. This was the first time he had heard of the soybean.[51] His interest would not have been simply a casual fascination with an exotic food: he and his dining companions belonged to the Seventh-Day Adventist Church, which promoted vegetarianism, and which even then sought novel substitutes for meat in American meals. But at the meal in Kobe, there was little time to investigate: mostly they simply "ate, and

[50] Harry W. Miller, typewritten memoir transcribed from voice recordings, ca. 1958, Department of Archives and Special Collections, Del E. Webb Memorial Library, Loma Linda University, Loma Linda, CA, 52-53.
[51] Miller Memoir, 250.

ate, and ate, and visited," lingering so long that they almost missed the *Empress* as she sailed for Shanghai.[52]

If Tsuru Yamauchi often had little say in her fate, Harry Miller's passage to China was the culmination of a series of willful choices. Some of these reflected his ambition, which found ample scope within a growing religious organization. The rather sudden decision of Miller and his wife to go to China, on the other hand, was a seeming rejection of his own promising future in medicine. Indeed, this may have been what appealed to him most about the venture: the magnitude of his sacrifice was proof of the depth of his faith. At the same time, his obedience to a greater cause permitted him a moment of rebellion against a mentor whom, later in life, he would strive to emulate as a surgeon, sanitarium director, and inventor of new foods.

The Seventh-Day Adventist Church had its origins in the Millerite movement of the 1840s, whose leader, William Miller, argued that, on the basis of a passage of the Book of Daniel, Christ would return sometime during 1843. Going by the Hebrew calendar, this meant sometime between March 1843 and March 1844. When April 1844 arrived, he recalculated and set an even more specific date: October 22, 1844. In the wake of the Great Disappointment that followed, various Millerite groups – who had never joined together in an institutional church – coped by calculating a new date or alternately by reinterpreting the meaning of October 22.[53] Some argued that an event had occurred on October 22, but in heaven rather than on earth: like a high priest of ancient Israel cleansing the Temple in preparation for the annual Day of Atonement, Christ had entered a celestial sanctuary and cleansed it with his own blood. In the process, he had shut the

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[52] Miller Memoir, 54.
[53] Anne Devereaux Jordan, *The Seventh-Day Adventists: A History* (New York: Hippocrene Books, 1988), 36-37

door behind him, denying salvation to all those who had doubted the October 22 prophecy.

In December 1844, Ellen G. Harmon, then sixteen, confirmed the truth of the "shut door" while in a visionary trance.[54] She persuaded a small number of other Millerites, including future husband James White, of her prophetic gift. She also convinced her followers that God intended the Sabbath to be honored on Saturday. This group, through years of itinerant ministry and prolific publication – and by the force of Ellen White's personality – was able to slowly coalesce a following. As the preponderance of believers shifted to the west, so did the Whites, eventually settling among a core of followers in Battle Creek, Michigan, where the Seventh-Day Adventist Church was formally established in 1863. On June 5 of that year, White had a vision that people "should take special care of the health God has given us" by avoiding "intemperance of every kind, – intemperance in working, in eating, in drinking, and in drugging" and by availing themselves of "God's great medicine, water, pure soft water, for diseases, for health, for cleanliness, and for luxury."[55] Three years later, the Adventists took a step that would ultimately make them, out of all proportion to their numbers, a large influence on the way Americans would eat in the next century: they founded a sanitarium, the Western Health Institute.

White's conception of the laws of health reflected her involvement in the Water Cure movement (or *hydropathy*), which advocated a drugless mode of healing involving, as White's vision indicated, the use of water in multifarious ways, including damp compresses and bracing showers, in addition to simply drinking it. With roots in Austria,

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[54] Seventh-Day Adventists 47; Ronald L. Numbers, *Prophetess of Health: Ellen G. White and the Origins of Seventh-day Adventist Health Reform* (Knoxville: University of Tennessee Press, 1992), 14-16.
[55] Numbers, 81.

it appealed to American temperance reformers, who saw water as a pure alternative to alcohol. The Hydropaths did not favor sulfurous hot springs – the traditional sites of fashionable resorts where wealthy invalids "took the cure" – but clear, pure water consumed in conjunction with a highly regulated diet. That diet, in turn, had its origins in the health crusade of Sylvester Graham, who in the 1840s inveighed against the use of all stimulants: not just alcohol, but tobacco, tea, sugar, spices, white flour, and meat. White became aware of the movement in 1863 when a treatment recommended in an article by hydropath James Caleb Jackson cured her two sons of what seemed to be diphtheria.[56] The article also outlined the basic principles of health in terms similar to White's later vision. After her vision, she visited Jackson's sanitarium in Dansville, New York, hoping to duplicate its program (without the card-playing and dancing) in an institution that kept the seventh day sacred.[57]

The attraction of White to hydropathy was not entirely an accident of biography. Throughout the nineteenth century, unorthodox religious movements had an affinity with alternative medicine,[58] linked in part by a focus on the links between body and spirit. Graham based his dietary strictures on a vitalist physiology which envisioned life force as something distinct from and not reducible to chemical processes, which were associated with decomposition and death.[59] Conversely, it was vital force that transformed dead matter into living tissue, with some foods – the ones to be avoided, such as meat –

[56] Ibid., 76.
[57] Ibid., 93.
[58] Charles E. Rosenberg, *The Cholera Years: The United States in 1832, 1849, and 1866* (Chicago: University of Chicago Press, 1987), 162.
[59] Stephen Nissenbaum, *Sex, Diet and Debility in Jacksonian America: Sylvester Graham and Health Reform* (Chicago: Dorsey Press, 1980), 88. Graham was influenced by French physiologist Bichat's famous definition of life as "the totality of those functions which resist death," which allows a mechanistic interpretation.

draining more vital force than others during digestion. A weakened life force in turn left the body vulnerable to disordering external influences: that is, disease. Stimulants were especially pernicious because not only did they consume life force, but provided a counterfeit sense of vitality in its place.

Vitalism did not necessarily equate physiological life force with the soul, but some slippage was perhaps inevitable: White was not alone in arguing that stimulants excited the animal passions, and that transgressions against the laws of health led inescapably to transgressions against God's moral law. There were other Adventist beliefs moreover that inclined them to an abstemious vegetarian diet. They honored the prohibition on pork, then America's favorite meat. Like the Mormons, Adventists believed that Christ would grant physical immortality, and that in the meantime the body should be respected as sacred. White abhorred immodesty and extravagance, advocating plain dress and simple living. Finally, Christian vegetarians had argued long before Graham that flesh-eating had arrived with the Fall and that a non-meat diet was one element of Eden that could be recovered even before Christ's return. White herself wrote in 1864 that "God gave our first parents the food [and it] was contrary to His plan to have the life of any creatures taken. There was to be no death in Eden." In 1866 she insisted further that "God has bountifully provided for the sustenance and happiness of all creatures; if His laws were never violated, . . . health, peace, and happiness, instead of misery and continual evil, would be the result."[60]

Even so, White's commitment to vegetarianism wavered over the years. She never made her health recommendations a test of fellowship – although smelling of tobacco

[60] Karen Iacobbo and Michael Iacobbo, *Vegetarian America: A History* (Westport, CT: Praeger, 2004), 98.

ruled out candidates for the ministry – and the American farm families who joined her church often did not become vegetarians. She herself would return to eating meat later in life before giving it up entirely in her final decade.[61] The importance of the Western Health Institute, as well as the other sanitariums, schools and colleges that the Adventists founded, was that they institutionalized the vegetarian regimen, remaining strict where Adventist households backslid. And as the sanitariums came to treat non-Adventists, they became important sites for spreading vegetarianism and, crucially, for inventing new, more palatable foods. This was especially true of the Western Health Institute – renamed the Battle Creek Sanitarium (or simply The San) – when it came under the direction of Dr. John Harvey Kellogg, a brilliant young Adventist who had insisted on receiving, at the White's expense, orthodox medical training in addition to a course in hydropathy.

Kellogg would transform the American diet. His inventions of granola and flaked cereal reshaped the American breakfast. His tireless promotion of peanut butter – which he most likely was not the first to invent, as he often claimed[62] – helped to make it a fad food and eventually a staple of the American lunch. His assault on the canonical American dinner, in which meat figured prominently, was less successful but no less creative. From his perch in Battle Creek and through thousands of lectures, he was the America's most popular and forceful advocate for vegetarianism, even making it faddish in high society for a time.[63] But as the force of his personality and national reputation as

[61] Numbers, 171-72, 174.

[62] Andrew F. Smith*, Peanuts: The Illustrious History of the Goober Pea* (Urbana, IL: University of Illinois Press, 2002), 30.

[63] One of his followers was "Mrs. John B. Henderson, society leader, mistress of the beautiful Boundary Castle," who wrote a vegetarian cookbook and served a meatless dinner for the National Society for the

a surgeon attracted a greater share of wealthy non-Adventists to The San, it began to resemble the kind of fashionable resort that White abhorred, especially as she began more vehemently promoting agrarian values.

As early as 1902, when she pronounced Battle Creek under a "sword of fire" for its worldliness, she began to relocate the General Conference to the east coast. She dismissed New York City as "too near hell," settling on the rural environs of D.C.: "Let the light show forth from the very seat of government."[64] Her prophecy became literal as several Adventist buildings burned down, including The San. Kellogg immediately drew up plans for a six-story Italian Renaissance pile which White considered overly grandiose, and promised to finance part of the construction of his new sanitarium by writing a book. *The Living Temple* couched Kellogg's vitalist health message in a florid theism – intended to be devout – that so poetically described the presence of God's intelligence in everything, animate and inanimate, that it struck Adventist leaders as heretical pantheism, forcing Kellogg to make drastic edits.[65] Disaffected, Kellogg sided with a group of Adventist dissidents who published a pamphlet casting doubt on White's prophetic power, suggesting that she plagiarized her health doctrines from other writers. Kellogg was expelled in 1907 and gained complete control of The San, which became thoroughly cosmopolitan.[66]

Even as it was being torn apart by the tensions between its rural and urban factions, Adventism provided a link between the country and the city for a young Harry Miller, who was born in 1879 on a farm in Laura, Ohio. Recording his childhood memories for a

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Study and Prevention of Tuberculosis which included "Broiled Slices Pinenut Protose" and "Protose Timbale." "Feast Without Meat," *Washington Post*, 19 May 1905, 4.

[64] Gerald Carson, Cornflake Crusade (New York: Rinehart & Company, Inc., 1957), 136.

[65] Ibid., 142.

[66] Ibid., 142.

biographer in 1958, Miller recalled himself as an honest, hard-working youth – responsive to his stern father's demands and constitutionally incapable of lying – and, alternately, as a curious boy, full of life, who frequently got into mischief.[67] His parents converted to Adventism when he was a teenager, embarrassing him with their strict enforcement of the Saturday Sabbath, but a visiting minister, who helped him husk corn, swayed him.[68] He was baptized during a camp meeting in Newark, Ohio, which he had reached by riding his mother's low-gear bicycle 120 miles over gravel and dirt roads, his first time out of Miami County.[69] As with the voyage to China, physical suffering made it a true rite of passage. It was the summer after his graduation from his local school, and he was recruited to Mt. Vernon Academy, a failed sanitarium in the Ohio countryside – established against Sister White's wishes by followers eager to duplicate The San's success – which had recently been converted to a school reflecting White's new passion for agrarian education.[70] It was one of a series of stepping stones that providentially appeared just as Miller needed it.

His parents scraped together enough money to buy him a train ticket and outfit him with clothing, but he otherwise had to earn his tuition at Mt. Vernon: he made the early morning milk run for the school, helped in the kitchen, and canvassed the countryside selling Adventist literature during the summer. He thrived in the "puritan-strict" atmosphere of the school and on its vegetarian diet of "whole grains, nuts, vegetables,

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[67] Miller Memoir, 5-7, 67.
[68] Ibid., 9.
[69] Ibid., 13-15.
[70] Ellen G. White, St. Helena, CA, to addressee unknown, 20 May 1890, in *Manuscript Releases, Vol. 20* (Hagerstown, MD: Review and Herald Publishing Association, 1993), 378; Ellen G. White, Auckland, NZ, to J.H. Kellogg, 19 Feb. 1893, in *Manuscript Releases, Vol. 6* (Silver Spring, MD: E.G. White Estate, 1990), 227; Roger Coon, "Minneapolis 1888: The 'Forgotten' Issue." (John Osborne Lectureship, Loma Linda University, Loma Linda, CA, 23-25 Oct. 1988, http://text.egwwritings.org/publication.php?pubtype=Book&bookCode=1888FI), 30.

and fruits"; at home, his family had regularly eaten meat.[71] He was inspired by Adventist health doctrines to become a doctor, arriving at Battle Creek's American Medical Missionary College in 1898, which had been established just four years earlier to supplement an existing school of nursing. White recognized the value of medical missionaries as spearheads of evangelism, and Kellogg was eager to produce more physicians in his own image. Miller was just that. By his junior year, he was instructing classes in anatomy and had become adept in surgery. He studied at the College's branch in Chicago, which offered resources to students that Battle Creek could not, and considered transferring to the Rush Medical School. Kellogg persuaded him to graduate with his class, lest he demoralize the others. This too was providential, as he would soon marry the youngest of his classmates: Maude Thompson, one of several women training to become "lady physicians," whom he would for the rest of his life affectionately refer to as "Dr. Maude."[72]

As he had at Mt. Vernon, Miller worked his way through medical school. For a time, he worked as an office boy for Dr. Kellogg, who took a fatherly interest in him. His favorite job was as a tour guide ushering visitors through the Sanitarium and demonstrating Kellogg's many inventions: electrical devices for stimulating blood flow, mechanical contraptions for measuring the strength of each individual muscle in the body. The tour continued on to the Sanitas food factory, which offered free samples of granola and wheat flakes.[73] Miller would also have been familiar with nut-based meat analogs that Kellogg had developed in the 1890s, including Nuttose, which had the

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[71] Harry W. Miller, "A Legacy of Long Life," unpublished manuscript, n.d., Archives of the E.G. White Estate Branch Office, Loma Linda University, Loma Linda, CA, n.d., 1.
[72] Miller Memoir, 35.
[73] Ibid., 29.

consistency of cream cheese, and Nuttelene, a "delicate white meat as dainty and juicy as the breast of a spring chicken."[74] And in 1899, at the prompting of Assistant Secretary of Agriculture Charles Dabney, who worried about meat's high cost and agreed with Kellogg that "the craving of meat is an artificial one, like the taste for alcohol,"[75] Kellogg developed Protose.

Protose combined powdered wheat gluten with peanut meal and cooked the mixture until its consistency and flavor were "changed in a remarkable way": it resembled "potted veal or chicken" and had a "distinctly meaty odor and flavor." When chewed, "it showed a distinct fiber" and could be "masticated like tender meat"; when cooked it retained its form.[76] Kellogg strived to duplicate both the "dietetic and gustatory properties" of meat, having realized early on that an Edenic diet, to become popular, would have to accommodate the postlapserian eating habits of Americans. He received a patent for Protose in 1901, during the period Miller was giving tours, and the product remained popular through the 1930s.

Kellogg's patent, striving to be as broad as possible, suggested that other glutinous cereals and "oleaginous" legumes could be used. He later mentioned that he did not consider soybeans, which are richer in oil than peanuts, because he had not yet heard of them.[77] Dabney himself had suggested that Kellogg experiment with navy beans (which are starchy, not oleaginous). A year earlier, however, Dabney's own USDA had

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[74] Iacobbo and Iacobbo, 128.
[75] Ibid., 127.
[76] John H. Kellogg, "Vegetable-Food Compound," U.S. Patent 670283, 19 March 1901 (filed 3 June 1899), 1.
[77] Soyinfo Center, "Dr. John Harvey Kellogg and Battle Creek Foods: Work with Soy, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, http://www.soyinfocenter.com/HSS/john_kellogg_and_battle_creek_foods.php.

published a bulletin about the use of the soybean as a forage crop which included an appendix describing tofu and other Asian foods. This was excerpted in a number of health journals – *The Dietetic and Hygienic Gazette*, the *Sanitary Home*, and *The Phrenological Journal and Science of Health* – with which Kellogg might have been familiar.[78] If Asian soy foods did not influence Kellogg's development of Protose, however, Kellogg's analogs were part of Miller's mental luggage when he first encountered tofu.

After graduation, Miller and Dr. Maude interned in Chicago, where Miller's star rose rapidly. When the head of the surgical department retired, Kellogg anointed Miller to be his successor. The call to China was sudden. Miller would later recount how he had prayed to God, promising him to go anywhere in the Lord's service, when he contracted a potentially fatal infection while performing an autopsy.[79] The appeal for medical missionaries was passed on to Miller by one of his students, and Miller and Dr. Maude's decided to respond, recruiting another medical couple and two nurses. Kellogg himself made a special trip to Chicago to dissuade Miller from throwing away a promising future – but such arguments only confirmed to Miller that he was following God's will, not his own.[80] In the tug-of-war between rustic virtue and urban sophistication that typified Adventism at the moment, Miller was pulled to White's side and to her ethic of sacrificial service.

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[78] M.L. Holbrook, "The Science of Health: Vegetable Cheese," *The Phrenological Journal and Science of Health*, Sept. 1900, 88-89; "Vegetable Cheese." *The Dietetic and Hygienic Gazette*, June 1900, 340-341; *Soy Bean as a Forage Crop*, 21-23.
[79] William Shurtleff and Akiko Aoyagi, "Harry W. Miller," in unpublished manuscript, *History of Soybeans and Soyfoods, Past, Present, and Future* (Lafayette, CA: Soyfoods Center, ca. 1999).
[80] Miller Memoir, 49.

As he had at Mt. Vernon and the American Missionary Medical College, Miller entered the Adventist mission field in China near the moment of its inception. The failure of the Boxer Rebellion had brought a reformist faction to power in the Chinese government that welcomed western technology and, as teachers of western skills, Christian missionaries. The numbers of missionaries of all denominations increased sharply. While most still abided in the coastal cities, Erik Pilquist, the Millers' mentor, had begun his work under the auspices of the China Inland Mission (C.I.M.), an ecumenical organization long dedicated to reaching China's vast interior. Pilquist informed Miller's party that they would dedicate themselves to learning Chinese in a remote village deep in the central province of Honan.[81]

Pilquist's first order of business was to outfit the new missionaries after the Chinese fashion, explaining that there was no capacity in Chinese villages for laundering western clothes. This came as a surprise to Miller, who later claimed that he had supposed China to be a nation of laundrymen.[82] Pilquist's logistical argument did not account for his insistence that Miller adopt the *queue* and *mao-tze*, the pigtail and cap that signified Han subservience to the Manchu Dynasty. When C.I.M. missionaries had first adopted Chinese dress in the 1870s, they did so for strategic and spiritual reasons. Their goal was to "become Chinese to the Chinese" in order to better reach and convert them, as well as to avoid violent hostility. One C.I.M. missionary noted that after they had begun dressing in Chinese clothing, dogs stopped barking at them. C.I.M. founder Hudson Taylor – whose accounts of China the Millers read before leaving Chicago – argued that missionaries should follow the example of Christ, who, though divine, had adopted the

[81] "Dr. Miller's Life," typewritten insert, Miller Memoir, 2.
[82] Ibid., 3.

speech, dress and manners, save those that were sinful, of the mortals he was determined to save.[83] It thus provided missionaries like Miller a means to dramatize their commitment.

Immersion in Chinese life meant eating Chinese food. On their first evening on a three-day journey on foot to their mission station, they went without supper after entering an inn through the kitchen. “I never will forget the expression on the faces of the ladies of our group as they saw the black soot. . . . The cooks were wiping their faces and eyes with the towels as a result of the irritation of the smoke.”[84] They ate little, so that the time they arrived at the mission station, they were so starved that they hoped for a great feast, “but we found that the missionary lived on the food of the land. He and his wife and two children were quite accustomed to eat the diet of the people, which was rice and noodles.” They managed to eat some rice, and also peanuts in a syrup made from malted wheat that the family had on hand.[85]

Once in control of their own kitchen, Miller’s group quickly reconciled themselves to the local diet, occasionally supplemented with available Western canned goods. They purchased flour, sweet potatoes and peanuts from local vendors, often in large quantities that they attempted to store, giving them a reputation as enormous eaters among the local Chinese, who purchased small amounts on a daily basis.[86] They also ate tofu. Miller later described being curious, even then, about why the Chinese did not drink soy milk straight. He was told that it was only drunk by the elderly with poor digestion. The milk struck him as a more complete food, and he considered the coagulant commonly used in

[83] Frank Houghton, ed., *The Fire Burns On: C.I.M. Anthology* (London: China Inland Mission Overseas Missionary Fellowship, 1965), 115.
[84] “Dr. Miller’s Life,” 4.
[85] Ibid., 6.
[86] Miller Memoir, 63.

China – gypsum, or plaster of Paris – as akin to an adulterant, indicating his Adventist affinity to the pure foods movement.[87]

Their attention during these first years, in any case, were elsewhere as they embarked on the difficult and sometimes dangerous work of missionary outreach. They first had to learn to speak Chinese, spending the first year under the tutelage of a scholar, although the nurse who spent her time on the streets and in the market became fluent – and comprehensible to the local population – most quickly. They moved to separate villages after their year of language study, the Millers charged with setting up a hand printing press to publish tracts in Chinese. Miller had never operated a printing press before, and had to contend with organizing the 3,000 characters of its Chinese font, as well as a lack of proper rollers and recalcitrant ink that he ultimately learned to thin with castor oil. All the while, they operated a small dispensary where, in addition to providing small amounts of medicine, Dr. Maude cared for opium addicts and Miller performed minor surgeries – including cataract surgery – under the open sky to be free of the risk of falling dirt.[88]

In 1905 Dr. Maude became gravely ill. Miller himself had contended with dysentery – and would later suffer from recurring bouts of malaria – but Dr. Maude's malady, which plagued her in varying degrees for months, was mysterious. A notice in the *Journal of the American Medical Association* would list the cause of her death as *psilosis*,[89] a failure of the small intestine to absorb nutrients, leading to fatigue, diarrhea, and wasting away. She was the first Adventist missionary to die in China. After her death, Maude remained Miller's only regular Western companion in the village, as he would frequently visit her grave. Adventists believe that the dead are unconscious,

[87] Harry W. Miller, *The Story of Soya Milk* (Mt. Vernon, OH: International Nutrition Laboratory, 1941), 6-7.
[88] Miller Memoir, 86.
[89] "Medical News: Deaths," *Journal of the American Medical Association* 44 (3 June 1905): 1793.

awaiting resurrection. Despite the hope this belief provided, "these were hours and days of great loneliness and of great grief of soul."[90]

Missionaries from other denominations would sporadically visit, sometimes as patients, but Miller became fully immersed in Chinese life. He spoke only Chinese, and gradually came to think in Chinese and lose his command of English. He learned to cook Chinese food, and ate it exclusively. His parents wrote letters entreating him to come home, but he refused to leave his work or his wife's grave. After two years, the arrival of his youngest brother and a missionary couple – whom he outfitted with Chinese clothing – broke his isolation from other Americans. He finally consented at the end of 1907 to the summons of the Adventist General Conference to return to the States, ostensibly to make fundraising appeals to church groups, implicitly to find a new wife.

To avoid the long passage over the Pacific, he decided to travel overland by way of Manchuria, Russia and Europe. The journey allowed him a long reentry period, in which he gradually shed his Chinese trappings. He let the hair grow back on the sides of his head, where he had shaved it, "so I wouldn't be such an awful monstrosity and sight when I got back to the homeland."[91] The western clothes he had arrived in had shrunk, so that the sleeves only reached halfway between his elbows and wrists; his shoes had holes, though he was able to replace them with what he considered and odd-looking French pair in Peking. He carried little baggage, and it consisted mostly of curios (including opium pipes) that he thought would interest his friends back home.

The large Russian railroad cars were more comfortable than the small Japanese trains that took him through Manchuria – which the Japanese had recently wrested from

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[90] Miller Memoir, 87.
[91] Ibid., 88.

Russian control – but his inability to speak Russian caused him anxiety in the dining car. Upon reaching St. Petersburg, where he was hosted by fellow missionaries, he found that he had also lost fluency in English as well. He then traveled by way of Hamburg, Paris, and London, where he finally had a decent suit of clothing made but where communication was complicated by the local idiom and his own slow recovery of American English: as he translated his thoughts into English, he found himself using Chinese word order. The Atlantic was even choppier than he remembered the Pacific, but he had arranged for the shortest possible passage from England to the St. Lawrence River, which mercifully only took five days. His father was now an Adventist minister in New Brunswick, Canada, so he visited his family before entering the United States, by which time he had once again become, for the most part, American.[92]

He had left Chinese food behind, including tofu, much as he had his cap and pigtail. But he carried with him, as would many returning missionaries, the knowledge that soybeans were used to produce meat substitutes, a knowledge that would someday inform the ongoing tradition of Adventist food innovation.

The Plant Explorer: Frank N. Meyer

The son of a sailor, Frank Meyer showed no signs of seasickness during his passage from San Francisco to Yokohama (by way of Hawaii) in the late summer of 1905, despite a fierce three-day storm. In fact, he rather enjoyed the voyage: he found that he made friends easily at sea, and the captain – eager to trade stories about Meyer's birthplace, Amsterdam – invited him to dine at his table, where they were served by Chinese mess

[92] Ibid., 90-96.

boys in long queues.[93] Peking, on the other hand – which he had reached via Shanghai and Tientsin – troubled him. "You people in America haven't any idea of the filth here," he wrote to a friend. "In one place people are eating their dinner, while next to them ragpickers are emptying their bags. Opposite these parties is an open sewer into which refuse is dumped, and some men are sitting on the edge obeying the call of nature!"[94]

It would be pleasant to think that during his stays in Peking, where he returned between increasingly arduous treks into the countryside, Meyer gravitated to the more appetizing smells of a Chinese sweets shop – for among his early shipments to the USDA's Office of Foreign Seed and Plant Introduction (S.P.I.) was a sample of soybeans that, according to the attached description, were "roasted and sold in Peking as delicatessen."[95] Salted and roasted soybeans were eaten plain or included in sweets in both China and Japan, and Meyer collected these soybeans at the same time that he acquired samples of apricot seeds, "sold in Peking as 'almonds,'" which were also used in confectionery.

Whatever their origin, these soybeans did not loom particularly large in the shipment that arrived in Washington. The published S.P.I. inventory did not indicate how many seeds were in this sample, but even as little as one pound would have contained roughly 6,000 seeds. Meyer would have put them in a sack, tagged with a number (in this case, "17a," the "a" designating seeds), and packed them in a tin with other sacks of seeds. This particular shipment, sent in late December or early January and arriving at the end of

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[93] Isabel Shipley Cunningham, *Frank N. Meyer: Plant Hunter in Asia* (Ames, IA: The Iowa State University Press, 1984), 24, 31.
[94] Cunningham, 33.
[95] U.S. Department of Agriculture, Bureau of Plant Industry, *Seeds and Plants Imported During the Period from December, 1905, to July, 1906: Inventory No. 12; Nos. 16797 to 19057* (Washington, D.C.: Government Printing Office, 1907), 55. The use of "delicatessen" as a plural for specialty food was common English usage at the time, not an indication of Meyer's Dutch origins.

February, included 112 packages of seeds, including three other kinds of soybeans, eight kinds of radish, six kinds of cabbage, four kinds of sorghum, three kinds of cowpeas, three kinds of chestnut, three kinds of oak, three kinds of persimmon, two kinds of millet, and two kinds of adzuki beans. Each was assigned an S.P.I. number: the soybeans sold as delicatessen became number 17852.

Because they were also food, soybean seeds were relatively easy to come by. Other fruits and vegetables that he encountered in markets presented more of a challenge, as he needed to track down to their sources in the countryside to find sufficient stores of seed – and, even then, he often found that farmers had only enough for their own needs.[96] The most desirable fruits were not grown from seed, but propagated by grafting the stems of favored plants onto the roots of others. In the market of Tientsin, he had come across "a strange persimmon, perfectly seedless," as well as "strange quinces [that] look like fine yellow pears . . . and they are melting in one's mouth." In search of cuttings, he walked twenty miles outside the city, but it was only later, during a ten-day journey west of Peking, that he finally located the persimmons – but still no "quince-pears."[97] It was the hunt for this type of quarry that absorbed him. Soybeans were incidental: despite their availability, Meyer collected only a half-dozen samples during his first eight months in China.[98]

The unsavory sights and smells of Peking soon paled next to the hardships Meyer endured in the Chinese countryside. Plant exploration as a rule took place on foot, and Meyer in particular was a heroic walker, but the roads in China were especially bad and pack animals scarce. On long treks in the fall, he was exposed to icy winds and dust

[96] Cunningham, 34.
[97] Ibid., 32, 34.
[98] Seeds and Plants Imported No. 12, 55-56, 72.

storms, once nearly blown from a precipice five hundred feet above a river. At nights he slept on brick beds in inns that swarmed with lice, centipedes, and the occasional scorpion. In one inn, he saw on a wall in French the "amusing and disgusting inscription: 'Hotel of 1000 Bedbugs'"; he slept in the bitter cold rather than start a fire that would rouse the bugs. And, as he wrote to a USDA colleague, "when I tell you that chamberpots and water closets are unknown, you may imagine the rest." [99] A solitary man by temperament, he often felt lonely, having little fellow feeling for the Europeans in the cities, who led "fast lives and [went] to the dogs" or the Chinese who accompanied him on treks, guides and coolies who complained about his arduous itineraries.[100]

Shipping his finds to the U.S. was a painstaking labor: he had to sew the thousands of cuttings he obtained into burlap sacks, packed with damp peat or moss. Learning later that bundles arrived moldy or desiccated, he experimented constantly with packing methods; seeds he packed in charcoal or coated with paraffin.[101] He waited for hours at post offices and express companies, only to find that they did not have the proper forms. "Things go very slow here," he wrote to his superior at the USDA, "and one who is in a hurry wears himself out and accomplishes nothing."[102]

He was also plagued by the bureaucratic demands of the USDA itself, whose accountants instructed him to record all transactions in Chinese currency – despite the fact that numerous brass, copper, and silver coins were in circulation, requiring him to carry hundreds of pounds of Mexican or Hong Kong dollars at all times – and to file all expenditures within twenty days of a transaction, despite the fact that he was often in the

[99] Cunningham, 35.
[100] Ibid., 45.
[101] Ibid., 43.
[102] Ibid., 36.

field for months at a time.[103] The Department required that he use elaborate blue and white vouchers that Chinese merchants often refused to sign, and it routinely denied reimbursement for "excess" baggage.[104] "Have these gentlemen who drew up all these regulations," he inquired, "ever been out in a foreign country like China?"[105] Whatever the rigors of his treks, he invariably grew most depressed filling out paperwork.[106]

Meyer also faced the hostility of the population in the countryside, who called him a "foreign devil," and the ever-present risk of bandits. Later in 1906, while in the Siberian town of Khabarovsk, he was attacked by three men, only escaping by plunging his bowie knife into one of them.[107] This exploit won him press coverage in the U.S. (which Meyer disliked for its sensationalism)[108] through the efforts of S.P.I. Director David Fairchild, who was eager to publicize the difficult, dangerous and valuable work conducted by his office. As Fairchild passed along excerpts of Meyer's letters to magazine writers, the Dutch botanist was transformed into a figure from a pulp western. *The Outing* magazine recounted in 1908 that, while venturing into a hilly northern region in search of the finest peaches in China, Meyer's party was warned by soldiers that a band of robbers was roaming the country. "At the word, the coolies jumped from sleep, ghastly pale and trembling with fright. They threatened to desert. Meyer forced them to go on. . . ." The following day they encountered "a ragged mob gathered in a farm field making a pretense of work, with bludgeons and huge swords ready to hand." These were six-foot tall northern Chinese, not "the dwarfed specimens seen in Oriental colonies of America."

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[103] Ibid., 41, 45.
[104] Ibid., 76, 68.
[105] Ibid., 45.
[106] Ibid., 72.
[107] Ibid., 56.
[108] Ibid., 73.

The sun "glinted on the long nickel-plated barrel of Meyer's biggest pistol" and the "leader of the brigands nodded to his followers. They dropped their bludgeons and made still greater pretense of working."[109]

In another incident, while scouting out ahead of his group, he was awoken in a roadside hut, where he had taken shelter, by a man pointing a sword at his throat. Again, the men fled when they caught sight of the "flash of his pistol-barrel," which he did not need to fire as "Americans have a world-wide reputation for shooting to hit." This turned out to be a misunderstanding, cleared up as soon as Meyer's interpreter caught up, "and all sat down to a smoking of pipes like Red Indians."[110]

The evocation of the American frontier was not unusual. Many Americans imagined at the time that, with their own frontier closed, China would provide an outlet for American enterprise and energy and opportunities for both adventure and reform.[111] In one way, at least, China was the Wild West. Among the myriad hassles and inconveniences Meyer noted, he never mentioned any harassment from Chinese officials about the valuable plant materials he was sending to the U.S. or any restrictions placed on their shipment. As America pursued an Open Door policy in China to ensure that all European powers had equal access to the Chinese market, here was another open door: the unimpeded transfer of biological wealth, with the intention of fostering crops and industries in America that would compete directly with Chinese goods, thus profoundly

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[109] "The People Who Stand for Plus: Frank N. Meyer, Scientific Explorer for the United States Government in China and Russia," *The Outing Magazine* 53:1 (Oct. 1908), 73-74.

[110] "The People Who Stand for Plus: Frank N. Meyer, Scientific Explorer for the United States Government in China and Russia," *The Outing Magazine* 53:1 (Oct. 1908), 73.

[111] Jerry Israel, *Progressivism and the Open Door: America and China, 1905-1921* (Pittsburgh: University of Pittsburgh Press, 1971), xi.

transforming the trade between the two countries whatever its official framework.[112] And over the course of the next century, nowhere would this transformation be greater than in the case of soybeans, no matter how unobtrusive their initial entry into the U.S.

Meyer, born Frans Meijer in 1875, was well suited to "skim the earth in search of things good for man," as he put it.[113] Doted on by a mother and two sisters, he was nonetheless driven by a restlessness that seemed to put settled happiness outside of his reach. From an early age, he was entranced by travel stories and most at home outdoors; even as a boy, he envisioned a future career exploring the world as a botanist.[114] His education might have ended after the sixth grade, however, if he had not successfully sought a job at the Amsterdam Botanical Garden, whose renowned directory, Hugo de Vries, he impressed with his intelligence and work ethic. By eighteen, Meijer supervised the experimental gardens and was as skilled as de Vries himself in propagating plants. In his free time, he explored Holland by taking 50-mile walks. After ten months of compulsory military service and a six-month leave to attend the University of Groningen, he journeyed the 100 miles back to Amsterdam on foot, sleeping in haystacks and drinking from streams.[115]

He fell in with a bohemian crowd that, inspired by the Theosophy movement, engaged in long discussions of Buddhism and Schopenhauer, giving Meijer a philosophical vocabulary to express his keen sense of the transitory nature of happiness. "I am pessimistic by nature," he would write, "and have not yet found a road which leads

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[112] Indeed, David Fairchild, head of S.P.I, promoted a "philosophy of a free exchange of plant varieties between the different nations of the world," even to peasant farmers who, in giving him cuttings, might undermine their own livelihoods. David Fairchild, assisted by Elizabeth and Alfred Kay, *The World Was My Garden: Travels of a Plant Explorer* (New York: Charles Scribner's Sons, 1938), 168, 202.
[113] Cunningham, 55.
[114] Ibid., 10.
[115] Ibid., 11.

to relaxation. I withdraw from humanity and try to find relaxation with plants."[116] He left the Botanical Garden for a utopian community inspired by Thoreau's *Walden*, but soon left to walk through Belgium, Germany, France and Switzerland, observing plants along the way. Having long dreamed of seeing the orange groves and vineyards of Italy, he traversed the Alps guided by map and compass, almost dying in a blizzard. He spent a year in London working in commercial nurseries, saving money to cross the ocean. America held a special allure for him, perhaps as the source of Theosophy and Thoreau, or perhaps because he had learned about it through the stories of James Fenimore Cooper and still imagined that wild Indians inhabited Virginia.[117]

In November 1901, he arrived at Ellis Island, where he became Frank Meyer. He found work at the USDA greenhouse on the Mall, and made lifelong friends at the Department, but restlessness compelled him to board a train for Los Angeles in September 1902. This pattern dogged him: elation at new landscapes followed by the weariness of familiarity. He eventually got bored of California's perpetually sunny skies. "[T]he more a man travels, the less he feels himself attached to a certain place," he wrote to a friend who was urging him to "stick to" work he had obtained at the USDA plant introduction garden at Santa Ana.[118] He worked at a commercial nursery in Montecito through 1903, then embarked on a journey through Mexico, walking 240 miles from San Blas to Guadalajara, eating whatever was available along the way, including stewed dog meat. He delighted to see wild relatives of familiar domesticated plants, and sent varieties – at his own expense – to the USDA garden in Chico. Diverted by a yellow fever outbreak at Vera Cruz, he returned to the U.S. via Cuba, landing in New Orleans

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[116] Ibid., 13.
[117] Ibid., 9.
[118] Ibid., 15.

and gradually working his way up to St. Louis, where he found work in the Botanic Garden – supervising the propagation of thousands of plants – and attended the World's Fair.[119]

During Meyer's wanderings, his name had likewise circulated in Washington. The offer to accompany a government plant-seeking expedition to China came unexpectedly in March 1905, just as he was tiring of the smoke of St. Louis. It seemed to him to be a miracle. By the beginning of August, he would be crossing the Pacific, now as the leader of the expedition. In the meantime, he had won the confidence of David Fairchild.

Fairchild had catalyzed the establishment of the Office of Foreign Seed and Plant Introduction eight years earlier, and – even as he took a leave during S.P.I's early years to gather plants himself – he was its animating force. Fairchild, born in 1869, had been nurtured within America's evolving agricultural education and research establishment.[120] His father was a long-time president of the Kansas State College of Agriculture, one of the land-grant colleges founded in the wake of the 1862 Morrill Act and the school where Fairchild earned his degree in botany. The elder Fairchild was a deeply religious man, but saw no contradiction in being equally devoted to the cloistered realm of research science; he actively lobbied for passage of the 1887 Hatch Act which established state agricultural experiment stations supported, in part, by the federal government.[121] David was a shy young man entranced by the revelations of microbiology – his specialty was plant pathology – and might have become absorbed in a life of scientific contemplation if not for the recurring influence of Barbour Lathrop.

[119] Ibid., 18-20.
[120] Fairchild, 11-12.
[121] R. Douglas Hurt, *American Agriculture: A Brief History* (Ames, IA: Iowa State University Press, 1994), 193.

Lathrop was a wealthy, imperious, frequently dyspeptic world traveler – he would one day offhandedly estimate that he had circumnavigated the globe eighty-three times[122] – who had been a journalist in San Francisco, and a founder of the Bohemian Club there, before coming into his father's money. He was heir to the Cavalier spirit of his Virginia mother – at 14, he had attempted to join the Confederate Army – but also had something of his New England-born Abolitionist father in him. He wished for his travels to serve a useful and practical purpose. As a journalist, he had visited Peru in the 1880s, where he observed laborers chewing coca leaves; he sent samples to the California Academy of Sciences, where they were ignored, leaving it to a German chemist to later isolate cocaine.[123] This may have sparked his interest in useful plants, the pursuit of which became his passion despite his lack of botanical training. He encountered Fairchild in 1893 on a ship en route to Europe, where the younger man was to deepen his scientific training at the Zoological Station in Naples. He ascertained Fairchild's latent promise, much as a plant explorer might notice the potential of an otherwise unprepossessing grass, and set about cultivating it.

He funded Fairchild's dream of doing research in Java, only later to find him there entranced by the study of tropical termite societies. Lathrop pulled him away to the coast of Sumatra to collect plants, his patience running out when Fairchild lagged behind collecting termites. "If you're going to travel with me, I'll show you the world; but you can't stop every minute and collect specimens or you won't get any general idea of the countries we travel through," he remonstrated.[124] It was the first harangue of many that,

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[122] Marjory Stoneman Douglas, *Adventures in a Green World: The Story of David Fairchild and Barbour Lathrop* (Coconut Grove, Miami, FLA: Field Research Projects, 1973), 9.
[123] Ibid., 11.
[124] Fairchild, 82.

in the course of years of travel together, would ultimately teach Fairchild social graces, travel savvy, but – above all – speed.

Fairchild would eventually become a voluble and sophisticated man of the world, with a gentler and more diplomatic temperament than Lathrop's. Lathrop once visited the Commissioner of the Department of Agriculture to inquire after plants he had sent, only to be told that they were "no good to us. We don't any land to grow them in." He glared at the Commissioner, returning later with a deed to ten acres in Maryland; nothing came of the donation.[125] In 1897, on the other hand, when Fairchild rejoined the USDA, where he had earlier worked in the office of Plant Pathology, he won the allegiance of A.C. True, the head of the Office of Experiment Stations. Together they presented a plan to Agriculture Secretary James Wilson to add a clause to an appropriations bill to divert $20,000 from the $100,000[126] Congressional Seed Distribution budget – a means by which congressmen could win favor with constituents by sending them what were in Fairchild's opinion fairly worthless seeds – to a new Section of Foreign Plant Introduction. Wilson agreed, but with the proviso that "Seed" be added to the section's title to enable smoother passage. Fairchild objected to the clumsiness of the new name – seeds after all were parts of plants – but decided not to make an issue of it.[127]

While waiting for the appropriation to pass, Fairchild accepted a temporary position in the Forestry Division and set to work writing a bulletin explaining the new section's goals and methods. *Systematic Plant Introduction*, issued in early 1898, anticipated the transition from frontier expansion to colonial acquisition, noting that "all colonizing nations have established botanic gardens in their new colonies, one important function of

[125] Douglas, 12.
[126] Ibid., 21.
[127] Fairchild, 106-07.

which is to secure and distribute exotic economic plants throughout the colony."[128] On the other hand, Fairchild emphasized that the continental U.S. was the most profitable destination for new plants. There was no other "country in the world tilled by progressive cultivators whose connected territory presents such varied conditions of soil and climate as ours." Plant explorers were to carry a map of this geography in their heads, linking each foreign region to a climatically similar region in the U.S. in the effort to find better crops for American farmers.[129] Of special interest were crops – including new varieties of traditional crops – that could thrive in the arid southwest or frigid far north of the country. The agricultural frontier, waiting to be settled by plant immigrants, was far from closed.

China held the most promise of any field of plant exploration. Its rich wild flora had not been touched by the last ice age that had covered much of North America and Europe, and it had a history of cultivation that stretched back thousands of years.[130] Its continental expanse matched that of the United States. Augustine Henry, a former Irish consular official in China and renowned botanical collector, wrote to Fairchild that "the interior of China is one vast treasure of plants, useful, ornamental, and unknown." There were few missionaries and diplomats in the Chinese interior, so Henry counseled "not [to] waste money on postage. Send a man!"[131] Fairchild tried to convince Henry himself

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[128] Department of Agriculture, Division of Forestry, *Systematic Plant Introduction: Its Purposes and Methods*, by David Fairchild (Washington, D.C.: Government Printing Office, 1898), 7. Indeed, the following year Fairchild and Lathrop visited the Philippines to investigate its crop needs, finding it so militarized that "a cavalry officer [was] in charge of the little Botanic Garden. He may have known his manual of arms, but he did not know one plant form another." Fairchild, 152-153.

[129] *Systematic Plant Introduction*, 13.

[130] Cunningham, 6; F.H. King, *Farmers of Forty Centuries or Permanent Agriculture in China, Korea and Japan* (New York: Harcourt, Brace & Company, 1911).

[131] *Systematic Plant Introduction*, 19. Fairchild and Lathrop's own plans for journeying up the Yangtze in the spring of 1902 were scuttled by an outbreak of cholera. Farichild, 214.

to take the job. He then turned to Charles Sprague Sargent, director of the Arnold Arboretum at Harvard, promising him an able assistant. He heard of Meyer through Adrian J. Pieters, the director of S.P.I. in Fairchild's absence who had befriended Meyer during his stay in Washington. Meyer's feats of pedestrianism, his skill as plant propagation, his willingness to send plants from Mexico at his own expense: all of this convinced Fairchild to wire Meyer a job offer.[132]

He first met Meyer months later, after Sargent had withdrawn to an advisory role. Meyer arrived at Fairchild's office on a hot summer day in a striped shirt drenched with sweat, its colors running, and sat across from the suave Fairchild. Meyer related how, when he worked at the plant introduction garden in Santa Ana, bamboos collected by Fairchild and Lathrop "had been planted by a stubborn plant pathologist who did not know enough to mulch them and would not let Meyer do it either. They had died in consequence, and, as Meyer [spoke] about it, his eyes filled with tears."[133] Fairchild knew he had his man.

In 1898, when S.P.I. began its work, there was only a handful of varieties of soybean grown in the United States.[134] A variety is a plant population with consistent characteristics from one generation to the next, and one of Fairchild's goals was to import as many varieties of economically important plants as possible in order to grow them in varied climates and to aid the work of breeders.[135] Soybeans had been planted on American soil since at least 1765, when a former seaman of the East India Company

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[132] Cunningham, 8-9.
[133] Fairchild, 315.
[134] William J. Morse estimated that there were at most eight, a figure that has become canonical. U.S. Department of Agriculture, Office of Forage Crops, Bureau of Plant Industry, *Soy Beans: Culture and Varieties*, by W.J. Morse, Farmers' Bulletin 1520 (Washington, D.C.: Government Printing Office, 1927), 2.
[135] *Systematic Plant Introduction,* 14, 17.

briefly manufactured soy sauce in Georgia for the London market.[136] Benjamin Franklin Edwards distributed his "japan peas" to horticultural societies. The Perry Expedition brought back the first to be registered at the patent office. Agricultural experiment stations began importing them from Japan and Europe in the late 1870s. Fairchild himself arranged in 1898 for the U.S. Minister to Japan to send him not only ten soybean varieties from Tokyo, but also samples of the earth they grew in,[137] as researchers were beginning to understand the symbiotic relationship between legumes and nitrogen-fixing bacteria in the soil.[138] By the time Meyer reached China in 1905, S.P.I. had logged 58 foreign soybean introductions – not necessarily distinct varieties – at a rate of roughly seven per year.[139] In the three years of his expedition, Meyer would send forty-four.[140]

This was a major accomplishment, but during the same period the growing network of correspondents sending plant material to S.P.I. – disparaged by Henry – contributed eighty-three soybean introductions. These arrived from private seed companies in Europe and Japan, from consular officials in Shanghai and Saigon, from missionaries in China, from directors of foreign agricultural experiment stations, and from an array of private individuals whose profession was not identified in the S.P.I. inventories.[141] It was indeed an important part of Meyer's mission in this and future expeditions to cultivate a network of contacts, if for no other reason than to aid future explorers. As Meyer noted, "If it

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[136] Theodore Hymowitz and J.R. Harlan, "Introduction of the Soybean to North America by Samuel Bowen in 1765," *Economic Botany* 37 (Dec. 1983): 377.
[137] Department of Agriculture, Division of Botany, *Inventory No. 1. Foreign Seeds and Plants Imported by the Section of Seed and Plant Introduction. Numbers 1-1000* (Washington, D.C.: Government Printing Office, 1898), 53.
[138] Fairchild, 196, 259.
[139] *Seeds and Plants Imported Nos. 1–11,* passim.
[140] *Seeds and Plants Imported Nos. 12–15*, passim. His total number of plant (and some entomological) introductions during this period was 1,108.
[141] *Seeds and Plants Imported Nos. 13–15*, passim.

weren't for the missionaries throughout the land, I wouldn't have obtained as many things as I have now."[142]

Meyer's soybean collecting had started slowly, perhaps in part because he considered it primarily a food item: in addition to the beans sold as delicatessen, he found some in Tientsin "used to make bean cheese from" and some in Mongolia "esteemed for human food," including one type that required "but little irrigation, and is well worth trying in the arid West." [143] And, though he was always ready to eat strange foods himself, he doubted whether Chinese foods would find a market in America. He noticed Chinese eating lotus, water chestnuts, and bamboo and alfalfa shoots, but sought Fairchild's advice about sending vegetables that Americans might consider "rubbish."[144] He concentrated instead on procuring hemp and matting rushes as new crops for the abandoned rice fields of South Carolina.[145] He next turned his attention to finding hardy cereals, fruits and vegetables for the northern U.S. by traveling to Manchuria, which happened to be the soybean heartland of Asia.[146] Even here, he collected only three samples, noting that they were crushed for their oil, the remaining "cake" being sent to southern China as fertilizer.[147] He obtained one sample in Korea, and then, traveling

[142] Frank Meyer, Peking, to David Fairchild, Washington, D.C., 8 Jan. 1908, quoted in William Shurtleff and Akiko Aoyagi, *William J. Morse - History of His Work with Soybeans and Soyfoods (1884-1959): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 25.

[143] Department of Agriculture, Bureau of Plant Industry, *Seeds and Plants Imported During the Period from December, 1905, to July, 1906: Inventory No. 12; Nos. 16797 to 19057* (Washington, D.C.: Government Printing Office, 1907), 56, 72.

[144] Cunningham, 42. As it happened, chop suey, which included water chestnuts and sprouts, was something of a craze in the U.S. at the time.

[145] Ibid., 44.

[146] Department of Agriculture, Bureau of Plant Industry, *Seeds and Plants Imported During the Period from July, 1906, to December 31, 1907: Inventory No. 13; Nos. 19058 to 21730* (Washington, D.C.: Government Printing Office, 1908), 7; Cunningham, 41.

[147] *Seeds and Plants Imported No. 13,* 16.

further north, nine in Siberia, six of which came from one farmer in Markoechofka.[148] Another was a gift from the Russian director of the agricultural experiment station in Khabarovsk, where he purchased two more samples in the town market. Finally, circling back through Manchuria in early 1907, he picked up three more. In all, it was only sixteen soybean samples collected in the span of nine months of travel. Even so, when he visited the Japanese agricultural experiment station in Mukden, Manchuria, he was amazed to find that the Japanese had collected even fewer.[149]

Meyer's soybean efforts intensified in early 1908, however, after he received a USDA bulletin, *Soy Bean Varieties*, which was the Department's first systematic attempt to determine exactly how many distinct varieties it was actually growing on its experimental farm in Arlington, Virginia.[150] One of Meyer's contributions – the one sold in Peking as a roasted delicacy, which up to now had been known only as 17852 – already made the list of named varieties, and in fact was named "Meyer." "I see that my name has been immortalized in the christening of a humble, mottled bean," he wrote to Fairchild. "[W]hat a joy!"[151] More than this honor, it was most likely a push from the Department that focused more of his attention on soybeans. By November 1907, he was "anxiously awaiting" a full set of soybean samples from Washington to help him avoid duplicates, although this was not a big worry for him. "You know that the Chinese have no seed-shops like what we have," he commented. "Every farmer saves his own seeds of all his crops and as such, there may be countless strains of plants here in existence of which an

[148] Ibid., 92-93.
[149] Shurtleff and Aoyagi, *Morse*, 25.
[150] Ibid., 22.
[151] Meyer, Peking, to Fairchild, 18 Dec. 1907, quoted in Shurtleff and Aoyagi, *Morse*, 25.

explorer gets hold only once in a while." [152] He was only beginning to realize just how many varieties of soybean there might be.

In the remainder of his expedition, he was assiduous in gathering soybeans, whether he was gathering herbarium specimens in the desolate Wutaishan region for Sargent at the Boston Arboretum or scouring the southern provinces of Chehkiang and Kiangsu for bamboos to add to an enormous collection that included three hundred live specimens he had obtained the year before in Peking and had accompanied south to Shanghai on a steamer.[153] In all, he packed eighteen samples of soybeans when he embarked for America on the Standard Oil steamer *Ashtabula* in early May 1908. They were the least of his worries.

The weather in Shanghai had turned hot and rainy as Meyer struggled to pack and load twenty tons of plant material: seeds, cuttings, and live plants potted in soil. The hundreds of bamboo trees, representing thirty different varieties, were packed in 100 large crates full of soil.[154] He was the only passenger on board the *Ashtabula*, with none of the conviviality of his voyage to China. But he was distracted from his solitude by the constant demands of his cargo – the plants had to be exposed to sun and air as often as possible – as well as by the care of two macaques of a rare northern species that he had obtained for the National Zoological Park. The monkeys caused him "as much trouble as babies," he wrote, adding that a plant explorer is "some kind of mother to his charges in any case."[155]

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[152] Meyer to Fairchild, 8 Jan 1908, quoted in Shurtleff and Aoyagi, *Morse*, 25.
[153] Cunningham, 66. The Superintendent of Parks in Shanghai agreed to hold them for him.
[154] Ibid., 67.
[155] Ibid., 81.

His cares did not end when he arrived in San Francisco on June 12. He complained that "the amount of time and paper" wasted in connection with Customs matters was "something fierce." Not yet a naturalized citizen, he was also visited by immigration officers. Most distressing, however, was the treatment of his precious bamboo trees at the hands of California horticultural inspectors: noticing some scale insects, they fumigated the 100 crates in a way that even Meyer, who always urged that his plant materials be fumigated thoroughly, found excessive. Many of the trees later died, a loss that Fairchild later wrote "nearly broke Meyer's heart."[156]

He managed, just barely, to fit his collection onto a Southern Pacific freight car, which carried it to the USDA Plant Introduction Garden in Chico, California. There, he repacked part of the collection and sent it to Washington, D.C. This included the eighteen packages of soybeans which, having a limited shelf-life before they lost their power to germinate, now sought to take root in American soil.

[156] Ibid., 81.

Chapter 2: Footholds

In the great many cases of plant species from one continent becoming the uncontrollable weeds of another, just crossing over is enough to ensure proliferation, even dominance, in ecosystems free of the plant's customary pests and competitors. This was not the case with the soybean, for despite its relative freedom from pests and disease in North America, it could not thrive unless it also won the alliance of humans – who, among other favors, went so far as to transport soil that contained the soybean's other crucial ally, the right kind of nitrogen-fixing bacteria. But there was fierce competition for human care: as both a crop and a food, the soybean had entered a crowded field. Its supporters, primarily at the USDA and state agricultural experiment stations, who gave it its first small footholds in test plots, viewed its prospects with optimism in the 1910s as a series of crises seemingly provided opportunities for it to gain a permanent place on American farms and in the American diet. The cotton boll weevil both symbolized the pathology of agriculture in the South and energized attempts to reform it, in some cases by introducing soil-building soybeans as an alternative cash crop to cotton. The first World War created shortages of meat that created the need for substitutes, tofu and other soy foods included. And the health risks associated with cow's milk led some to propose deriving milk from the soybean instead.

As it turned out, however, these openings were not as favorable as its advocates expected. The soybean established some new footholds, but struggled to expand beyond them. The boll weevil created turmoil, but left the labor system of the South largely intact, which in turn favored the cultivation of cotton and tobacco, the crops providing the highest cash returns to hand labor, and thus the highest rents to the landlords of tenant farmers. When poultry was widely perceived as a substitute for "meat," tofu had little chance as a substitute for poultry. And rather than find a sanitary substitute, Americans reformed the dairy industry. So the soybean abided, waiting for its next chance.

The Agronomist: William J. Morse

On an October day in 1920, William J. Morse composed a letter to his superior at the USDA, Charles V. Piper. Even after more than a decade of close collaboration, he addressed his correspondence deferentially to "Prof. Piper," who addressed him in return as "Mr. Morse." Usually their letters made a short journey across the Potomac River from the Arlington Experimental Farm where Morse worked to the headquarters of the USDA. In the fall, however, Morse typically traveled throughout the country to review work at agricultural experiment stations and among private farmers who were part of his network of cooperators. This day, he was writing from Biloxi, Mississippi on stationery from The Kennedy Hotel. He reported that his plans to review nearby test plots had fallen through, but that the visit was not a total loss.

He had come across a "coffee roasting establishment" and, "rather interested in seeing how they got rid of the fumes," he had entered and struck up a conversation with the manager. Eventually, the conversation got around to soybeans and the possibility of roasting them for coffee: "I promised to send him some of our Mammoth Yellow seed. He said he would roast the beans and send us some samples." He added hopefully that it was "quite possible that we can get something started with them, although at the present time it is a small concern. I understand they are to enlarge in the near future."[1]

This was not a significant moment in Morse's career, but it was a typical one. He was a soft-spoken, unaggressive man,[2] but he was affable, persistent, and endlessly willing to talk shop. And he rarely let an opportunity pass, no matter how small, to promote soybeans and their possible uses. And he was ever hopeful. Since the 1890s, when it was a topic at agricultural experiment stations – and when some individual farmers prepared it for their own use – soybean coffee had received mixed reviews. The head of the agricultural experiment station at Lafayette, Indiana, declared it "agreeable," though he conceded it would not have satisfied "the lover of high-grade coffee";[3] the Secretary of Agriculture, on the other hand, thought it a "poor substitute . . . about equal to scorched wheat or rye."[4] By 1920, it also faced competition from the popular coffee substitute Postum. Morse nonetheless adhered to his conviction that with enough testing – trying out different methods and different soybean varieties for specific uses – the commercial possibilities would follow.

Morse's visit to Biloxi also bookended a decade in which his primary focus for creating a soybean industry in the U.S. was the South. It had never been his exclusive focus: his tours of experiment stations, as well as the farms of private individuals

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[1] W.J. Morse, Biloxi, MS, to C.V. Piper, Washington, D.C., 22 Oct. 1920, Record Group 54, Subgroup: Div. Of Forage Crops and Diseases, Series: General Correspondence, 1905-29, Box 92-93: Morgan-Morse to Morse-Napier, National Archives II, College Park, MD (henceforth "Morse Correspondence.")
[2] William Shurtleff and Akiko Aoyagi, *William J. Morse - History of His Work with Soybeans and Soyfoods (1884-1959): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 380.
[3] Charles S. Plumb, "A Substitute for Coffee," In *Purdue University: Seventh Annual Report of the Agricultural Experiment Station, Lafayette, Indiana, 1894* (Indianapolis, IN: Wm. B. Buford, 1895), 45-47.
[4] *Report of the Secretary of Agriculture, Executive Documents of the House of Representatives for the Second Session of the Fifty-Third Congress, 1893-'94* (Washington, D.C.: Government Printing Office, 1895), 378.

cooperating with the USDA, had encompassed twenty states, and he had correspondents in at least fifteen others.[5] But the South's many cottonseed crushers – who produced crude cottonseed oil – seemed like natural customers for soybeans, which could likewise be pressed for oil. This in turn held out the promise that the region's many cotton farmers might turn to soybeans as an alternative cash crop. To agricultural reformers at the USDA and elsewhere, the soybean's great promise was that it might prove a remedy for the pathologies of Southern agriculture. This hope was not fulfilled in the 1910s, despite the crop finding small footholds in the region. By the 1920s, Morse himself would turn his attention to an unexpected boom in the Midwest.

Morse was born in Lowville, New York, in dairy country. His ancestors were German-speaking Catholics who had emigrated in the middle of the nineteenth century. Both of his grandfathers were Union soldiers who died not long after Morse's parents were born: one perished as a POW in Lynchburg, the other from dysentery in New Orleans.[6] His father, John Baptist Morse, born in 1863, made a comfortable living as a butcher, eventually buying out his partners to become the sole proprietor of Lowville's Union Meat Market.[7] The fact that his father was a small-town merchant may account for Morse's lifelong ease talking with farmers and shopkeepers, but Morse's education at the Lowville Academy – where he took the "Latin-Scientific" courses and played football – indicated that he was not meant to take over the family business. His studies at the agricultural college at Cornell, which he entered in 1903, allowed him to pursue science for practical ends. He took courses in botany – with a heavy emphasis on taxonomy – but also in horticulture, where he "had nursery and orchard practice, dealing with the

[5] Morse Correspondence, passim.
[6] Shurtleff and Aoyagi, *William J. Morse*, 418.
[7] "Twenty-Five and 45 Years Ago," *Journal and Republican (Lowville, NY)*, 14 July 1938, 5.

multiplication and subsequent care of plants," and agronomy, where he learned "the best methods of crop production."[8]

His achievements earned him a letter of recommendation from one of his professors to Piper, director of the USDA's Office of Forage Crop Investigations, who – after some budgetary delays – offered Morse a job on June 18, 1907. Morse reported to Washington on the 22nd, having paused only to receive his BS in Agriculture degree from Cornell on the 20th.[9] The next week, Piper signaled the official start of Morse's work by requisitioning for him a supply of string and 500 tags for labeling seed bags.[10] The young man would be working at the Arlington Experimental Farm, adjacent to the national cemetery. As Piper initially described the job, it would "involve breeding work with the grasses and legumes and also testing of a large number of miscellaneous new forage plants."[11] That so much of his work would involve soybeans was largely an accident of timing.

When Piper had arrived at the USDA four years earlier,[12] the Department's collection of soybean seeds, which had been planted and harvested at Arlington Farm each year since 1898, were in classificatory disarray.[13] Piper, formerly Head of the Department of Zoology and Biology at Washington State College, was a highly skilled and exacting taxonomist for whom finding the correct botanical relationship among

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[8] W.J. Morse, Ithaca, NY, to C.V. Piper, Washington, D.C., 20 Feb. 1907, Morse Correspondence.
[9] W.J. Morse, Ithaca, N.Y., to C.V. Piper, Washington, D.C., 19 June 1907, Morse Correspondence; Edward Jerome Dies, *Soybeans: Gold from the Soil* (New York: The MacMillan Company, 1942), 1.
[10] C.V Piper, Washington, D.C., to Mr. Ashmore, Washington, D.C., 28 June 1907, Morse Correspondence.
[11] C.V. Piper, Washington, D.C., to W.J. Morse, Ithaca, NY, 16 Feb. 1907, Morse Correspondence.
[12] He was hired as the Office of Farm Management's Agrostologist, meaning that he was an expert on grass species, but his mandate to improve grazing and fodder crops for livestock led him to examine a wide variety of legumes as well, soybeans among them. In 1905, he would become Agrostologist in Chief of his own Office of Forage Crop Investigations. Charles Vancouver Piper 3
[13] Soy Bean [1910] 39-74; World Was My Garden 259

known plants was the key to fresh discovery. As a colleague would later describe his approach, he would search for missing links “whose existence seemed probable . . .but whose like had never actually been seen.”[14] In this way, Piper discovered Sudan grass – the missing link between Johnson grass, a prolific weed, and sorghum, a cultivated cereal – which, in some estimates of the time, was “the greatest boon that has ever happened [to] the dry-land farmer of Texas.”[15] Using similar methods, he was able to revolutionize the grasses used on golf greens, the other accomplishment for which he was highly celebrated at the time of his death in 1924. Although he eventually devoted a good deal of time determining the correct botanical name of the soybean, arguing successfully that it should be *Soja max* rather than *Glycine hispida*, the payoff for this effort was not comparable his success with Sudan grass. All soybeans, wild and cultivated, belonged to the same species: the real task was classifying the variation within the species.

The lineages of soybeans grown in Arlington had been gathered largely from agricultural experiment stations, foreign and domestic, as well as from seed merchants. Having circulated in Europe and the U.S. for some time, these lineages were often from the same ultimate source, and thus represented a much smaller number of actual varieties, which as of 1903 were named according to a simple system based on the color of the seed – white, green, or black – and the time it took for the beans to reach maturity: “Early White,” “Late Black.”[16] Early varieties ripened sooner and were most suitable for

[14] L.W. Kephart, "Charles Vancouver Piper," typed manuscript prepared for *Wallace's Farmer*, 1926, Folder: MorsPipe, Record:Keph-1926, Soyinfo Center, Lafayette, CA., 3.
[15] Shurtleff and Aoyagi, Morse, 59; Kephart, 4; U.S. Department of Agriculture, Bureau of Plant Industry, *Seeds and Plants Imported During the Period from January 1 to March 31, 1909: Inventory No. 18; Nos. 24430 to 25191* (Washington, D.C.: Government Printing Office, 1909), 55.
[16] Department of Agriculture, *The Soy Bean as a Forage Crop*, by Thomas A. Williams, with an appendix on "Soy Beans as Food for Man" by C.F. Langworthy, Farmers' Bulletin No. 58 (Washington, D.C.: U.S. Government Printing Office, 1899), 6.

northern states with short growing seasons. The system was already complicated by "medium" and "late medium" varieties, and was moreover frequently ignored by seed dealers and experiment stations, who applied names of their own. The task of Piper's assistant, Carleton Ball, was to clear up the confusion.[17] Ball spent four years completing his work, in part because he classified varieties on plant characteristics, such as height and habit, which he felt required at least three consecutive annual plantings to reach "a state of equilibrium" in any given location.[18] Thus it would take at least three years to figure out which lineages, perhaps outwardly distinct at the outset, in fact belonged to the same variety.

Ball eventually settled on twenty-three named varieties, some of which consolidated seeds from as many as sixteen different sources. Ball gave each variety a single proper name based variously on the appearance of the seed ("Buckshot," "Butterball"), the size of the plant ("Mammoth"), the experiment station that first grew it ("Manhattan" as in Kansas, "Kingston" as in Rhode Island), the overseas explorer who collected it ("Baird," "Meyer"), or the idiosyncratic names, some Asian in origin, that had already become attached to them ("Ito San," "Eda"). In addition, some honored men who were already prominent in soybean history ("Nuttall", "Haberlandt.")[19] Ball listed important characteristics for each variety, with the hope that a consistent nomenclature – adopted, it was hoped, by seed dealers as well – would allow farmers to find soybeans that fit their specific climatic needs.[20]

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[17] U.S. Department of Agriculture, Bureau of Plant Industry, *Soybean Varieties*, by Carleton R. Ball, Bulletin No. 98 (Washington, D.C.: Government Printing Office, 1907), 3.
[18] Ibid., 8.
[19] Thomas Nuttall had written about the soybean in America in 1804, and Friedrich Haberlandt was widely credited for sparking interest in the soybean in Europe. Ibid., 14.
[20] Ibid., 3

Ball published his work in 1907 – which in turn spurred Meyer to collect more soybeans – but was no longer in Forage Crop Investigations. Piper assigned the next phase of varietal development to H.T. Nielsen. With many new samples arriving directly from Asia, where, as Meyer had noted, farmers saved their own seed, the problem was the opposite of the duplication that preoccupied Ball.[21] Rather, it was that these samples, however outwardly similar the seeds were, were a mix of numerous lineages which had to be sorted out. Thus Nielsen, with the help of the newly arrived Morse, combed through the test plots in the fall of 1907, evaluating the soybean plants according to a much expanded list of characteristics. These included height and habit – bushy or slender, "erect" or "suberect" – but also the color of the flowers (purple or white); the color of the pubescence, or plant hairs (tawny or green); the size of the pods and how swollen they were ("tumid" or "compressed"); the size and shape of the seed ("oblong," "elliptical," "flattened"); the tendency of the pods to "shatter," or to break apart and release the seeds; and the color of the seed – now expanded to include olive yellow, straw yellow, brown, chromium green, and bicolored – as well as the color of the hilum, the little scar joining together the two halves of the seed, and the color of seed's germ once its outer skin was removed.[22]

The plants were then painstakingly sorted according to minute differences in these characteristics: for these plant immigrants, America was anything but a melting pot. "Pure" selections contained no discernible differences – except for height, within a

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[21] U.S. Department of Agriculture, Bureau of Plant Industry, *The Soy Bean: History, Varieties, and Field Studies*, by C.V. Piper and W.J. Morse, Bulletin No. 197 (Washington, D.C.: Government Printing Office, 1910), 34: "It is very interesting fact that the same variety has rarely been secured a second time unless from the same place. It appears that practically every locality in China has its own local varieties. If this be true, then there are probably several times as many varieties existing as have yet been obtained."
[22] Ibid., 37, 39-74.

certain range – while "mass" selections were less uniform.[23] Soybean breeding, at this time and for decades afterward, consisted of this massive program of sorting and separating, creating pure lines from mixes of seeds. Soybeans lent themselves to this procedure, as they were largely self-pollinating, something long believed and finally confirmed in 1909 by the simple expedient of "bagging" certain plants, so that no external pollen could reach their flowers, and noting that they produced as many pods as their unbagged neighbors.[24] This helped soybean lineages to remain pure, but it also made it difficult for breeders to create new varieties through cross-breeding,[25] an effort made largely superfluous in any case by the sheer diversity of samples arriving from Asia.

Between 1907 and 1908, the number of soybean varieties grown annually on Arlington Farm grew by over 60 percent, from around 170 to around 280. Fully sixty-four of the new varieties were field selections, not fresh foreign introductions.[26] Three out of the sixty-four became named varieties,[27] including one derived from the sample of beans, sold as delicatessen, which Meyer had collected in Peking. Logged as S.P.I. 17852, this lot was received in February 1906, enough time to be planted that year. The results were promising enough as a hay variety that Ball named 17852 "Meyer," judging it to be "a distinct variety of the mottled group."[28] The following fall, however, Nielsen discerned as many as seventeen separate varieties in the stand of Meyer soybeans, each

[23] These were "field selections": the following spring, they began sorting newly-introduced seeds even before planting them, so-called "seed selections". Ibid., 25.
[24] Ibid., 20.
[25] Morse and other breeders did note, and separate out, natural crosses when they occurred. Even at Arlington Farm, where so many distinct varieties were grown in contiguous rows, only one out of every two hundred plants was a natural cross. Ibid., 23.
[26] Ibid., 39-74.
[27] All of the varieties were given distinct S.P.I. numbers. Ibid., 39-74.
[28] Ball, 20.

designated as 17852 followed by a letter.[29] Collectively they displayed remarkable diversity: seed color ran the gamut from black to brown to chromium-green to olive-yellow; some had white flowers, some purple, some both; some were bushy, though most were "slender, erect, the tips twining," good qualities for hay.[30] 17852 B, a pure field selection, was named "Peking" and – as the Meyer variety fell by the wayside – was widely distributed throughout the following decade. Thus did a Chinese treat become American hay.

Nielsen coauthored a bulletin on soybeans in 1909, but he had already transferred to another office, Field Crop Investigations.[31] In the S.P.I. inventories, his notes accompanied new soybean listings up to March 1909,[32] so he likely left Forage Crops around that time. At that point, it seems, soybeans fell to Morse. As he had before, he implemented the office's work on Arlington Farm, planting various crops in numbers and under conditions specified by Piper's other assistants. This included alfalfa, peas, velvet beans, bluegrass, millet, sorghum, rye grass, timothy grass, and cowpeas, and several types of clover.[33] He undoubtedly carried out much of the expanded soybean work from 1907 on, perhaps qualifying him to take over from Nielsen. Or perhaps, being the only member of the staff not already concentrating on a specific set of crops, he became the soybean man by default. In his 1942 *Gold from the Soil*¸ Edward Dies would recount how Piper would visit Morse often at Arlington Farm "on Sundays, evenings and at other odd times" and paint "word pictures of a future agricultural economy in which the little

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[29] 17852 B through 17852 R, although E through M are not listed in Piper and Morse's 1910 bulletin; 17852 A was the Meyer variety. Piper and Morse (1910), 48-49.
[30] Ibid., 48-49.
[31] Department of Agriculture, *Soy Beans*, by C.V. Piper and H.T. Nielsen, Farmers' Bulletin No. 372 (Washington, D.C.: U.S. Government Printing Office, 1909), Cover.
[32] *Seeds and Plants Imported 18*, 36.
[33] Morse Correspondence, passim.

[soy]bean would play a tremendous role." According to Dies, whose promotional agenda raises doubts about the story, Piper would say, "Young fellow, these beans are gold from the soil. Yes, sir, gold from the soil. One must truly stand in awe of their potential power in the life of the western world."[34] In truth, there were many crops and many assistants vying for Piper's attention: even Morse would devote much of his personal research over the next decade to other legumes: principally cowpeas, but also velvet beans.

Morse's duties gradually expanded from developing improved varieties of soybeans – the massive sorting program – to distributing them to experiment stations and other interested parties, frequently in the South. In 1911, for instance, Morse fielded a request from George Washington Carver, at the Tuskegee Institute in Alabama, for soybeans and cowpeas.[35] Carver planted the soybeans in 1912 and was impressed by their abundant forage "of the nicest possible kind." In 1914, in cooperation with a New Jersey paint company, he tested five varieties to determine the quantity of oil they provided.[36] Morse also sent seeds to Samuel M. Tracy, a retired botany professor whom the USDA commissioned as a special agent to conduct field tests along the Gulf Coast. The results from one of Meyer's introductions, S.P.I. 23211, earned it the name "Biloxi," after the city where Tracy lived.[37]

Morse sent several lots of seeds to a colleague at the USDA's Office of Tobacco and Plant-Nutrition Studies, W.W. Garner, who investigated the effect of environmental

[34] Dies, 2.
[35] Oakley, R.A., Washington, D.C., to W.J. Morse, Arlington Farm, VA, 23 May 1911, Morse Correspondence.
[36] Linda O. McMurry, *George Washington Carver: Scientist and Symbol* (New York: Oxford University Press, 1981; Oxford University Press paperback, 1982), 91.
[37] W.J. Morse, Agricultural College, MS, to C.V. Piper, Washington, D.C., 17 Aug. 1914; W.J. Morse, Washington, D.C., to S.M. Tracy, Biloxi, MS, 23 Jan. 1915, Morse Correspondence.

conditions on oil production in peanuts, cottonseeds and soybeans.[38] Though rooted in highly practical concerns, Garner's research led in an unexpected direction when he noted, as others had before him, that soybeans planted later in the spring or summer flowered at roughly the same time as those planted earlier, indicating an environmental trigger that Garner ultimately determined to be the shortening length of summer days.[39] The discovery of this ability of plants to track day length – which Garner dubbed "photoperiodism" – was a landmark in botanical science. He used four varieties of soybean in his research, two of which were Meyer introductions: Biloxi and Peking. S.P.I. 17852, having gone from a mixed collection of beans to a pure hay variety, was now further transformed into the data appearing in charts, graphs, and tables.

Eventually Morse would follow up his correspondence with visits, as he began touring the nation to record the results of soybean tests in 1910. He primarily visited state experiment stations, whose extension agents in turn convinced private farmers to plant test rows of soybeans, but Morse did some extension work on his own behalf. A USDA colleague later described how Morse "would take a few bushels of soybeans with him as he traveled by train into the southeast; how he would hire a spring wagon and team of horses at the livery stable and strike out across country; [and] how he would induce [farmers] to plant a few rows from the seed he had."[40] His first tour included Illinois, Indiana, Ohio and New York State, as well as Virginia and Tennessee. Later

[38] W.J. Morse, Washington, D.C., to Chas. W. Lee, Arlington Farm, VA, 19 Jan. 1911, Morse Correspondence; C.V. Piper, Washington, D.C., to W.J. Morse, 8 March 1920, Morse Correspondence; W.W. Garner and H.A. Allard, "Effect of the Relative Length of Day and Night and Other Factors of the Environment on Growth and Reproduction in Plants," *Journal of Agricultural Research* 18 (March 1920): 553; W.W. Garner, H.A. Allard, and C.L. Foubert, "Oil Content of Seeds as Affected by the Nutrition of the Plant," *Journal of Agricultural Research* 3 (Dec. 1914).

[39] Garner and Allard (1920).

[40] Walter O. Scott, "Cooperative Extension Efforts in Soybeans," in *50 Years with Soybeans*, ed. R.W. Judd (Urbana, IL: National Soybean Crop Improvement Council, 1979), 64.

trips, however, included more Southern states – Georgia, Mississippi, Alabama, Louisiana, Arkansas, and the Carolinas[41] – and it was the South that was to be the focus of his energies.[42] This focus was not determined by soybean biology – Ball's 1907 bulletin had stated that "soybeans are at their best in this country [between] 37° and 43° north," roughly the latitudes of Illinois[43] – but by the needs of American agriculture and the existing constellation of competing crops.

The Cotton Belt had long been regarded as American farming's problem child, mired in one-crop dependency, soil exhaustion, primitive methods – the "one-horse plow"[44] – and poverty. Those who sought to reform Southern agriculture did not often mention race – the region's poor tenant farmers consisted of both blacks and whites, after all – but did on occasion use it as shorthand to indicate the most worn-out land, one reformer noting that a farm "has been under cultivation by negro tenants for from eighty to one hundred years and is in sore need of special treatment,"[45] a hint that reform would entail displacement. Most progressive farmers in the region, speaking through the rural press, stuck to a positive message of "lime, legumes and livestock": that is, improving the soil

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[41] R.A. Oakley, Washington, D.C., to W.J. Morse, Arlington Farm, Virginia, 10 Sept. 1910, and passim, Morse Correspondence.

[42] Shurtleff and Aoyagi, *Morse*, 38. As one memo stated, Morse's "field work is principally in connection with soy beans," adding that this would "necessitate some traveling throughout the Southern States." This memo summarized the roles of Piper's staff as he prepared for a journey to the Philippines, where he would advise the War Department on the best forage crops to grow there for army horses and mules (Ibid., 59). He would return by way of India, where he would gather, among other things, 108 lots of soybeans (Ibid., 384).

[43] *Soy Bean Varieties,* 9. Ten years earlier, a bulletin on "leguminous forage crops" had given the 37th and 44th parallels "east of the Rockies." U.S. Department of Agriculture, Division of Agrostology, "Leguminous Forage Crops," by Jared G. Smith, in *Yearbook of the U.S. Department of Agriculture: 1897* (Washington, D.C.: Government Printing Office, 1898), 498.

[44] G.H. Alford, *Southern I.H.C. Demonstration Farms* (Chicago: International Harvester Company of New Jersey, c1914), 20.

[45] Ibid., 18.

by applying limestone (which kept it "sweet," not acidic), growing fertility-enriching legumes, and applying the manure of animals.

Legumes such as soybeans were an important part of the program due to their ability to incorporate atmospheric nitrogen into compounds usable by plants. They do this through nodules that form on their roots that were often called "tubercles" in the early 1900s, when it was already understood that they contain symbiotic soil bacteria that do the actual work of nitrogen fixation. The nodules themselves provide ideal conditions, for instance by filtering out oxygen as air passes from the adjacent soil to the bacteria: too much oxygen being fatal to the process. (The hemoglobin-like molecules that perform this role give the nodules a pinkish hue.)[46] This symbiosis only works with the right bacteria, sometimes specific to a given species of legume. Thus, soil often has to be "inoculated" with the appropriate strain. David Fairchild understood this when, beginning the Arlington Farm's soybean work in 1898, he imported both seeds and soil from Japan.[47] It was later one of Morse's duties to occasionally ship hundreds of pounds of soil to farmers interested in planting soybeans.[48]

The ability to fix nitrogen meant that, plowed under as a green manure, legumes could provide an alternative to the most expensive component of commercial fertilizers. This recommended legumes to all regions, but nowhere more than the South, where

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[46] John King, *Reaching for the Sun: How Plants Work* (New York: Cambridge University Press, 1997), 46-48. These symbiotic bacteria are not the only kind that fix nitrogen – species of "free" bacteria in the soil do as well – but they are a major source of fixed nitrogen, particularly in temperate regions where the free bacteria is comparatively rare.

[47] David Fairchild, assisted by Elizabeth and Alfred Kay, *The World Was My Garden: Travels of a Plant Explorer* (New York: Charles Scribner's Sons, 1938), 259.

[48] Scientific Assistant, Washington, D.C., to W.J. Morse, Arlington Farm, VA, 2 May 1908; W.J. Morse, Augusta, GA, to R.A. Oakley, Washington, D.C., 15 Aug. 1911, Morse Correspondence. By the 1910s, it became more common to inoculate soil by coating seeds in pure bacterial cultures.

cotton had long extracted large amounts of nitrogen from increasingly depleted soils.[49] A legume crop would contribute less nitrogen to the soil if fed to livestock, even if a farmer conscientiously spread the resulting manure on the land, but could in that case contribute to a farm's income. However they were fed to animals – whether left in the fields as forage, taken fresh to the barn (*soiling*), combined with corn and stored wet in silos (*silage*), or stored dry in bales (*hay*) – legumes were higher in protein than cereal crops. While protein was less vital for draft animals, which consumed rations consisting largely of carbohydrates – typically oats grown by the farmer[50] – the requirement for meat and dairy cattle was much higher and was usually met by feeding them commercial supplements (*concentrated feeds*) made from milled seeds. Thus the legume-growing farmer could reduce fertilizer and feed costs in one blow. The North, as it happened, already had many options for forage legumes, the most valuable being clover and alfalfa, perennials whose long roots excavated nutrients from deep in the soil and helped prevent erosion. Piper hoped, in fact, that similarly productive perennial legumes might yet be found for the Cotton Belt.[51]

Reformers believed that diversified farming, providing income through the sale of hay, meat and milk, would help small farmers survive better than growing cotton alone – and would moreover lead to a general renovation of the Southern economy and culture. "This system will enable us to build better roads, better homes, better schools and better churches," argued a North Carolina agricultural extension agent. "It will make us better

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[49] Gavin Wright, *Old South, New South: Revolutions in the Southern Economy Since the Civil War* (New York: Basic Books, Inc., Publishers, 1986), 110; Rosser H. Taylor, "The Sale and Application of Commercial Fertilizers in the South Atlantic States to 1900," *Agricultural History* 21 (Jan. 1947): 46, 49.
[50] Smith, 489.
[51] U.S. Department of Agriculture, Bureau of Plant Industry, "The Search for New Leguminous Forage Crops," by C.V. Piper, in *Yearbook of the U.S. Department of Agriculture: 1908* (Washington, D.C.: Government Printing Office, 1909), 245.

citizens and better Christians."[52] Diversifying required investment, however. Struggling tenant farm families typically only broke even from year to year, requiring them to devote as much land as possible to the crop that gave the highest return – cotton – even to the point of reducing their acreage of corn, their main subsistence crop, and buying it instead from nearby towns that imported it from the North.[53] There were other obstacles to diversification. Most families kept livestock, usually pigs, but these were typically low-quality breeds raised for home consumption as better breeds were typically decimated by disease.[54] And major cities were too few and far between to support a large dairy industry.

Thus it was not simply the absence of good perennial legumes in the South that caused Piper to identify the soybean's "region of maximum importance" as "south of the red-clover area and in sections where alfalfa can not be grown successfully,"[55] or to prompt him to write in 1909 that "the soy bean is especially adapted to the cotton belt and northward into the southern part of the corn belt,"[56] an assessment he and Morse would maintain for the next ten years. It was also that soybeans could conceivably provide Southern farmers with an alternative cash crop, one that provided a substitute for one of cotton's highly valued products, the oil from its seeds. Cottonseed crushing was a growing industry – crude cottonseed oil was used to make soap, while refined oil was used for salads and in shortening[57] – and one that especially benefitted tenant farmers,

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[52] N.E. Winters, "Soil and Crop Improvement Under Boll Weevil Conditions," *The Atlanta Constitution*, 4 January 1920, 2F.
[53] Wright, 107; Gilbert C. Fite, "Southern Agriculture since the Civil War: An Overview," *Agricultural History* 53 (Jan. 1979): 7.
[54] Ibid., 11.
[55] Piper and Nielsen, 5.
[56] Ibid., 6.
[57] "Crisco" is a portmanteau of "crystallized cottonseed oil."

who frequently paid their rent in cotton fiber while keeping the returns from the seed for themselves. The *cake* (or *meal*), left over after the oil was pressed out, was used for feed. Cottonseed mills dotted the South, never far from the sources of the highly perishable seed. The hope was that soybeans could initially supplement cottonseed – helping to lengthen the crushing season, which was compressed into a short period following the cotton harvest – and then gradually supplant it. Cottonseed oil production perpetually fell short of demand, as the quantity of cotton responded to the price of the fiber, not the seed. Soybeans, grown in sufficient quantities to fill the gap, might provide income to both tenant and landlord.

This hope was sparked in 1909 by a special consular report compiled by the U.S. Department of Commerce at the behest of the American cottonseed industry, which was worried about competition overseas. Shortages of cottonseed and linseed in 1908 had compelled British oilseed mills to import soybeans from Manchuria. They conducted a "series of tests to demonstrate the uses to which the soya cake, meal, and oil may be put, and it is claimed that the results have been eminently satisfactory," stated the report. "The seed crushers in England have been very active in seeking outlets for their products," the report added, "and have offered it in practically every market for such manufactures in Europe."[58] Where American cottonseed producers saw worrisome competition, the USDA saw revolutionary potential. In 1909, Piper and Nielsen's bulletin noted, "The recent enormous exportations of soy beans and soy-bean meal from Manchuria to Europe would seem to indicate that there is practically an unlimited market for this product [and that] the soy bean can be profitably grown in practically all parts of

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[58] Department of Commerce and Labor, Burea of Manufactures, *Soya Beans and Products,* Special Consular Reports Vol. XL (Washington, D.C.: Government Printing Office, 1909), 29.

the cotton belt as a grain crop."[59] In 1916, Piper and Morse published a map identifying where the "soy bean is especially adapted for growing for oil," an area that included Southern states up to southern Virginia, Kentucky and Missouri. (The area "less certain of profitable production" edged up into southern Illinois.)[60] The South had a natural advantage when it came to producing soybeans for oil – its long growing season resulted in larger crops of mature seeds[61] – but more importantly, it had the crushing infrastructure already in place.

The breakthrough in soybean crushing occurred in North Carolina, taking Morse somewhat by surprise. In a letter to Piper in 1914, Morse reported that "this past fall, I learned that the Southern Cotton Oil Mill, of Elizabeth City, North Carolina, conducted experiments in the fall of 1913 with soy beans as an oil proposition. I was not able to learn further than that experiment was successful." He added, "If the farmer can be brought to realize the possibilities and value of the crop not only as a cash crop, but the value to his land, the oil mills will not lack for a cotton-seed substitute."[62] Elizabeth City was in the northeast corner of the state, where farmers had grown soybeans for forage since the 1880s, initially in modest amounts,[63] and where, rather exceptionally, they harvested a substantial amount of seed. This they sold to northern states where the

[59] Piper and Nielsen, 2.

[60] U.S. Department of Agriculture. Bureau of Plant Industry, *The Soy Bean, with Special Reference to Its Utilization for Oil, Cake, and Other Products,* Bulletin 439, by C.V. Piper and W.J. Morse (Washington, D.C.: Government Printing Office, 1916), 8. A note on the first page explained, "This bulletin is intended for general distribution in the Southern States, where it will be of special interest to farmers and cotton-oil millmen."

[61] Ibid., 7.

[62] W.J. Morse, Washington, D.C., to C.V. Piper, Washington, D.C., 4 Dec. 1914, Morse Correspondence. A Seattle mill had crushed imported soybeans as early as 1911, but this was the first recorded use of American soybeans for producing oil. Soyinfo Center, "History of Soybeans in North Carolina, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/north_carolina.php.

[63] Or possibly as early as 1870, when legend has it they were brought to the state by an old sea captain who had obtained them in the Orient. Ibid.

favored hay varieties matured too late for farmers to collect their own seed.[64] Thus even before 1913, these North Carolina farmers were producing commercial soybeans, often using mechanical harvesters manufactured in Elizabeth City.[65]

This first experiment was most likely aimed at finding something to crush during the mill's downtime. When soybean crushing began in earnest in 1915, on the other hand, it was because of an acute shortage of cottonseed. The onset of the First World War in 1914 temporarily curtailed shipments of cotton and caused its price that autumn to plummet.[66] North Carolina cotton growers cut back on production in 1915, often growing soybeans instead. The war ultimately boosted the demand for cotton, and the price for both fiber and seed skyrocketed in the fall, when the local surplus of soybeans made them a cheaper alternative for Elizabeth City mills. In December 1915, the Elizabeth city Oil and Fertilizer Company, crushed 10,000 bushels of soybeans in a test run;[67] its manager, William Thomas Culpepper, later a member of the North Carolina legislature, was afterwards given credit for founding the state's soybean industry.[68] Others followed Culpepper's lead, with mills in at least nine of the state's cities and towns crushing perhaps 100,000 bushels in the spring of 1916.[69] The price of soybean seed rose after the 1916 harvest, and mills apparently turned to cheaper Manchurian beans; but mills contracted with farmers for the 1917 crop – with imports from Manchuria dropping in

[64] E.E. Hartwig and W.L. Nelson. "Soybeans in North Carolina," *The Soybean Digest,* Nov. 1947, 11.
[65] W.J., Beaumont, TX, to C.V. Piper, Washington, D.C., 19 Aug. 1917, Morse Correspondence.
[66] Fite, 7.
[67] Soyinfo Center, "Soybeans in North Carolina."
[68] Woody Upchurch, "Soybean Industry Builds on Foundation Laid by Tar Heel Farmers, Businessmen," [Lumberton, NC] *Robesonian*, 23 Dec. 1967, 5.
[69] Soyinfo Center, "Soybeans in North Carolina."

1918 – and American soybeans were routinely crushed in North Carolina in the years that followed.[70]

Morse greeted these developments enthusiastically and sought to export the North Carolina model to the rest of the South in part by issuing a series of bulletins: *The Soy Bean, with Special Reference to Its Utilization for Oil, Cake, and Other Products* in 1916 (with Piper); *Harvesting Soy-Bean Seed* in 1917; and *The Soy Bean: Its Uses and Culture* in 1918. In a contribution to the USDA's 1917 *Yearbook of Agriculture*, he wrote, "The cottonseed-oil mills of the South saw the possibilities of the soy bean as an oil seed, and many mills throughout the cotton belt contracted with planters for seed of the 1917 crop."[71] Morse's expansive reference to the "cotton belt" somewhat belied the fact that North Carolina produced almost half of the nation's soybean seeds in 1917, more than double the amount of neighboring Virginia, which meant that something less than a third of the total was produced in the rest of the South combined – and an unknown portion of this, certainly the majority, was to be planted for forage, not oil.[72] By 1917, national soybean acreage had increased tenfold from 1907: from an estimated 50 thousand acres[73] to around 500 thousand acres.[74] But this was scattered among the more than 300 million acres of farmland harvested each year,[75] including some 30 million acres of cotton. Thus

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[70] W.J. Morse, "The Soy-Bean Industry in the United States," *Yearbook of the Department of Agriculture 1917* (Washington, D.C.: Government Printing Office, 1918), 104; Charles V. Piper and William J. Morse, *The Soybean* (New York: McGraw-Hill Book Company, Inc., 1923; reprint, NewYork: Peter Smith, 1943), 22 (Table 13).
[71] Morse, "Soy-Bean Industry," 104
[72] Soyinfo Center, "Soybeans in North Carolina"; W.J. Morse, "Soy-Bean Output Increasing in United States," *Yearbook of the Department of Agriculture 1926* (Washington, D.C.: Government Printing Office, 1927), 671.
[73] Approximately 78 square miles, or slightly bigger than two American townships.
[74] Morse, "Soy-Bean Output," 671.
[75] W.J. Morse and J.L. Cartter, "Improvement in Soybeans," in *U.S. Dept. of Agriculture Yearbook 1937* (Washington, DC: Government Printing Office, 1937), 1155; Morse, "Soy-Bean Output," 671; Bruce L.

soybeans had hardly made any progress in the South, especially when measured against the dominance of cotton. Even in North Carolina, which remained the leading soybean grower until 1924, the crop struggled to expand beyond the beachhead it had established in the northeast.

There were several reasons for this disappointment. One potent ally of soybeans – and agricultural reform more generally – turned out to be less of a help than anticipated. The boll weevil had entered Texas from Mexico in 1892 and, carried by late-summer winds, had spread inexorably to every cotton growing county of the South by 1922.[76] Its impact in the years following its first arrival in a county was catastrophic, reducing the cotton crop by up to 50 percent.[77] Reformers thought it just the "paralyzing shock" required to induce Southern farmers to make a "material change" [78] and to adopt a program of lime, legumes and livestock. The preface to Piper's 1909 bulletin described the "great interest" in soybeans "owing to the possibility that it may be grown on an extensive scale in regions where the boll weevil has rendered the returns from cotton culture uncertain."[79]

But this pessimism about cotton's resilience was altogether too optimistic. Given the boll weevil's slow eastward spread, unaffected areas had ample opportunity to expand their cotton acreage – as had already been the trend since the 1880s – to make up for the shortfall in affected areas. And as the weevil approached a given county, its production

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Gardner, *American Agriculture in the Twentieth Century: How It Flourished and What It Cost* (Cambridge, MA: Harvard University Press, 2002), 19.

[76] Fabian Lange, Alan L. Olmstead, and Paul W. Rhode, "The Impact of the Boll Weevil, 1892-1932," *The Journal of Economic History* 69 (Sept. 2009): 687.

[77] Piper and Morse, *Soy Bean* (1916), 18.

[78] G.H. Alford, *How to Prosper in Boll Weevil Territory* (Chicago: International Harvester Company of New Jersey, c1914), 26.

[79] Piper and Nielsen, 2.

of cotton skyrocketed as growers, aided by an influx of refugee labor from weevil-affected counties, tried to "squeeze out one last big crop."[80] It was this inflated amount that was reduced by fifty percent: within ten years, acreage typically crept back to something near what it had been before the anticipatory run-up.[81] Some land was diverted to corn, but corn yields also went down, indicating that farmers were devoting more acres to bare subsistence, not to the improved methods that involved rotation with legumes and sweet potatoes.[82] The boll weevil put the cotton-growing South into turmoil, causing waves of internal migration that spilled over into other regions as well, but it left its cotton dependence intact – for the simple reason that cotton remained the most valuable cash crop that could be harvested with hand labor.

The boll weevil arrived in North Carolina in 1920[83] and was thus not a factor in the advent of soybean crushing there. Its destruction of cotton after 1920 only provided limited help, moreover, because the state's cotton farmers could turn to another labor-intensive cash crop. The cultivation of "bright-leaf" tobacco had begun spreading east from the piedmont to the coast in the early 1900s. Valued for its sweetness, it was used widely in plugs of chewing-tobacco and subsequently in cigarettes. It also upended the soil-enrichment program of rural reformers, as its color and taste were the result of being starved of nitrogen after the initial stages of growth. Tobacco farmers accordingly applied commercial fertilizer in strictly controlled doses to the most sterile land they

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[80] Lange, Olmstead and Rhode, 715.

[81] Cotton production – measured in bales – recovered more slowly because farmers adapted to the weevil primarily by planting varieties of cotton that matured earlier, giving the weevil population less time to expand. These varieties were of lower quality – their fiber was shorter – and were lower yielding. Ibid., 691.

[82] Ibid., 704, 709.

[83] Ibid., 688.

could find[84] – and unlike some progressive cotton farmers, they refused to grow it in rotation with legumes precisely because they made the land too fertile.[85] As bright-leaf tobacco arrived in the northeast of the state, rates of tenancy rose and the average size of farms shrank,[86] reinforcing the sharecropper model. Soybeans earned relatively low returns per acre and, for decades afterward, were planted by small farmers as a cash crop of last resort.[87]

In other areas, soybeans faced competition from other legumes. When Southern tenant farmers did divert to legumes, it was more often to cowpeas – "black-eyed peas" – and peanuts. These were familiar subsistence foods in the South, and George Washington Carver, who largely abandoned soybean research, was not alone in thinking that small farmers could be convinced more easily to expand their patches of these crops than to plant soybeans.[88] As a cash crop, peanuts also had the advantage of having become big business in the north well before Carver's famous peanut bulletin of 1915: roasted peanuts, shelled salted peanuts, peanut butter and Cracker Jack were all in high demand.[89] Peanuts – but not cowpeas, which were starchy – could also be crushed for oil. The soybean's chief advantage next to these legumes was its erect habit, making it easily mowed as hay or mechanically harvested for beans; peanuts and cowpeas were viny, spreading along the ground. Morse, the leading advocate of soybeans, was in fact

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[84] J.B. Killebrew and William H. Glasson, "Tobacco - Discussion," *Publications of the American Economic Association, 3rd Series* 5 (Feb. 1904): 138.
[85] Soyinfo Center, "Soybeans in North Carolina."
[86] Parnell W. Picklesimer, "The New Bright Tobacco Belt of North Carolina," *Economic Geography* 20 (Jan. 1944): 14.
[87] John Fraser Hart and Ennis L. Chestang, "Turmoil in Tobaccoland," *Geographical Review* 86 (Oct. 1996): 554.
[88] David Manber, *Wizard of Tuskegee: The Life of George Washington Carver* (New York: Crowell-Collier Press, 1967), 117.
[89] Andrew F. Smith, *Peanuts: The Illustrious History of the Goober Pea* (Urbana, IL: University of Illinois Press, 2002), 22-27 (roasted), 48-54 (salted), 30-39 (peanut butter), 74 (Cracker Jack).

also the USDA's cowpea man during the 1910s, and he worked to create a hybrid cowpea – using breeding techniques more sophisticated than the sort-and-test procedures of soybean development – that was more erect, arguably undermining his promotion of soybeans.[90]

But, in truth, the soybean's habit was an advantage mainly for larger, mechanized farms – the sort that reformers favored without overtly addressing the consequent displacement of sharecroppers. Soybeans could only move onto the land if thousands of tenant farmers moved off, precisely what happened decades later. In the meantime, when demand for soybean oil was high during the war, refiners obtained it mainly from overseas.[91] Mills that crushed soybeans likewise purchased much of their beans from Manchuria. In the aftermath of the war, demand for both oil and beans declined, forcing Morse, as he toured a South devoid of large-scale soybean mills, to talk up the possibilities of soybean coffee instead.

The Emissary: Yamei Kin

On a hot summer day in 1918, a reporter named Sarah McDougal visited a test kitchen on the top floor of a massive red-bricked Romanesque-revival building at 641 Washington Street, near the piers of the Hudson River in Manhattan.[92] Since 1904, this floor had been the location of a branch laboratory of the USDA Bureau of Chemistry (precursor to the Food and Drug Administration), which tested "samples of doubtful

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[90] The culmination of his work was the Victor Cowpea, so named because Piper, always a stickler in matters of language, thought that naming things "Victory" had become "rather overworked" during the war. C.V. Piper, Washington, D.C. to W.J. Morse, 7 April 1919, Morse Correspondence.
[91] Piper and Morse, *Soybean* (1923), 22.
[92] McDougal, Sarah. "The Soy Bean's Many Aliases." *San Antonio Light,* 6 Oct. 1918, 44..

foods, wines, and oils" entering the U.S. at its busiest port.[93] There was worry in 1918 that U.S. merchants were adulterating olive oil, selling at record-high prices, with cheaper oils derived from cottonseed, corn and soybeans,[94] but olive oil was expensive because very little was being imported, thus making it unlikely that any was being analyzed on the day of McDougal's visit. Instead, she was reporting on another of the Bureau's functions, which had expanded markedly during the war: the search for "meritorious substitutes" for scarce foods. Specifically, she had come to witness the transformation of the soybean, a suspected adulterant, into a meritorious substitute for meat: tofu.

A "Chinese lad had just finished milking the soy beans before I came in," she recounted, explaining that although that "may sound queer," it was "all very simple." The beans had been soaked overnight, then ground in a mill which "looks primitive, being made of two huge pieces of granite, imported from China. In its homeland this mill is worked by coolies, in New York by electricity." The "soy bean cheese" made from the milk – McDougal never called it "tofu" – was "a base for a series of camouflage experiments," the success of which was vouched for by a number of chemists from the floor's other labs who fortuitously dropped in. "We made ours into fish for dinner last night," reported one man. "My wife fried a couple of fish and then fried some soy bean cheese in the gravy, and honest to goodness I couldn't tell which was which. It has a way of absorbing the flavor of whatever it's cooked with."

"We had ours with chops," remarked another visitor, who insisted that if he hadn't known better he might have thought he was eating an additional chop. "Everybody in the place was ready to root for soy beans," McDougal observed. She herself was impressed

[93] "Testing Food Stuffs at Appraiser's Stores," *New York Times*, 18 Sept. 1904, SM7.
[94] Jane Eddington, "Tribune Cook Book: Oil as a Food," *Chicago Daily Tribune,* 17 Oct. 1918, 14.

by the array of soybean products displayed in a row of glass jars on a long table: a white cheese, a brownish paste, a brown sauce familiar to the increasing number of Americans eating chop suey. "Talk about dual personalities! The soy bean has so many aliases that if you shouldn't like it in one form you would be pretty sure to like it in another."

Overseeing these experiments was Dr. Yamei Kin, a small Chinese woman dressed in a blue kimono and white apron. "I have never seen a quieter, quicker or daintier person in a kitchen," McDougal remarked, adding that "Dr. Kin is a woman of few words and these words are spoken in a tone so quiet that you have to keep right beside her to hear what she has to say." She was tightlipped in part because she was working for the U.S. government: she had traveled throughout China the year before as a "special emissary of the United States Department of Agriculture"[95] to investigate traditional soy foods. But her manner also reflected a level of refinement she hoped to lend to the soybean – and, through it, to America itself.

"This whole movement about finding out the possibilities of food is part of the cultural development of the American people," Kin argued. "All this bother about beans is not a question of science or what is good for us, but it is a question of what is dainty, what is nice, what appeals to the taste. Making a study of eating is a part of the fine art of living." In this, America would benefit from the tutelage of Kin's homeland: "The older a civilization becomes, the more people like to be surrounded by beautiful things. Chinese art, you know, is the most highly developed in the world." A special emissary to China, Kin was equally a cultural emissary to the U.S.

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[95] "Chinese Woman's View of Japan: 'A Spoiled Child Among Grown-Up Nations." *Cumberland [MD] Alleganian*, 23 Aug. 1919, 4.

She treated McDougal to an all-soybean luncheon at her 11th Street apartment. Kin could not herself attend, but Wai, the Chinese youth, served her guest. With a gracious smile, he placed a plate with a stuffed green pepper in front of her. "Soy beans," he said, then disappeared silently. McDougal scarcely "believed that pepper was stuffed with anything that was even a distant relation to the soy beans" she had once prepared in the manner of baked beans, with disappointing results. Kin later told her the peppers were stuffed with chopped tofu, prepared like chicken hash. "Honestly I've never tasted anything more delicious." The accompanying biscuits were made with soybean flour. Wai brought out the dessert, a "trembling pyramid of chocolate blanc mange topped with white sauce." "Soy beans," he said.[96] The meal concluded with soybean cheese. This was not fresh tofu, which Kin also tended to call "cheese," but a fermented product – bean curd put through the "cheese process" – that resembled Roquefort.

If McDougal's meal scrambled the nationality of the soybean, using a Chinese ingredient to make American-style dishes, Yamei Kin's identity was no less ambiguous. On a mahogany desk was a photo of Kin's 21-year-old son, "a strapping, tall fellow, in uniform." An American citizen, Alexander Kin was in Europe with Pershing's army. Alexander's father, Kin claimed, had died years before. As with many American mothers who conserved and canned during the war, Kin cited her son as the inspiration for her culinary work: "My boy is at the front doing his bit. I want to do mine, too." Sadly, by the time McDougal's article was published in October, Alexander was already dead, killed during an assault on the Hindenburg line six weeks before the war ended.[97]

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[96] Kin later told McDougal that the dessert was made with "a little red bean," which probably referred to the adzuki bean, not the soybean.

[97] Gerald Jacobson, comp., *History of the 107th Infantry U.S.A.* (New York: Seventh Regiment Armory, 1920), 208. The full posthumous citation reads: "CORPORAL ALEXANDER A. KIN (deceased), *Company I*.

Yamei Kin had spent her entire life negotiating between Eastern and Western influences, continually recalibrating her persona in the process. She was born in 1864 in the Chinese port city of Ningpo, which had been opened to Western traders and missionaries twenty years earlier. Her parents, converts to Christianity, died in a cholera epidemic when she was two, and she was taken into the family of D.B. McCartee, a American medical missionary with the Presbyterian Church. McCartee – a "physician, scientist, educator, diplomatist, scholar, author, evangelist," and student of the Chinese language[98] – taught at the nascent University of Tokyo as a professor of natural science for a time; Kin spent as much of her childhood in Japan as in China. When young, she dressed in embroidered breeches and wore her hair in braids, Chinese-style.[99] She learned the Chinese classics. She also showed an aptitude for science, and McCartee prepared her to follow in his footsteps.

At age 16, after some preparatory courses, she enrolled as Y. May King in the Women's Medical College at the New York Infirmary for Women and Children, an institution founded by pioneering physician Elizabeth Blackwell.[100] May King wore high-collared Victorian dresses, spoke five languages, and in 1885 graduated at the top of

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This corporal declined an important technical detail to duty in Paris in order to remain with his company and take part in the assault on the Hindenburg Line. With inspiring courage and leadership he commanded his men and was killed at their head, September 29, 1918.

[98] Robert E. Speer, "The Man and His Work: From an Occidental Viewpoint," in *A Missionary Pioneer in the Far East: A Memorial of Divie Bethune McCartee*, ed. Robert E. Speer (New York: Fleming R. Revell Company, 1922), 9.

[99] James Kay MacGregor, "Yamei Kin and Her Mission to the Chinese People." *The Craftsman,* 1 Nov. 1905, 244.

[100] Her father's surname has been alternately rendered "Chin" (K. Chimin Wong and Wu Lien-Teh, *History of Chinese Medicine: Being a Chronicle of Medical Happenings in China from Ancient Times to the Present Period* (Shanghai, China: National Quarantine Service, 1936), 346) and "Kying" (Woh Cong-Eng, "The Man as an Oriental Christian Saw Him," in *A Missionary Pioneer in the Far East: A Memorial of Divie Bethune McCartee*, ed. Robert E. Speer (New York: Fleming R. Revell Company, 1922), 209).

her class, the first Chinese woman to earn a U.S. medical degree.[101] She was a scientific prodigy, mastering microscopic photography to the point of publishing a well-received report in the *New York Journal of Medicine*.[102] She was also a devoted Christian, traveling in 1887 to Amoy, China, as a missionary for the Reformed Church of America, which believed she had "every prospect before her of great usefulness to her people."[103] She lasted only a year in Amoy, perhaps because she became seriously ill or maybe because her ambition to duplicate Blackwell's achievement in China – to establish a special hospital for women and children – did not garner enough financial support from churchgoers.[104] The announcement of her departure only revealed that it was "for reasons deemed entirely satisfactory by herself and her more immediate friends."[105] She joined her foster parents in Kobe, where for five years she operated a clinic for women and children.[106]

In 1894, May King gave way to Yamei Kin Eça Da Silva when she married a Macao-born Portuguese musician and self-described linguist. The couple moved to Hawaii in 1896, and she gave birth to Alexander on what would soon be American soil. Motherhood notwithstanding, she applied for a medical license, submitting a letter from

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[101] "Among the Recent Graduates," *Iowa State Reporter (Waterloo)*, 13 Oct. 1887, 1; "Miss May King," *Sumner (Iowa) Gazette*, 11 June 1885, 1; All-China Women's Federation, "Women in History: First Woman Overseas Student of Modern China and Legend in Her Own Time," last modified July 4, 2010, http://www.womenofchina.cn/html/report/106099-1.htm.

[102] Y. May King, "The Photo-Micrography of Histological Subjects," *New York Medical Journal*, 2 July 1887, 7-11.

[103] "Notes and Comments." Gospel in All Lands, 1887-07, 332.

[104] "Woman's Department: China," *The Mission Field [of the Reformed Church in America]*, July 1888, 12.

[105] "Notes and Notices," *The Mission Field [of the Reformed Church in America]*, Nov. 1888, 19. In 1903, Kin gave a divergent account: "Then I went back to China and practiced among women and children for nine years. But women physicians are still few and rare in China, and my practice grew too large and too arduous for me. My health could not stand it. So I gave up the practice of medicine in my own country, and came to San Francisco, where I lived for some time." "First Chinese Woman with American Medical Degree," *Chicago Daily Tribune,* 3 May 1903, 47.

[106] "First Woman Overseas Student."

the Rev. F.W. Damon which "rejoice[d] that a Chinese lady has proved that she is able so thoroughly to acquire the training of our Anglo-Saxon civilization, and to a degree that would be a credit to any American or English woman."[107] Eça Da Silva was still involved in mission work as well, appearing before congregations in California to win support for missionary work among the women of China, whom she characterized – if a news report's paraphrase is to be trusted – as "sunk in stolidity and sensuality, the abject slaves of their lords and masters," surrounded by "dense clouds of superstition and ignorance."[108] She and her family moved to San Francisco permanently in 1902, her own marriage in crisis.

That year she published a short story in the *Overland Monthly* as "Dr. Yamei Kin," full stop. "The Pride of His House: A Story of Honolulu's Chinatown" was a sympathetic portrayal of Ah Sing, a prosperous merchant and Confucian gentleman – taught that "the superior man preserves harmony" – who gently and reluctantly proposed to his barren wife that they bring a handmaiden into their household to bear him an heir. Despite this violation of Christian morals, nowhere did Kin suggest that the wife was an abject slave to her lord and master.[109] In 1903, a women's club in Los Angeles announced "a series of FOUR LECTURES OF THINGS ORIENTAL by the Noted Chinese Woman DR. YAMEI KIN."[110] Over the following two years – as she traveled to Chicago, Boston, New York City and Washington, D.C. – she became a popular secular speaker, mainly but not exclusively on the woman's club circuit. In Washington, she

[107] "A Chinese Woman Physician, Dr. Yamei Kin," *Outlook*, 16 May 1917, 108.
[108] "Their Day of Rest," *Los Angeles Times*, 1897-07-14, 6.
[109] Yamei Kin, "The Pride of His House: A Story of Honolulu's Chinatown," *Overland Monthly and Out West Magazine*, Feb. 1902, 655-59.
[110] "Brevities," *Los Angeles Times*, 10 Jan. 1903, 1.

"delivered a lecture at the residence of Senator Kean before an audience representative of all that is best in Washington society."[111]

When the topic of her family came up – news reports noted that she enrolled Alexander in a military academy in Manlius, New York[112] – she let it be known that she was a widow. Her husband in fact sued her for divorce in her absence, charging her with desertion. He claimed that she had told him he was not "up to date" and that she was a "new woman." A judge granted him the divorce in Kin's absence, who "when last heard of [was] in Boston."[113] But if she was a modern American woman in her private life, her persona on stage was that of a visitor from an ancient culture. She appeared in elaborate Chinese costume, often with a tastefully coordinated flower in her hair, in striking contrast to what her audiences perceived as her incongruously flawless English of the "purest Anglo-Saxon."[114] For her women's club audiences – whose pursuit of "self-culture" and collective study was frequently ridiculed by elite men as the acquisition of superficial "women's club knowledge"[115] – she must have seemed like a transparent window onto an exotic landscape, a means of mastering the basics of Asian civilization in a series of short lectures.

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[111] "By a Chinese Woman Doctor," *The Washington Post*, 25 March 1904, 7.

[112] "Noted Chinese Doctore Here." *(Syracuse) Post-Standard*, 21 Sept. 1904, 8.

[113] "Cathay Meets American Law," *San Francisco Call*, 13 Aug. 1904, 14. Apparently the husband was something of a rake: he was arrested in St. Louis in October 1904 on charges of transporting prostitutes to the Chinese Village at the World's Fair. He was acquitted on a technicality, but the scandal sheets revealed in the meantime that he had two fiancées – presumably while still married to Kin – one of whom funneled him information from inside the Chinese Bureau of the immigration department. They later married and had two children. Mae Ngai, *The Lucky Ones: One Family and the Extraordinary Invention of Chinese America* (Boston: Houghton Mifflin Harcourt, 2010), 109; "Arrested in St. Louis," *Los Angeles Times,* 21 Sept. 1904, 3; "Da Silva Turned Over," *Los Angeles Times,* 28 Sept. 1904, 3; "Hart North Is Accused," *Oakland (CA) Tribune*, 7 Feb. 1905, 7; "Letters Tell of Love and Plan to Defraud," *San Francisco Call*, 30 Sept. 1904, 1; "Miss Burbank Is Dropped from the Service," *San Francisco Call*, 16 March 1905, 1.

[114] "Novelty for Medicos," *Los Angeles Times*, 7 March 1903, 12.

[115] Anne Ruggles Gere, *Intimate Practices: Literacy and Cultural Work in U.S. Women's Clubs, 1880-1920* (Urbana, IL: University of Illinois Press, 1997), 175, 180.

But Kin's costuming delivered a broader message as well. In part, it was a reassurance that, as China increasingly opened up, it would be receptive to Western science, technology and – as many in America envisioned – social and political reform.[116] Kin's appearance indicated that even those who were not fully Westernized could absorb Western influences, that it was "possible for an eastern woman to enjoy western education and training and remain characteristically oriental."[117] Kin argued that China, having long been a leader in scientific discovery – until its energies were absorbed in assimilating the Mongols and Manchus, who had overwhelmed China much as the Goths and Visigoths had "swarmed down upon the Romans" – was now "ready to go forward," but on its own terms.[118] "Western civilization, particularly as developed in America," she explained in an interview, "cannot be applied in its entirety to China."[119] Indeed, she predicted that a modernized China, again at the apex of world civilization, would have valuable lessons to teach the brutishly individualistic West.

She suggested that Chinese culture, having mastered the art of living, offered a model of reform in turn to younger nations. To clubwomen, she urged that the clothes of Asia were not simply more beautiful than American clothes – with their "crude, abrupt lines" – but also comfortable, loose, and simple, the ideal reform dress. Members of Chicago's North Side Art Club at least jocularly agreed that kimonos would make good street wear: "They could be worn on all occasions, and then the pockets in the sleeves would be a

[116] Robert McClellan, *The Heathen Chinee: A Study of American Attitudes toward China, 1890-1905* (Columbus, OH: Ohio State University Press, 1971), 137; Jerry Israel, *Progressivism and the Open Door: America and China, 1905-1921* (Pittsburgh: University of Pittsburgh Press, 1971).
[117] "Woman's World: The First Woman in China to Practice Medicine," *Altoona Mirror,* 29 Aug. 1911, 7.
[118] "Yamei Kin and Her Mission," 245.
[119] Ibid., 246.

great convenience," Mrs. La Verne W. Noyes told a reporter.[120] To a Peace Congress in Boston, Kin "expressed herself as glad she is a representative of a race that has always advocated peace." Likewise, before a pacifist audience in New York, she pointed out that "my nation is the only one in the world which has lived up to your doctrine."[121] To the Ethical Culture Society, she pointed out that "all China is one vast ethical culture society."[122] At a talk at the Cooper Union, she responded to questions from Socialists. To the query, "Have you any Social Democratic party?" she answered, "No, we tried that in 200 B.C. It proved a failure and we adopted Confucianism."[123]

Even in this period, her insistence on mutual cultural exchange extended to food. She took advantage of the new American craze for *chop suey*, a peasant hash that originally included organ meats but, after being discovered by New York bohemians visiting Chinatown, was tamed by enterprising Chinese restaurateurs, who took it uptown and then gradually to points west.[124] American housewives soon sought to make the dish themselves, and in 1903 Kin taught a recipe to women of the Evanston Woman's Club.[125] She most likely used soy sauce in her demonstration, as this was the primary seasoning for chop suey in Chinese restaurants, but as the dish became popularized in American cookbooks, even that ingredient was optional.[126]

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[120] "Kimonos for Street Wear," *Coscocton (Ohio) Daily Age*, 4 Nov. 1903.. The topic of Kin's talk on this occasion was actually "Chinese Women," but it was the digression into Japanese clothes that made the society column.

[121] "Women Workers in the Cause of Peace," *Boston Globe*, 26 Sept. 1904, 5.; "Women the Speakers," *Boston Globe*, 6 Oct. 1904, 8.; "Little Oriental Lady Who Won Peace Conference," *New York Times,* 16 Oct. 1904, 9.

[122] Ibid.

[123] "Little Dr. Yamei Kin Answers Socialists," *New York Times,* 18 Feb. 1905, 7.

[124] Andrew Coe, *Chop Suey: A Cultural History of Chinese Food in America* (New York: Oxford University Press, 2009), 156-174.

[125] "Chop Suey Fad in Evanston." *Chicago Daily Tribune,* 26 Sept. 1903, 2.

[126] Of the two chop suey recipes in the *Club Woman's Cook Book* published in 1911, one included "1/2 cup Chinese liquor." *Club Woman's Cook Book: A Collection of Tested Receipts Compiled and Originally*

In a 1904 lecture on the Chinese diet, however, she highlighted the role of the soybean. "One surprising thing Dr. Yamei Kin tells is that Chinese 'soy' is made from a sort of red bean ground up and fermented," read one slightly garbled account. "While fermenting it smells much like sauer kraut, only worse. The fermented product is shipped in large cases to England, where it is mixed with vinegar and other products and is sold as Worcestershire sauce." Kin also described how tofu was made, which she called "bean cake," noting that it "may be cooked and mixed with other things, fish, chicken, etc." Using it as a meat extender, as she later would during the war, was thus a common Chinese use for tofu. Kin went on to explain that tofu was "highly nutritious and explains why the Chinese laborer can endure so much on so little food." [127] There is no indication that she ever prepared or served tofu to clubwomen.

Kin returned to China in 1905, where she hosted Frank Meyer in Chefoo one evening as he made his way to Peking. Meyer described her as a friend of David Fairchild, whom she had apparently met during a sea voyage.[128] In 1907, she accomplished her goal of becoming the Elizabeth Blackwell of China when she became director of the Imperial Peiyang Women's Medical School and Hospital in Tientsin, where she devoted herself to bringing Western medical and sanitary techniques to China.[129] She held on to the position through the overthrow of the Manchu Dynasty and establishment of the Chinese Republic in 1910, and she began traveling to the U.S. again in 1911, when she brought

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Published by the Ramblers' Club (Minneapolis, MN: Ramblers' Club, 1911; revised edition, Chicago: M.A. Donahue and Company, 1913), 30, 44.

[127] "Chinese Food Products," *(Algona, IA) Advance,* 22 Dec. 1904.

[128] Isabel Shipley Cunningham, *Frank N. Meyer: Plant Hunter in Asia* (Ames, IA: The Iowa State University Press, 1984), 32.

[129] "Woman's World: Around the World with Women," *(Winnepeg) Free Press*, 15 April 1911; "First Woman Overseas Student."

with her a Chinese nursing student for American training.[130] She hit the lecture circuit again, this time criticizing not only American women's clothes, but the tight dresses that young Chinese women were beginning to adopt.[131]

It is unclear to what degree she was a spokesman for the new Republican government: she did justify its policy of denying women the vote, but she had been against immediate suffrage for Chinese women during the previous decade as well, arguing that they needed to be better educated first.[132] She also adopted a more militant tone against Japanese imperial aspirations.[133] She traveled regularly between China and the U.S. in the years that followed, making it unclear exactly which nation she represented when the USDA sent her on her mission to China in 1917 to research the soybean.

For Kin, tofu was an example of the Chinese art of living: a lesson to the West during its time of need on how to live simply without sacrificing delight. By the time of America's entry into World War I, there were however efforts within the USDA to use the soybean in a different manner: to more thoroughly Americanize it, making it a substitute for meat while bypassing traditional Asian soy foods. The man who oversaw these efforts was Charles F. Langworthy, who had been the first at the USDA to publish an account of "Soy Beans as Food for Man" – an appendix to the 1899 bulletin, *The Soy Bean as a Forage Crop* – in which he drew on Japanese sources to describe natto, tofu,

[130] "China's Foremost Woman Physician." *(Frederick, MD) Evening-Post,* 25 Jan. 1911, 1.. This was perhaps the first of many such students. "Forty Young Chinese Women," *Chicago Commerce*, 10 May 1912, 28.
[131] "Fashion's Fads and Fancies," *The Washington Post,* 7 Feb. 1911, 7; "Society Outside the Capital." *The Washington Post*, 13 Feb. 1911, 7.
[132] "Chinese Suffragist Puts Modesty First," *New York Times,* 8 Jan. 1913, 7; "Women Advancing in China," *New York Times,* 14 Jan. 1913, 7; "Chinese Women Have No Power to Vote," *Titusville Herald,* 13 Feb. 1913, 3.
[133] Kin, Yamei. "Commercial War Should Be Made with Commerce, Noth with Human Lives." *Coriscana (TX) Daily Sun*, 18 Nov. 1915, 2.

miso, yuba and shoyu. He pointed out that the "deficiency of protein in [rice] is made up by the consumption of large quantities of . . . soy-bean products," much as Kin later pointed to soybeans as the secret of Chinese laborers' endurance.[134] His article was reprinted or paraphrased in the *Sanitary Home* and *The Hygienic Gazette.*[135] He never attempted to adapt tofu to American tastes, however. Rather, he sought to prepare soybeans in a way that Americans would find more familiar: as green beans, baked beans, or incorporated into muffins.

Langworthy entered the USDA as an assistant to Wilbur Atwater, then head of the Office of Experiment Stations. Atwater was widely regarded as the founder of nutrition science in America, largely by transmitting ideas that he learned while studying in Germany. Above all, he believed that the value of food was reducible to its constituent nutrients: protein, carbohydrates, fat and minerals (along with bulk to aid digestion). For reasons largely of status, however, Americans spent more money than necessary to obtain these nutrients, although the time would come when, due to an increasing population, they would no longer be able to. Above all, he argued, Americans needed to economize on sources for what he regarded as the most precious of nutrients – protein – as this was "tissue-building," not simply a source of energy.[136] Atwater's estimated protein requirement was high, 125 grams per day for a moderately active man,[137] and contested

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[134] Department of Agriculture, *The Soy Bean as a Forage Crop*, by Thomas A. Williams, with an appendix on "Soy Beans as Food for Man" by C.F. Langworthy, Farmers' Bulletin No. 58 (Washington, D.C.: U.S. Government Printing Office, 1899), 23.

[135] "Vegetable Cheese," *The Dietetic and Hygienic Gazette,* June 1900, 340-41; Department of Agriculture, Office of Experiment Stations, *A Description of Some Chinese Vegetable Food Materials*, by Walter C. Blasdale (Washington, D.C.: Government Printing Office, 1899).

[136] W.O. Atwater,"American and European Dietaries and Dietary Standards," *Fourth Annual Report of the Storrs School Agricultural Experiment Station, Storrs, Conn.* (Middletown, CN: Pelton & King, Printers and Bookbinders, 1892), 168.

[137] Ibid., 160.

during the first decade of the twentieth century by vegetarians and rival academics, who ultimately succeeded in arguing the consensus down to between 70 and 100 grams per day.[138] Despite Atwater and Langworthy's consequent hostility to vegetarians, they advocated that, in addition to using legumes as feed to increase the protein content of meat, Americans eat more beans directly.

It was precisely the soybean's high protein content – up to 43 percent of its weight, in comparison to the navy bean's 23 percent[139] – that interested Langworthy. Unfortunately, this high quotient of protein (and lack of starch, as the soybean stored its reserve energy in its oil) made it harder to cook and less palatable as a whole bean than the popular navy bean. Jane Eddington, a food writer for the *Chicago Tribune* and an early proponent of soybeans, cautioned that the "soy bean is in the world of vegetable foods what the old hen is among meat foods. Both contain a rocky sort of protein which can be cooked soft and savory if you know how. A good many people have not known how, so have discarded the soy bean after a trial or two."[140] She recommended soaking the beans overnight and cooking them for a long time on a low heat: they "really ought never to be subjected to a boiling temperature."[141] In 1917, with the price of navy beans spiking, Eddington noted that "more people were trying them and failing in their cooking than ever before."[142]

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[138] Harvey A. Levenstein, *Revolution at the Table: The Transformation of the American Diet* (Berkeley: University of California Press, 2003), 91. By 1911, Langworthy reluctantly acknowledged that less than 100 grams per day might be sufficient.
[139] Williams and Langworthy, 21. As with everything else, the protein content of the soybean depended on the variety.
[140] Jane Eddington, "Tribune Cook Book: Baked Soy Beans," *Chicago Daily Tribune,* 13 Dec.1917, 18.
[141] Jane Eddington, "The Tribune Cook Book: Beans, Soy Special." *Chicago Daily Tribune,* 14 Oct. 1917, E8.
[142] Eddington, "Baked Soy Beans."

Langworthy, who was Chief of the Office of Home Economics by this time, addressed this by directing his staff to test the cooking qualities of 800 numbered soybean varieties obtained from Morse. They discovered that two varieties, 34702 and 40118, cooked very soft. The first, subsequently named Easycook, was ready in about twenty minutes, while the average soybean required from three to six hours.[143] Both Easycook and 40118, called Hahto after its Japanese varietal name,[144] were large, unusually starchy soybeans.[145] But they were identified only in 1918, with Morse distributing them in 1919 to, among other correspondents, George Washington Carver and a small Adventist college in Tennessee.[146] In the meantime, the soybeans that were readily available to buyers were the overflow from the seed market – as late as 1914, they were hard to find outside of seed stores[147] – and tended to be popular hay varieties, like Mammoth Yellow, which did not readily soften when cooked.[148] With seed prices rising in 1917, both housewives and canneries scaled back their use of soybeans after an initial enthusiasm.[149] By April 1918, Eddington was praising the pinto as a cheaper alternative; it was,

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[143] William Shurtleff and Akiko Aoyagi, *History of Edamame, Green Vegetable Soybeans, and Vegetable-Type Soybeans (1275-2009): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2009), 117.

[144] U.S. Department of Agriculture, Bureau of Plant Industry, *Inventory of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction during the Period from January 1 to March 31, 1915: Inventory No. 30; Nos. 39682 to 40388* (Washington, D.C.: Government Printing Office, 1918), 69. *Hato-koroshi-daizu*: "Daizu" means "large bean," a common suffix for the large-seeded soybeans used as green vegetables; "Hato-koroshi" means "dove killer," perhaps also somehow a reference to the bean's size.

[145] Piper and Morse, *Soybean* (1923), 111, 193.

[146] Shurtleff and Aoyagi, "History of Edamame," 117.

[147] Jane Eddington, "Economical Housekeeping: Soy Beans," *Chicago Daily Tribune*, 11 Feb. 1914, 11.

[148] Piper and Morse, *Soybean* (1923), 111.

[149] Jane Eddington, "Tribune Cook Book: Pinto Beans," *Chicago Daily Tribune,* 29 Dec. 1917, 10.; R.A. Oakley, Washington, D.C., to Carl L. Alsberg, Washington, D.C., 25 May 1917, Record Group 88, Records of the Food and Drug Administration, Subgroup: Records of the Bureau of Chemistry 1877-1943, Series: World War I Project File 1917-19, National Archives II, College Park, MD (henceforth "Records of the Bureau of Chemistry").

moreover, "a digestible bean," while she had "doubts about the soy bean in that regard."[150]

A product that circumvented this problem was soybean flour, for which hard beans like Mammoth Yellow were well suited. The Chinese had long used ground roasted soybeans as a flour, in particular to make confections, but it was the Germans in the nineteenth century who, following the lead of Austrian Friedrich Haberlandt, pioneered the production of unroasted soybean flour.[151] Haberlandt, credited with popularizing the soybean in Europe after collecting seeds at an international exposition in 1868, had a vision for it similar to Langworthy's: as a cheap form of protein for Europe's poor. The flour was most used mostly, however, as a specialty food for diabetics, mixed with wheat flour in varying degrees to lower the carbohydrate content of bread. With the advent of soybean crushing in Britain, flour also represented a higher-value use for the press cake than feed or fertilizer; Morse in fact sought to interest Northern mills and bakeries in this byproduct of what he envisioned as the Southern crushing industry.[152] Defatted flour also had the advantage of keeping better.

With America's entry into World War I, home economists recommended soybean flour as a good substitute for wheat flour. Langworthy's office circulated a bulletin, *Use Soy-Bean Flour to Save Wheat, Meat and Fat* in 1918, which offered recipes for quick breads, muffins and yeast breads using soybean flour, though it cautioned that "it is rich in protein and fat and should be combined with starchy substances like, rice, potatoes, or

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[150] Jane Eddington, "Tribune Cook Book: Baked Pinto Beans," *Chicago Daily Tribune,* 2 April 1918, 14.
[151] Soyinfo Center, "History of Soy Flour, Grits, Flakes, and Cereal-Soy Blends - A Special Report on the History of Soy Oil, Soybean Meal, & Modern Soy Protein Products: A Chapter from the Unpublished Manuscript, History of Soybeans and Soyfoods: 1100 B.C. to the 1980s by William Shurtleff and Akiko Aoyagi," last modified 2007, www.soyinfocenter.com/HSS/flour1.php.
[152] Soyinfo Center, "History of Soy Flour," 3; Piper and Morse, *Soy* Bean (1916), 1.

corn flour"; on the other hand, because even the defatted flour of the era still contained a fair amount of oil, it reduced the need for added fat. The bulletin recommended a one-to-one ratio of soybean and wheat flours for quick breads and a one-to-three ratio for yeast breads.[153] It also instructed housewives to make "soybean mush" by cooking the flour in a double boiler for two hours. This was a "meat saver," as it could be sliced and baked as croquettes or used as an ingredient – along with actual meat – in Soy-Bean Meat Loaf.[154] The bulletin presumed that housewives could grind their own flour, as commercial soybean flour was still scarce: in 1917, as in 1914, the *Tribune's* Eddington obtained it through a "medical manufactory" that produced it for diabetic patients.[155]

It is hard to gauge the influence of a single bulletin, but USDA demonstrators, notably Hannah Wessling from the Bureau of Chemistry, also toured the country to show agricultural extension workers the uses of soybean flour.[156] Home economics departments at universities also worked with soybeans, and "soy loaf" recipes – either using beans or flour – were published frequently in newspapers. Soybeans also had a presence at the Chicago Patriotic Food Show, which opened to the public for two weeks in January 1918 and was billed as the first of its kind in the nation or even, more grandiloquently, the world.[157] It was organized by a special committee of the Illinois

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[153] Department of Agriculture, *Use Soy-Bean Flour to Save Wheat, Meat and Fat,* contributions from The States Relations Service, A.C. True, Director, Circular No. 113 (Washington: D.C.: U.S. Government Printing Office, 1918), 3.
[154] Ibid., 4.
[155] Jane Eddington, "Tribune Cook Book: Soy Bean Flour," *Chicago Daily Tribune,* 21 March 1917, 12., Jane Eddington, "Tribune Cook Book: Soy Beans as Human Food," *Chicago Daily Tribune,* 12 Jan. 1919, B4.
[156] Helen B. Wolcott, Lexington, KY, to Hannah L. Wessling, Washington, D.C., 9 May 1917; H.L. Wessling, Washington, D.C., to Helen B. Wolcott, Lexington, KY, 23 May 1917, Records of the Bureau of Chemistry.
[157] Margery Currey, "World's First Patriotic Food Show Starts," *Chicago Daily Tribune*, 6 Jan. 1918, 5.

State Council of Defense and blessed by Herbert Hoover's Food Administration, although he sent a subordinate to actually attend the exposition.[158]

Its floor plan expressed the principles of scientific nutrition, consisting of five parallel aisles representing the "five food groups": Proteins, Fats, Sugars, Fruits and Vegetables, and Starches.[159] In the median of each aisle, running its length, was the demonstration space, where students and teachers from nearby home economics departments stood behind broad counters handing out samples, the recipes for which visitors could find in the *Official Recipe Book*, available for 5 cents. Flanking the demonstration spaces were commercial booths, frequently showcasing the products used by the demonstrators.[160] Ring Lardner, the humorist and sports writer, who gently satirized the event in his *Chicago Tribune* column, summed up the overall message of the show this way: "The life-supporting principles in food are proteins, starches, sweets, and fats. . . . [T]he purpose of the food show is to acquaint the public with victuals containing the aforesaid principles but transgressing none of the laws of patriotic conservation."[161]

Soybeans appeared in three of the five aisles – as a "meat saver" along with other legumes in Protein, paired with cowpeas in Vegetables, and ground into a flour in Starches. It did not appear in Fats, however, among the "various new oils . . . now upon the market" made from cottonseed, peanuts, or coconut.[162] Twelve of the over 300 recipes in the official cookbook contained soybeans. Its Soy Bean Loaf recipe called for the use of "soy bean pulp," which required soaking the beans for 24 hours, simmering

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[158] Mrs. Lynden Evans, "A Call for Kitchen Patriotism," *Chicago Daily Tribune*, 12 Jan. 1918, 5; "Learning How to Win the War," *Chicago Daily Tribune*, 6 Jan. 1918, 5.
[159] Currey.
[160] Routzahn, Mary Swain. *The Chicago Patriotic Food Show: A Brief Review of Its Main Features* (New York: Russell Sage Foundation, 1918), 3-4.
[161] Ring Lardner, "In the Wake of the News: War Eats." *Chicago Daily Tribune*, 9 Jan. 1918, 11.
[162] Currey.

them with baking soda for two hours, placing them in a "fireless cooker" for an additional twelve hours, and then putting them through a meat grinder.[163] The recipe book did not recommend soybean flour for yeast breads, but had several recipes for muffins, nut breads, cakes, and cupcakes that used soybean "meal," indicating that it was to be ground by the baker herself, in equal proportions to wheat flour.[164]

The soybean's ubiquity, belying its small overall presence, made an impression on Lardner, who learned that they were "a general utility food, said at the show to be a conglomeration of practically all the essentials." (He may have missed that they were low in starch due to their presence in that aisle.) He added, "If you have a little soy bean in your home there is no danger of malnutrition. This little fellow appears to be an effective substitute for everything from the anchovies to the 'zert, or from a to z." Lardner went on to offer a mock menu "for a day's patriotic meals" which included many courses of soybeans. Breakfast, for example, consisted of: "PROTEINS. Soy beans. STARCHES. Stand-up or Turn-down hash. This is made by cutting two worn-out stiff collars into small flakes and mixing them with soy beans. FATS. Boiled Kaiserkopf. Remove the brains from a Hohenzollern's head in a thimble and sterilize the balance in boiling water. SWEETS. Oney Fred potpie, with soy beans."[165]

It is perhaps not possible to reduce Lardner's levity to a specifically male outlook, but the women who covered the show for the *Tribune* tended to take it more seriously. Mrs. Lynden Evans, who chaired the Committee on Demonstration for the show, wrote in the

[163] *Official Recipe Book: Containing All Demonstrations Given During Patriotic Food Show, Chicago, January 5-13, 1918* (Chicago: Illinois State Council of Defense: 1918), 25.
[164] Ibid., 59-72. The Bean Spice Cake, however, used no wheat flour at all.
[165] Lardner. Oney Fred Sweet was a *Tribune* features writer. Lardner's "Luncheon" included, in references now equally obscure to today's readers, "SWEETS. Rosie O'Grady and Annie Rooney, with soy beans. FATS. Filet of Bob Lee, with soy beans."

paper, "Our government has called the housewives to a definite part in the wartime program. . . . If she does not do it will not be done. If it is not done, millions will starve . . ." Jane Eddington likewise reported that the "marvel and glory of our patriotic food show is that it is truly and wonderfully educational."

Like Lardner, Eddington also highlighted the presence of soybeans. She zeroed in on a "unique exhibit . . . of Chinese soy bean products," a commercial booth staffed by two Chinese women, Hattie Don Sang and Marion G. Moy, which showcased "bean bread":[166] bread and rolls made, they said, with ten percent white flour, only "enough to forward fermentation." These were, in Eddington's estimation, "deliciously palatable, so much so as to provoke criticism of ordinary baker's products made of white flour and flavorless almost save for the fat." When she asked where she could get soybean flour, however, she was informed, "We only make enough for our own bakery." The booth also displayed "toufu" and soybean sprouts, with recipes. Eddington concluded, "If we watch out we may find out how to make the soy bean cheese or toufu."[167] The most she offered her readers in a subsequent column, however, was an extended quote from one of Morse's bulletins describing how tofu was made, not a personally kitchen-tested process.[168]

With this display at the Chicago Patriotic Food Show indicating that there were Chinese companies in America producing tofu alongside breads that used soybean flour – and this isn't to mention the existence of Japanese tofu makers on the west coast and in

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[166] "Learning How to Win the War." A photo in this article shows Hattie Don Sang in front of a table with a sign reading, "bean bread"; Eddington did not identify it by that name. Nor did she give the name of the young women staffing the booth; see Currey.
[167] Jane Eddington, "Tribune Cook Book: Soy Bean Products, Etc.," *Chicago Daily Tribune*, 8 Jan. 1918, 14.
[168] Eddington, "Soybeans as Human Food."

New York City – it is not entirely clear why the USDA found it necessary to send Kin to China to do her research.[169]

Frank Meyer may have had something to do with it. In the course of expeditions to China during the 1910s – before his mysterious death in 1918, when he disappeared from a boat traveling on the Yangtze River on its way to Shanghai[170] – he lost his hesitancy about soy foods. He took numerous photographs of shoyu and tofu production (which later appeared in Piper and Morse's *The Soybean*), and in November 1916 sent samples to Morse of fermented tofu. He called this "bean cheese" and noted that while "beancurd and beanmilk always taste beany" or had a "peculiar paint- or putty-like flavor,"[171] the fermented cheese had "lost this unpleasant characteristic." In an August 1917 letter, he was gratified "to hear that Mrs. Kin has obtained a commission from the Bureau of Chemistry to investigate the bean cheese industry." [172] This hinted that it was fermented soybean cheese – and the exact fermenting agent used to make it – that was the goal of her mission. And she would indeed serve McDougal a Rocquefort-like soybean cheese the following year.

Press accounts were unclear about the exact scope of her mission. The June 10, 1917 edition of the Sunday *New York Times Magazine* featured a full-page story: "Woman Off to China as Government Agent to Study Soy Bean: Dr. Kin Will Make Report for United States on the Most Useful Food of Her Native Land." The article remarked that the

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[169] Morse was certainly aware of the Chicago company. Piper and Morse, *Soybean* (1923) contains tofu recipes from the Chicago Bean Bread Company (p. 273), which was incorporated shortly after the Food Show and had its plant in Chicago's Chinatown. There is no definitive indication that this was the same group that mounted the Food Show booth, but it seems likely. "Trade Items," *The National Baker*, 15 May 1918, 70.
[170] Cunningham, 243, 247-48.
[171] Shurtleff and Aoyagi, *Morse,* 73
[172] Ibid., 64

"appointment of Dr. Kin marks the first time the United States Government has given so much authority to a Chinese. . . . That it is a woman in whom such extraordinary confidence is now reposed detracts nothing from the interest of the story." The rest of the piece was an extended quote from Kin, probably drawn from one of her lectures: "In some things we Chinese have far outstripped you," she emphasized. "Instead of taking the long and expensive method of feeding grain to an animal until the animal is ready to be killed and eaten, in China we take a short cut by eating the soy bean, which is protein, meat, and milk in itself." [173] While the *New York Times* implied that Kin's mission was to collect information, another account reported that she would actively organize, "with the cooperation of the government there," an "effort to multiply the production of the soy bean [for export to] the United States, Canada, and Great Britain." She was even to recruit Chinese farmers to return with her, the Chinese Exclusion Act ban on laborers notwithstanding, to "aid the Allies in opening bean patches, the Chinese being, she thinks, experts in the best mode of selection."[174]

These plans did not come to fruition, in any case, and the American press did not track her activities in China. The *North-China Herald* reported from Shantung in August that Kin "is out here making some investigations into bean curd for the U.S. Government at Washington, with the idea of introducing it into America, [spending] several days on the mountain side making frequent trips into the country."[175] Meanwhile, the American Legation in Peking was baffled when it intercepted a telegram from Kin to the USDA regarding agreements with landowners to set up cotton plantations in the Shantung, Honan, and Chihli provinces under the direction of American experts; the State

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[173] "Woman Off to China as Government Agent to Study Soy Bean," *New York Times,* 10 June 1917, 65.
[174] "Emperor Forgot China," *Peace River [Alberta, Canada] Record,* June 1917.
[175] "Bandits of Shantung," *North-China Herald*, 25 Aug. 1917, 428.

Department reassured the Legation that the Chinese government was not involved.[176] And by September, Meyer – always sensitive about perceived slights – wrote that he had "not heard from Mrs. Kin yet; she surely will get along without my assistance, for she 'knows the ropes' here in her own land."[177]

Kin returned to New York in October 1917. As early as February 1918, there were newspaper accounts of "one of the most interesting kitchens in the world, presided over by a Chinese woman doctor" at 641 Washington Street.[178] In late July, about the time that McDougal toured Kin's kitchen, Dr. B.R. Hart, chief of the Bureau of Chemistry's Eastern District, sent a letter to members of the National Canners' Association. The year before, when first notified of her mission, Hart had argued that Asian soy foods – shoyu, miso, tofu, and yuba – were "consumed only by the Oriental population, with the possible exception of a small portion of the shoyu. In fact, the flavor of most of these foods is so distinctive and peculiar that there is little likelihood of their ever being accepted by Occidental peoples."[179] Now he informed the canners that Kin had developed soybean dishes "well suited for canning, and in view of the present shortage of meat they can be added with advantage to the preparation[s] you now have on the market." He added that a "number of prepared dishes of various kinds have been made up ready for use, and these as well as the process for manufacturing the curd have been worked out quite in detail. . . . Dr. Kin would be glad to grant you or your representative a personal interview

[176] American Legation, Peking, to Secretary of State, Washington, D.C., 15 Sept. 1917, Record Group 59, Textual Records from the Department of State, M329, Roll 183, 893.61321/6a and 893.61321/7, National Archives II, College Park, MD.
[177] Shurtleff and Aoyagi, *Morse*, 63.
[178] "Makes New Kind of Meat," *[Monticello, Iowa] Express,* 25 July 1918, 3.
[179] B.R. Hart, San Francisco, CA, to Chief, Bureau of Chemistry, Washington, D.C., 22 May 1917, Records of the Bureau of Chemistry.

and explain the whole matter."[180] There is no indication that any canner took Hart up on the offer.

Kin also hoped to use tofu "to increase the bulk and food value of meat dishes served to soldiers in training at near-by camps," even serving an all-soybean meal to a group of army officers. This, and perhaps her other efforts, was hampered by wartime logistics: she was unable to arrange for large-scale shipments of soybeans from North Carolina on the government-controlled railroads.[181] Mass-production schemes aside, she did demonstration work, giving a lecture on the soybean to a Home Demonstration Conference in Washington, D.C.,[182] and even traveling to places like Buffalo, New York, to "demonstrate the use of Soy Bean Curd as a wheat substitute."[183] It is not clear that she ever taught women how to make tofu at home, however. And, in any case, her efforts were too small to make a dent in the American diet. The war may not after all have provided the opportunity for tofu that it seemed to: in press accounts, she presented it as a substitute for chicken or fish, or described it as tasting "a little like brains and a little like sweetbreads." [184] In other words, it was a substitute for foods that Americans were already substituting for beef, pork and mutton, the only meats that the Food Administration defined as "meat" for the purposes of conservation.[185] Restaurants

[180] "A New Meat Substitute," *New York Times,* 21 July 1918, 18.

[181] Walter T. Swingle, "Our Agricultural Debt to Asia," in *The Asian Legacy and American Life,* ed. Arthur E. Christy (New York: Asia Press, 1945), 91.

[182] "Use of Soy Beans as Fat Substitute Urged by Chinese Expert," *Oil, Paint and Drug Reporter*, 17 Dec. 1917, 25.

[183] Daniel J. Sweeney, compiler, *History of Buffalo and Erie County, 1914-1919* (Buffalo, NY: Committee of One Hundred, 1919), 434. This may be a garbled recollection, as she, like others, probably used soybean flour, not tofu, in bread.

[184] "Food Value of Soy Bean: Chinese Expert Rates It High," *Evening Capital and Maryland Gazette*, 2 Oct. 1918.

[185] *Official Recipe Book,* 14.

regularly served poultry and fish on meatless days.[186] In *The Soybean*, published in 1923, Piper and Morse simply noted that "Attempts have been made during the past 5 years to introduce tofu to the American people, but without much success."[187]

As an indication of priorities, the USDA in fiscal year 1919 (which included the latter half of 1918) allotted only $500 to Kin's work, which moreover she had to share with Carl Johns, also of the Bureau of Chemistry.[188] Johns represented a new generation of nutrition scientists who experimented with rats to identify trace nutrients in foods, such as vitamins. His own interest was in the constituents of protein, the amino acids, and in determining which were crucial for the human diet. He theorized – wrongly, as it ultimately turned out – that it was an abundance of the amino acid cysteine that made soy foods such a good source of protein for the Asian masses.[189] Like Langworthy before him, however, he turned his attention to bread, finding that the addition of either peanut or soybean flour to wheat bread promoted the growth of rats,[190] an early indication of the value of what would later be called complementary proteins. His work also foreshadowed the primary use of the soybean during the next wartime emergency.

Kin herself returned to China at the end of 1918.[191] By August of the next year, she was back in California, traveling to Washington, D.C. to protest the Versailles Treaty's provisions for China's Shantung province, where Kin had researched tofu and promoted

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[186] "Eggs and Fish Defeat Meat," *Los Angeles Times,* 24 October 1917, II5.
[187] Piper and Morse, *Soybean* (1923), 273.
[188] Dept. Of Agriculture, *Program of Work of the United States Department of Agriculture for the Fiscal Year 1919* (Washington, D.C.: Government Printing Office, 1918), 300.
[189] H.E. Howe, "Progress in the Field of Applied Chemistry: Notes Culled from Current Technical Literature," *Scientific American Monthly* 1 (June 1920): 560.
[190] Carl O. Johns and A.J. Finks, "Studies in Nutrition: V. The Nutritive Value of Soy Bean Flour as a Supplement to Wheat Flour," *American Journal of Physiology* 55 (April 1921): 455.
[191] "Corporal Alexander A. Kin," *London and China Telegraph,* 30 Dec. 1918, 884.

cotton cultivation, and which the treaty allowed to remain in the hands of the Japanese.[192] The 1920 U.S. Census listed her as living on 11th Street with her foster mother, Joanna McCartee, but she left again for China even before McCarteee died on December 31. Among a small coterie of soybean enthusiasts, Kin would be remembered as a "particularly well-known exponent of bean curd" in the U.S., [193] but her decades of shuttling between two continents were at an end.

The Missionary

In 1917, Dr. Harry W. Miller, medical superintendent of the Washington Sanitarium, located just outside the nation's capital in Takoma Park, Maryland, received notice from his main milk supplier that their entire stock had been requisitioned by the federal government for the Walter Reed Medical Hospital. This was a crisis for the Sanitarium, which served an Adventist vegetarian diet and relied on fluid milk and dairy products to provide its patients with protein. In response, the Sanitarium purchased some nearby land and spent several thousand dollars acquiring a dairy herd in the hopes of becoming self-sufficient in milk. "Our heavy investment," Miller later recalled, "suggested that I should give some study to the dairy business" – an investigation that sparked his interest, he said, to develop a substitute for cow's milk.[194]

Miller had experienced several wild swings of fortune since his departure ten years earlier from his first mission post – and the grave of his first wife – in China. In mandating that he take his furlough earlier than scheduled, the more-or-less overt

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[192]Edith Moriarty, "With the Women of Today," *Eau Claire (WI) Leader,* 3 Aug. 1919, 3; "Chinese Woman's View of Japan: 'A Spoiled Child Among Grown-Up Nations." *Cumberland [MD] Alleganian*, 23 Aug. 1919, 4.
[193] William Henry Adolph, "How China Uses the Soy Bean as Food," *Journal of Home Economics* 14 (Feb. 1922): 69.
[194] Harry W. Miller, *The Story of Soya Milk* (Mt. Vernon, OH: International Nutrition Laboratory, 1941), 8.

intention of the Adventist leadership was to find Miller a second wife. So, as he toured churches raising funds for missionary work, he found himself introduced, with varying degrees of awkwardness, to numerous young women. He eventually married a nursing student named Marie Iverson and returned with her to Shanghai, where he was put in charge of the general Adventist mission. He no longer wore a queue or dressed in Chinese robes. He and his wife had two daughters, and he worked to establish schools throughout central China, until he was stricken with the same disease, it seemed, that had killed Dr. Maude. Unable to digest food, he became emaciated. In 1911, the Board ordered him to return to the U.S., where doctors declared his case hopeless. At death's door, he moved his family into his parents' home in New Brunswick, Canada, where he gradually regained strength and appetite by virtue, he later concluded, of plentiful fresh fruits and vegetables.[195] He did not think himself strong enough to resume mission work in China, however.

He was almost lured away from working for the Adventist church altogether when his wealthy uncle – and then his widowed aunt – offered him work caring for them and their land holdings in Ohio, with a guarantee to inherit a quarter-million dollars when his aunt passed away. After caring for his uncle and making arrangements for his aunt, however, he decided to forego the inheritance and instead taught Bible classes for a year at his old school, Mt. Vernon Academy. The Adventist General Conference then recruited him to be both the Medical Secretary for North America and the superintendent of the struggling

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[195] Raymond S. Moore, *China Doctor: The Life Story of Harry Willis Miller* (New York: Harper & Brothers, 1961), 92-101.

sanitarium in Takoma.[196] Despite the toll that two jobs might take on his still-fragile health, Miller answered the call.

The Washington Sanitarium had been established in 1908 in the wake of the separation of the church from the John Harvey Kellogg's Battle Creek Sanitarium. Harry Miller took charge of the new flagship sanitarium at a low point, with most of the staff stricken by typhoid fever – misdiagnosed by the sanitarium's physicians as "ptomaine poisoning."[197] After Miller had treated the institution's own staff, its beds were mostly empty. Miller's surgical credentials were an immediate boon to business – the sanitarium had heretofore only treated nervous disorders – and although he felt his skills were rusty after a decade of missionary work (some refresher courses at Johns Hopkins notwithstanding), he plunged in and, with what he felt was God's assistance, performed five successful surgeries in one day. Soon after, he performed abdominal surgery on a local hunchback, despite the man's inability to lie flat, and garnered good word-of-mouth around Takoma.[198] Thyroid surgery expanded into one of the Washington Sanitarium's specialties because it too made for good advertising: people noticed when an acquaintance's goiter disappeared, and patients were eager to testify to the success of what was at the time a risky procedure. Miller successfully removed 24 goiters before his 25th patient died from complications, prompting him to institute new practices to further reduce risk.[199] He received an modest annual salary, thus plowing most of his surgical fees back into the institution. This, along with frugal management and active lobbying –

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[196] Harry W. Miller, typewritten memoir transcribed from voice recordings, ca. 1958, Department of Archives and Special Collections, Del E. Webb Memorial Library, Loma Linda University, Loma Linda, CA., 116-118 (henceforth "Miller Memoir").
[197] Miller Memoir, 118.
[198] Miller Memoir, 122.
[199] Ibid., 129-130.

he and another Adventist won seats on the Takoma city council, which then voted to improve the roads leading up to the sanitarium, and he pressured the county and state to exempt the institution and neighboring medical school from taxes[200] – put the sanitarium on a solid financial footing.

Miller addressed the milk crisis with his usual thoroughness. He visited the USDA's Animal Husbandry and Dairy Divisions, toured several creameries and dairy operations, and read the current literature. In particular, he was struck by *The Milk Question*, published in 1912 in the midst of controversies over milk safety, by Dr. Milton Rosenau of the U.S. Public Health Services Hygiene Laboratory. Rosenau argued that milk was the cause of an epidemic of child deaths in American cities, despite bans instituted during the previous century on the sale of "swill milk" from sickly urban cows fed the byproducts of breweries. He in fact blamed milk's unwholesomeness on the distance it now traveled from the countryside: "To separate the mouth of the baby from the teat of the cow by several hundred miles is often a serious matter for the baby . . . Dirt and bacteria enter, decomposition proceeds, poisons may develop, so that a glass of ordinary market milk may be very unlike the food that leaves the mammary gland."[201] Rosenau advocated mandatory pasteurization – and indeed such a law was in place in New York by 1914 – but the way he "graphically pictured the hazards underwent by cow's milk" made a strong impression on Miller, who suspected that even pasteurization often failed "to make infected milk good and safe."[202]

Miller later recalled that his faith in another food safety strategy – inspection – took a blow after he scrupulously purchased cows "only from reliable certified herds" declared

[200] Ibid., 123-125.
[201] M.J. Rosenau, *The Milk Question* (Boston: Houghton Mifflin Company, 1912), 6.
[202] Miller, *Story of Soya Milk*, 10.

free from tuberculosis. A veterinarian he brought in found five reactors among the thirty cows. Miller told him “there must be some mistake as these cows showed no sign of disease; they were fat and plump and among the most expensive cows of the herd.” Nonetheless, he sent them to the slaughter house, where the veterinarian “demonstrated tuberculosis lesions in every one.”[203] For all its hazards, Rosenau insisted that milk was a necessary food: “It is true that several large nations comprising millions of people get along reasonably well without the use of the milk of the cow or of any of our mammalian friends . . . Western civilization, however, has come to depend upon cow's milk as an essential article of diet for children and it has become a very important article of diet for adults.”[204] Miller was beginning to wonder, however, if there were substitutes that might provide all of the nutrients of cow’s milk with fewer risks. As it happens, he was not the only one.

There were several patents for soymilk approved in the U.S. during the 1910s. A number of these were filed by residents of Europe who did not generally feel obliged to justify the need for their invention; innovations in artificial dairy products such as margarine, tied to wartime shortages or the needs of armies, had a longer history in Europe. In his 1919 application, for instance, Danish citizen Knud Erslev simply noted that “efforts have already been made to prepare artificial milk from vegetable products,” and that his invention came closer to resembling cow’s milk in composition and taste than these earlier efforts.[205] The earliest U.S. soymilk patent was awarded in 1913 (filed 1911) to Yu Ying Li, a Chinese Republican who operated a tofu factory outside of Paris,

[203] Ibid., 10-11.
[204] Rosenau, 2.
[205] Knud Erslev, "Process for the Manufacture of Artificial Milk," U.S. Patent 1297668, 18 March 1919 (filed 3 Jan. 1919).

and whose application was unusual in the variety of products it proposed to derive from the milk: not just tofu and several varieties of fermented cheese, but soy sauce and, for industrial purposes, purified soy "casein."[206] Like Erslev, Li did not mention public health concerns.

American soymilk innovators, on the other hand, routinely foregrounded the sanitary advantages of their products. Louis J. Monahan, a prolific inventor in Oshkosh, Wisconsin, best known for being a designer of automobile engines, submitted an application in 1913 for a "Process of Making Soy-Milk" that promised "the elimination of germ disease due to the animal secretions," as well as a product "free from elements harmful to diabetics."[207] American press accounts of German efforts to produce synthetic milk – in which "the Soya bean appears to be one of [the] important ingredients" – stressed that one of its advantages, "so obvious that the importance of the announcement of its achievement is manifest," was that it "would largely eliminate the danger of infection through milk." The key was that the preparation of vegetable milks, including soymilk, typically involved boiling the liquid, making it "absolutely sterile."[208] Pasteurization, on the other hand, maintained temperatures below the boiling point to avoid denaturing the proteins of cow's milk.

The primary purpose of boiling the soymilk in most of the applications was not to sterilize it, however, but to improve the milk's flavor. A persistent, difficult-to-mask "beany" taste was the chief impediment to wide acceptance in the West and a spur to ingenuity. Li was an exception, perhaps because he was Chinese. He did not state the

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[206] Yu Ying Li, "Method of Manufacturing Products from Soja," U.S. Patent 1064841, 17 June 1913 (filed 10 Oct. 1911).
[207] Louis J. Monahan and Charles J. Pope, "Process of Making Soy-Milk," U.S. Patent 1165199, 21 Dec. 1915 (filed 10 April 1913).
[208] "To Make Synthetic Milk," *Washington Post*, 24 Nov. 1912, M4.

removal of a “beany,” “nauseous,” “disagreeable” or “raw” taste as a goal. Nor did he boil the milk (he did pasteurize it, however).[209] Boiling was not the only strategy for diminishing the beany flavor. Monahan, the automobile engineer, emulsified a fine soybean flour with lime water (that is, water with a high calcium content) and sodium bicarbonate, “the reason for using these agents [being] to counteract the taste of the bean as much as possible as well as to partially arrest the oily odor therefrom.”[210] Gaston Thévenot, a resident of Milwaukee and later New York City whose name suggests that he was an émigré, was among the most dogged in attacking this problem in four patents in the late 1910s and early twenties. In the earliest, he simply boiled the soymilk, but by 1923 he also soaked the pureed beans in grain alcohol or other solvents.[211] British applicant William Melhuish located the “nauseous” taste in the soybean’s oil: he therefore thoroughly removed it using a centrifugal separator, and then replaced it with better-tasting sesame oil. This, however, involved “considerable expense in separators [and] their cleaning and upkeep,” so that even before his patent was approved, he submitted another for an artificial milk made of peanuts.[212] The cow, however unsanitary it might be, would not be easy to supplant with the soybean.

It is not clear to what extent Miller himself experimented with soymilk while at the Washington Sanitarium. Like most Adventist institutions, the Sanitarium was supplied

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[209] Li, “Products from Soja.”

[210] Monahan and Pope.

[211] Gaston D. Thévenot, "Process of Manufacturing Milk and Cream Substitutes," U.S. Patent 1359633, 23 Nov. 1920 (filed 24 Jan. 1919).; Gaston D. Thévenot, "Process of Making Vegetable Milk," U.S. Patent 1444812, 13 Feb. 1923 (filed 21 Feb. 1922); Gaston D. Thévenot, "Process of Making Vegetable Milk," U.S. Patent 1541006, 9 June 1925 (filed 11 June 1923); Gaston D. Thévenot, "Process of Making Vegetable Milk," U.S. Patent 1556977, 23 Oct. 1925 (filed 8 Dec. 1923).

[212] William J. Melhuish, "Manufacture of Vegetable Milk and Its Derivatives," U.S. Patent 1175467, 14 March 1916 (filed 1 June 1914).; William J. Melhuish, "Process for the Manufacture of Artificial Milk, and Treatment of Its Residues," U.S. Patent 1210667. 2 Jan. 1917 (filed 22 Oct. 1915).

by an onsite food plant which produced Kellogg-invented vegetarian foods such as Nuttose and Protose. Miller's son Harry Willis, Jr. (born 1912) later recalled his father making soymilk and tofu at the plant as early as 1921 and adding soybean flour to their meat analogs – then largely made of wheat gluten and peanuts – in 1923.[213] Soybeans had already begun in a slow way to enter the network of Adventist Sanitariums and colleges. In 1918, William Morse visited the Nashville Agricultural and Normal Institute in Madison, Tennessee, an Adventist school founded in 1904 as a way to extend the denomination's reach into the South. He reported that Professor Floyd Brailliar, the school's horticulturalist, "has done a considerable amount of work with different food products from the soy bean. At the present time they have a factory for canning several different soy products from the soy beans which are grown on their farm,"[214] the outcome of experiments apparently begun in 1917. (Their canned soybeans undoubtedly improved after Morse sent them Easycook seeds in 1919.) In 1922, Madison Foods – the Institute's commercial food factory – added Soy Bean Meat to its line of nut-based meat substitutes.[215] While the rest of America showed little interest after the war of using soybeans as a meat substitute, the Adventists were adopting it into their program of creating vegetarian meat analogs. They apparently did not produce a substitute milk at this time, however.

John Harvey Kellogg, no longer an Adventist but still influential in vegetarian circles – he was a good friend of the founder of the Nashville Institute – had known of the

[213] William Shurtleff and Akiko Aoyagi, "Harry W. Miller," in unpublished manuscript, *History of Soybeans and Soyfoods, Past, Present, and Future* (Lafayette, CA: Soyfoods Center, ca. 1999).
[214] W.J., Washington, D.C., to R.A. Oakley, Washington, D.C., 18 Nov. 1918, Morse Correspondence.
[215] Soyinfo Center, "Madison College and Madison Foods, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/madison_college_and_foods.php.

soybean as early as his 1903 *Living Temple*, but not from firsthand experience. "It requires longer cooking, and is less well flavored than ordinary beans," he reported at the time.[216] He did not mention the soybean in a section on "vegetable milk," where he instead recommended nut milks, with almond milk having the most delicate flavor.[217] By his 1917 *New Method in Diabetes*, however, Kellogg recommended soybeans as a "highly valuable food for diabetics,"[218] and in his 1921 *New Dietetics*, he was a full-blown enthusiast, declaring that "the soy bean is the best of all the beans."[219] Quoting the growing body of literature on soy foods, he described soymilk, tofu, soy sauce and sprouts. He himself had made "a quite palatable milk from the soy bean" – his recipe called for boiling the milk for ten minutes, but not otherwise altering the flavor – though he acknowledged that the "flavor is different from that of cow's milk." He added that " a similar product can be made from peanuts." [220]

Methods for producing soy foods, including soymilk, circulated through the network of Adventist institutions in the late 1910s, though who influenced whom is not entirely clear. Whatever his work with soymilk at this stage, however, Miller perhaps furthered its cause most by strengthening this Adventist network of colleges and sanitariums, which provided vegetarian meals to staff and patients and continued Battle Creek's tradition of culinary experimentation. As Medical Secretary, Miller toured sanitariums throughout the country offering advice., and by putting the flagship sanitarium on a solid footing, he provided a model for success and expansion. This would be this model that

[216] J.H. Kellogg, *The Living Temple* (Battle Creek, MI: Good Health Publishing Company, 1903), 120.
[217] Ibid., 158-59.
[218] J.H. Kellogg, *The New Method in Diabetes* (Battle Creek, MI: Good Health Publishing Co., 1917), 64.
[219] John Harvey Kellogg, *The New Dietetics: What to Eat and How.* (Battle Creek, MI: Modern Medicine Publishing Co., 1921), 299.
[220] Ibid., 302.

he himself would emulate when in 1925 he again answered the call to do mission work in China. This time he would take charge of the Shanghai Sanitarium, where his work with soymilk would begin in earnest.

Chapter 3: Field Days

After a decade of struggling to expand in the South as an alternative to cotton, with limited success, soybeans took off in the Corn Belt. With hindsight, it is apparent that the conditions in states such as Illinois, Indiana, Iowa and Ohio favored this takeoff at this moment. Generally a more innovative agricultural region than the South, the Midwest faced a crisis after World War I that echoed the pathologies long associated with the Cotton Belt. Yields of wheat and corn fell, a phenomenon attributed mainly to lower soil fertility, just as productive new regions for these crops opened up further west, creating competition that triggered a dramatic fall in prices following the peak demand of wartime. Thus Midwest farmers were placed in the vice of simultaneously declining prices and production familiar to Southern farmers, with a similar sense of having exhausted the soil. During the 1920s, a pest comparable to the boll weevil – the European corn borer – underscored the parallel. Unlike the South, the North had a host of perennial legumes that might restore fertility and provide the basis for diversified dairy and livestock farming, but legumes such as clover started failing on increasingly acidic soil. The soybean's promise, as it was in the South, was as a legume that could restore the land and provide a cash income, initially through the hogs and other livestock it would feed. Soybean hay would not be the basis for takeoff, however. Much as the South sought an alternative to cotton, the Midwest sought an alternative to grains; but growing soybeans for its "grain" required the one thing that seemed to be lacking, an indigenous crushing, or soybean-oil producing, industry comparable to the cottonseed mills of the South. There was in fact the nucleus of such an industry among the mills that expelled oil from the corn germs. At the same time, Midwestern farmers were quick to adopt harvesting machines from the West – the combine in particular – to enable them to grow soybeans on a scale to make them pay in a way impossible for the manual laborers of the South.

These enabling conditions combined to give the soybean an opportunity in the Corn Belt, but active work was required to create the necessary linkages between breeders, farmers and manufacturers. The 1910s had also been a period of growth of intermediary institutions devoted to promoting and modernizing American farming; this included extension specialists such as J.C. Hackleman, who formed a powerful link between Illinois farmers and W.J. Morse in Washington, who curated the soybean varieties that would prove so valuable to them. With renewed plant exploration in Asia in the late 1920s, Morse – who would embark on the most ambitious soybean expedition of all – and Hackleman formed a pipeline from Manchuria to the Midwest. Hackleman also provided a link between farmers and manufacturers, but this link was forged most powerfully by the processors themselves, including the consummate starch salesman, A.E. Staley.

The Extension Specialist: J.C. Hackleman

About a month before William J. Morse chatted up the coffeemaker in Biloxi about soybeans, with more hope than solid results, he had a more heartening time during his tour of the north. “My trip thus far has been one of the best soy bean trips I have ever experienced,” he wrote C.V. Piper from The Beardsley in Champaign, Illinois on August 31, 1920. “It is remarkable how interest in the soy bean has increased throughout the northern and central states. It is rather gratifying to note how the varieties sent out by our office are taking hold." Near Quincy, he observed an eight-acre field of Virginia soybeans averaging six feet – "needless to say the grower is mighty proud" – and earlier had toured a county in Missouri projected to produce seven thousand bushels of Morse-variety seed. He planned to visit a farm in Tolono, Illinois, where they produced seed on 170 acres, and on "Thursday I leave with Prof. Hackleman by auto for Camden, Indiana, for a visit to the famous soy bean farms of the Fouts Bros. They call it 'Soyland.'"[1] The crop extension specialists at Purdue University, in nearby Lafayette, had arranged a statewide event there as the culmination of similar county soybean field days throughout the summer; as a "good neighbor policy," they invited growers and experiment station staff from neighboring Corn Belt states. There is no indication, however, that they thought to invite Morse from Washington.[2]

This visit would be more momentous than anticipated, as a crowd of over a thousand converged on the farm on Friday, September 3. There were farmers, county farm advisers, and staff from agricultural experiment stations, colleges and universities from a number of Midwestern states. On this "First Corn Belt Soybean Field Day" visitors inspected demonstration fields – 150 acres planted for seed and hay, 200 acres sown with soy and corn for the benefit of black-faced lambs, a number of which could be seen happily browsing on the soybean leaves – and enjoyed a lunch prepared by the Presbyterian Ladies Aid Society which included, along with the sandwiches and pies, baked soybean salad and roasted, salted soybeans. As entertainment, a quartet of local

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[1] W.J Morse, Champaign, IL, to C.V. Piper, Washington, D.C., 31 Aug. 1930, Record Group 54, Subgroup: Div. Of Forage Crops and Diseases, Series: General Correspondence, 1905-29, Boxes 92-93: Morgan-Morse to Morse-Napier, National Archives II, College Park, MD. (henceforth "Morse Correspondence.")

[2] W.A. Ostrander, "It's Fun to Remember," *Soybean Digest* 4 (Sept. 1944), 17; Record Group 54, Subgroup: Div. Of Forage Crops and Diseases, Series: Corresondence with State Agricultural Experiment Stations, 1899-1928, Box 12: Illinois-Indiana, National Archives II, College Park, MD. (henceforth "Indiana Correspondence.")

growers sang “Growing Soybeans to Get Along,” [3] which may have included lyrics that farmer Taylor Fouts later published as an ode to his favored crop: “Soybeans! Soybeans! You're like a Musical Band / To the Farmer who's tuned for the "Best on his Land." / Microbic Composers, on the millionth wave length, / Sing "love" to the Rootlets as they're reveling in strength. . . . The "Pop o' the Pods" is Jazz to the Pigs – / Puts pep in the Porkers – they grunt and grow big.”[4] Lunch was followed by speeches under the trees. Morse, now that he was there, reported on the breeding work underway at Arlington Farm. Afterward, a group of growers decided that the day’s success should be followed up by a National Soybean Field Day the following September, and that an organization, which they named The National Soybean Growers’ Association, should be charged with organizing it.[5]

For a decade, Morse had promoted the soybean throughout the country in an even-handed way, touring experiment stations in every region, with the expectation that it would most likely take off in the south, where – not for any lack of trying on his part – its expansion had stalled. The story of the soybean in the coming decade would instead be its remarkable expansion in the Corn Belt, due largely to the efforts of the types who congregated at Soyland: farmers and seedmen evangelical about the soybean, county farm advisers, and – as the crucial link between these groups and Morse in Washington – agricultural extension specialists based at agricultural colleges like Purdue. Of the corn belt states, Illinois would see the most dramatic growth in its soybean crop, for which

[3] *Proceedings of the American Soybean Association, Volume I: 1925, 1926, 1927* (American Soybean Association: 1928), 39-40.
[4] Taylor Fouts, "Putting Soybeans on the Hoof," in *Proceedings of the American Soybean Association, Volume I: 1925, 1926, 1927* (American Soybean Association: 1928), 125.
[5] *Proceedings, Vol. 1*, 42. Later this organization would become the American Soybean Association.

much of the credit would go to J.C. Hackleman, the University of Illinois crops extension specialist who conducted Morse to the Fouts farm.

The trip was a homecoming of sorts for the 32-year-old Jay Courtland Hackleman, known as Hack to his colleagues. He was born on a farm near Carthage, Indiana, and went to college at Purdue University in Lafayette, about 30 miles from Camden. His energy and leadership abilities were displayed at Purdue, where at various times he was President of the Agriculture Society, Editor of the *Purdue Daily Exponent*, Organization Editor of the Purdue Yearbook, and President of the Emersonian Literary Society. He graduated with a B.S. in 1910 and moved on to the University of Missouri, where he received a Masters in 1912. This would be his highest degree, though in later years he would at times aspire to complete a doctorate.[6] At Missouri, he served as an instructor in Farm Crops until 1917 and as an Assistant Professor in Crops Extension until 1919. His talent and enthusiasm seemed to lie in creating and shepherding organizations; in what would become a familiar role for him, he was Secretary and Treasurer of the Missouri Corn Growers' Association from 1914 to 1919.[7] His position proved useful during World War I, when several years of drought and crop failures forced farmers in twenty-five counties to appeal to F.B. Mumford, simultaneously the Dean of the Missouri College of Agriculture and the state food administrator during the war, for aid in obtaining seed. According to the *Country Gentleman*, Mumford called in Hackleman, whose business it was "to know what kind of seed and how much of it there was in

[6] Hackleman to Morse, 27 May 1924, Record Group 54, Subgroup: Div. Of Forage Crops and Diseases, Series: Corresondence with State Agricultural Experiment Stations, 1899-1928, Boxes 10-12: Idaho-Illinois to Illinois-Indiana, National Archives II, College Park, MD (henceforth "Illinois Correspondence.")
[7] The Hacklemans, "Memorial to Prof. J.C. Hackleman" [presented to the Urbana-Champaign Faculty Senate on 14 Dec. 1970 by a committee of the University of Illinois Department of Agriculture, W.O. Scott, Chairman], http://thehacklemans.com/id121.htm.

Missouri and how and where to get it. Dean Mumford knew that Hackleman was the man for that particular job." Hackleman convinced the Missouri Corn Growers' Association to donate one thousand dollars' worth of seed to the drought area – "and it was mostly in pedigreed seed, too" – and he garnered similar contributions from seed merchants in St. Louis and Kansas City.[8]

In 1919, Hackleman joined the University of Illinois Department of Agronomy as Assistant Professor in charge of Crops Extension.[9] He wrote his first letter to Morse soon after taking up his new post. "As you will notice I have changed my location somewhat," he wrote, "but have not changed my source of soybean information."[10] Indeed, in 1914 Hackleman conducted "cultural experiments" with soybeans – that is, measuring how different methods of seeding affected the yield of seeds or hay – and convinced farmers to participate in variety tests.[11] He may have gained some enthusiasm for soybeans earlier at Purdue, where several professors were interested in soybeans, as part of a range of legumes, and provided seeds to Taylor Fouts, another Purdue graduate, as early as 1904.[12] A year later, Dr. Isaac Smith (later to be nicknamed "Soybean" Smith), convinced the Purdue experiment station to give him inoculated soil to give seeds he had earlier obtained from the USDA "the proper amount of growing energy."[13] Whatever his earlier brushes with soybeans, however, they had never been a major focus of his

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[8] Samuel O. Rice, "Missouri's War Rations: The 'Show-Me' State Is Showing the Nation How to Grow More Food," *The Country Gentleman*, 10 Aug. 1918, 13.

[9] His lack of a doctorate notwithstanding, he became a full Professor in 1923 and served as a Crops Extension Specialist in the Department until his retirement in 1956. Hacklemans, "Memorial."

[10] Hackleman to Morse, 25 Nov. 1919, Illinois Correspondence .

[11] Mumford, F.B., *Work and Progress of the Agricultural Experiment Station for the Year Ended June 30, 1915,* University of Missouri Agricultural Experiment Station Bulletin 141 (Columbia, MO: University of Missouri, 1916), 30, 53.

[12] William Shurtleff and Akiko Aoyagi, *Fouts Family of Indiana - Soybean Pioneers (1882-2012): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2012), 5.

[13] Frank Sumner Bash, ed., *History of Huntington County, Indiana,* Vol. II (Chicago: The Lewis Publishing Company, 1914), 650.

energies until he reached Illinois – at Missouri, he also worked on alfalfa, cowpeas, and, in particular, corn – and whatever his past contact with Morse, his first letter from Illinois marked a period of actively cultivating the relationship.

It also marked the beginning of sustained soybean work at the University of Illinois. As at many other agricultural experiment stations, the one in Urbana planted soybeans from year to year, and there had been brief flurries of correspondence with the USDA. Contact was initiated in 1909 by C.V. Piper, when he sent a list of 168 varieties grown at Arlington Farm to Cyril Hopkins, Professor of Soil Chemistry, "in view of the soybean work you are doing in Illinois." Piper made it clear that he was sending similar letters to every experiment station engaged in soybean work to any degree, as he was eager that "the enormous number of varieties . . . be tested for each part of the country so that only the best may be introduced." Hopkins requested some varieties to test on his own farm in Tonti, Illinois – in particular, he wanted some of the new "long-legged" varieties with "pods borne high enough to permit harvesting with a machine" – and referred Piper's offer to O.D. Center, Professor of Crop Production, who received it enthusiastically, as the "growing of soybeans is taking a very decided increase throughout the state." Center later reported being "well pleased with the show that some of these varieties have made for us this year," adding that "the soybean question is of sufficient importance and magnitude to warrant our giving it considerable more attention." He requested more varieties the following year. By 1912, however, Center was gone and his successor was unable to send Morse seeds of varieties he had requested, explaining that "soy beans are not very well distributed thru our state [and] those that are comprise a very few varieties."[14]

By the end of 1916, when Morse wrote Hopkins requesting data about soybeans in Illinois for the Bureau of Crop Estimates, Hopkins replied that "we regard both the cowpea and the soybean as valuable crops in Illinois, primarily as substitution crops in years when the farmer has no clover in his rotation because of clover failure." As was typical for these years, soybeans were part of a spectrum of legumes valued for enriching the soil and providing hay, but they lower in the hierarchy of preference to clover and, it seems, less common than cowpeas. Though lacking hard statistics, Hopkins guessed that "about one farmer in ten in southern Illinois grows some cowpeas, perhaps on one-tenth of his cultivated acreage. Possibly half as large a proportion of soybeans is grown in central and northern Illinois [north of the cowpea's typical range] in seasons when there is little or no clover, but, in normal seasons when clover is abundant, the soybean is correspondingly more rarely grown."[15] This likely struck Morse as a pretty dismal assessment, and there was little indication that the university was eager to push the crop. In early 1917, W.L. Burlison, who would later become an avid promoter of soybeans, turned down an offer from Morse of thirty new Manchurian varieties for testing. He addressed his letter to "Mr. W.J. Moore." The following year, Piper received a request from Professor Robert W. Stark for pure strains of nine older varieties, as "certain of our varieties have become quite seriously crossed," an indication of some disarray. When Morse sent fifteen pounds of seed, Stark, like Burlison, sent his acknowledgment to W.J.

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[14] C.V. Piper, Washington, D.C., to Prof. C.G. Hopkins, Urbana, IL, 24 March 1909; Hopkins to Piper, 31 March, 1909; O.D. Center, Urbana, IL, to Piper, 1 April 1909; Center to R.A. Oakley, Washington, D.C., 5 Oct. 1909; Leonard Hegnauer, Urbana, IL to Morse, 16 Feb. 1912, Illinois Correspondence.

[15] Hopkins to Morse, 9 Dec. 1916, Illinois Correspondence.

Moore. The next contact was the November 1919 letter from Hackleman, a request for information he could use in a talk to a county institute, signaling a new push to have farmers plant soybeans.

The timing of this push, which coincided with Hackleman's appointment and preceded the organization of what would become the American Soybean Association by less than a year, was not entirely of Hackleman's doing. It was an outcome of the recent war and the agricultural depression that followed it. Wartime demand had pushed farmers to increase their production of corn and wheat at the expense of other crops in the customary rotations – in particular, legumes such as clover grown for hay – leading to what Hackleman later assessed as widespread depletion of the soil not just of nitrogen but of lime (calcium-containing minerals). The lime deficit made soils more acidic, which in turn reduced yields of clover, leading farmers to seek an acid-tolerant legume. Cowpeas were popular further south, but soybeans were the most promising alternative in the north.[16] Moreover, prices for corn and wheat collapsed after the war, corn dropping from $1.52 a bushel in 1918 to 60 cents a bushel in 1920. Ultimately, the Corn Belt did not produce corn; rather, in a system that originated in Virginia and Kentucky in the early nineteenth century and then arrived in the Midwest with migrants, the end product was corn-fed meat. When the market for corn faltered, many farmers could fall back on feeding it to hogs on their farms' feedlots. But the price of slaughtered hogs was also

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[16] J.C. Hackleman, "The Future of the Soybean as a Forage Crop," typewritten manuscript enclosed with Hacklelman to Piper, 7 Dec. 1923, Illinois Correspondence. While more acid-tolerant than clover, which often failed entirely on "sour soils," the yield of soybeans increased notably with the application of lime, as reduced acidity promoted the growth of its symbiotic bacteria. Ibid.; P.W. Pendleton and Edgar E. Hartwig, "Management," in *Soybeans: Improvement, Production, and Uses*, ed. B.E. Caldwell (Madison, WI: American Society of Agronomy, Inc., Publisher: 1973), 218.

falling due to oversupply.[17] According to the *Chicago Tribune*, many Corn Belt farmers "closed the gates to their feedlots, declaring they would stay out of the game until conditions improved."[18] Faced with this dual crisis of soil and markets, farmers began, as Hackleman put it, "to listen more favorably to the recommendations of the various state agricultural colleges and the United States Department of Agriculture."[19]

At the same time that farmers were softened up for a gospel of legumes, the infrastructure for carrying the message had been similarly bolstered by war and depression. The farm demonstration movement, in which volunteer farmers would exhibit new crops and methods under the direction of agricultural experts, was inaugurated in 1903 when a farmer in Terrell County, Texas, made a substantial profit despite the invasion of the boll weevil by practicing the diversified farming advocated by USDA agent Seaman A. Knapp. The first agricultural agent devoted to a single county – and whose salary was provided in part from farmers and businesses from that county – appeared in Smith County, Texas in 1906. These early county agents were itinerant teachers, usually farmers from the counties they served, who coordinated demonstration work according to a program dictated by Knapp.[20] In the North and West, where demonstration work developed more slowly, state agricultural colleges were more commonly involved: agents, sometimes known as "farm advisers," were typically college graduates versed in scientific agronomy who, at the same time, were attentive to the

[17] John C. Hudson, *Making the Corn Belt: A Geographical History of Middle-Western Agriculture* (Bloomington, IN: Indiana University Press, 1994), 69-70, 156.
[18] Frank Ridgway, "Corn and Soy Beans," *Chicago Tribune*, 10 Aug. 1920, 14.
[19] Hackleman, "Future of the Soybean as Forage Crop."
[20] Gladys Baker, *The County Agent,* Studies in Public Administration, Vol. XI (Chicago: University of Chicago Press , 1939), 25-32.

practices of productive local farmers with a view to making them more widespread.[21] In 1914, the Smith-Lever Act increased federal funding for county agents in addition to their state and county support and consolidated the system under the joint control of the USDA's Office of Extension Work and state agricultural colleges. Similarly, in 1917 the Smith-Hughes Act supplemented state funding for vocational education in agricultural subjects. During the war, increased federal support boosted the number of county agents from 1,436 (up from 928 in 1914) to 2,435, representing almost two-thirds of all American counties. Their prestige was enhanced by their role in national campaigns to increase food production, even as demonstration work suffered.[22] It was not until 1918 that the University of Illinois, responsible for coordinating this burgeoning network, established a Crops Extension office, briefly managed by W.B. Gernert before Hackleman's arrival the following year.[23]

The growth of the agricultural extension system, reaching from the USDA down to the county agent or farm adviser, was matched by the growth of voluntary farm associations during the same decade. The two movements were in fact highly interconnected, as the first county farm bureaus emerged in 1911 and 1912 to support the work of county agents, providing financial support from nominal membership fees and other contributions. With the encouragement of agricultural colleges, there were hundreds of farm bureaus by 1919 with an aggregate membership in the hundreds of thousands. Many bureaus had joined state federations, and in 1920 they created a national umbrella, the American Farm Bureau Federation, which moved rather quickly to

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[21] Ibid., 33.
[22] Ibid., 37-41; M.C. Burritt, *The County Agent and the Farm Bureau* (New York: Harcourt, Brace, and Company, 1922), 208-09.
[23] Illinois Correspondence [1-57].

lobby legislators on farm policy (joining organizations such as the National Grange which had undergone a similar evolution in prior decades, but which had lately declined in membership).[24] County farm bureaus, often led by local businessmen and the more prosperous farmers, meanwhile exerted a strong influence on farm advisers – often reinforced by the power to fire them – ensuring that, whatever their links to state colleges or the USDA, they remained responsive to local pressure.[25] In addition, the surpluses and price declines that followed the war prompted the creation of numerous purchasing and marketing cooperatives, which county agents were instrumental in organizing, advising and sometimes, when small cooperatives could not afford full-time managers, operating. These included poultry marketing associations, truck produce marketing associations, livestock shipping associations, creameries, and fertilizer pools, as well as larger marketing associations such as the Dairymen's League of New York State (which would later be instrumental in propping up the market for Illinois soybeans).[26] Of these, seed marketing associations, which promoted certified seed in an effort to prevent fraud while improving crop yields, would be particularly important both to Hackleman and to the spread of soybeans.

If developments in the latter half of the 1910s provided the motive and means to promote soybeans, a sad and unexpected opportunity arose in October 1919 when Cyril Hopkins, the head of the Agronomy and Chemistry Department, died at the age of 52 from complications of malaria on his way back from Greece, where he had been engaged

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[24] Baker, 15-20. 4-H Clubs, in which rural boys and girls pledged their heads, hearts, hands and health to their community and country, had their roots in this decade as well, beginning as canning and gardening clubs; by the end of the 1920s, many county agents spent a quarter of their time promoting club work, and hundreds of counties had appointed additional agents devoted exclusively to this work. Ibid., 50-52.

[25] Ibid., xiv.

[26] Ibid., 46-47.

in soil reclamation work. While Hopkins, renowned as a "soil doctor" for his work on fertility, was by no means hostile to soybeans – his *Soil Fertility and Permanent Agriculture*, first published in 1910, contained dozens of references to them, usually in lists with other legumes – he did not single them out for a push. His successor, W.L. Burlison, was much more enthusiastic in 1919 than he had been in 1917, when he responded to Morse so tepidly. In March he contributed an article to the *Orange Judd Farmer*, "Soybeans Gain Popularity: They Make Good in Illinois," in which he described the crop as having "rapidly gained popularity in Illinois during the last ten years because it fits so well into systems of farming when clover fails," a rather more upbeat take on Hopkins' earlier assessment of soybeans as a substitute for clover.[27] By some later accounts, he hired Hackleman and plant scientist C.M. Woodworth, who performed much of the actual breeding work over the following two decades, with the express purpose of developing better varieties of soybeans for Illinois.[28] Whether or not this was so, by late 1920, Hackleman wrote to Piper that "we are contemplating putting on a legume campaign in this state next year" and to Morse that "Dr. Burlison told me some time ago that he wanted me to take charge of the soybean work and recast it for all of the state."[29] The legume campaign was part of the larger goal of soil improvement and won support

[27] W.L. Burlison, "Soybeans Gain Popularity: They Make Good in Illinois," *Orange Judd Farmer* 66 (1 March 1919): 349. Burlison did not officially take charge until 1920; in the meantime Hopkins continued to be listed on the letterhead as head of the department, but with an asterisk indicating that he was deceased. Illinois Correspondence [1-60, 100].

[28] "Dr. William Leonidas Burlison: Your Friends Say," Transcript of the Burlison Banquet, Illini Union Ballroom, University of Illinois, Urbana, 26 June 1951. William L. Burlison Papers, 1888-1968, Series 8/6/22, University of Illinois Archives, Urbana, IL., n.p.

[29] Hackleman to Piper, 30 Nov. 1920; Hackleman to Morse, 13 Oct. 1920, Illinois Correspondence.

among farmers, many of whom were reported at the outset of 1921 to have "decided that this is a good year to sow more legumes and build up their land."[30]

Hackleman's primary role in this campaign was to provide a link between Morse in Washington and the newly robust networks of county agents, farm bureaus, marketing cooperatives and other groups in Illinois. This link was especially salient in the case of soybeans, more so for instance than with the development of better corn, another effort to which Hackleman would devote decades of effort. In the case of maize, breeding at experiment stations and selections by farmers would be the primary means of improvement. In the case of soybeans, on the other hand, it was the hundreds – and then thousands – of varieties arriving from Asia that offered the best hope for fast progress. Hackleman would ensure that the most promising varieties for Illinois were distributed to the appropriate regions of the state and into the hands of seed merchants and individual farmers. The bulk of his correspondence with Morse over the years would involve requests for seeds, sent free of charge from Washington, to plant at the University of Illinois experimental farms in Urbana and in the demonstration plots of cooperating farmers. To this end, he cultivated his contact with Morse, writing him in early January 1920 to ask, "Do you have any new variety or strain of soybeans that you think especially promising and which you would like to have propagated here in the Corn Belt?" He assured Morse that "I am going to do all I can to foster soybean production in Illinois and the county advisers are already working on the subject very vigorously." Morse replied tentatively that it would be possible to cooperate with Illinois in variety testing if the

[30] Frank Ridgway, "Farm and Home: Crop Rotation," *Chicago Daily Tribune*, 20 January 1921, 8.

work was “not too extensive, as our supply of seed of the various varieties is somewhat limited.”[31]

Hackleman was able to report to Morse in February that, at a conference with farm advisers, he lined up demonstrations in two counties in southern Illinois, across from St. Louis; Morse agreed to send seeds of seven varieties (including Peking) directly to the advisers. Losing no time, Hackleman mentioned in his reply that he was now taking a trip to the northwestern section of the state and would write upon his return “as to the varieties and the amount of seed that will be needed.”[32] In June, Hackleman invited him “to take a day off and visit us here at Urbana” during Morse’s customary tour of northern and western states in the fall, and then expanded this invitation in later letters to include a tour of the demonstrations in the southern counties. As with sending seeds, Morse’s first response was noncommittal – “If I am in that region during the season, and can manage it, I shall be pleased to drop in and see you” – but Hackleman’s persistence seemed to eventually impress him. He agreed to meet Hackleman in St. Louis in late August and tour the farms of cooperators – those enlisted by farm advisers host demonstrations – in a number of counties.[33] This tour ultimately ended in the visit to Soyland in Indiana. Hackleman succeeded not only in forging a personal link with Morse, but in shifting Morse’s orientation decisively to the Midwest, as well as bringing him into contact with what would become the first national soybean association. As his ties with Morse strengthened, Hackleman would send him annual requests for seed, as much as 100 pounds each of several varieties for demonstrations in a growing number of counties:

[31] Hackleman to Morse, 9 Jan. 1920; Morse to Hackleman, 13 Jan. 1920, Illinois Correspondence.
[32] Hackleman to Morse, 14 Feb. 1920; Morse to Hackleman, 10 March 1920; Hackleman to Morse, 18 March 1920, Illinois Correspondence.
[33] Hackleman to Piper, 12 June 1920; Piper to Hackleman, 16 June 1920; Morse to Hackleman, 30 June 1920; Hackleman to Morse, 6 July 1920, Illinois Correspondence.

sixteen in 1921 and 1922, twenty-seven in 1923.[34] These demonstrations could have a dramatic impact. During one of the January meetings of farm advisers, when demonstrations were planned for the year, Hackleman reported that one adviser was reluctant to go against the popular sentiment in his southern Illinois county favoring cowpeas over soybeans. Other advisers told him that they had been in the same position a year earlier, but that "one or two demonstrations had changed things materially."[35]

In addition to convincing farmers to grow more soybeans, Hackleman sought to improve the marketing of seeds – assuring farmers that they were getting what they paid for – by establishing a system to certify seed of official varieties. Morse sent him small vials of the more common varieties grown in the Corn Belt to help him identify seeds submitted to him by farmers and seedmen, though more often than not Hackleman would send the samples to Morse to identify against the collection at Arlington Farm. Varietal confusion had arisen in part because seed companies, to garner repeat business from farmers who could save and replant their own seed, sometimes invented new names to sell old varieties. In April 1920, for instance, Hackleman sent Morse a sample of "Mongol" soybeans from the Wing Seed Company, said to be a single plant selection from a field of Hollybrooks. Morse responded that the Mongol was simply the "old medium yellow," according to the traditional nomenclature, which some experiment stations had renamed Hollybrook. He had been sent samples before, and had previously contacted the Wing Seed Company, but "they did not seem inclined to give me much

[34] Hackleman to Morse, 22 April 1921; Hackleman to Morse, 3 March 1922; Hackleman to Morse, 25 April 1922; Hackleman to Morse, 9 July 1923; University of Illinois Department of Agronomy, "Project: Soybean Varieties," typewritten report, enclosed with Hackleman to Piper, 17 July 1923, Illinois Correspondence. There are 102 counties in Illinois.
[35] Hackleman to Morse, 25 April 1922, Illinois Correspondence.

information."[36] The Wing Seed Company's practice indicated that there was a market for improved varieties and that farmers were willing to purchase new seed each year if they believed it provided a clear advantage.[37] Hackleman sought to build up trust and expand this market by ensuring that seed dealers sold only bona fide new varieties tested for desirable qualities.

In was in this same exchange that Hackleman, having perhaps inadvertently reminded Morse of the shortcomings of the seed business, wrote, "Doubtless you will be interested to know that we have formed in [Champaign] county what, I believe, is one of the first soybean seed growers organizations in the United States. . . . These farmers are pledging themselves to grow only approved beans, to handle them in the best way possible and to make possible field certification of their seed this fall." In his response, Morse noted this development "with considerable interest." This was certainly another reason for Morse to visit Champaign in the fall of 1920, although he noted that similar organizations had been formed in North Carolina and Wisconsin during the previous three years. In many states, in fact, there were early adopters of soybeans who touted their potential to provide nitrogen to the soil and protein to livestock. These pioneers typically branched into selling seed, and sometimes would become so closely associated to the crop that it would become their sobriquet: William Stone and E.F. "Soybean" Johnson in Ohio, the Fouts family and Isaac "Soybean" Smith in Indiana. In Illinois, these included the Funk Brothers Seed Company in Bloomington and a pair of growers, John T. Smith and W.E. Riegel of Tolono, who were the backbone of Champaign's new seed growers organization, Smith as a breeder and Riegel, head of the Riegel Seed Company, as a

[36] Hackleman to Morse, 16 April 1920; Morse to Hackleman, 26 April 1920, Illinois Correspondence.
[37] Another motive for farmers to buy new seed rather than save their own was the well-known difficulty of maintaining soybean seed that germinated well.

specialist in harvesting machinery. Hackleman provided the connection to University of Illinois resources and, through Morse, new varieties from Asia. As with soybean pioneers in neighboring states, they were no longer alone in their promotional efforts, but linked together in associations and networks.

At the same time, they performed a valuable service to Hackleman and Morse: increasing the amount of available seed for a new variety, in particular one originating from a single plant selection, was a slow process. In Illinois, for instance, the Manchu soon emerged as an important variety, second only to an older variety, appropriately named the Midwest, in the value of seed and hay it produced.[38] Like the Midwest, the Manchu was a bushy variety making it good for hay – as its branches were less woody – but it was also notable for its high oil content, making it promising as an oilseed.[39] One of its quirks, however, was that its hilum – the tiny scar where the two halves of the seed joined – varied in color between black and brown. It is a measure of the importance placed on consistency when it came to marketing certified seed of official varieties that Morse put a great deal of effort over several years to isolate and propagate a pure black-hilum strain of Manchu. When he succeeded in 1924, John T. Smith agreed to grow the seed on his farm in Tolono. As it turned out, this arrangement hit a snag. Despite being grown in the middle of a field of clover where soybeans had never been raised – meaning that there was "absolutely no chance of volunteer beans, unless the seed was carried there

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[38] W.J. Morse, "Soy-Bean Varieties Newly Developed for U.S. Farms," In *U.S. Dept. of Agriculture Yearbook 1926* (Washington, DC: Government Printing Office, 1926), 679.

[39] L.B. Breedlove, "Soybean - The Magic Plant, Article VII: Oil Characteristics and Content of Varieties Classified," *Chicago Journal of Commerce and La Salle Street Journal*, 16 June 1936, 14; U.S. Department of Agriculture, Bureau of Plant Industry, *Seeds and Plants Imported During the Period from April 1 to June 30, 1911: Inventory No. 27; Nos. 30462 to 31370* (Washington, D.C.: Government Printing Office, 1912), 22. This was true of many of the varieties from Manchuria, the center of China's soybean oil industry, which also happened to be at roughly the same latitudes as central Illinois. The Manchu was procured through a Mr. Edward C Parker in 1911 from the agricultural experiment station in Mukden.

by the birds" – the resulting crop seemed to be badly genetically mixed, including what Morse described as "gray plants" of a type never before seen among Manchus. He concluded that these were "volunteer plants," the birds having apparently been quite busy. It underscored that producing pure varietal seed in large quantities was no easy task.[40]

Given that it was a problem if a given lot of seed appeared mixed, one of the major challenges Hackleman and Morse grappled with in the early 1920s was the phenomenon of mottling. Aside from the hilum, a soybean's seed coat was typically an even color, whether yellow, green or black. Sometimes, however, seeds were mottled with specks and patches of brown or black. The assumption was that these seeds were genetic crosses of, for instance, yellow and black varieties, disqualifying them for certification, but Morse thought that mottling might be a response to environmental conditions, not a sign of contamination. Determining what those conditions were would simultaneously allow mottled beans to be certified and to enable growers to take preventive measures. At the 1922 annual business meeting of the National Soybean Growers' Association – as with previous business meetings, aimed largely at electing officials and planning the next summer's field meeting, this one was held in Chicago during the winter International Stock Show – Morse discussed the problem with Hackleman and other members of the Soybean Nomenclature Committee charged with establishing official varietal names. He arranged to send committee members samples of mottled beans from several varieties for

[40] Hackleman to Morse, 18 March 1924; Hackleman to Morse, 27 March 1924; Morse to Hackleman, 7 Nov. 1924, Illinois Correspondence.

them to plant in their experimental plots, and then to collect and tabulate data from them on mottling among the resulting crops.[41]

This strategy turned out to be insufficient. Hackleman, for instance, had an "unfortunate experience" with his beans, which were destroyed by wet weather and an early frost.[42] The data that did emerge was inconclusive. The 1923 business meeting was largely devoted to exchanging theories about it, and by 1924 Morse had concluded that the NSGA's approach to settling the issue "would not get us anywhere" – best to have the individual experiment stations conduct their own work, or to assign it as a dissertation topic to a graduate student who would have the time to devote to it.[43] By the 1925 meeting, a report acknowledged that while "the causes of mottling are not known at the present time," they seemed to be a combination of genetic and environmental factors that had little to do with genetic crossing. Nonetheless, it was "objectionable to the seed growers because it gives the appearance of a mixture of varieties or of impurity due to crossing."[44] As growers gradually learned to avoid varieties especially prone to mottling and to adopt practices that reduced its occurrence, the topic faded as a central concern, although, as it turned out, it would take researchers decades to fully solve the scientific riddle.

As Hackleman and Morse grappled with quality issues, their work was given urgency by a veritable boom in soybean acreage in Illinois and neighboring states, characterized by Hackleman in a talk he gave to the American Society of Agronomy at the end of 1923 as "probably the greatest change in an agricultural practice in the history of corn belt

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[41] Morse to Hackleman, 17 Jan. 1923, Illinois Correspondence.
[42] Hackleman to Morse, 8 Nov. 1923, Illinois Correspondence.
[43] *Proceedings, Vol. 1*, 24; Hackleman to Piper, 12 June 1920, Illinois Correspondence.
[44] J.B. Park, "The Soybean Mottling Problem," in *Proceedings of the American Soybean Association, Volume I: 1925, 1926, 1927* (American Soybean Association: 1928), 129.

agriculture." Although the USDA did not track soybean acreage prior to 1923, he estimated that it had grown in Illinois from under 300 acres in 1909 to 40,000 acres in 1919. In 1923 it reached almost 900,000 acres. Hackleman attributed this remarkable growth in part to the work of himself and his colleagues in several states, but the collapse in prices of more traditional crops, which had only intensified since the early postwar years, was undoubtedly a key factor. Hackleman mentioned that "the oat crop seemed to offer less returns each successive season," giving farmers a reason to divert those acres to an alternative crop.[45] Corn prices had meanwhile recovered since 1920 to from 60 to 81 cents per bushel, but this was still far below the wartime high. Declining yields on older Corn Belt farms did not reduce the national surplus, as newer varieties enabled corn and hog production to expand in states further west and north, exacerbating the crunch for corn growers in states such as Ohio, where acreage fell 39 percent between 1919 and 1924.[46]

This created an opening for soybeans, at first not as an alternative to corn but as an adjunct to reduce the cost of hog production. They took to sowing soybeans among their corn, and then "hogging down" the fields in the late summer, when the plants were young enough to provide easy forage, but when the beans were mature enough to contain substantial amounts of protein.[47] Taking hogs to the field in this way was more commonly associated with low-quality subsistence production in the South rather than the commercial pork production of the Midwest. Indeed, disdain lingered: as late as

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[45] Hackleman, "Future of Soybean as Forage Crop."

[46] W.J. Spillman, "Changes in Type of Farming," *Yearbook of the Department of Agriculture 1926* (Washington, D.C.: Government Printing Office, 1927), 206; Hudson, 158; Historical Statistics of the United States: Millennial Edition Online, "Table Da693-706 - Corn, barley, and flaxseed - acreage, production, price, and corn stocks: 1866–1999," last updated 2006, hsus.cambridge.org.

[47] A variant of this practice, for instance on the Fouts farm, was to "lamb down" a field.

1925, a newspaper column felt it necessary to point out that "lazy farmers are no longer the only ones who practice hogging down corn to avoid the work of husking."[48] But Illinois farmers increasingly turned to the practice to avoid the labor costs not just of husking, but of conveying the grain to feedlots. Soybeans were a key part of this strategy, as they supplied the concentrated protein ration in the field that in the feedlots was typically provided by tankage (processed meat scraps) or oilseed meal.[49] Alternately, farmers might harvest the corn-soybean fields to provide fresh soilage or winter silage. A serious issue that would prove longstanding, on the other hand, was the tendency of the high oil content of soybeans to produce soft pork, with a flabby appearance that lacked "eye appeal" and was an increasing detriment as demand shifted from fatter hogs for lard to leaner hogs for bacon. Eventually producers learned to limit the consumption of whole soybeans to no more than ten percent of the hog's ration, potentially putting a drag on soybean expansion.[50]

In the meantime, however, the expansion of acreage grown for feed triggered a secondary boom in soybeans grown for seed, abetted by the work of Hackleman and Morse to introduce more prolific varieties such as the Manchu and to organize marketing channels through growers associations. One indication of this secondary boom was the increasing percentage of acres on which soybeans were grown alone rather than mixed

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[48] Frank Ridgway, "Hogging Down of Corn Profitable Farming Method," *Chicago Daily Tribune*, 14 October 1925, 31.

[49] Ridgeway, "Corn and Soy Beans."

[50] Peanut-fed hogs also produced soft pork for the same reason. When produced commercially, as had long been the custom in Smithfield, Virginia, these hogs were taken off peanuts several weeks before slaughter and, more importantly, specially cured to make the hams more attractive. As this was a niche product, the latter option was not available to northern pork producers. Andrew F. Smith, *Peanuts: The Illustrious History of the Goober Pea* (Urbana, IL: University of Illinois Press, 2002), 66; Alonzo E. Taylor, *Corn and Hog Surplus of the Corn Belt* (Stanford University: Food Research Institute, 1932), 562; George H. Primmer, "United States Soybean Industry," *Economic Geography* 15 (April 1939): 210.

with corn and other crops. In 1919 these constituted a tenth of soybean acres, in 1923 a quarter, even as total acres had increased twentyfold.[51] Another indication was the attention Hackleman began to pay to harvesting methods, with a view to decreasing the number of beans left in the field. In March 1922 he wrote to Morse for advice and was referred to manufacturers of bean harvesters in North Carolina.[52] But even as he sought to expand and improve the soybean seed business, there were indications even by the end of 1920 that he feared the boom would become a bubble. As he put it to Morse, "the soybean must be studied and some uses found for the seed in addition to its present use which is almost one hundred percent for seed."[53] To that end, Hackleman and farm advisers obtained a guarantee from four processors – referred to by Morse as "the cornstarch people,"[54] although only one, Staley, was a cornstarch manufacturer – that they would purchase 250,000 tons of soybeans for crushing, one factor that increased the acreage in soybeans that year. In the fall, however, farmers feared that a large harvest would drive down prices, and many decided to store their beans until the spring, when a still-strong market for seed as seed sustained high prices. As a result, the companies received only a few thousand tons of beans.[55] By early 1923, Hackleman complained to Morse that he did not "understand how the rumor started that Indiana and Illinois have an overproduction of beans. We are practically sold out in this state on Manchus," beans high in oil. "The oil companies have pushed their prices to $1.45 a bushel at local

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[51] Hackleman, "Future of Soybean as a Forage Crop."
[52] Morse to Hackleman, 10 March 1922; Hackleman to Morse, 18 March 1922, Illinois Correspondence.
[53] Hackleman to Morse, 7 Dec. 1920, Illinois Correspondence.
[54] Morse to Hackleman, 6 Jan. 1922, Illinois Correspondence.
[55] Deborah Fitzgerald, *The Business of Breeding: Hybrid Corn in Illinois, 1890-1940* (Ithaca, NY: Cornell University Press, 1990), 117. Fitzgerald bases her account on a 1922 Extension Office annual report by Hackleman, which has since disappeared; other accounts do not have Hackleman and farm advisers playing such a big role in brokering the guarantee.

stations and are not getting enough beans to pay them to run."[56] It was perhaps still premature to head off a bubble in soybean seed.

Nonetheless, by the time of his talk to the Society of Agronomy at the end of 1923, Hackleman urged greater sobriety in the promotion of soybeans. It was time for "a fundamental study of the soybean crop to determine its real value and to ascertain its proper place in the farming system." Some of its early selling points had been overstated. It indeed grew on sour or acidic soils where red clover failed, but good yields nonetheless required a generous application of limestone; in fact, he estimated that it took more limestone to produce a ton of soybean hay than a ton of red clover.[57] Likewise, "much has been said about the merits of the soybean as a soil builder, and great promises have been made for it. In fact, it now seems that entirely too much emphasis has been given to this characteristic of the crop." While it did make a considerable amount of "its own nitrogenous food" given the right conditions, he noted that in the rush to expand acreage, "a comparatively small percentage of the corn belt farms producing soybeans are really raising the crop as a legume." That is, they were not taking care to inoculate their seeds properly with symbiotic nitrogen-fixing bacteria, in the absence of which soybeans required almost twice the nitrogen of oats, not to mention substantially more phosphorous and potassium. Whether soybeans truly built up the soil, as indicated by the yield of crops that followed in the rotation, was a matter of effective inoculation – and even when inoculation was thorough, evidence suggested that soybeans provided little more benefit to a subsequent stand of wheat than oats did.[58] The real promise of soybeans, in

[56] Hackleman to Morse, 23 Feb. 1923, Illinois Correspondence.
[57] The reason why it could grow where red clover failed was because it required less limestone per acre, as red clover grew more densely. Hackleman, "Future of Soybean as Forage Crop."
[58] Ibid.

Hackleman's view, was as a cost-effective feed for a range of livestock. In the value it provided for a given cost of production, soybean hay compared favorably to alfalfa, while soybean seed and oil meal compared favorably to cottonseed and flaxseed meal, both widely used as high-protein concentrates in feed rations. On average, soybean oil meal provided the greater value, underscoring again the necessity of fostering a crushing industry.[59]

This was work he ultimately left to the oil mills themselves. The problems in 1922 had indicated the difficulty of creating stable marketing channels, even for someone with Hackleman's organizational talent and success in forging links between Washington experts, county agents, seed dealers and farmers. In the mid-1920s, while still hammering on soybeans – he wrote a bulletin on the topic in 1928 – he gradually shifted his focus. In March 1923, he wrote to C.V. Piper – not to Morse – that "we are in the third year of our legume campaign . . . and while we do not propose to quit hammering on [soybeans and sweet clover], we are going to add alfalfa to our list this year."[60] And he devoted a greater share of his energy to what was still the region's primary crop: corn. He had already sought to educate farmers to select better seed corn by devising a new scorecard – widely used by seed dealers and publicized to farmers as well through fairs and expositions – that rated ears less on the basis of aesthetics and more on characteristics correlated to disease resistance.[61] In 1923, he launched a "Better Seed Corn" campaign, in which he trained farm advisers to identify corn disease in the field and to in turn teach farmers the lessons. He also sought to ensure the quality of seed by

[59] Ibid.
[60] Hackleman to Piper, 16 March 1923, Illinois Corresopondence .
[61] He and Morse discussed devising a scorecard for soybean seed as early as 1923, but they forgot about the proposal until 1926. Hackleman to Morse, 4 Oct. 1926, Illinois Correspondence..

conducting a week-long "corn germination school," in which he taught extension workers how to test the viability of seed corn using a germinator of his own devising that farmers could easily build and operate on their farms. Finally, in 1921 he helped found the Illinois Crop Improvement Association – modeled on members of the International Crop Improvement Association, founded two years earlier – which certified seed corn of strains released by the experiment station and grown under the supervision of the Farm Bureau. It was analogous to the association of Champaign soybean growers he had described to Morse in 1920, and which was soon subsumed as the Soybean Club by the ICIA. Soybean Club member W.E. Riegel was in fact president of the ICIA from its inception until 1932. Hackleman would serve as the organization's secretary-treasurer from 1921 to 1927 and again from 1929 until 1937.[62]

At the same time, after having successfully lobbied to host the NSGA Field Meeting in Champaign in 1921 – establishing the importance of Illinois at the first official field meeting of the new organization – and after leading a large Illinois delegation to Washington in 1925 to an annual field meeting organized by Morse, in 1926 Hackleman let his membership lapse in what had been renamed the American Soybean Association. In part this was to protest the association's new five-dollar membership fee, which Hackleman deemed too high as a matter of policy, and certainly as a matter of his own personal outlay. "If I could justify paying $5.00 in this organization for membership, I would certainly have to pay that amount in each of two others" that he felt had an equal claim for his support.[63] He had served to introduce Morse to the nascent organization – a bond that would increase in importance as Morse served several important roles,

[62] Fitzgerald, 117-123.
[63] Hackleman to Charles Meharry, Attica, IN, 10 Nov. 1926, copy enclosed with Hackleman to Morse, 11 Nov. 1926, Illinois Correspondence.

including president, over the following decade – and he continued to provide an avenue for new varieties to make their way from Washington to the farm fields of Illinois and, through the ICIA, to exercise substantial control over the quality of seed offered in the state. But in the crucial development of the decade's second half, the emergence of a crushing industry that produced oil and protein-rich meal from soybeans, the initiative had shifted to entrepreneurs, A.E. Staley a leader among them.

The Salesman: Augustus E. Staley

On March 11, 1927, *The Decatur Review* announced that the Illinois Central line planned to operate a Soil and Soybean special train along its rails that featured displays of soybeans and soybean products, as well as lectures by "soil doctors and soybean specialists." In announcing the traveling exhibit, the railroad's General Development Agent, a Mr. Schweitert, underscored its broad public purpose in a time of agricultural depression and linked it to the associationalist ethos championed by Commerce Secretary Hoover: "The success and prosperity of this country depends upon the well-being of its agriculture. And we are all beginning to learn that it is good business practice to help one another instead of profiting at each other's expense. Let us be unselfishly energetic and energetically unselfish in our efforts to rebuild our agriculture." The prosperity of Illinois farmers had a direct bearing on the profits of the I.C., of course, as much of its business was devoted to transporting grain, and Schweitert pointed out that soybeans "are more profitable as a money crop than wheat, oats or corn from statistics gathered throughout the state."[64]

[64] "Soybean Special to Carry Experts," *The Decatur [IL] Review,* 11 March 1927, 30.

The train consisted of two cars of exhibits prepared by J.C. Hackleman on soybean production from planting to end uses, as well as on the threat posed by the European corn borer; two cars converted into motion picture theaters; a lecture car; and, in the rear, an office car where officials dined and slept. The train traveled 2,478 miles, making 105 stops and attracting almost 34,000 people to view its exhibits, films and lectures and to compete in a contest to guess the number of soybeans in a five-gallon glass jug. The prize was 50 tons of limestone for improving soil.[65] The Soybean Special was the latest in a long line of agricultural demonstration trains, extending back to the 1904 "Seed Corn Gospel Train" organized by Iowa State College in cooperation with two railroads. In 1911 alone, seventy-one trains ran in twenty-one different states with a collective attendance of almost a million people.[66] The addition of cinemas was a more recent innovation. It is not clear what movies were shown. The USDA's Office of Motion Pictures, a division of the Federal Extension Service, had offerings covering hundreds of topics, including "Four Men and the Soy," a 20-minute film which debuted at the 1925 National Soybean Growers' Association meeting and followed four farmers as they attended demonstrations at the Ohio State University Soybean Day.[67]

One of its biggest draws, during the time he was aboard, was A.E. Staley, the cornstarch manufacturer who had conceived of the Soybean Special and had enlisted the support of the railroad, the USDA, and the University of Illinois. When asked by a child whether he had invented the soybean, Staley demurred that he had not; when asked by a reporter whether he had any hobbies, he answered, "Soybeans – just soybeans, I guess."

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[65] Dan J. Forrestal, *The Kernel and the Bean: The 75-Year Story of the Staley Company* (New York: Simon and Schuster, 1982), 65.
[66] Baker, 7.
[67] Department of Agriculture, *Motion Pictures of the United States Department of Agriculture,* Misc. Circular 86 (Washington, D.C.: Government Printing Office, 1926), 13.

Staley had been born sixty years earlier in North Carolina, and he would recount how in 1880 his father attended a Methodist camp meeting where a missionary returning from China gave him a handful of soybeans from a bushel she had brought back. "My father turned them over to me to play with. I planted two rows of the beans in the family vegetable garden. I was proud of them. I weeded them and picked them. Then I planted some more. The missionary said they would be good for the soil. I believed it – even if no one else did." He would sometimes add, "There are still some soybeans in North Carolina," the leading soybean state until Illinois dethroned it in the early 1920s, "parented by that original handful from China which I planted when I was a boy."[68] The line from Staley's boyhood experience to his becoming a leading soybean processor by the time of the Soybean Special was not a straight one, however. He became a soybean processor in Decatur by way of being a cornstarch manufacturer, which he became by way of packaging cornstarch in Baltimore. This business had its roots, in turn, in his life's true vocation: sales. Staley was a salesman through and through, mostly leaving the technical matters to others, but always quick to adopt new methods of promotion, which – as exemplified by the Soybean Special – had become much more elaborate than handing out beans at a camp meeting. Salesmanship alone would not overcome the difficulties in marketing soybeans, however: ultimately more meaningful may have been the funding Staley provided to research efforts to improve the quality of soybean oil.

[68] Forrestal, 9; Soyinfo Center, "A.E. Staley Manufacturing Company (1922-1980s): Work with Soy, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/ae_staley_manufacturing.php. He did not grow up, however, in what would become soybean country in North Carolina: Elizabeth, on the coast, was quite distant from Greensboro.

Staley's first foray into business was auspicious:[69] at age fourteen, eager to escape the confines of farm life, he ventured to the nearby town of Randleman and sold a wagonful of farm produce. At sixteen, he sought a job as a clerk in a Greensboro hardware store, but he was assigned to the back room, where he lifted plowshares and other heavy equipment onto racks, only to be dismissed at Christmas with a cruel comment by the owner: "You'll never make a businessman, Staley. You better go to Sargent's Foundry and get a job where you can use your brute strength." Perhaps goaded by the comment, Staley managed during the next fifteen years to become a successful traveling salesman, moving far beyond the ambit of the North Carolina piedmont, traveling as far as Seattle. By 1896, we was making a net annual profit of as much as $5,000, which enabled him to stay in hotels, sometimes fancy ones, during his travels – although he sent most of his money back to his family's farm. His specialty, plied for the benefit of a number of different manufacturers, was convincing small retail grocers to carry lines of tea, coffee, spices, tobacco products, and baking powder.

In the midst of a marketing revolution, in which products previously sold in bulk, such as crackers from the proverbial barrel, were now packaged and sold by national brands such as Nabisco, Staley saw an opening for these modern methods in a modest but steady item still sold in a humdrum fashion: starch, used as a powder to add body to pudding and, in lump form, stiffness to laundry. With $1,500 he had managed to save, he set up shop in Baltimore packaging starch purchased in bulk and sold as Cream starch label, a trademark he had acquired for $200, to which he soon added Cameo laundry starch. The Great Baltimore Fire of 1904, which burned down his business, proved to be

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[69] Staley's life story, summarized below, is told in Forrestal.

only a minor setback, as he was able to borrow the money to rebuild. A more serious challenge emerged in 1905, when the large starch manufacturers who supplied him decided to cut off his supply of raw material, having decided that his competition was too much of a threat. In the face of this, he decided to incorporate the A.E. Staley Company to manufacture its own starch, selling stock primarily among the grocers he had first met during his years as a traveling salesman and who subsequently carried his starch products. He reasoned that if they owned part of a company, they would become even more avid in selling its brands.

It was his quest to manufacture his own starch that led him to Illinois after foregoing the purchase of a plant in Lafayette, Indiana (the home of Purdue) during the financial crisis of 1907. In 1908, he received information about a thirteen-year-old starch plant in Decatur that had been shuttered for two years for which he paid $45,000, outbidding an offer by Standard Oil by $2,000. His appraisers estimated that it contained $600,000 worth of machinery, although much of it needed repairs, and a physical plant worth over $200,000; moreover, they pointed out that “coal is at your doorstep” and “all the corn you’ll ever need is within 75 miles.” Decatur was served by five railroads, creating competition that kept freight rates low, and there was a ready supply of labor. Staley financed the purchase out of 2,000 shares of preferred stock that his sales force had sold by 1908, largely to grocers who had faith in Staley’s personal guarantee of semiannual dividends. At the same time, he had to sell his presence to the citizens of Decatur, who distrusted him as an outsider and were skeptical that the cornstarch factory – having failed once already for Staley’s predecessors – could succeed. Rumors spread in 1908 that he intended to bring in Italians, Greeks and Poles – or to employ only Catholics –

rather than hire local Protestants; Staley assured the press that his $25,000 weekly payroll would provide wages to 1,000 local workers and that millions in capital investment would aid the local construction industry.

As it turned out, Staley's salesmanship momentarily outran his ability to fulfill his promises. He went so far into debt refurbishing the plant – which began operations in 1912 – and covering his other costs that he was forced to close down operations for fifteen months in 1914-15 and default on dividend payments. The months before the closure were nerve-racking for him, one of the periods of his life plagued by uncertainty in his own salesmanship. In a letter to Charles Schuster, the company's secretary-treasurer in Baltimore, he mentioned attending a ballgame to settle his nerves "so I can put up a good, strong proposition to the Millikin Bank tomorrow"; the bank refused to extend him more credit. "If this company is not able to pay me a salary, or pay up my back salary, I shall be obliged to seek employment elsewhere," he despaired in a later letter. But his powers of persuasion ultimately rescued the company when he convinced a Chicago bank to back a $600,000 bond issue, offered once again to the grocers/shareholders on whose dividends he had defaulted. He only obtained approval from stockholders for the issue because he himself held seventy percent of the common stock, but he managed nonetheless to sell $400,000 of the bonds, which, along with some lucky speculation in corn futures – which he credited to his "sixth sense" – enabled him to settle his other debts, upgrade the plant, and be up and running again in November 1915. Despite war and other turmoil, his business would be generally profitable going forward. By the 1920s, the original six-acre site had grown to forty-seven and the number of manufacturing buildings from eight to forty-one (not to mention the company's semiprofessional football team that he financed until its costs too clearly outweighed its publicity value, at which point it decamped to Chicago to become the Bears).

Staley would ultimately bring the force of his personality to bear on promoting soybeans. Keeping an open door to the farmers who sold him his primary raw material, he heard their postwar complaints about declining yields on land that he, like the state's extension agents, worried was being "corned to death." Seeking a solution, he was apparently reminded of his boyhood experience with soybeans during a visit to North Carolina in 1919. One of his colleagues later recalled him visiting his office following the trip and pulling out a handful of beans from his pocket, declaring that "farmers need something to rotate with corn and I think soybeans are the answer." Initially, he seemed to think there would be value in removing green soybeans from their pods and plowing them into fields as a nitrogenous manure – advice which he later realized to be a "bum steer" – but he soon garnered better information from the University of Illinois.[70] Soon, he was publishing leaflets distributed to farmers encouraging them to try soybeans in rotation with corn. In 1920, he ordered two expellers, heavy pieces of equipment used to produce corn oil, from the V.D. Andersen Company of Cleveland. Determined to provide a market for the crop he was pushing, he directed his talented plant superintendent, George Chamberlain, to adapt them for soybean crushing.

As it happened, Staley was not the first one in Illinois to have had this idea, an indication that there was a business logic behind it beyond the philanthropic mission to improve the state's soil. The Chicago Heights Oil Manufacturing Company, established in 1907 to produce refined oils and greases, was offering a diverse array of livestock

[70] Forrestal, 60-61.

feeds by 1919 that suggested it had expanded beyond refining. These included cottonseed and flaxseed meal, indicating that it was crushing these seeds for oil and meal, as well a wheat and rye middlings, byproducts of milling. It also offered "corn oilcake," the residue left over after oil was pressed from corn germs. Corn was the raw material most readily available to the company – cottonseed came from the south, of course, and the center of flax production was moving further west – and was likely the mainstay of its business. Commercial production of corn oil was itself a relatively new development of the previous quarter century. As mills shipped hominy products (i.e., cornmeal, grits and flour) longer distances, they removed the germs – which, while only ten percent of the kernel, contain half the oil – to prevent rancidity. Likewise, "wet" millers like Staley, who dissolved the starch out of kernels and then chemically treated it to produce various starch products or glucose, also removed the germs.

Initially, these were fed to livestock, but with rising demand for vegetable oil, and shortages of olive oil during World War I – the same factors that led to a rise in soybean oil imports from Manchuria – it became profitable to press them for oil.[71] But there was a limit to which the corn oil supply could rise to meet domestic demand and drive out imports. Like cottonseed and flaxseed, corn germs were a byproduct whose availability was determined by demand for the main product, in this case hominy and starch. Thus companies like Chicago Heights were compelled to seek out an oil-producing crop that would not face such a limit, even before extension specialists like Hackleman encouraged them to experiment with soybeans. That Chicago Heights embarked on its first experiment with soybeans in the fall of 1919 may have also been due in part to the

[71] Department of Agriculture, Division of Plant Industry, *The Production and Utilization of Corn Oil in the United States*, by A.F. Sievers (Washington, D.C.: Government Printing Office, 1920), 1-2.

passage of Prohibition. Corn grits found their principal use at the time as an adjunct to malted barley in beer brewing.[72] The company's operators, George Brett and I.C. Bradley, may have anticipated a looming decline in milling, which would in turn make corn germs much harder to come by.

Their first foray into soybean processing was disappointing. Drawing from farmers in Illinois and Indiana, they obtained only those soybeans, mostly cracked, not fit for planting. They were also still figuring out how to adapt corn-oil equipment for soybeans, in particular the grinders and dryers that cracked the corn germs and adjusted their moisture content for optimal results. "The few drums of oil produced," according to one account, "were as sorry-looking as the beans." During the 1920 harvest, there were no soybeans to be had, the farmers saving or selling them for seed, leading Brett and Bradley to buy ten carloads of soybeans from North Carolina and Virginia, from which they produced twenty barrels of soybean oil successfully sold to an oil compounding company, presumably to be mixed with higher-quality oils.[73] The company's primary challenge at this point was to convince farmers in the region to sell them more beans, and a key component of this was encouraging them to feed their livestock soybean meal rather than hay or whole soybeans. The hope was that as they were convinced of its value, they would grow more beans to sell to crushers – extending what was at that point a closed loop on farms themselves – with the additional advantage, once farmers began actually buying the meal, of lowering the price of the oil by largely cancelling out the

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[72] Ibid., 4.

[73] Edward Jerome Dies, *Soybeans: Gold from the Soil* (New York: The MacMillan Company, 1942), 16; Helen M. Cavanaugh, *Seed, Soil and Science: The Story of Eugene D. Funk* (Chicago: Lakeside Press, 1959), 348; William Shurtleff and Akiko Aoyagi, *History of Cooperative Soybean Processing in the United States (1923-2008): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2008), 19.

cost of the beans. This would make soybean oil more competitive, thus achieving a virtuous cycle of increasing production. Hence, as Bradley later recounted, “in the three years from 1920 we coaxed and forced feeders to try the meal. We hauled meal to them all over the state, gave it to them free. We sent it to experiment stations. We exhibited it at state and county fairs.” They also tried to foster a market for the meal ground into flour, sending samples to bakers or blending it with wheat flour and giving “five-pound bags to hundreds of grocery stores who would consent to accept it.”[74]

Between 1920 and 1922, on the other hand, Staley’s soybean plans were stalled. During 1920, Chamberlain modified the expellers and worried over the design of the bean dryers. In 1921, he had to grapple with providing truck access to the plant, as too few beans were expected to justify the use of railroad freight cars. He ended up improvising a ramp out of rail ties that led up to the area where trucks could dump their beans. More seriously, 1921 saw a business downturn for the nation and operating losses for the company; finances were so tight that Staley borrowed against daily invoices to cover corn purchases and payroll checks. By early 1922, it was common knowledge that Staley was building the plant: in announcing plans by farm advisers for a soybean mill in Monticello, roughly midway between Decatur and Champaign, the March 11 *Decatur Review* noted that it would “be competitive to the plant that is to be established by the Staley company in Decatur.”[75] Finally in June, late in the planting season but still in time for farmers to increase their soybean acreage, Staley issued a formal announcement that acknowledged pressure from farm groups and county agents: “in response to the general and urgent desire on the part of the farmers of Central Illinois, it has been decided to

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[74] Dies, 16-17.
[75] "Monticello is to Have Soybean Mill," *Decatur [IL] Review*, 11 March 1922, 2.

install a soybean plant." The bean dryers were still under construction, but storage "for 150,000 bushels of beans is ready for use." In October the company announced that the new plant was in operation, "thus inaugurating a new industry for Central Illinois and providing the growers of this territory with a market for their beans." With characteristic bravura, he predicted rather fantastically that "the day will come when our plant will process more soybeans than corn" – this at a time when his company was processing 40,000 bushels of corn every day.[76]

Staley was not the only one bullish on soybeans that year or feeling the effects of the push by farm advisers. The Monticello plant announced in March was an initiative by Piatt County farm adviser J.W. Watson who, after touring a mill under construction in Peru, Indiana, announced plans for a facility that could crush 50,000 bushels during the 1922-23 season.[77] The venture was ultimately organized as a cooperative, with stock sold to local farmers and businessmen, which built an ambitious $35,000 solvent-extraction plant which opened in the fall of 1923 with much fanfare; both Hackleman and Morse attended the festivities. Solvent extraction was a cutting edge technology, widely used in Europe but as yet untried in the United States, which washed the oil out of flattened soybean flakes with benzene, and then distilled the benzene out of the oil. The method would not catch on in the U.S. until the 1930s, making Monticello a truly pioneering venture. The expellers installed by Staley consisted of a worm screw that conveyed the beans within a cylindrical cage of closely spaces steel bars and pushed them out of a restricted opening, creating enough pressure to squeeze the oil out of the sides and the

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[76] Forrestal, 60-61, 56; F.A. Wand, "Relation Between the Soybean Grower and the Oil Mill," in *Proceedings of the American Soybean Association, Volume I: 1925, 1926, 1927* (American Soybean Association: 1928), 105. A bushel of corn is 56 pounds,, a bushel of soybeans 60 pounds.
[77] "Monticello is to Have Soybean Mill."

meal out of the end, as out of a meat-grinder. Meanwhile, the Chicago Heights Company increased their crushing capacity in 1922 by installing two hydraulic presses, which used rams to push cast-iron plates together, the oil flowing out of the sides. A batch rather than a continuous-flow technology, presses involved higher labor and operating costs but represented a smaller capital investment. In addition to these investments, Hackleman indicated in his letters to Morse that the East St. Louis Cotton Oil Company was gearing up to process soybeans in 1922; by the following fall, the plant in Peru, Indiana that J.W. Watson had toured would also open its doors.[78]

As Hackleman noted by April 1923, this push to expand crushing capacity was premature. Farmers saved or sold their beans for seed, and the new mills stood idle for want of a raw material. The Monticello plant operated, having stored or contracted several thousand bushels of beans, was able to operate for six months in 1923-24 and, it appears, was shuttered thereafter until taken over by a new owner in 1929.[79] By some accounts, the Chicago Heights Oil Mfg. Co. went out of business; in any case, it sold its expeller equipment in 1924 to the Funk Brothers Seed Company, which hired I.C. Bradley to oversee it.[80] Staley meanwhile made his first purchase of beans on September 28, 1922: 1,547 bushels, purchased for just under a dollar a bushel. This and additional purchases kept the mill running for sixteen days. Chamberlain took advantage of the subsequent shutdown to further modify the dryers. The plant ended up operating 74 days in 1922 and 57 days in early 1923 before closing down in April, a period during which he perhaps crushed 60,000 bushels, forty percent of the 150,000 he had assured farmers he

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[78] Hackleman to Morse, 18 Nov. 1922, Illinois Correspondence.
[79] Shurtleff and Aoyagi, *Cooperative Soybean Processing*, 14, 20.
[80] Klare S. Markley and Warren H. Goss, *Soybean Chemistry and Technology* (Brooklyn, NY: Chemical Publishing Company, Inc., 1944), 138-39.

had the capacity to store.[81] The situation was no better during the 1923-24 season, when Staley paid $1.50 for a bushel. In response to an inquiry from West Virginia, he wrote in May 1924 that "some new companies which have entered the processing field have paid $1.70 to $1.80 in order to get a supply to maintain their operations," not having the luxury of idling their plants. "Our experience so far has been both unprofitable and discouraging." Calculating the costs of investment, depreciation and plant idleness, he estimated that "our loss for one month's operation amounted to approximately twelve thousand dollars." He planned to leave the machinery in place for another year, but if profits did not improve, he stated with some resignation that "it will be our intention to dismantle the plant and discontinue the soybean business."[82] Convinced that the 1924 harvest would also go for seed, Staley did not operate the mill that fall.[83]

Staley may have been momentarily discouraged, but, as he had almost a decade earlier when faced with insolvency, he rallied with a renewed sales push. In this case, he focused on expanding acreage harvested for beans, producing posters that hung in stores, grain elevators and banks and distributing free booklets on growing soybeans.[84] The idling of the mill worked at cross purposes to this. As Frederick A. Wand, head of the soybean department, recounted in a speech to the American Soybean Association in 1925, "growers, on being informed that our mill was not operating, refused to increase the soybean acreage to the extent that we had hoped for."[85] Nonetheless, perhaps banking on a continued strong market for seed, acreage did increase by 25 percent in 1924. Although production of beans went up by only seven percent due to lower yields,

[81] Forrestal, 63; Hackleman to Morse, 23 April 1923, Illinois Correspondence.
[82] Dies, 26; Forrestal, 63.
[83] Wand, "Relation," 105.
[84] Dies, 26.
[85] Wand, "Relation," 105.

by early 1925 some growers "could not dispose of their soybeans at any price," according to Wand. Less hyperbolically, Staley found that he could purchase a bushel for $1.30, making it worthwhile to run the plant for seven months in 1925 and, as the price declined further, eight months in 1926.[86] The number of acres grown for beans had actually dipped in 1925, perhaps in part as a response to Staley's closure in 1924, but good yields nonetheless pushed the production figures up, a trend that would accelerate after 1928 when both acreage and yields would rise substantially.[87] It seems that a threshold had been crossed, where the demand for seed no longer was so strong as to price beans out of reach of the crushers, even as the number of acres doubled by 1930. Staley's encouragement of this expansion reached a high point in the 1927 Soybean Special, whose message that season was aided by dry conditions and fear of the European corn borer, which was making an incursion into the Midwest, all of which made soybeans an attractive crop to turn to. But as prices stayed above the $1.00 per bushel that Staley had paid in 1922, he opened campaigns on two other fronts as well: the promotion of new technology to boost yields, thus increasing the supply and lowering his costs; and the funding of research to improve the marketability of both soybean oil and meal, thus raising his revenues.

On the production side, the Staley Company was influential in introducing the combine to Illinois, although it was Frederick Wand who was their chief promoter. He was responding to dissatisfaction among growers over the amount of beans lost to the

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[86] Ibid., 105; Forrestal, 63. Staley was well positioned as a buyer; national estimates put the price of a bushel of soybeans at $2.50 at the time; it wouldn't reach $1.30 until after 1930. Department of Agriculture, Bureau of Agricultural Economics, *Soybeans in American Farming,* by Edwin G. Strand, Technical Bulletin No. 966 (Washington, D.C.: Government Printing Office, Nov. 1948), 12.
[87] University of Illinois Agricultural Experiment Station, *Supply and Marketing of Soybeans and Soybean Products,* by C.L. Stewart, W.L. Burlison, L.J. Norton and O.L. Whalin, Bulletin 386 (Urbana, IL: University of Illinois, 1932), 440.

shattering of pods when harvested with a conventional binder, which would gather the plants for later threshing by a grain separator. In the early 1920s combines – which both cut and threshed crops in the field, leaving the straw behind – were being used to harvest wheat in the American southwest, but, as Wand later recounted at an ASA meeting, "even our Agricultural Experiment Stations could not be enthused over the idea of introducing such a large machine on Corn Belt farms." In 1924, however, one grower demonstrated its use on 212 acres of soybeans in central Illinois, and Wand subsequently traveled to the headquarters of the Massey-Harris Harvester Company in Batavia, New York, to convince its board of directors to "expand their sales organization . . . in territory that a number of agricultural authorities believed was not adapted to Combine harvesting." Wand insisted to them, rather colorfully, "that the Combine would take the 'H' out of harvesting and revolutionize soybean growing in the Central West." He also pointed out that the Staley Company had developed a grain dryer specially designed for combined grain, including wheat and corn. Massey-Harris helped sell the first eight combines sold in Illinois.[88] Thereafter, their spread was extremely rapid, with five manufacturers, including McCormick-Deering and International Harvester, offering machines that could be adjusted for wheat, corn, soybeans, rye, flax, buckwheat, peas, and other crops. Their number increased to 300 by 1927 and to 3,000 by 1936, when ninety percent of soybeans were harvested by combine.[89] In his 1928 bulletin, Hackleman listed six advantages of combines for harvesting soybeans, including lower losses due to shattering, a shorter harvest that could better avoid bad weather, the

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[88] Frederick A. Wand, "Commercial Outlet for Soybeans," in *Proceedings of the American Soybean Association, Volume II. 1928, 1929* (American Soybean Association: 1930), 35.
[89] "International Harvester," *Wall Street Journal*, 7 December 1927, 18.; Mabel P. Crompton, "The Soybean Crop of Illinois," *Journal of Geography* 39 (April 1940): 147.

avoidance of injuries to the plants while they awaited threshing, and the increased amount of litter – stalks, leaves, pods, etc. – left on the ground to provide fertilizer. Among the drawbacks, on the other hand, was that "combines are costly," an element of a more efficient but more capital-intensive agriculture.[90]

On the marketing side, one of Staley's first breakthrough came with selling the meal. In response to demands by ranchers and farmers, who said they wanted a special feed for their cattle and sheep that they could use in the wintertime, the company developed pellets that were easy to find when the fields were covered in snow. They had the circumference of a broom handle and were about two inches long; they consisted mostly of soybean meal, but also included limestone and bone meal for calcium and used molasses as a binding agent. Kenneth Maltas, who was a traveling salesman for Staley in the late 1920s, later recalled their popularity in western states. "Some ranchers bought small supplies at the start but I wound up selling pellets by the ton. Perfecting the formula for pellets at the Decatur plant was not an easy job. The pellets had to avoid crumbling during shipment to Colorado and other cattle states. They had to be hard enough so that they wouldn't soak up moisture and disintegrate. But they also had to be soft enough for cattle and sheep to eat." Cowhands would use ponies or light trucks to "scatter pellets off toward the horizon – thousands and thousands of pellets. One of the most picturesque sights on a snowy range was to see cattle and sheep strung out, single file, over a great distance, munching the special winter diet from Decatur, Illinois."[91] This specialized product aside, disposing of the meal would remain a problem through the 1930s. As two-thirds of the weight, it theoretically represented the majority of the

[90] University of Illinois Agricultural Experiment Station, *Soybean Production in Illiinois,* by J.C. Hackleman, O.H. Sears, and W.L. Burlison, Bulletin No. 310 (Urbana, IL: University of Illinois, 1928), 492-93.
[91] Forrestal, 66-67.

value in a bushel of soybeans, but it was bulky to transport, and farmers closer to home were slow to see its advantage over the soybean hay or ground soybeans they could produce for themselves. Larger feeders and mixers of formulated feeds, while appreciating the high quality of soy protein, only started using larger amounts of soybean meal as its price went down in 1931 to become competitive with other oilseed meals: in 1930, around 100,000 tons were consumed, compared with around four million tons of cottonseed and flaxseed meal.[92]

The other route to profit was to improve the quality of soybean oil for higher-value uses. Cottonseed oil, flaxseed oil and, most recently, corn oil had undergone a process of improvement over decades, first by trial and error on the part of small-scale producers and subsequently by scientifically trained chemists such as David Wesson of the Southern Cotton Oil Company (based in New York City). Regarding cottonseed oil, Wesson wrote in 1915 that the "chemist's greatest service to the industry has been in the refining of the oil," which eventually involved neutralizing the free fatty acids with lye or other alkalis and filtering them out; bleaching the oil with fuller's earth, a special clay; and removing disagreeable flavors by deodorizing the oil with superheated steam. The result was a product "as pure as granulated sugar, regardless of the kind of crude oil from which it has been made."[93] In liquid form or solidified through hydrogenation,[94] refined

[92] *Supply and Marketing of Soybeans,* 462.
[93] David Wesson, "Contributions of the **Chemist** to the Cottonseed Oil Industry," *The Journal of Industrial and Engineering Chemistry* 7 (April 1915): 277.
[94] This was a recently developed process that involved bubbling hydrogen gas through a hot oil in the presence of a catalyst, and by this means "saturating" the carbon chains with hydrogen. The hydrogen molecules – bonding with carbon molecules that had been linked to each other by single or double bonds – essentially straightened out the chains. Saturated or hydrogenated fats tend to be solid at room temperature: imagine a ream of flat paper. Unsaturated fats, on the other hand, are fluid at the same temperature: imagine the sheets of that ream crumpled into balls and piled up on one another. Markley and Goss, 232.

cottonseed oil became the highest quality oil for edible purposes. A similar process resulted in flaxseed oil becoming the highest quality oil for paint because, as a "drying oil," it produced a solid film when it dried on a surface. During the 1920s, refining processes were adapted to corn oil, which became competitive with cottonseed oil for edible purposes. While there was experiments to refine soybean oil in the late teens and early twenties for both purposes – it was considered a semi-drying oil – these were conducted mainly on Manchurian oil, which was uneven in quality.[95] Experience during World War I, when substantial amounts were used in shortening and margarine – though still constituting less than five percent of the oils used in those products – had served mainly to give soybean oil a bad reputation. Refined by methods then in use for cottonseed oil, it retained a "fishy" or "painty" taste.[96] Thus, by the middle of the 1920s, as other oils shifted to higher-value uses, soybean oil found use mainly in soap, to a lesser extent in paint, varnish and linoleum, and to a vanishing extent in edible products.[97]

This began to change in 1928, when Staley and other manufacturers experimented with refining soybean oil using the methods developed for corn oil. As Maurice M. Durkee, a chemical engineer who had worked for the Southern Cotton Oil Company at the same time as David Wesson before eventually ending up at Staley in the late 1920s, recounted to the American Chemical Society in 1936, these methods "gave results that

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[95] H.P. Trevithick, "Soy Bean Oil Sub-Committee Report," *The Chemists' Section of the Cotton Oil Press* 7 (July 1923): 33.
[96] M.M. Durkee, "Soybean Oil in the Food Industry," *Industrial and Engineering Chemistry* 28 (Aug. 1936): 899.
[97] *Supply and Marketing of Soybeans,* 467. Sometimes the literature listed other industrial uses such as printer's ink, but this was no indication of actual practice: when the *Prairie Farmer* planned to print its December 1928 issue on cornstalk paper, Hackleman suggested that it use soybean ink as well, but was then unable to track down a manufacturer. Morse was unable to suggest one; Staley referred him to a company in New York, but it's not clear if they ever responded to Hackleman's query. Hackleman to Morse, 29 Oct. 1928; Hackleman to Morse, 13 Nov., 1928; Hackleman to Morse, 26 Nov. 1928, Illinois Correspondence.

were surprisingly good; the soy oil was remarkably low in color, contained less than 0.015 per cent free fatty acid" – the major source of bad flavors and rancidity – "and was sweet and bland." Unfortunately, after a few weeks of storage, the oil "reverted," developing off flavors described as "grassy" or "beany," putting it at a disadvantage to other salad oils. In subsequent years, the process was fine-tuned to give oil with less of a tendency to revert, although this problem would not be fully solved for decades.[98] In the meantime, it found use in cheaper salad oils and in shortening, as hardening led to better flavor stability. Staley also developed a special oil that sold at a premium to margarine manufacturers. Purified but not bleached, it was dark in color, and when used even in small amounts it made margarine a buttery yellow without triggering the punitive taxes directed at "artificially" colored margarine. Previous experiments with dark corn oil had given margarine an undesirable brownish tinge. Staley sold his full output of refined soybean oil, some two million pounds, to margarine producers in 1930, but this success proved somewhat short-lived. Dark refined palm oil displaced it by 1932, and the law was subsequently changed to tax naturally yellow margarine as well.[99] Utilization in the early 1930s would tilt toward industrial uses, particularly after research at the University of Illinois beginning in 1930 established reliable standards for its use in paint. But Staley's focus on edible uses would have a larger long-term impact once several states and the federal government enacted taxes against coconut and palm oil – decried as foreign in a campaign supported by the soybean industry – in 1934, and margarine producers once again turned to domestic oils.[100]

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[98] Durkee, 899.
[99] Ibid., 901.
[100] William H. Nicolls, "Some Economic Aspects of the Margarine Industry," *The Journal of Political Economy* 54 (June 1946): 222.

While he worked to popularize soybeans and develop markets for oil and meal, Staley stood aloof from one major development in the late 1920s, the so-called "Peoria Plan" of 1928, which was the work of I.C. Bradley and Eugene Funk at the Funk Bros. Seed Company in Bloomington, in conjunction with H.G. Atwood of the American Milling Company in Peoria and James McConnell of the New York Grange League Federation (G.L.F.), which represented dairy farmers in that state. The G.L.F., fearing a shortage of protein for milk cows that year, agreed to purchase meal from Funk Bros. and American Milling, allowing those companies in turn to announce a guarantee to pay Illinois farmers $1.35 a bushel up to one million bushels (roughly 50,000 acres) of soybeans; the offer allowed farmers to sell to other bidders at a higher price as long as they gave the two mills the first opportunity to buy at that price. The agreement was finalized at Urbana at a meeting with fifteen farm advisers. It is unclear if Hackleman was present, but Frederick Wand attended the meeting and pledged to urge Staley to join.[101] But as he reported to the ASA's annual meeting in September, "it has never been the policy of the Staley Company to contract for soybeans for more than 30 days in advance." He pointed out that "during the past 60 days we have paid as high as $1.40 per bushel . . . which is five cents a bushel above the contract price."[102] As it happened, the Funk and Atwood had ensured that Staley and other mills were unable to find cheaper soybeans by buying even non-contract beans at the contract price, ending up with forty percent more beans than they had originally intended. Beans flooded in faster than Funk or Atwood could find storage for them.[103] Funk continued the Peoria Plan for several more years, despite some

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[101] Cavanuagh, 353.
[102] Wand, "Commercial," 35.
[103] L.B. Breedlove, "Soybean - The Magic Plant, Article XIX: Trading in Futures Next Development in Perfecting Market Facilities," *Chicago Journal of Commerce and La Salle Street Journal*, 16 July 1936, 12.

misgivings about negotiating with a farmers cooperative, the Soybean Marketing Association, which emerged in 1929 and which other processors opposed. He likely had his biggest impact in 1930, when he continued to pay a contract price of $1.30 at a time when, acres and bean production having almost doubled over the previous year, prices had fallen steeply.[104]

By 1930, several other companies had joined Staley, Funk Bros. and American Milling, including the Iowa Milling Company of Cedar Rapids, the first to crush soybeans west of the Mississippi (1928), the William O. Goodrich Company of Milwaukee, Wisconsin (1926), which was acquired by Archer-Daniels Midland in 1928, and the Shellabarger Grain Products Company, also of Decatur (1929). Smaller mills were emerging throughout the Corn Belt, to the point that crushers organized their own trade association, the National Soybean Oil Manufacturers Association – later the National Soybean Processers Association – in May 1930, almost ten years after the establishment of the American Soybean Association. Mills located at strategic points near the supply of beans, but due to Staley's leadership in the industry, Decatur would eventually become the headquarters of several major processers, making it the center of soybean production not just of Illinois, but arguably the world. Staley himself turned 63 in 1930 and would gradually relinquish the reigns of the company to his son Augustus E. "Gus" Staley. Staley Sr. had developed diabetes, which perhaps deepened his appreciation of soy foods, as soy flour – which his company produced for bakers – had its earliest use in Europe and the U.S. as a low-starch ingredient in diabetic bread. He died in December 1940, having been profiled earlier that year by *Forbes*, which noted,

[104] Cavanaugh, 365.

"Curiously, a man who hated farming has done more for the American farmer than almost any other man alive. A.E. Staley is the great salesman of the soybean, the only new crop of importance in many years."[105]

The Agronomist

On a hot, muggy, overcast morning in the middle of July 1929, William J. Morse and his colleague, P.H. Dorsett, rode a trolley for an hour to the outskirts of Tokyo where they attended an agricultural fair held in the public school of the small village of Hanabata. The displays of vegetables were larger and more attractive than at similar events the two had attended, but Morse noticed only two legume varieties, of bonavist and yardlong beans, that he had not seen before. So they struck out into the countryside where soybean plants grew in the fields next to the roads to be sold as green vegetables at local markets, their pods intact. In one field, some of these soybeans were drying on a mat in the sun. Through their interpreter, Mr. Suyetake, they ascertained that these beans would be soaked overnight and then made into soy milk used to prepare cloth for dyeing. As Morse recorded in the small notebook he used as a diary, by first dipping the cloth in the soy milk, "it was said that . . . the dye was more uniformly spread."

The three men then entered a farmyard where the "Japanese women kindly consented to pull some green vegetable soybeans so might get motion pictures" with their handheld, black-and-white DeVry camera. (For events that warranted it, such as cherry-blossom festivals, they had a second movie camera with a Vitacolor attachment.) In another, they captured the process by which the plants, having been pulled up with their roots, were

[105] Quoted in Soyinfo Center, "A.E. Staley."

bundled with the aid of a wooden frame. Most of the leaves were stripped off and tied into small bunches eight inches long, four inches wide and two inches thick. The soybean plants were placed upside down in the frames, so that the pods spread out at the bottom, and the bunches of leaves were inserted in the middle of the stalks to space them out. When tied with rice straw and turned right-side up, it made a "very pretty bundle."

They stopped at what Morse described as a "small grocery and lunch place" where "about twenty children were noted about. Five or six little girls were eating soybeans. They had two or three handfuls of soybean pods in some pieces of newspaper and were busy eating the cooked green beans from the pods." They consented to be filmed. As Morse, Dorsett and Suyetake made their way back to the train, they turned the camera on a "bean curd man coming up the road [but] were able to catch only a few feet of him just as he turned into a farmyard." They followed, and the vendor "posed [and] showed how he sold his product. The farm women gave him a pan of water and he took two good sized bricks of bean curd from one of his tubs and placed [them] in the tub."[106] In the late afternoon, Morse and his companions caught a trolley back into central Tokyo.

This outing was fresh in Morse's mind as he composed a letter the next morning to the Tenth Annual Meeting of the American Soybean Association slated to take place in Guelph, Canada. It was the first annual meeting outside of the U.S., as well as the first that Morse would miss. He and Dorsett were in the early months of what was officially known as The Oriental Agricultural Exploration Expedition, the first such expedition with a primary focus on collecting soybeans, but Morse could already testify that the journey had been eye-opening. "It is amazing, the extent to which the soybean is used for

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[106] Morse Logbook, July 1929, Plant Exploration Collections, No. 325: USDA Forage Crop Investigation Records, Special Collections, National Agricultural Library, Beltsville, MD (henceforth, "Morse Logs.")

food in Japan. . . . It may interest you to know that the beans produced in Japan are used entirely for human food, green manure, and planting purposes." Uppermost in his mind were the green vegetable soybeans whose cultivation and marketing he had documented the day before. He described his surprise, when hunting down varieties at groceries and seed houses, "to find the soybeans listed with the garden beans and as garden beans." And, indeed, he noticed in forays near Tokyo that "in 95 percent of the cases there are other crops planted between the bean rows, such as early cabbage, onions, lilies (for the edible bulbs) . . . and other early truck crops." As early as May, "small bundles of plants with full grown pods were seen on the market. . . . The pods are boiled in salt water and the beans eaten from the pods."[107] He would eventually learn that the Japanese classed these garden varieties as *mame*, as opposed to *daizu*, field soybeans grown for grain and forage.[108]

The note of surprise so evident in his report to the ASA would recur in Morse's letters and notebooks throughout the two years of the expedition – surprise that was, on the face of it, itself surprising, as there was arguably nobody in America better informed or more passionate about the multifarious uses of the soybean. Indeed, he had pushed for over a decade for the use of Easycook and Hahto soybeans as canned and garden vegetables. Up to this point, however, most of these uses had remained for him in the realm of possibility, of the as yet unrealized. But now he found himself in "the land of the soybean" – a sobriquet he would later apply to Manchuria – immersed in a reality that he had previously only read about or imagined. As on his outing to Hanabata, he found

[107] William J. Morse, "Letter from Dr. Morse," in *Proceedings of the American Soybean Association, Volume II. 1928, 1929* (American Soybean Association: 1930), 51-52.
[108] William Shurtleff and Akiko Aoyagi, *William J. Morse - History of His Work with Soybeans and Soyfoods (1884-1959): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 255.

soybeans, often used in ways he did not expect, virtually everywhere he pointed his motion-picture camera. He maintained a sober outlook on the potential for transferring this reality to America: "Whether or not it can be used in the United States in all of the ways used here is extremely doubtful, that is for human food," he wrote to the ASA.[109] Similarly, in a letter to his Forage Crop colleague R.A. Oakley, he wrote that "this trip has more than opened my eyes on the soybean problem. Soy sauce, the green vegetable bean, and possibly miso are the only products now used extensively in the Orient that have possibilities in the United States as foods."[110] This restrained hope, centered in particular on the possibility of expanding the presence of green vegetable soybeans in the American diet, would inspire his work over the ensuing decade, but this was a full half century before edamame would catch on among the non-Japanese population. In the 1930s, the growth of soybeans in America would be due instead to the phenomenon that provided much of the impetus to Dorsett and Morse's expedition in the first place: the processing of beans in the Corn Belt into oil and meal.

As the soybean's profile rose during the 1920s, so did Morse's. One landmark in the career of both man and bean was the publication in 1923 of *The Soybean*, which Piper and Morse initially prepared during World War I. As the wartime interest in the soybean faded, the manuscript landed in a drawer; with the Corn Belt boom, however, the project was revived, revised and updated. A compendium of Piper and Morse's previous bulletins – including a lost list of varietal descriptions – it also featured extensive information on Asian foods and methods of preparation, illustrated by Frank N. Meyer's

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[109] Morse, "Letter," 51.
[110] Morse, Tokyo, Japan, to R.A. Oakley, Washington, D.C., 27 April 1929, Morse Correspondence.

photographs of such things as the Manchurian oil industry and various kinds of tofu.[111] Morse also had access to the USDA's collection of books on Chinese agriculture and those of Walter T. Swingle of the Office of Crop Physiology; Fairchild's erstwhile classmate and Yamei Kin's USDA supervisor, Swingle spoke fluent Chinese and had traveled extensively in Asia himself.[112] Hence, the chapter "Soybean Products for Human Food" was able to provide information on six varieties of tofu – including "bean curd brains" (*Tofu Nao*), "dry bean curd" (*Tofu Khan*), "thousand folds" (*Chien Chang Tofu*), and "fragrant dry bean curd" (*Hsiang Khan*) – in addition to *natto* (fermented bean curd), *hamanatto* (soy cheese), *yuba* (soymilk skin), *miso* (soy paste), green or vegetable soybeans eaten directly from the pod. A five-page spread showing the traditional method for making *shoyu* (soy sauce).[113] In addition to soybean loaf and bread recipes provided by Home Economics Departments, Morse also included tofu recipes provided by the Chicago Bean Bread Company (garnered most likely during the Patriotic Food Show) and the rather mysterious Soy Products Company.[114] Thus Morse was already familiar with Asian soy foods, and not always at second-hand. "The junior author has conducted a large number of tests to determine the yield of curd from different varieties," the results of which were presented in a table. Variety 37050, with a black seed, provides a good yield of tofu, although the color of the curd was "slate"; likewise 37282, with a green seed, produced a "greenish" curd. The results from seventeen other varieties, treated

[111] Charles V. Piper and William J. Morse, *The Soybean* (New York: McGraw-Hill Book Company, Inc., 1923; reprint, NewYork: Peter Smith, 1943), 196, 238-242.
[112] Soyinfo Center, "William J. Morse and Charles V. Piper: Work with Soy, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/morse_and_piper.php..
[113] Piper and Morse, 238-57.
[114] Ibid., 273-279.

under identical laboratory conditions, were also tabulated; made with olive or straw yellow beans, most were more conventionally cream-colored or white.[115]

In his work with Piper, Morse – with no sign of resenting it – had long been the junior author, doing most of the tedious experimentation and research, while Piper revised the manuscripts to add sharpness, concision and clarity. One chapter that was wholly the work of Piper, reprinted from 1914 and reflecting his interests in taxonomy and etymology, surveyed the "Botanical History of the Soybean" with the purpose of establishing *Soja max* as its scientific name rather than the current *Glycine hispida* – among the other contenders in what would prove to a longstanding tangle were *Soja angustifolia*, *Glycine soja*, and *Dolichos soja*. Quoting at length a detailed 1897 study by Sir David Prain, Piper argued that descriptions of the soybean plant appear twice in Linnaeus' 1753 *Species Plantarum*. One was used erroneously to describe *Phaseolus max*, intended to be the entry for the mung bean, but because this appeared a few pages earlier in the work – and because, rather than correct the mistake in later editions, Linnaeus created a new entry for mung beans – *max* had precedence by the rules of international taxonomy as the soybean's species name. Piper's argument for placing soybeans in the *Soja* genus was even more involved, hinging on an argument that Linnaeus intended the American wild bean to be the "type species" for the genus *Glycine*, thus ruling it out for soybeans according to American botanical rules; *Soja* was the next option. In 1917, Elmer Drew Merrill had argued that *Glycine* was the genus dictated by international botanical rules, a divide that would persist until 1948, when Morse and

[115] Ibid., 236.

others conceded that the international name should prevail in the U.S.[116] Thus, in a letter from Tokyo in 1930, Dorsett and Morse would refer to themselves as "Soja maxers."[117] In any case, most of the action in soybean research was at the varietal level, Morse's painstaking work making different shades of tofu providing only one example – and the reason why, though he was the junior author, *The Soybean* was very much his book.

Junior author or no, his name on *The Soybean* established Morse's status as a leading expert on the crop, a status cemented when Piper, whose health had been failing for some time, died in early February 1926 at the age of 58, leaving the office of Forage Crops "very much upset."[118] Their book quickly became a classic in the field of agronomy: in a letter to Morse, Hackleman lauded it as "a masterpiece on the subject . . . I had no idea that the book would be as complete as it is"; his only objection to the complimentary copy he received was that it was not autographed.[119] While Hackleman gradually became less engaged with the National Soybean Growers' Association as it matured, Morse became a mainstay. He was elected President in 1924 and 1925, and during the latter year he hosted the annual field meeting in Washington, D.C. At that year's business meeting in Chicago – which Morse was unable to attend – the renamed American Soybean Association (ASA) became a dues-paying organization with a

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[116] Ibid., 28-34; Soyinfo Center, "The Soybean Plant: Botany, Nomenclature, Taxonomy, Domestication, and
Dissemination, A Special Report on The History of Soybeans and Soyfoods Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2007, www.soyinfocenter.com/HSS/soybean_plant2.php.

[117] Morse and P.H. Dorsett, Tokyo, to Knowles A. Ryerson, Washington, D.C., 5 March 1930, Morse Correspondence.

[118] Morse to Hackleman, 24 Feb. 1926, Illinois Correspondence. This came fast upon a personal tragedy for Morse, the stillbirth of a son in January 1926; questioned by their four-year old daughter, Margaret, about why they had not returned from the hospital with a promised baby, they explained that they hadn't seen any that they liked. H.L. Westover, Washington, D.C., to Hackleman, 20 Jan. 1926, Illinois Correspondence; William Shurtleff, personal communication.

[119] Hackleman to Morse, 23 Feb. 1923, Illinois Correspondence.

constitution and bylaws. In the coming years, he chaired the Soybean Nomenclature and Soybean Score Card committees – which both included Hackleman as a member – and was appointed Editor in charge of bulletins. He published the first *Proceedings of the American Soybean Association*, which summarized the events at field and business meetings back to 1920 and included papers delivered at the 1925 through 1927 meetings, in 1928.[120] The ASA would later fall wholly under the direction of growers, but in its early years experiment-station and USDA staff, Morse prominent among them, were indispensable.

As he did in his day-to-day work, at the ASA Morse concentrated on varietal development and crop improvement. A score-card for soybeans – following one of Hackleman's favored practices for improving seed corn – had been proposed in 1923 and then forgotten until a professor at Purdue inquired about the idea in October 1926; by the middle of 1927, Morse's Score Card committee had prepared a draft that assigned percent values to a seed lot's Purity, Uniformity (including lack of mottling), and Condition.[121] To ensure that the seeds were viable – that they would germinate, something difficult to test directly – and that they reliably produced the advertised variety, these criteria were more stringent than in the grading system for soybean grain established the year before. The Nomenclature Committee, meanwhile, dealt with varietal names rather than the issues of botanical taxonomy that had most interested Piper. Morse described as his "main object [to] get out improved varieties that will be of benefit to the various sections"; a system for quickly and consistently applying names to these varieties would expedite this process. Other considerations were less important. When he succeeded in

[120] *Proceedings of the ASA, Vol. 1*, 6-8, 12-13.
[121] Hackleman to Morse, 4 Oct. 1926; Hackleman to Morse, 10 May 1928, Illinois Correspondence.

his efforts to breed a pure-line, black-hilum Manchu soybean, some proposed calling it the Morse Manchu; he suggested Mansoy instead, professing to Hackleman with typical modesty that he was "not at all concerned about merited honor or publicity."[122] The work of getting out improved varieties was made more urgent by an influx of new introductions from Asia: in April 1925, Morse mentioned to Hackleman "800 new things which have been received this past winter and spring from Korea, Manchuria, and Japan,"[123] mostly from the usual networks of missionaries, diplomats and foreign agronomists at agricultural research stations. Then, in 1926, came a flood from Northern Manchuria through the efforts of USDA plant explorers P.H. Dorsett and his son, Jim.

P.H. Dorsett was not himself a soybean man, nor was he highly trained in formal botany. He had worked his way up through the ranks of the Office of Foreign Plant Introduction beginning in 1901. His skills in carpentry and mechanics – as well as a green thumb – were crucial in establishing the office's five plant introduction gardens and earned him the respect and friendship of Frank Meyer. He was also a talented photographer and, later, enthusiastic filmmaker. He went on his first expedition, to Brazil, in 1914 and later accompanied David Fairchild to Panama.[124] His expedition to China began in 1924 in the region around Peking, and he and his son focused mainly on vegetables, ornamentals and, above all, fruits: peaches, pears, apples, apricots, grapes and, of particular interest to Dorsett, persimmons. They also collected about fifty samples of soybeans, plus about ten more when they first shifted into Manchuria in the summer of

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[122] Morse to Hackleman, 4 Nov. 1927, Illinois Correspondence.
[123] Morse to Hackleman, 25 April 1925, Illinois Correspondence.
[124] J. McKeen Cattell and Jacques Cattell, "Dorsett, P(alemon) H(oward)," *American Men of Science*, Sixth Edition (New York: The Science Press, 1938), 373-74; David Fairchild, "Award of Meyer Medal to P.H. Dorsett." *Journal of Heredity* 27 (Aug. 1936): 307-10..

1925.[125] The first substantial lot came in October, when the Russian botanists at the Manchurian Agricultural Research Society of Harbin presented him with over one hundred single-plant selections – seeds in the pods with some of the vine attached – that they had planted in anticipation of his arrival. In a demonstration of the efficiency of the pipeline from Asia to Illinois, Morse would send some of these seeds to Hackleman to plant in Urbana by April the following spring in the hopes of finding promising early-maturing varieties for northern Illinois.[126] During the winter of 1925-26, the Dorsetts wisely traveled south to join David Fairchild in Ceylon, Sumatra and Java, returning to Manchuria for the better part of 1926. By early 1927, Morse was advising Hackleman that "so far this winter we have received in the neighborhood of 1200 introductions from Manchuria and China," mostly as a result of Dorsett's arrangement with the Manchurian Postal Commissioner to have postmasters throughout the region collect samples of soybeans and mung beans from their villages.[127]

By this time, the Dorsetts felt that the wealth of soybean agriculture in the region merited the attention of the Department's soybean specialist, and they wrote letters urging the Morse be sent to "see and experience for himself what we were seeing and experiencing in connection with the growing, harvesting and handling of soybeans." Henry Allanson, Assistant Chief of the Bureau of Plant Industry, agreed and, almost as

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[125] Department of Agriculture, *Seeds and Plants Imported by the Office of Foreign Plant Introduction, Bureau of Plant Industry, During the Period from Oct. 1 to Dec. 31, 1924: Inventory No. 81; S.P.I. Nos. 61738 to 62230* (Washington, D.C.: Government Printing Office, 1927), 1, passim; see also Inventories Nos. 82 and 83.

[126] Department of Agriculture, *Plant Material Introduced by the Office of Foreign Plant Introduction, Bureau of Plant Industry, During the Period from Oct. 1 to Dec. 31, 1925: Inventory No. 85; S.P.I. Nos. 65048 to 65707* (Washington, D.C.: Government Printing Office, 1928), 15; "Explorers Send Plants Home for Trial," *Los Angeles Times*, 3 April 1927, J20; Morse to Hackleman, 16 April 1926, Illinois Correspondence.

[127] Morse to Hackleman, 28 Feb. 1927, Illinois Correspondence.

soon as the Dorsetts returned, proposed that they mount another expedition to the region within a year or two with Morse in tow. Morse was enthusiastic about the prospect of becoming an explorer after so many years at the receiving end of plant introduction. A devoted family man, he proposed that his wife and daughter accompany him on such a long trip away from home (Mrs. Morse initially objected to the idea); Dorsett, whose son died in 1927 of tuberculosis, likewise arranged to bring his daughter-in-law.[128] By March 1928, Dorsett and Morse submitted a proposal to explore Japan, Korea ("Chosen"), Northeastern China (including Manchuria) and Formosa, with a focus on soybeans, Oriental persimmons and kudzu. Morse, as it turned out, was the Department's kudzu man: Piper, seeking a perennial legume for the South, was as evangelical about kudzu – which he defended against those who feared it would become a pernicious weed – as he was about soybeans.[129] Like the soybean, it enriched the soil with nitrogen while providing products of commercial value: very high-quality starch and forage for livestock and dairy cattle. Moreover, unlike the soybean, its dense root systems helped soil resist erosion. Its chief disadvantage was that, "as yet, propagation is carried on by rooted plants, a very expensive way of establishing a field." The hope was to discover methods of seeding that could be copied in the U.S. The persimmon, adapted to the South and the Pacific coast, meanwhile promised "to be of very great economic importance" and "may

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[128] Department of Agriculture, Bureau of Plant Industry, Foreign Plant Introduction and Forage Crop Investigations, *Agricultural Exploration in Japan, Chosen (Korea), Northeastern China, Taiwan (Formosa), Singapore, Java, Sumatra and Ceylon, by Dorsett, P.H. and Morse, W.J., Agricultural Explorers,1928-1932,* Vol. 1, 1-2, Plant Exploration Collections, No. 51: Dorsett-Morse Oriental Agricultural Exploration Expedition, Series I: Journals, Special Collections, National Agricultural Library, Beltsville, MD; Theodore Hymowitz, "Dorsett-Morse Soybean Collection Trip to East Asia: 50 Year Retrospective," *Economic Botany* 38 (Oct.-Dec. 1984): 379.
[129] Piper to Hackleman, 25 Oct. 1921, Illinois Correspondence.

someday vie with the apple in value" to American horticulture.[130] The Department's plant explorers prided themselves on being able to recognize potential value in plants, but they were by no means clairvoyant.

By the time they gained approval to embark in February 1929, the geographical scope of the expedition had broadened further to embrace southern China (Shanghai, Nanking, Hong Kong), the Dutch East Indies (Sumatra, Java), Singapore, and Ceylon. In part, this was due to the desire to locate late-maturing soybean varieties suited to the American South. In a sense, this was a continuation of the push in the 1910s to establish the soybean as an alternative crop to cotton, but it was no longer envisioned as a competing oilseed. In fact, in a memo to the Chief of the Bureau of Plant Industry, Plant Introduction head Knowles Ryerson pointed out that the varieties in Java and Sumatra were reputed to be low in oil content and used primarily for green manure, pasture and forage; the oil industry was ceded to the Corn Belt. The explorers would also seek drought-resistant varieties, hoping to push the frontier of the crop west into more arid regions. Even in the case of the Corn Belt, there was not a singular goal dictated by the interests of processors. Morse would simultaneously seek low-oil varieties suited for hog feeding – that is, without resulting in soft pork – and high-oil varieties suited for crushing. This attempt to solve the soft-pork problem through new varieties implied that the crushing industry was not yet big enough to provide the obvious solution: buying the full soybean crop from growers and returning the oil-free meal for hog feeding.[131]

Finally, in addition to these varied goals, there were several miscellaneous missions. A.J. Pieters in Forage Crops had heard tell of a hardy grass in northern Korea, Zoyzia

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[130] *Agricultural Exploration in Japan*, 14.
[131] Ibid., 61-62.

pungens, which he thought would be particularly valuable for athletic fields and, more importantly, the nation's growing number of air landing strips. Pieters, who acted as head of Forage Crops much of the time due to the failing health of his superior, R.A. Oakley, would frequently send Morse nagging letters urging him to make locating this species a priority.[132] Pieters also pointedly reminded Morse that Admiral Taylor of Virginia had thrown his support behind the expedition – "how much he actually had to do with securing the funds, I do not know, of course, but I do know that he . . . took the matter up with some members of Congress" – in the hopes that a legume might be found in the vicinity of Peking that would thrive in his state's poor soils. "I feel . . . that we cannot allow the expedition to come to a close without its having made a very serious effort to find such a legume."[133]

Ultimately the scope of the expedition narrowed both geographically and botanically. Morse collected wild legumes in passing to satisfy Admiral Taylor, and he pursued leads on Z. pungens to the point of dismissing the venture: a Japanese botanist informed him, and he relayed the news to Pieters, that "Z. pungens is a tender grass and is not found in Korea. This grass does not even survive the winter at Tokyo."[134] Morse also tracked down kudzu in the region around Mt. Fuji, where he was told most seed was gathered, but he wrote Oakley that he could not "see the kudzu investigations will take much of our time" as, in what was perhaps a bad portent, the "Japanese do not cultivate it, for it grows wild everywhere."[135] Dorsett pursued persimmons in Korea and around Peking; plans to send a colleague to assist him in this work never materialized, however, and in Japan he

[132] Ibid., 31, 62; Morse, Tokyo, to Pieters, 3 Jan. 1930, Morse Correspondence.
[133] Pieters to Morse, Tokyo, 30 Jan. 1930, Morse Correspondence.
[134] Morse, Tokyo, to Pieters, 15 Feb. 1930, Morse Correspondence.
[135] Morse, Tokyo, to Oakley, 30 July 1929, Morse Correspondence.

was just as often at Morse's side pursuing soybeans. They also collected a miscellany of other legumes, grasses, wheats, barleys, rices, ornamentals, and other plants of interest. But mostly they gathered soybeans: almost 4,500 introductions logged by the Division of Foreign Plant Introduction by the end of 1932.[136] It was partly this unexpected bounty that compelled them to scale back their plans.

Geographically, the southern leg of the trip eventually fell away. They had arrived in Tokyo, having sailed to Yokohama from San Francisco on the *President Grant*, in mid-March 1929; after the preliminaries of finding office space and securing a translator, they traveled to the northern island of Hokkaido, the soybean heartland of Japan, and then back to Tokyo. Early on, Morse had some time for sightseeing – cherry blossom festivals and Buddhist temples, where he honed his skill with the expedition's various cameras – but by the end of April, he noted to Oakley that "we do not get much time for sightseeing, although going about our many errands is sightseeing in itself." Mostly this entailed visiting small seed merchants whose stores, with living quarters in the back, were part of the throng that lined the narrow, muddy streets of Tokyo so numerously that "how they do sufficient business [was] a wonder" to Morse.[137] The crunch time came in the fall, however, when farmers and agronomists at experiment stations – which made up a large part of Morse's tour – harvested their seed, enabling Morse to get a fuller idea of the different varieties he was collecting. He and Dorsett decided to return to Hokkaido in late August, which delayed them from reaching Korea until mid-October, late in the season when the peninsula's harsh winter made travel difficult. In December, he expressed amazement at "the wealth of varieties" he had discovered there, as "there are

[136] Hymowitz, 382. Dorsett and Morse returned in early 1931, but their contacts at experiment stations continued to send them samples through 1932.
[137] Morse, Tokyo, to Oakley, 27 April 1929, Morse Correspondence.

not nearly so many varieties in the Japanese islands as in Korea," where at one Japanese imperial experiment station, "they are testing out about a thousand selections." And here he stated for the first time that the "East Indies are not included in my present soybean plans for I think after being in this section that my time can be spent much more profitably in Manchuria and China."[138]

Back in Tokyo in January, he expressed the dilemmas of exploration to Pieters. "It is simply impossible to be everywhere at once and to get all crops everywhere at one time. If you don't believe it, come over and try the explorer's life for awhile." He would like to have spent the entire season in Hokkaido, and "Korea is another place where I would like to spend an entire year."[139] In March, Dorsett and Morse proposed a change of itinerary to Pieters that would extend their imminent exploration of Manchuria, where "time might be better spent investigating the oil and oil meal industry" than in gathering green-manure varieties further south. "Our hunch along this line has been borne out by considerable recent correspondence from station friends throughout the Corn Belt states telling of the increased interest in soybeans and the erection of new oil mills." They noted that Dorsett had "pretty well cleaned northern Manchuria of varieties" during his previous expedition, but that southern Manchuria, with varieties suited to the latitudes of the Corn Belt and the upper South, had not yet been "combed." Only four introductions had been secured from the region, all by Frank Meyer in 1906; three had led to named varieties, two of them for hay, which Dorsett and Morse claimed with some exaggeration were "now extensively grown in the United States and have brought in many millions of dollars to our farmers." In addition to combing the area of varieties, they proposed

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[138] Morse, Keijo (Seoul), to Pieters, 4 Dec. 1929, Morse Correspondence.
[139] Morse, Tokyo, to Pieters, 30 Jan. 1930, Morse Correspondence .

making a complete study of the Manchurian oil industry and then, rather than a southerly route, taking the Trans-Siberian Railroad to Europe, where a growing oil industry – particularly in Germany, France and England – was absorbing so many Manchurian soybeans that mills in Manchuria itself were suffering as a result. The interests of the emerging crushing industry were now paramount, particularly that of the Corn Belt.[140]

If the scope of the expedition narrowed in some respects, one of its missions broadened: the collection and documentation of what Morse called "soybean products," mainly Asian foods made with soybeans. This had been an important objective from the outset: the idea was to retreat to cities during the winter months to investigate soy food industries rather than head south, as Dorsett had during his previous expedition.[141] And Morse certainly knew in general about the types of products to expect. If he was amazed by the number of soybean varieties he encountered, however, he was even more amazed by the ubiquity and variety of soy foods. As he wrote to a colleague in January 1930, while wintering in Tokyo, "during the last two weeks, along with our other work, we have collected more than two dozen different products." As he toured miso, natto (fermented whole soybeans) and tofu factories, he also found that it was difficult to get exhaustive data. "The beancurd factories are only small places, but they are very numerous and each has its own way of making the curd. At first I thought by visiting one or two I would obtain sufficient data on this product but when I had been to two I found out my mistake and since have visited several."[142]

If he continued to doubt that Asian soy foods would find a market in America, he did not let that slow him down. In addition to miso, natto and tofu – including numerous

[140] Dorsett and Morse, Tokyo, to Ryerson, 5 March 1930, Morse Correspondence.
[141] *Agricultural Explorations in Japan*, 33.
[142] Morse, Tokyo, to R.A. Hollowell, 12 Jan. 1930, Morse Correspondence.

types of deep-fried and "dried-frozen" tofu – he investigated and collected endless varieties of soy sauce, yuba (the "skin" of boiled soybean milk), sweet bean paste, soybean flour, soybean vermicelli, pickled vegetable soybeans, vegetable soybean in the pod, roasted beans used in numerous confections, and such miscellaneous products as Almen, a canned health food beverage made from soybean flour and sold in Korea.[143] In addition to photographs, Morse forwarded samples to his office in Washington, sealing the more perishable items in tin cans. He estimated that "we will have the best collection of soybean products in the world as well as the best collection of soybean varieties."[144] He rather fretted over this collection, sending storage instructions to keep it safe from mice and refusing a request from Burlison at the University of Illinois to borrow items for an exhibit; in his experience, such loans never came back undamaged, if they came back at all.[145]

Some uses especially tickled Morse. While touring the Tokachi experiment station in Hokkaido, he happened upon a crowd of women attending a cooking demonstration; his guide informed him that they were making soybean wine. As he wrote to Oakley, for many years he had been kidded "about making everything out of soybeans except home brew." Now, having obtained the recipe – he was unable to taste the finished product, as it had yet to ferment – "no more can they taunt me about not making soybean beer." He predicted, "after I get back, just watch the acreage of soybeans in the states go up. No matter what happens now, I feel that I am amply repaid for the trip here."[146] In a letter to Pieters in February, he also expected that "by the time we return home we should be

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[143] Shurtleff, *Morse*, passim. He sent a can of Almen for the chronically ill Oakley to try. Morse, Keijo, to Oakley, 3 Nov. 1929; Morse, Tokyo, to Pieters, 30 Jan. 1930, Morse Correspondence.
[144] Morse, Keijo, to Oakley, 3 Nov. 1929, Morse Correspondence.
[145] Morse, Keijo, to R.A. Hollowell, 21 Nov. 1929, Morse Correspondence.
[146] Morse, Sapporo, Hokkaido, to Oakley, 28 Sept. 1929, Morse Correspondence .

able" to use the various soybean products "to open a candy, store, bakery, drug store, meat shop, feed store, and a voodoo shop" – a voodoo shop, he explained, because the Japanese loudly scattered parched or roasted soybeans in their homes and temples to scare away demons during the seasonal festival of Setsubun, all the while shouting, "Fortune in and Devils out!" "One of the large temples in Shiba Park, not very far from the hotel, used twenty-five bushels of parched soybeans in their bean-scattering ceremony," while homes typically used a pound. "We have therefore scored another use for the soybean."[147]

In their revised plan, the expedition would travel to Europe after visiting Peking, Hong Kong, Shanghai and Formosa, all "said to be centers for soybean products," many of which differed significantly from those found in Japan.[148] For a variety of reasons, however, the expedition's travels beyond the emerging Japanese empire were cut short. The expedition itself, which might have been extended through 1932, ended in February 1931 with the Morses' departure from Tokyo. Funding may have been an issue: certainly, there were anxious letters from Pieters about cost overruns during 1929, even before the onset of the Great Depression.[149] Dorsett's health was another. In April 1930, not long after he and the Morse family had established a new headquarters in Harbin, Manchuria, the 74-year-old was stricken with double-pneumonia and would likely have died but for the care provided by his daughter-in-law. When Forage Crops learned of Dorsett's illness after a long delay – Morse, perhaps at Dorsett's insistence, failed to notify his superiors about it – he was ordered to seek better medical care in Peking, where he was told to avoid strenuous exercise. Dorsett, undaunted, instead set about his

147 Morse, Tokyo, to Pieters, 15 Feb. 1930, Morse Correspondence.
148 Dorsett and Morse, Tokyo, to Ryerson, 5 March 1930, Morse Correspondence.
149 Pieters to Morse, Tokyo, 8 Jan. 1929, Morse Correspondence.

persimmon work in earnest.[150] One evening in September, he dined with Yamei Kin, who had hosted his friend Frank Meyer decades earlier. Always the nationalist, Kin bristled at his suggestion that the "Japanese utilize soybeans as human food more extensively than do the Chinese." As he related to Morse, "She said the Chinese have a large number of soybean jams and other products which are used extensively. Well, when you get to Peking, you will have to look these matters up. The Doctor may be right . . . but I have my doubts."[151] But when Morse visited Peking in October, it was for less than three weeks; doing the work of two plant explorers, he was too busy shuttling between Korea and Manchuria.[152] Finally, having sent – or arranged to soon be sent – thousands of soybean and soybean product samples, Morse was eager to return to Washington to ensure their proper care. Hong Kong, Shanghai and Formosa were set aside.

Morse returned to the United States rather triumphantly. In August, the American Soybean Association elected him president for the third time – the first in its current incarnation – and chose Arlington Farm, where so many of Morse's new introductions were growing, as the location of the following year's field meeting.[153] But the aftermath of what would become known as the Dorsett-Morse Soybean Expedition was full of disappointment. On a personal level, Morse sought to write a comprehensive book on the soybean in Asia, but with the press of work during the 1930s – when his office was underfunded and understaffed and the soybean industry booming – he only completed one section, an unpublished 181-page manuscript titled, "Soybeans – Manchuria."[154] The entire Morse family had developed an abiding love for Japanese culture – little Margaret

[150] Hymowitz, 381.
[151] Shurtleff and Aoyagi, *Morse*, 232.
[152] Hymowitz, 381.
[153] "W.V. [sic] Morse New Head of Soybean Association," *The Washington Post*, 19 Aug. 1931, 3..
[154] Shurtleff and Aoyagi, *Morse*, 7. Shurtleff declares the work "superb," and he should know.

quickly learned the language – and prepared sukiyaki dinners for friends; but his admiration for Japan must have been strained by the events of the following decade, beginning with its invasion of Manchuria some six months after he left.[155] More broadly, the impact of the expedition was blunted by several factors. Many of the introductions were lost. By one estimate, only 945 of the 4,451 strains that Morse sent to Washington survived in the so-called germplasm collections that were established in the late 1940s – around the time of Morse's death in 1949 – to preserve and catalogue the soybean gene pool.[156] The preponderance of vegetable-type soybeans in Morse's collection, which he used to breed what he hoped would become a popular garden bean, perhaps added to their neglect, as interest in eating or growing edamame was decades away.

As the corn and soybean frontier moved northward into states such as Minnesota, moreover, the value of soybeans from northern Manchuria – collected by Dorsett on his previous expedition – proved to be of more value than those from the latitudes of the existing Corn Belt. In fact, new breeding techniques that overcame the difficulty of crossing soybean strains would utilize Dorsett's 1924-1927 soybeans to a greater extent than those from the later expedition. The decision to forego exploration of southern regions, which may have revealed an unexpected variety both high in oil and suited to the South, in fact may have made such techniques a necessity when the crushing industry that Morse had first envisioned for the region in the 1910s finally gained traction in the 1950s. Through the 1970s, the 1924-27 Dorsett expedition would have a greater legacy in the genome of the American soybean than the grander 1929-31 outing. But as fears of vulnerability due to genetic uniformity increased, the surviving Dorsett-Morse soybeans

[155] Ibid., 380.
[156] Hymowitz, 382, 384.

became a valuable research for breeding plants for disease resistance.[157] Whatever the short-term disappointments, the Dorsett-Morse expedition would have a substantial, if delayed, impact.

[157] Ibid., 385.

Magic Bean, Chapter 4: Manifold Uses

During the 1930s, as soybean fields expanded throughout the corn belt landscape, the soybean was drawn up into the industrial and business life of the nation. More beans went to market as beans, not seeds for future planting. And as industry became interested in what one boosterish account called the soybean's "manifold uses," it was transformed into a growing array of specialized substances: oil and meal, at first, and from these, various grades of oil and protein, as well as lecithin and sterols. This was simultaneously the outcome of capitalist logic, as embodied in the Glidden company, and the technical accomplishments of chemists, including Glidden's own Percy Lavon Julian.

As the crop grew in value, that value itself was subdivided by a new futures market in Chicago into high-risk fractions that appealed to speculators and low-risk fractions that became the steady income of grain merchants and soybean crushers – though not without some trepidation on the part of the latter, who worried about being forced to ship their soybeans to Chicago in the event of a corner. Chicago was emerging as the financial center of the soybean industry, but was in tension with its physical geography, which was centered further south in Decatur and was highly local in any case.

During the Depression, the intrinsic capitalist logic of diversification into manifold specialized uses gained voice in what sought to be a social movement centered on farmers, but which was promoted largely by anti-New Deal industrialists. The Chemurgy Movement took the soybean and its branching utilization tree as one of its emblems. Chemurgists, Henry Ford prominent among them, argued that the soybean's future lay at the far reaches of this tree in industrial uses distant from conventional ideas of food. There were already indications, however, that its predominant use would in fact be in food, albeit industrialized food. A protective tariff against competing oils – in particular, coconut oil from the Philippines – ensured greater use of domestic products, cottonseed and soybean oils, in margarine. Other substitutes, such as soy milk, had a more difficult time finding traction, although Adventists such as Harry Miller put a great deal of effort to make a palatable product for the American public. Ultimately, after the war, it would find a niche in formulas for infants allergic to dairy milk. Its breakout remained decades away.

The Industrialist: Henry Ford

During the second year of Chicago's Century of Progress World's Fair, a spectacular tribute to scientific progress and antidote to the hopelessness of the Great Depression that extended three miles along the city's lakefront, no participant garnered more attention than Henry Ford. He had boycotted the fair in 1933 out of righteous anger, instead mounting his own successful Ford Exposition of Progress in Detroit and New York City. Although organizers in 1931 had invited him to exhibit a working assembly line – a reprise of Ford's triumphant exhibition at the 1915 Panama-Pacific Exposition in San Francisco, when the very concept of a moving assembly line was still new – he delayed in giving his go-ahead. In the meantime, General Motors signed on to duplicate a Chevrolet assembly line in a deal that barred other carmakers from following suit.[1] As the success of the fair's first year prompted its organizers to continue it for a second, Ford rethought his absence. In a section adjacent to the GM Building – on land that in 1933

[1] David L. Lewis, *The Public Image of Henry Ford: An American Folk Hero and His Company* (Detroit: Wayne State University, 1976), 297; Cheryl R. Ganz, *The 1933 Chicago World's Fair: A Century of Progress* (Urbana, IL: University of Illinois Press, 2008), pn.79-80.

featured the American Indian Village Midway attraction and, hemming it in on two sides, a U.S. Army camp[2] – the Ford Exhibition Building appeared in the early months of 1934.

Once in, Ford did not stint: investing $2.5 million, the largest amount ever spent on a fair exhibit, he built a space 900 feet long by 213 feet wide whose gear-shaped rotunda rose twelve stories. At night, 5,600 blue, red and green lights on top of the rotunda created a pillar of light that could be seen for twenty miles. This architectural extravagance helped Ford steal the show in 1934, attracting more than 75 percent of all visitors that year, beating GM by a two-to-one margin.[3] But Ford also gained attention with a much more modest structure standing next to, and dwarfed by, the main building: a weather-beaten hay barn built in 1863, the year Ford was born, and carefully transplanted from his boyhood farm. And at the heart of the Ford Industrialized Barn was a vision of agricultural revival that centered on soybeans.

In April 1934, Ford announced that that he was devoting more of his attention to the barn than to his main exhibit, as it represented "an enduring solution to the farm economics problem" and, by extension, to the Great Depression: "Just as soon as the individual farmer can make money the farm problem will vanish, and so will most of our other economic problems."[4] Shortly before the fair opened in late May, he inspected the exhibit and took the opportunity to explain its meaning to a group of corn, wheat and

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[2] If the displacement of Indians represented one sort of "progress," Ford, renowned for his pacifist belief that modern industry would one day make war obsolete, may have been gratified to supplant the army. *Official Guide: Book of the Fair 1933* (Chicago: A Century of Progress and The Cuneo Press, 1933), 1; *Official Guide Book of the World's Fair of 1934* (Chicago: A Century of Progress International Exposition, 1934), n.p. (map of exhibits).

[3] Lewis, 298-99; Lisa D. Schrenk, *Building a Century of Progress: The Architecture of Chicago's 1933-34 World's Fair* (Minneapolis, MN: University of Minnesota Press, 2007), 112; Roland Marchand, "The Designers Go to the Fair: Walter Dorwin Teague and the Professionalization of Corporate Industrial Exhibits, 1933-1940," *Design Issues* 8 (Autumn 1991): 4.

[4] Earl Mullin, "Ford Will Push His Farm Ideas in Fair Exhibit," *Chicago Daily Tribune*, 4 April 1934, 14.

dairy farmers taking a guided tour of the site. In a promotional pamphlet issued by the Ford Company, one farmer, struck by the “oddity of the exhibit,” asked about “the REASON of it all.” Ford responded that he wanted to give “the American farmer a new idea to work with” to help give “him and his family an abundant livelilhood and, on top of that, . . . a cash surplus with which to buy the things that he and his family need and want.” At the core of this abundance was the use of farm products in industry. In terms similar to his promotion of the five-dollar day twenty years earlier – where Ford workers were offered an unprecedented wage as a means of boosting their ability to buy, among other things, Tin Lizzies – Ford told the farmers, “Business is only exchange of goods. If we want the farmer to be OUR customer, we must find a way to become HIS customer.”[5]

The barn was flanked by fields of soybeans, while its thoroughly modernized interior demonstrated how to transform them into something more valuable. Gone were the stalls and haylofts, replaced by an immaculate arrangement of machinery and pipes that washed the oil out of soybeans using a solvent consisting of “high-test gasoline or naptha” (hexane). Threshed soybeans were stored in the barn’s loft and gravity-fed into rollers that flattened them into flakes. Traveling through a pipe set at a ten-degree angle, the flakes were carried upward by a screw-like conveyor through a stream of solvent flowing down in the other direction. At the top of the pipe, the meal passed over hot steam which removed the solvent; at the bottom, the oil-solvent mixture was forced upward through a thin neck and then downward through a still, where the solvent was similarly carried upward by steam, leaving behind the oil. The system held around 100 gallons of solvent, which was cooled and recirculated. “As every seam and vent is

[5] James Sweinhart, *The Industrialized American Barn: A Glimpse of the Farm of the Future* (Dearborn, MI: Ford Motor Co., 1934), 5.

closed," the brochure pointed out, "there is very little waste of gasoline and very small fire hazard."[6]

At the time, Americans soybeans were predominately crushed for oil by means of pressure. Solvent extraction had been used by European firms in Manchuria for several decades and was most highly developed in Germany, but its unsuitability for cottonseed – which tended to disintegrate in the solvent – made it unappealing for American crushers diversifying into soybeans. In 1934, as Ford's barn was being transported and repurposed, two large companies – Archer-Daniels-Midland and Glidden – were the first to use the method, importing their equipment from Germany. Solvent extraction's primary advantage, as the Ford pamphlet pointed out, was that it separated the oil and meal for thoroughly, on average extracting "95 per cent of the oil."[7] This not only improved the volume of oil, which was pound for pound the more valuable product, but it increased the value of the meal as well. Without oil to make it go rancid, the meal had a longer shelf life. It also made a better hog feed – high levels of soybean oil in feed resulted in "soft" pork – and, more to Ford's point, made it better suited for industrial purposes such as the production of plastics.

As Ford presented it, solvent extraction was also well suited to small-scale farm operations. "The machinery is simple and easily installed," the pamphlet explained. "It can be obtained almost anywhere, at small cost. Much of it is standard piping." In part because Ford tractors were making draft animals obsolete, there were "many barns in the United States, now standing abandoned, that could easily be converted into factories such

[6] Ibid., 15-16.
[7] Ibid., 15.

as is shown at the Exposition."[8] Modernizing these barns, in line with the mechanization of farm operations generally, would allow farmers to capture for themselves the value added to their crop by its initial transformation into industrial inputs. An indication that solvent extraction may not have been suitable for farm-level operations, however, occurred in mid-August when the 70-year-old barn was damaged by fire, with one man severely burned fighting the blaze. Press accounts did not indicate the cause, but having boilers in close proximity to 100 gallons of hexane repeatedly vaporized into volatile fumes was risky, even with the safety precautions which the Ford Company, unlike many farmers, had the expertise and resources to implement.[9] Ford continued to exhibit solvent extraction equipment at state, regional and world's fairs throughout the decade, although it is not clear that he ever recreated the Industrialized Barn.[10]

More than a few of the millions of fairgoers who visited the Ford Building may have shared the view of the farmer who found the exhibit odd. Why was one of the nation's premiere manufacturers involving himself in growing an obscure crop? Why was the carmaker famous for taking centralization and vertical integration to new levels at his River Rouge production plant so eager to promote small-batch processing in old barns? On the other hand, many of the visitors were likely already aware of Ford's wide-ranging views on society, health, economics and politics – he was the most frequently quoted and widely admired businessman of his day – and were accustomed to the way his vision seemed to pull in two contradictory directions: towards both a highly mechanized future and a venerated rural past. Ford himself did not see the contradiction, holding firm to his core conviction that, whether among city or farm dwellers, the elimination of drudgery –

[8] Ibid., 15.
[9] "Ford Barn at Fair Burned," *New York Times,* 10 Aug. 1934, 15.
[10] Lewis, 286.

poorly organized work that wasted human effort – would allow Americans to pursue lives of efficient labor and wholesome leisure. By all accounts, Ford was a concrete, visual thinker, to the point of demanding that his automotive engineers work up three-dimensional models from their blueprints so that he could have something to hold and examine from all angles. Likewise, the soybean, as something he could handle and tinker with, provided a material anchor for his visions of social engineering.

Despite his eventual advocacy of them as an industrial input, Ford first became an enthusiast for soybeans as a food. Like the Adventists, he was a strict teetotaler and opponent of tobacco; and, like them, he argued that these vices were the outcome, not the origin, of dissipated habits rooted in bad food. He may have absorbed these ideas, as well as his interest in soybeans, from John Harvey Kellogg: he has frequently been included in lists of The San's notable guests, "lounging about, a buckwheat blossom in his lapel," and at one point stated, "I like Mr. [*sic*] Kellogg's philosophy."[11] But Ford did not require Kellogg's tutelage: as with the rest of his worldview, he drew upon populist cultural traditions, in this case health doctrines that stretched back not just to Sylvester Graham but to Samuel Thomson, whose herbal medicine kits were immensely popular in backwoods regions during the nineteenth century. Ford generally hated experts, doctors very much included, and he tended to view the body as he did one of his durable Model T's, capable of running smoothly with only minor repairs if given the proper fuel and regular maintenance. As he put it, using an automotive analogy, anyone could "live to 125 or 150 if we would keep the carbon out of his system."[12]

[11] Ronald Deutsch, *The Nuts Among the Berries,* Rev. Edition (New York: Ballantine Books, 1967), 135-36.
[12] Lewis, 229.

Ford's notions were generally more idiosyncratic even than Kellogg's. In the 1890s, he was convinced that sugar crystals lacerated the digestive tract. In the 1920s, he flirted with but did not embrace vegetarianism; insisted that fresh dough was harmful and that bread should only be eaten after it had sat for a day; proclaimed that "chicken is fit only for hawks"; warned against combining starches, proteins and fruit acids during one meal; inveighed against fried salt pork and boiled potatoes; and concluded that people should not eat anything until 1:00 p.m.[13] In 1926, he hired his boyhood friend Dr. Edsel A. Ruddiman, formerly dean of Vanderbilt University's pharmacy school, to conduct nutrition experiments.[14] That same year (it is not clear whether before or after Ruddiman began his work), Ford hosted a dinner that began dramatically with a figure dressed in black and orange announcing, "I am King Carrota! I am full of vitamins, full of iron, full of iodine, full of bottled sunshine. I have no enemy but a bad cook." This was followed by a 12-course meal of carrot dishes, including carrots á l'orange, carrot salad Henri Ford, and carrot ice cream. The mood of the diners, including Ford, was reportedly dampened when a dietitian mentioned once having seen orphans turn orange when fed too many carrots.[15]

Ruddiman began experimenting with soybeans in 1928. He later reminisced that some farmers in the area had begun planting them; his laboratory was in Greenfield Village, in southern Michigan near Ford's home town. Ford took an interest, so Ruddiman conducted chemical analysis, gauging the dietary value of the bean's protein, fat and

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[13] Ibid., 229; Steven Watts, *The People's Tycoon: Henry Ford and the American Century* (New York: Alfred A. Knopf, 2005), 328.

[14] Reynold Wik, *Henry Ford and Grass-roots America* (Ann Arbor, MI: The University of Michigan Press, 1972), 152.

[15] Watts, 326-327

carbohydrates by feeding them to rats.[16] By this time, of course, numerous USDA and experiment station bulletins, as well as Piper and Morse's *The Soybean* and studies by university home economics departments, were available, but he may have conducted his initial analysis before discovering them. In 1932, he visited Madison Foods and took home samples of Adventist soy foods, including Vigarost, a steak-like meat analog, and Soy Cheese, a very firm seasoned tofu; his wife made croquettes from the Soy Cheese which, he wrote to Madison, he enjoyed very much.[17] By this time, the laboratory had also obtained a copy of *The Soybean.*

By the time Ford joined the Century of Progress, Ruddiman had created enough foods from soybeans to provide the ingredients for a five-course dinner served to thirty guests in the Ford Building's executive lounge. The dishes, which may have been developed in collaboration with Jan Willemse, Ford's executive chef,[18] included celery stuffed with soybean cheese, salted soybeans (eaten like peanuts), soybean croquettes in tomato sauce, buttered green soybeans, soybean coffee, and assorted desserts – apple pie, cakes and cookies – made to some degree with soy flour.[19] The *Christian Science Monitor* reviewed the dinner favorably, noting that "no meat was served and it was not missed" in "an excellent dinner in which every dish and drink was made in whole or in part from the little legume." One guest reportedly commented that the "soy bean cake is delicious, but

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[16] William Shurtleff and Akiko Aoyagi, *Henry Ford and His Researchers - History of Their Work with Soybeans, Soyfoods and Chemurgy (1928-2011): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 191.

[17] Shurtleff and Aoyagi, *Ford and His Researchers*, 191; Soyinfo Center, "Henry Ford and His Employees: Work with Soy - A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/henry_ford_and_employees.php.

[18] As Willemse and others recalled in the 1980s, though there is no mention of him in reports from the 1930s, which gave Ruddiman all of the credit. Shurtleff and Aoyagi, *Ford and His Researchers*, 37, 300-301, 306

[19] Soyinfo Center, "Ford and His Employees"; Shurtleff and Aoyagi, *Ford and His Researchers*, 37

after the soy bean croquettes, soy bean apple pie and soy bean coffee, you know, one isn't really hungry."[20] Ruddiman and Ford hosted at least two other soy banquets geared to journalists during the 1930s; they also published a 19-page booklet containing 58 soup-to-nut soybean recipes.[21] In contrast to these varied offerings, Ford urged Ruddiman to develop a soybean biscuit that included all of the nutrients necessary for human health – a compact, all-purpose food – and professed to enjoy the result, as did Ruddiman's rats. One of Ford's secretaries, pressured to eat one, described it however as "one of the most vile things ever put into human mouths."[22]

The soybean also offered Ford an opportunity to fulfill a long-held ambition to replace the dairy cow – potentially creating more barns to industrialize. His disparagement of cow's milk was not based on its health defects – though he held that to be healthful it should be drunk fresh, "before it strikes the air," and he regularly denounced pasteurization[23] – but on the inefficiency of its production. As early as 1921, he declared that "the cow is the crudest machine in the world" and that "it is a simple matter to take the same cereals that the cows eat and make them into a milk which is superior to the natural article and much cleaner."[24] He had disliked milking as a boy, later justifying this dislike as an instinctive aversion to wasted energy. "Why should a farmer spend a lot of time taking care of a bunch of cows? It takes 20 days of actual work to grow and harvest the grain crops on a dairy farm," he pointed out. "The rest of the time is spent taking care of animals. It is all wrong." The press, while generally respectful of Ford's prophecies, had some fun with the idea of a mechanical cow in the

[20] Shurtleff and Aoyagi, *Ford and His Researchers*, 36.
[21] Soyinfo Center, "Ford and His Employees."
[22] Lewis, 285.
[23] Watts, 328.
[24] Shurtleff and Aoyagi, *Ford and His Researchers*, 20.

garage, cranked like a Model T to produce a foaming pail of milk for breakfast. [25] In 1934, after Ruddiman had developed a palatable soybean milk – and a plant in Greenfield Village was producing several hundred gallons a day which was most avidly consumed, Ford aside, by the company's Filipino workers[26] – some newspapers voiced a more serious objection during years of farm surpluses: "if the automobile manufacturer succeeded in developing synthetic milk from soy beans . . . the dairy industry would be in even greater peril."[27]

Ford dismissed such criticism. His push to make farming more efficient was not a way to diminish the need for farmers or encourage the movement of the farm population to the city. Far from it. Even though the growth of cities seemed an inescapable feature of the modernity that Ford, more than any other individual in the public imagination, had brought about, he argued that this was merely a phase. The principles of production invented in the cities could, and would, spread to the countryside, enabling Americans to live a balanced life, one foot in farming and the other in industry. In this sense, his vision of production was consistent with the centrifugal effects of the cars he produced. While he had tried to reform the habits of those corrupted by urban living – to the point of using the Five Dollar Day as a carrot to promote his ideas of clean living and financial prudence – he felt it better by far to maintain people in the healthier moral environment of the countryside. With this end in mind, he established nineteen "village industries" in southern Michigan between 1918 and 1944, often on the sites or in the renovated

[25] Wik, 147.
[26] Soyinfo Center, "Ford and His Employees."
[27] Shurtleff and Aoyagi, *Ford and His Researchers*, 37.

buildings of nineteenth-century mills, to supply auto parts to his central factories.[28] These were intended to provide income during farmers' slack time – another efficiency upgrade – although the schedules of farm and factory rarely accommodated each other so neatly. In 1938 he opened two plants, both on the Saline River, to process soybeans using a scaled-up version of the solvent-extraction equipment he had installed in the Industrialized Barn.[29]

Ford was loathe to concede that one of his ideals, efficiency, undermined another, the American rural tradition, by producing surpluses that inevitably lowered the incomes of farmers. He argued that surpluses, whether resulting from mechanization or the less wasteful use of crops, were in fact something to be celebrated. The problem was that industry was not innovating fast enough to absorb this new abundance. His thinking in these matters was shaped by William Hale, a researcher with the Dow Chemical Company in Midland, Michigan, who lamented that everyone seemed to view farming "through the haze of bygone days" when farmers "solely and almost directly [provided] food and raiment for mankind." Rather, he suggested that an agriculturalist be defined as an "organic chemical manufacturer" who produced raw materials – starches, proteins, cellulose, oils – that could be transformed by the ingenuity of chemists into an array of substances whose collective value would soon place "the feeding of corn to hogs" in the same class "as that other unholy act, the feeding of raw bituminous coal to a furnace for heat supply." And just as coal tar – long considered a waste product – had provided the basis for organic chemistry in the nineteenth century, Hale predicted that what were

[28] Howard P. Segal, *Recasting the Machine Age: Henry Ford's Village Industries* (Boston: University of Massachusetts Press, 2005), 4.
[29] Ibid., 164. He had previously established a similar plant in the Rouge complex itself.

considered agricultural wastes would revolutionize it in the twentieth.[30] In 1934, after some misfires – "chemo-genetics" – Hale coined the word "chemurgy" to embody his principles: just as metallurgists derived valuable materials from mixed ores, so would chemurgists, as distinct from academic chemists, derive new products from organic sources.[31]

Hale had first published his ideas years earlier in an article that he submitted unsuccessfully to countless national magazines until someone suggested that he send it to *The Deaborn Independent*, a paper Ford had acquired in 1919 to promote journalism that reflected his view of the world.[32] Hale's piece appeared in 1926, a year before Ford shut down the paper in the wake of a libel suit and boycotts by the American Jewish community, outraged at Ford's numerous editorials denouncing a global Jewish conspiracy and embracing such works as *The Protocols of the Elders of Zion*. Indeed, in the same issue that featured Hale, the editorial on "Mr. Ford's Page" spoke of a "secret power . . . with which even the governments cannot or will not deal" that sapped the economic life of countries such as Germany and France that were otherwise "full of productive energy."[33] And indeed, Ford's anti-Semitism – which he renounced in a public apology but continued to espouse privately – was rooted in the same concerns that spurred his interest in Hale's ideas. As Hale put it, "agriculturalists are a most industrious class but in comparison with other industrialists they share no such full

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[30] William J. Hale, "Farming Must Become a Chemical Industry," *Dearborn Independent*, 2 Oct. 1926, 4-5, 24-26.

[31] Anne B.W. Effland, "'New Riches from the Soil': The Chemurgic Ideas of Wheeler McMillen," *Agricultural History* 69 (Spring 1995), 292.

[32] Christy Borth, *Pioneers of Plenty: Modern Chemists and Their Work*, New Enlarged Edition (Indianapolis: Bobbs-Merrill Company, 1939; New York: The New Home Library, 1943), 68.

[33] "Mr. Ford's Page," *Dearborn Independent*, 2 Oct. 1926, 9.. Ford, channeled by the *Independent's* editor, William J. Cameron, was less circumspect in his four-volume collection of essays, *The International Jew*.

degree of prosperity."[34] Hale, as did Ford, saw this as a technocratic problem – farmers needed to integrate with modern industry – but Ford also maintained a populist distrust of financiers, whether investors in his own companies, Wall Street bankers, or the "International Jew," who parasitized the hard work of primary producers.

If these two outlooks on the farm problem coexisted within Ford, as early as 1929 Hale's vision gained the upper hand, and Ford's support of chemurgy intensified in response to the Great Depression and the New Deal. In May 1935, a year after the Century of Progress, he hosted the Dearborn Conference of Agriculture, Industry and Science, where "one hundred and fifty millionaires, industrialists, farmers and scientists" gathered to "solve independently of government interference the economic problems which government has demonstrated its inability to solve." New Deal leaders, as one report pointed out, were not invited.[35] Those who did attend included Hale, Dr. Charles Herty, Wheeler McMillan, and Francis P. Garvan, who acted as the convention's chair. Herty, considered a co-originator of chemurgy, was an academic chemist who sought to revitalize the South by developing a method for converting slash pine, a weedy, fast-growing tree that could be farmed, into pulp for newsprint, at the time produced from the old-growth forests of the far north. McMillan was editor of *The Country Home*, which had sponsored a Model Farm House at the Century of Progress, designed using modern methods and materials – including soy paint – with an eye toward convenience and business efficiency.[36] Garvan, a lawyer by training, was the director of the Chemical Foundation, which had used its trusteeship of the U.S. patents of German chemical companies confiscated during the First World War to build the country's dye industry

[34] Hale, 4.
[35] "Industry, Farm Chiefs Lay Own Revival Plans," *Chicago Daily Tribune,* 8 May 1935, 31.
[36] Schrenk, 151

from the ground up and, more generally, to nurture the development of American organic chemistry. He was a relative late-comer to chemurgy, but the Chemical Foundation's support, along with Ford's publicity machine, was considered crucial to transforming the idea into a movement.

Garvan was among those who, in a replica of Independence Hall, signed a "Declaration of Dependence Upon the Soil and of the Right to Self-Maintenance" which added that right to those enumerated by Jefferson. "In order to enjoy and to hold secure this latter right," the document argued, "man must recognize that his basic sustenance issues from the soil and not from merchants' shelves; that, whenever industrial centralization causes harmful human congestion, and becomes destructive of the right of self-maintenance, man must turn again to the soil from which all new wealth springs except that from fisheries and mines. Otherwise the right of self-government cannot endure."[37] Chemurgy rejected the New Deal's attempts to limit agricultural production and solidified Ford's own personal antipathy toward Roosevelt and his policies. But while chemurgy never became the grassroots movement of farmers envisioned by its leaders – despite the establishment of the National Farm Chemurgic Council, with state chapters, and several more annual conferences – it did influence the Agricultural Adjustment Act of 1938, which established four regional laboratories under the USDA to investigate the industrial utilization of crops.[38] The Northern Regional Research Laboratory, in Peoria, Illinois, had soybean research as one of its focuses, even though two years earlier, under a provision of the Bankhead-Jones Act of 1935, the Federal

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[37] "Declaration of Dependence Upon the Soil and the Right to Self-Maintenance," 30-35, in *Proceedings of the Dearborn Conference of Agriculture, Industry and Science, Dearborn, Michigan, May 7 and 8, 1935* (New York: The Chemical Foundation, Inc., 1935), 30.

[38] David E. Wright, "Alcohol Wrecks a Marriage: The Farm Chemurgic Movement and the USDA in the Alcohol Fuels Campaign in the Spring of 1933," *Agricultural History* 67 (Winter 1993), 65.

Regional Soybean Industrial Laboratory was established in Urbana at the University of Illinois.[39]

The attention given to the soybean in this chemurgic-inspired legislation was partly a result of the growth of the crop in Illinois, but partly due to the influence of Ford. Other chemurgic leaders were focused on other causes, in particular the use of corn-derived alcohol as fuel (or at least a gasoline additive). Ford made the soybean a high-profile crop within the movement through research carried out in Dearborn at the Edison Institute, which he founded in 1929 in honor of his mentor and friend, Thomas Edison. This complex was in many ways backwards looking: the Museum housed the thousands of antiquities Ford had amassed over the previous decade, showcasing in particular the everyday tools of bygone eras. Greenfield Village likewise consisted of dozens of historic buildings from the 1600s through the present, either recreated (like Independence Hall) or transported and carefully reconstructed. The Village school revived the use of the nineteenth-century *McGuffey Reader* to teach a new generation of students old-fashioned values.[40] But the Institute also looked to the future: the arrangement of artifacts in the Museum told the story of material progress, and the buildings in the Village included landmarks of invention, including the Wright Brothers' bicycle shop, a replica of Edison's Menlo Park laboratory, and Ford's own birthplace. The Institute also included a chemistry lab and an experimental farm dedicated to Hale's program of deriving new raw materials from crops to supply to industry.

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[39] L.B. Breedlove, "Soybean - The Magic Plant, Article XV: Industrial Uses Already Manifold with More in Prospect," *Chicago Journal of Commerce and La Salle Street Journal*, 7 July 1936, 12; Mabel P. Crompton, "The Soybean Crop of Illinois," *Journal of Geography* 39 (April 1940): 142-150.

[40] Ford, an inveterate prankster, also encouraged a certain degree of mischief among the students. When some among them discovered that dry soybeans were perfect for peashooters, Ford himself delivered bags of soybeans to the classroom. Watts, 481.

To perform this work, Ford characteristically handpicked a bright, energetic young man with no university training in chemistry. Robert Boyer was the son of the manager hired by Ford to run the Wayside Inn in Sudbury, Massachusetts, the object of the carmaker's first foray into historic restoration. He convinced Boyer to forego his plans to attend Andover prep school and Dartmouth and instead enroll in the Henry Ford Trade School adjacent to the River Rouge factory. Boyer attended from 1927-29 and at the age of 21 was immediately hired by Ford to head a staff of a dozen fellow Trade School graduates.[41] They experimented with numerous crops, but in 1931 Ford instructed them to focus their efforts on soybeans. According to Bob Smith, one of Boyer's team, this happened after Ford wandered into the lab one day and, idly picking up a copy of Piper and Morse, perused it cover to cover.[42] By then, of course, Ford was familiar with soybeans as a food, and the oil had some fairly direct uses in car production. In his 1926 article, Hale had described the growth of the soybean industry as "of greatest interest" and had cited the oil's use in soap, inks, varnishes and enamels.[43] After "150 different tests" to find uses for soybean oil, Ford announced in 1933 with some fanfare that the following year's models would be painted with an enamel produced from synthetic resins and soybean oil.[44] The use of a farm product in manufacturing struck some in the press as

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[41] Soyinfo Center, "Ford and His Employees"; Watts, 483.

[42] Soyinfo Center, "Ford and His Employees." As Ford was famously not much of a reader, this tale was probably embellished.

[43] Hale, 25.

[44] Some of the oil was used in the production of the resins themselves. R.H. McCarroll, "Increasing the Use of Agricultural Products in the Automobile Industry," in *Proceedings of the Dearborn Conference of Agriculture, Industry and Science, Dearborn, Michigan, May 7 and 8, 1935* (New York: The Chemical Foundation, Inc., 1935), 60; Shurtleff and Aoyagi, *Ford and His Researchers*, 31.

a rather humorous incongruity, one paper reporting on Ford's "inauguration of another automobile plant. It is the soy bean."[45]

Eventually, Boyer would develop ways to use soybean oil in shock-absorber fluid and foundry cores as well.[46] The successful use of the oil created a problem, however: an excess of leftover meal. In 1926, Hale lauded it mainly as a stock feed – though small amounts went into dietetic foods – which Ford ended up selling back to the farmers themselves (advertising it in the *Soybean Digest* into the 1940s).[47] It was expensive to transport, however, and often exceeded demand. Moreover, finding high-value uses for neglected byproducts was one the primary missions of chemurgy: revenue from byproducts could either increase revenue directly or lower the cost of a crop's primary product, in this case oil, thus giving it a competitive advantage. One waste frequently cited by chemurgists was the skim milk discarded in the production of butter, which was the source of a protein, casein, which had found industrial uses in the production of plastics as far back as the 1890s. As part of the Fascist push for import independence, the Italians had also developed an imitation wool out of spun casein protein: Italy's Ambassador to Great Britain appeared in London sporting a suit he boasted contained forty-eight pints of skim milk. The majority of casein used by U.S. industry, largely as a coating for paper, was in fact imported from Europe.[48] As Ford had little desire to sustain American dairy farms, he sought instead to find similar uses for the soybean's

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[45] "Golden Grain," *Los Angeles Times,* 12 Dec. 1932, A4.

[46] A foundry core consisted of fine sand and oil baked solid into the shape of a hollow space in a metal casting; after the molten metal cooled, the core could be pulverized back into sand and removed through a small hole. McCarroll, 60; L.B. Breedlove, "Soybean - The Magic Plant, Article XIV: Industrial Uses Already Manifold with More in Prospect," *Chicago Journal of Commerce and La Salle Street Journal*, 2 July 1936, 12.

[47] Hale, 25; Soyinfo Center, "Ford and His Employees."

[48] Borth, 259-61.

predominant protein, glycinin, which resembled milk protein closely enough that some referred to it as “vegetable casein.”[49]

In the first half of the century, there was nothing unusual about plastics produced from natural products: celluloid, cellophane and rayon were all made from cellulose, a major component of the walls of plant cells. Plastic made from soybean protein, like that made from casein, was also not entirely novel. Patents had been issued in Great Britain and France as early as 1913, and the first U.S. patent for a soybean plastic was issued to a Japanese citizen, Sadakichi Satow, in 1917.[50] These shared a defect with casein plastics, however, which largely consigned the latter for use in small objects such as buttons: they absorbed moisture from the air, causing them to warp and crack. This was in contrast to the popular synthetic plastic Bakelite, heat-resistant and water-proof and well-nigh indestructible, which was made by subjecting a coal-tar derived molecule, phenol, to heat and pressure in the company of formaldehyde. Boyer’s team addressed the moisture problem, as it happened, by creating a composite material: partly a soybean-protein plastic hardened by formaldehyde, partly a synthetic phenol-formaldehyde resin, and 30 percent “wood flour.”[51] Lighter than Bakelite, this could be then be molded into small, durable automobile components: horn buttons, gear-shift level balls, light switch handles, distributor bases and covers, window-trim strips[52] – potentially using up to 28,000 acres

[49] L.B. Breedlove, "Soybean - The Magic Plant, Article XIII: Industrial Uses Already Manifold with More in Prospect," *Chicago Journal of Commerce and La Salle Street Journal*, 30 June 1936, 12.
[50] Brian Ralston, "Soy Protein Plastics: Material Formulation, Processing and Properties" (Ph.D. Diss., University of Wisconsin - Madison, 2008), 16.
[51] Ralston, 17; R.S. Burnett, "Soybean Protein Industrial Products," in Markley, Klare S., ed., *Soybeans and Soybean Products, Vol. II,* Fats and Oils: A Series of Monographs (New York: Interscience Publishers Ltd., 1951), 1035.
[52] McCarroll, 61.

worth of soybeans to provide fifteen pounds of plastic to each of the one million Ford cars that rolled off the assembly line each year.[53]

Its composite, partly synthetic nature notwithstanding, in the Ford publicity juggernaut it was "soybean plastic," a demonstration of how cars could increasingly be "grown on a farm," as he proclaimed as early as 1933.[54] The ultimate goal would be a car body made of plastic rather than steel, an ambition which spurred Boyer's creative efforts for the remainder of the decade. According to one account, he produced hundreds of experimental rear-compartment panels for a Mercury sedan, which Ford himself would then personally attack with an axe until they were cracked or nicked. The one that finally withstood the axe consisted of a matting of "long and short fibers obtained from field straw, cotton linters, hemp flax" – which by the late 1930s Ford had to obtain a special license to grow[55] – "ramie and slash pine." With an eye to mass production, he floated this "cellulosic mass" on water and lifted it out on "screens which preformed it into a rough approximation of the finished panel;" he eventually learned how to produce six at a time. He added soybean meal, synthetic resin and color, and then plasticized it all in a hot press. Ford engineers eventually produced a prototype "plastic car" which supported fourteen of Boyer's panels on a tubular steel frame.[56]

Ford unveiled his plastic car in stages. In 1938, calling in reporters to respond to a National Labor Relations Board ruling against his company's labor policies, he took them on a factory tour and, "picking up a curved sheet of a composition which he said was made from soybeans, the angular old man jumped enthusiastically up and down on it,"

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[53] Shurtleff and Aoyagi, *Ford and His Researchers*, 58; Ralston, 17.
[54] Shurtleff and Aoyagi, *Ford and His Researchers*, 31.
[55] Watts, 483.
[56] Borth, 363-65.

pointing out triumphantly that "if that was steel it would have caved in."[57] In November 1940, he again called in reporters and startled them, first with his axe demonstration on the plastic lid of a car, then with his prediction that his company would start producing "plastic-bodied" cars within three years. *Time* and *Fortune* each ran articles with prominent photos and touted the virtues of Boyer's material: it looked like polished steel but was half the weight and ten times more dent resistant; and its color, integral rather than painted on, was as enduring as the panel itself.[58] Finally, in August 1941, at the Dearborn Homecoming Day celebration, Ford proudly displayed a prototype and invited reporters to a fourteen-course soybean luncheon. The press was again largely adulatory: it "will revolutionize the automobile industry" and bring about a "peaceful agricultural revolution; "here is something an America on wheels has been waiting for. Please hurry it, Mr. Ford; hurry! Hurry!"[59] Introduced when wartime steel shortages loomed, the plastic car rehabilitated Ford's standing as a visionary. At the same time, newspapers had fun with the idea of car made of "vegetable plastic," suggesting that it be strengthened with the addition of spinach; or that it was "part salad and part automobile"; or that it ran on salt, pepper and vinegar rather than gas; or that, instead of buying a new car every year, consumers could have last year's car warmed over.[60]

Boyer also made progress it providing Ford with an answer to the Italian Ambassador's skim-milk suit. At the 1938 meeting of the American Soybean Association, he announced that his team had just "the other day" succeeded in producing

[57] Shurtleff and Aoyagi, *Ford and His Researchers*, 82.
[58] Soyinfo Center, "Ford and His Employees."
[59] The last quote was from the *Decatur* (Illinois) *Herald Review*, which obviously had a vested interest in soybean use. Lewis, 283.
[60] Ibid., 284

a skein of soybean fiber that resembled wool or mohair.[61] This was a first: an artificial fiber produced from vegetable protein. Boyer sprayed a solution of soybean protein through the tiny holes of a “spinnerette submerged in a coagulating bath” so that it instantaneously precipitated into strands. The protein solution itself was tricky to make on two counts: first, a pure protein had to be isolated from soybean meal, and, second, when dissolved the resulting liquid had to have just the right viscosity to work in the spinnerette. [62] The imitation wool’s largest prospective use was in the sidewall upholstery of Ford cars, but it garnered publicity mainly as a material in Ford’s clothing. He sported a tie made of 50 percent soybean fiber, and in 1941 he made a public appearance in a “soybean suit” – actually one-quarter soy fiber and three-quarters sheep’s wool[63] – which cost an estimated $39,000 to make and with which he was, as the *Detroit Times* reported, “as delighted as a boy with his first pair of long pants.”[64] By 1942, a pilot plant was making 1,000 pounds of soybean wool daily, with a new plant under construction with five times the capacity. He tried unsuccessfully to persuade the armed forces to make uniforms out of soy fiber, and in 1943, unable to develop a product that could compete with the price of wool, he sold the process and machinery to the Dracket Company of Cincinnati, which was similarly unsuccessful in marketing the fiber.[65]

This was a typical denouement to Ford’s soybean ventures. The plastic car ended with the prototype, as World War II curtailed all new domestic car production. The use of soybeans in other Ford cars would largely end with the passing of Ford himself: the

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[61] R.A. Boyer, "How Soybeans Help Make Ford," in *Proceedings, 18th Annual Meeting of the American Soybean Association,* 12-14 Sept. 1938 at Wooster and Columbus, Ohio, 9.
[62] Robert A. Boyer, William T. Atkinson and Charles F. Robinette, "Artificial Fibers and Manufacture Thereof," U.S. Patent 2377854, 12 June 1945 (filed 7 June 1941), 1.
[63] Soyinfo Center, “Ford and His Employees.”
[64] Shurtleff and Aoyagi, *Ford and His Researchers*, 313; Lewis, 285.
[65] Soyinfo Center, “Ford and His Employees.”

village-industry processing plants were shuttered or sold in 1947, the year he died. Efforts to create a true soybean plastic – rather than phenol-formaldehyde plastics that used soybean meal as filler – continued at the Regional Soybean Laboratory in Urbana, but without a breakthrough. During the war and its aftermath, synthetic plastics established their dominance, while petroleum-derived solvents likewise displaced both linseed and soybean oil in industrial and household paint. Boyer's work would later have unexpected applications to food uses, but the main benefit to the soybean of Ford's enthusiasm was undoubtedly the publicity he generated. While soybean acreage expanded in the late 1930s largely for other reasons – protective tariffs and government regulations – Ford kept soybeans in the public eye at the very moment when farmers sought to find a promising new crop to plant on their restricted acres. Even the publicity was not an unalloyed boon to soybeans, however: there is some indication that Ford was so successful in linking soybeans to industry that Americans during the war hesitated to think of them as food.

Ford was ultimately a soybean hobbyist, albeit one with the ear of the nation, a vast personal fortune, and a major corporation at his behest. As the industrial system at his flagship factory became more inhuman, as labor strife turned violent, as his company lost market share, and as his own image as a hero of the common man was tarnished, Ford increasingly devoted his time to the pursuits he best loved: spending time on a farm and tinkering with machinery. The soybean, among other passions, provided him the opportunity to do both, as he supervised the work of Ruddiman and Boyer and helped fine-tune the equipment in the solvent-extraction plant. Ford may have been the nation's preeminent capitalist, but the projects he pursued in the 1930s were visionary, meant to enhance the capital of the nation in a general way, rather than profit-maximizing. The soybean had captured Ford's imagination, but could it succeed in American industry on its own merits without his patronage? A paint company – known for its careful attention to the bottom line, as well as its highly sophisticated use of chemistry – indicated that it might.

The Chemist: Percy Lavon Julian

Percy Lavon Julian would likely never have become a soybean scientist if not for a deadly catastrophe at the company that would eventually hire him. A little before noon on October 8, 1935, Edgar Sullivan, a young man who worked filling bags from a hopper on the third floor of Glidden Company's soybean products plant in Chicago, suddenly found himself falling through the air for what seemed like miles. "I landed on a loose pile of bricks outside the building," he later told a reporter. "Things were falling all around me. But I was certainly lucky. All I got was a scratch over one eye." An explosion had razed the half-block-long plant and showers of brick and steel had crushed five cars parked in an adjacent alley and two railcars on a nearby spur. Windows within a radius of several blocks shattered, and the detonation was felt three miles away. Forty-three people were injured, and by the next day, crews working through the night under large searchlights mounted on fire trucks had found six bodies.[66] The death toll would eventually reach eleven.[67]

Such a dramatic collapse, physical or financial, was unusual for Glidden. While expansive in its ambitions – the slogan for its core product, paint, was "Everywhere on

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[66] "Probe Factory Blast Fatal to Six; 43 Injured," *Chicago Daily Tribune,* 8 Oct. 1935, 1.
[67] "Four More Bodies Are Taken from Ruins of Plant," *Chicago Daily Tribune,* 11 Oct. 1935, 14.

Everything"[68] – and sprawling in its organization, producing a seemingly indiscriminate assortment of goods, the company had actually been very carefully and deliberately built up in accord with the guiding principles of its president, Adrian D. Joyce. Joyce cut a very different figure than publicity-darling Henry Ford. In what seems to have been the only full-length profile of him in the business press – published late in his career – Joyce was described as a "businessman's businessman" who, like a "writer's writer" or "ballplayer's ballplayer," displayed "competence of a kind that almost conceals itself in action" and "technique too sound to be spectacular."[69] In other words, he was arguably rather dull, keeping his eye trained on the obscure details that determined the difference between loss and respectable profit. Unlike Ford, he did not let personal hobbies or social crusades – if, in fact, he engaged in either of these – affect his business decisions.

A farm boy from Iowa, Joyce had been tutored as a manager in Chicago's turn-of-the-century meatpacking industry at a time when it was gaining a larger share of its revenue from various by-products: brushes and binder for plaster from wool and hair; sausage casings and violin strings from viscera; combs and glue from bones; candles and margarine from discarded fat.[70] Joyce himself helped establish Swift and Co.'s fertilizer division, which turned scrap meat ("tankage") into dry, sterile plant food and, increasingly, livestock feed.[71] The scale of the new meatpacking industry, which concentrated a vast number of animals in one place, enabled it to find economic value in smaller and smaller fractions of those animals. Competition between packers, as well as

[68] The Glidden Company, "Green Fields for Golden Years Ahead" [Display Advertisement], *Wall Street Journal*, 24 June 1937, 2.
[69] "The House that Joyce Built," *Fortune,* May 1949, 95; for earlier profile of Glidden, also see "Expanded Line Speeded Growth of Glidden Co.," *Wall Street Journal*, 12 Nov. 1938, 40.
[70] Rudolf A. Clemen, *By-Products in the Packing Industry* (Chicago: University of Chicago Press, 1927), 6.
[71] "House That Joyce Built," 95; Clemen, 311.

the emerging industrial ethic of efficiency and a public outcry over pollution, motivated them to pursue this value. Their research programs underwent an evolution similar to the Bureau of Chemistry's: at first focused on food safety, they increasingly devoted themselves to finding higher-value uses for what were otherwise noxious wastes.[72]

Joyce moved to a new city and a new industry when he joined the Cleveland paint manufacturer, Sherwin-Williams. He mustered enough financing to purchase Glidden in 1917, when he was forty-five. Glidden was a small, one-factory varnish company established in 1875 and best known for its Jap-a-Lac brand. Joyce expanded it into a national corporation, buying or establishing plants to best take advantage of freight rates and – like Ford – standardizing the production of paints across his whole operation. He was also Ford-like in his pursuit of cheaper, more reliable sources of raw materials and his practice of vertical integration when it made economic sense: he obtained the patents for a revolutionary method for producing white lead, and bought a linseed crushing plant in St. Louis and a zinc mine in California.[73] He brought with him from Swift, however, the drive to find profit in the "shards and stinks of industrial processes."[74]

Like the meatpackers, Joyce directed substantial resources to laboratory research. Glidden scientists in Baltimore had one of their proudest moments when they analyzed the fumes emitted by a copper refinery on Long Island. The researchers discovered that the fumes contained zinc, which the company was then mining at great expense in order to produce lithopane, a key pigment; Glidden soon reached an agreement with Phelps Dodge, which owned the refinery, to process their fumes. Lithopane manufacture in turn produced a "miserable scum" that was discarded until the Baltimore lab discovered that it

[72] Clemen, vii, 1-3.
[73] "House That Joyce Built," 97-98
[74] Ibid., 96.

contained cadmium, which they further determined could be used to produce two previously unattainable colors, true red and true yellow, soon the most profitable in Glidden's line of dry colors. As the profile of Joyce put it, he was finding value in "the residue of the residue of the residue."[75] Joyce was a chemurgist before the word existed, quietly pursuing its program of discovering worth in waste.

Joyce himself called his strategy "functional diversification," which involved venturing into new businesses if they helped realize some hidden value in existing operations. Following this strategy, Glidden arguably became a more idiosyncratic company than Ford's despite Joyce's lack of personal eccentricity. To get the most out of his linseed plant, for instance, Joyce directed it to crush copra from the Philippines in the off-season to produce coconut oil, used mainly for soap. Seeking a more profitable outlet for coconut oil, he refined it for use in shortening and margarine. Having entered the margarine business in a small way, he quickly decided to compete with General Foods by acquiring a national distribution system. In 1929, Glidden acquired several food companies throughout the country, including E.R. Durkee and Co. on Long Island, which provided the trade name, Durkee Famous Foods, for the division's products.[76] Thus the food division joined three others, all of which produced some products that could be utilized by the others: Paint and Varnish; Naval Stores; and Chemicals, Metals and Mining.[77] Two of these divisions were potential markets for soybean oil, which could be used as a substitute for linseed oil in paint and coconut (or cottonseed) oil in margarine.

Characteristically, however, it was not the obvious value of soybean oil that prompted Joyce to establish the Soya Products Division. Rather, as with Ford, it was the potential

[75] Ibid., 98-99.
[76] Ibid., 99.
[77] Ibid., 95.

value of the meal, the high-bulk, low-return byproduct of soybean crushing, that interested him. As Glidden Vice President William O'Brien – a former USDA chemist and head of Glidden's research and development – explained at the Second Dearborn Conference, "at the present time the soy bean industry is dependent upon the disposal of the meal to the farmer," who used it mainly as cattle feed, but "frequently, due to economic conditions, this cycle is broken," undermining the profits of soybean oil.[78] During one of their research trips to Europe to observe advances in industrial chemistry, Joyce and O'Brien spotted a German process for extracting a protein from soybean meal which could be used as a substitute for casein.[79] The darling of chemurgists, casein was used in America primarily as an ingredient in paper sizings – the coatings that determine how paper holds ink – a market Joyce was eager to enter. Besides being expensive and largely imported from Europe, casein was highly variable in quality, a problem exacerbated in domestic production by the decentralized character of the American dairy industry.[80] Soybean protein, produced in mass quantities from graded soybeans, could resolve these issues and, as a side benefit, supply oil to the paint and food divisions.

Research on protein extraction began in Cleveland in 1932. O'Brien reflected four years later that "if the Glidden Company had known of the many difficulties to be encountered and the heavy expenditures involved to bring the problem to the present point of completion, [it] would have hesitated before embarking on such a program."[81] The goal was not simply to remove the protein from the soybean intact – a "very difficult

[78] O'Brien, W.J. "Soy Bean Proteins," in *Proceedings: Second Dearborn Conference, May 12, 13, 14* (Dearborn, MI: Farm Chemurgic Council, 1936), 260.
[79] "House That Joyce Built," 99.
[80] Hugh Farrell, *What Price Progress? The Stake of the Investor in the Discoveries of Science* (New York: G.P. Putnam's Sons, 1926), 197; Charles N. Cone and Earl D. Brown, "Protein Product and Process of Making," U.S. Patent 1955375, 17 April 1934 (filed 5 March 1930), 1.
[81] O'Brien, 258.

and intricate process" disrupted if the soybeans had been subjected to too much heat or pressure when initially crushed[82] – but to subtly alter, or denature, the protein in just the right way to produce desirable characteristics. This involved partially unfolding the protein by breaking some of the chemical bonds that determined its three-dimensional structure. Done right, the protein, when dissolved in a weak alkaline solution, would produce a paper sizing with good "color, viscosity, and adhesion"; done wrong, the result was a product that was dark, too gummy to be sprayed, or either too sticky or not sticky enough to hold ink on the paper properly. The difficulty was compounded by the fact that there were three principal proteins in soybeans, and only one, glycinin – fortuitously the most plentiful of the three – was a globulin soluble in weak alkalis.[83] A breakthrough occurred when Glidden acquired a patent, approved in 1934, from two Seattle chemists, Charles Cone and Earl Brown, for a process that not only denatured glycinin in what seemed like the right way, but also expeditiously filtered out the other two proteins.[84]

Glidden named the result Alpha Protein to distinguish it from two lesser grades, Beta and Gamma Protein.[85] By late 1934, Joyce and O'Brien were confident enough in the product to invest $650,000 in a new soy-processing complex on the west side of Chicago, next to the paint factory of one of its subsidiaries.[86] A remodeled six-story building, said to have once been a bootleg brewery, held the giant tanks where soybean meal was agitated with alkaline solutions, then pumped into an adjoining building to be dried and

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[82] Ibid., 256.
[83] Ibid., 255; Production of a Derived Vegetable Pro Percy L. Julian and Andrew G. Engstrom, "Process for Production of a Derived Vegetable Protein," U.S. Patent 2238329, 15 April 1941 (filed 3 Dec. 1937), 1.
[84] Cone and Brown, 1-2.
[85] O'Brien, 258; "Glidden Company to Make Soya Bean Oil and Meal," 1934, clipping in files, Oil-1934, PPC-Glid, #42099, Soyinfo Center, Lafayette, CA.
[86] Arthur Evans, "Lusty Industry Born in Chicago from Soy Bean," *Chicago Daily Tribune*, 29 March 1935, 4; "Probe Factory Blast Fatal to Six."

bagged.[87] Flanking the other side of the tank building, separated by a fire wall, were two four-story buildings where soybeans were cracked, flaked, and solvent-extracted – as Glidden chemists had determined that pressing the oil out of soybeans damaged the protein.[88] A final building, adjacent to the extraction operation, removed lecithin from the soybean oil. The new facility, which opened in early 1935, had the capacity to process 130 tons of soybeans a day – until it became rubble on October 8.

As bodies were still being pulled by the wreckage, O'Brien arrived from Cleveland to investigate the cause of the blast. The police and fire departments, state attorney's office, coroner's office, and experts from the USDA also launched investigations.[89] Suspicion centered at first on the highly flammable hexane used in solvent extraction. But the explosion had apparently originated in the tank building, not the extraction building, leading the Chief Fire Marshal's expert to insist that protein dust in a tank had spontaneously combusted, rupturing the tank and then escaping throughout the building, where it was in turn ignited by an open gas flame.[90] This theory did not gain much traction with the other numerous investigators, however, and hexane again became the likeliest culprit in the public's eye when a second soybean plant, not owned by Glidden, blew apart on October 22. In contrast to Glidden's operation, which used the latest German-designed extractors, the plant in Momence, Illinois, fifty miles south of Chicago, was a modest affair, a pilot project intended, like Ford's Village Industries, to prove the feasibility of processing soybeans in small rural towns. The owner designed the

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[87] "Science: Bean Blast," *Time*, 21 Oct. 1935, 34; David J. Price and Hylton R. Brown, "Glidden Soybean Plant Explosion," *Quarterly of the Natonal Fire Protection Association* 29 (Jan. 1936): 233-34..
[88] O'Brien, 256.
[89] "Probe Factory Blast Fatal to Six"; "Dig in Wreckage for 5 Men Still Missing in Blast," *Chicago Daily Tribune*, 9 Oct. 1935, 11.
[90] "Blast That Cost 11 Lives Laid to Dust Explosion." *Chicago Daily Tribune,* 24 Oct. 1935, 13.

apparatus himself and had it fabricated at a local iron works; it apparently leaked hexane fumes which, undetected, traveled through an open door into the boiler room, leveling the building – and killing the owner and his assistant – about an hour after operations got underway.[91] As in the case of the Industrial Barn, the Momence explosion demonstrated the risks, not the feasibility, of small-scale solvent extraction – at least until, as the National Fire Protection Association urged, researchers put more effort into discovering non-flammable solvents.[92]

Glidden's soybean plant, on the other hand, was hardly starved of capital or subject to neglect. In the five weeks prior to the blast, during which the extraction building had been closed due to lack of soybeans to process, it had been repaired and refurbished.[93] It was in fact the very interconnectedness of the complex that seems to have been the problem: hexane fumes leaked into the tank building from the adjacent extraction building, either over the firewall or via a water pipe, and a spark from equipment in a third building – where soybeans were flattened into flakes – set off either dust or gas in a burst that traveled into the tank building through a doorway.[94] There was an indication that workers were not proficient at operating the German-made machinery – one man injured in the explosion, who oversaw the still where the hexane was recovered for reuse, had complained to his wife of fumes and had been reluctant to return to his job – but there had been no change of crew on the day of the accident.[95]

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[91] "Soy Bean Plant Owner Killed in Blast on 1st Day," *Chicago Daily Tribune,* 23 Oct. 1935, 8; David J. Price, "A Rural Soybean Plant Explosion," *Quarterly of the Natonal Fire Protection Association* 29 (Jan. 1936): 241-43.
[92] Price, 243.
[93] Price and Brown, 236.
[94] Ibid., 239.
[95] "Probe Factory Blast Fatal to Six."

Glidden's response to disaster, which had been covered by insurance, was to rebuild the plant in five separate, "explosion-proof" buildings. A construction engineer assured the press that a "mechanical process will be used instead of the former chemical process in the treatment of soy bean products" – a reference to five new Anderson expellers – but in fact Glidden installed two new Hildebrandt solvent extractors as well, without which the production of Alpha protein would have been impossible.[96] The presence of the expellers did signal an emphasis on producing meal for feed, however. In place of the six-story protein unit, Glidden now built a smaller pilot plant. The Alpha protein that had been produced over the first nine months of 1935 had not been satisfactory and had not found commercial use; the blast was an opportunity to take the process back to the drawing board.[97]

Hence, by early 1936 Glidden was in need of somebody to breathe new life into its soy protein research. And it was then that O'Brien got wind of a man in search of employment who fulfilled the job requirements in spades: he was acknowledged as one of the nation's top organic chemists; he had specialized in isolating and synthesizing substances from beans; he had been trained in the rigors of European methods; and he was fluent in German, a boon when so much of the equipment was manufactured in Germany and installed by German engineers. Informed that these qualities were combined in an Alabama-born African American, whose grandparents had been slaves and whose employment difficulties were in large part due to his race, O'Brien did not

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[96] "Glidden to Erect Soy Bean Plant, Office Building." *Chicago Daily Tribune,* 1 Nov. 1935, 33; "Glidden Sales Up, But Profits Slip Behind Last Year," *Wall Street Journal,* 17 April 1936, 6; Soyinfo Center, "History of the Glidden Company's Soya Products / Chemurgy Division, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/glidden.php.

[97] "History of Glidden's Soya Products Division."

hesitate to make the hire. After all, Glidden's philosophy was to seek those resources that others, for whatever reason, had undervalued.

When a boy visiting his grandfather's Alabama farm, Percy L. Julian listened to his great-grandfather, Grandpa Cabe, sing the spiritual, "There is a Balm in Gilead," as young Percy and his brother helped pick cotton. Asked to explain the song, Grandpa Cabe recounted the Biblical story of prophet Jeremiah crying in anguish, "Is there no balm in Gilead?" – a town famous for its healing salves – when all hope seemed to be lost. As Julian recounted decades later to a college audience, the meaning of the spiritual to Grandpa Cabe was that "there is always a way out." [98] Grandpa Cabe's optimism inspired Julian to continue a family tradition of striving for educational achievement in the face of racial hostility. But his very success in circumventing racist barriers created a tension in Julian's outlook perhaps shared by many in what W.E.B. Du Bois dubbed the Talented Tenth of the African-American community. While being acutely aware of and outraged by the barriers he faced, at the same time he harbored a measure of disdain for those in his community who failed to find a way around them. He was proud to be exceptional, and this pride led to a fall. With his opportunities severely limited by the color of his skin, he focused his energies on the soybean, not because he had the faith of Henry Ford in its limitless possibilities, but because for a time it offered him a way out.

For generations, the Julians had progressed by taking opportunities for learning where they could find them. Grandpa Cabe, while still a slave, taught his children to read with the consent of his master; Julian's grandmother paid for his father to attend a missionary school in Montgomery by delivering vegetables and poultry every Sunday before dawn;

[98] Bernhard Witkop, *Percy Lavon Julian, 1899-1975: A Biographical Memoir,* Biographical Memoirs, vol. 52 (Washington, D.C.: The National Academy Press, 1980), 5.

his father attended jury trials, free lectures, and debates to learn public speaking, and later, on his salary as a U.S. mail clerk, amassed a library that his children used to research the oral reports he assigned them. Julian's own determination to become a chemist dated back to a day when he climbed a fence and peeked into the laboratory of a white high school, only to have a policeman tug at his coat and tell him, "Come on down, kid. That's not for you." [99] He made do with tutors, while his younger siblings attended a state normal school. For college, he went north to Greencastle, Indiana, where he entered DePauw University as a "sub-freshman" and was barred from campus housing. He lived in the attic of a fraternity house, where he earned his keep by waiting on his housemates.[100] He worked as a ditch-digger, among other odd jobs, and took remedial courses to catch up with his white counterparts. By the time he graduated in 1920, however, he was a member of Phi Beta Kappa and class valedictorian.

He had won over chemistry professor William Blanchard, a North Carolinian who initially tried to convince him to drop his course, when he was the only student to pass the first quiz.[101] Blanchard championed Julian's ambition to pursue a doctorate, but could only deliver the bad news that, in response to his recommendation letters, his colleagues had written, "Discourage your bright colored lad. We couldn't get him a job when he's done, and it'll only mean frustration."[102] Nonetheless, after a year in which Julian taught at Fisk, a black university in Nashville, Blanchard helped him secure a

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[99] William F. McDermott, "Slavery's Grandchildren," *Coronet,* Jan. 1948, 123-25.
[100] NOVA, "Transcripts: Forgotten Genius. PBS Airdate: February 6, 2007," last modified 2007, www.pbs.org/wgbh/nova/transcripts/3402_julian.html.
[101] Deton J. Brooks, Jr., "Julian's Genius Saved Firm from Huge Losses," *Chicago Defender (National edition)*, 13 March 1943, 13.
[102] "Forgotten Genius."

scholarship to Harvard,[103] where he earned a Master's degree in 1923. He spent three more years pursuing a doctorate on minor scholarships, but, as he later bitterly recalled, was denied a TA-ship in 1927 that would have allowed him to complete his degree. During a year at West Virginia State College for Negroes, Julian replicated the experiments of Ernst Späth – a pioneer in isolating and synthesizing alkaloids, compounds found in plants – and gained the notice of Mordecai Johnson, the President of Howard University in Washington, D.C., who hired him as the successor to Brady, who was returning to Fisk. Then in 1929, with the financial backing of a wealthy Harvard classmate and with Johnson's blessing, Julian took leave to complete his Ph.D. in Späth's laboratory in Vienna, returning triumphantly to Howard in the fall of 1931.[104]

The following year, things fell apart. In April, he recommended that two members of his department be dismissed: Robert Thompson, the assistant director of the chemistry laboratory, and Jacob Shohan, a white associate professor who had been Julian's classmate at Harvard. He cited the two men's "inefficiency" and "insubordination." Another explanation for Thompson's firing soon emerged when the lab assistant handed an affidavit to the Howard board alleging that, the previous October, he had caught Julian engaged in "improper conduct" with his wife, Anna. Julian sued for libel; Thompson countersued for the loss of Anna's affection. (Julian and the former Anna Thompson married in 1938.) In the case of Shohan, it was widely assumed that Julian had recommended the dismissal at the behest of President Johnson, who wished to appease a dean that Shohan had disobeyed.[105] In retaliation, both men handed compromising letters

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[103] Brooks.

[104] Paul de Kruif, "The Man Who Wouldn't Give Up," *Reader's Digest*, Aug. 1946, 115.

[105] "Two Professors Get Notices," *Afro-American*, 9 April 1932, 13; "H.U. Professor Sues Assistant," *Afro-American*, 30 April 1932, 1; Louis Lautier, "Capital Spotlight," *Afro-American*, 5 Feb. 1938, 16.

to the Baltimore *Afro-American* that Julian had written from Europe. The *Afro-American*, which relished a juicy scandal almost as much as it despised what it saw as Johnson's increasingly autocratic rule at Howard, printed the letters in full over the course of the summer, gleefully torpedoing the reputation of someone it considered to be Johnson's pet.

The letters were damaging on a number of counts. There was the liberal use of "damn" and "hell," which the *Afro-American* ridiculed as adolescent.[106] There were the allusions to having sex with Viennese girlfriends as Julian, a single man of 30, shook off "the cramped life of puritanic yet hypocritical America." He complained to Thompson about a date with a "a little Jewish girl who imagines that she must remain a *Jungfrau* (virgin) until she marries."[107] This sort of thing indirectly substantiated Thompson's charges of moral improprieties – as well as indicated how intimate the three now-estranged men had been prior to Julian's return. But perhaps most damaging to Julian were his rancorous references to Howard colleagues in which he occasionally stooped to racial epithets, including "chillun of Aunt Hagar" and one that the *Afro-American* usually, but not always, printed as "N---." He supported Shohan's rebellion against the "Uncle Tom Dean" of the College of Liberal Arts, telling him at the same time not to "try to reform Negro lassitude, inertia, hypocrisy, or what not."[108] He referred to Emmett J. Scott, Howard's Secretary-Treasurer and opponent to President Johnson, as a "virus."[109] He even disparaged his erstwhile hero Saint Elmo Brady, his Howard predecessor and the

[106] "Julian Is Asked to Resign," *Afro-American*, 18 June 1932, 13.
[107] "No Energy for Jewish Virgin, Wrote Julian," *Afro-American,* 6 Aug. 1932, 13.
[108] "Dr. Julian's Letters to His Assistant Report Sensations at Howard U," *Afro-American*, 11 June 1932, 18.
[109] "Julian Is Asked to Resign."

only African American to have attained a doctorate in chemistry before him, for not having published papers: “That guy don’t know what it’s all about.”[110]

The letters, remarkably unabridged, also revealed a man who was utterly dedicated to his work – to the point that he eventually had little time for girlfriends – as well as brilliant: he mastered German to the point of delivering a radio address and an hour-long pre-doctorate talk in the language.[111] He also took classes in German philosophy, learned some piano in his spare time, and attended operas.[112] But instead of voicing pride in his achievements, as proof of the high potential of all African Americans, the *Afro-American* characterized him as an arrogant braggart, a threat to the morals of Howard students, and a divisive figure in campus politics. The paper urged that he be fired at once, arguing that when he wrote private letters to Thompson and Shohan, “he penned his own resignation.” It was outraged when a meeting of Howard department heads convened by Johnson voted to retain Julian – and even when the trustees finally fired him in November, the paper protested against the six-month “discharge stipend” that Johnson’s continued support apparently won him.[113] It is not clear whether, after all of this publicity, any other black college was willing to have him. In the event, William Blanchard, now dean of the College of Liberal Arts at DePauw, threw him a lifeline, hiring him to teach the senior courses in organic chemistry.[114]

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[110] Ibid.; "Dates Feature Letters," *Afro-American*, 30 July 1932, 13; “No Energy for Jewish Virgin.”
[111] "To Hear H.U. Professor in German Broadcast," *Afro-American*, 2 May 1931, 17; "Julian Letter Describes Pre-Doctorate Speech Triumph," *Afro-American,* 23 Sept. 1932, 13.. Later he agonized over his one mistake, having said “der Atom” rather than “das Atom” at one point.
[112] “We do not see real opera in America,” he wrote after attending a five-hour performance of Wagner’s *Die Walkure*. "Dr. Julian Letters to Thompson Tell of Women and Sex in Vienna," *Afro-American*, 16 July 1932, 13.
[113] "Howard U. Prexy Reported Building Stone Dwelling at Harpers Ferry," *Afro-American*, 30 July 1932, 13; "H.U. Department Heads Vote 6 to 3 to Retain Julian as Chem. Head," *Afro-American*, 2 July 1932, 13; "Ousted Howard Faculty Members to Be Paid Six Months Salary," *Afro-American*, 12 Nov. 1932, 14.
[114] Max Tishler, "Percy L. Julian, the Scientist," *The Chemist* 42 (March 1965): 105.

Julian modeled his courses at DePauw after Späth's laboratory, where students had been assigned individual research problems to solve. Späth then offered guidance and not a little dogging. Julian himself had been somewhat cynical about this method, especially when his problem, the identification and synthesis of a mysterious alkaloid in a common Austrian shrub,[115] went poorly. At one point, he complained that one of Späth's suggestions "was so dumb I knew he made it only to signify his interest," leading him to feel that "brilliant students often make professors" and that his professor's "more than one hundred papers published" were the result of being "surrounded with brilliant young men who have always found a way out in such difficult times."[116] When he eventually succeeded, however, Julian acknowledged that it was "impossible to master organic [chemistry] until you have worked with a master in this field" and that he himself had learned "how to take workers who are half intelligent and make them do a good job with little expenditure of my own energy. That's an art and this art above all the German Professors possess."[117]

His embrace of German methods was, in fact, at the root of his troubles with Shohan, as he came to believe that the American practice of chemistry was "such a childlike thing, even at Harvard" – likewise, he dismissed Shohan's work as "child's play" – and that European students were "so much better trained. They know so damned much more than our best, they are superb workers, [and] their methods are so refined." Julian in fact had brought a fellow Späth student, Josef Pikl, in tow when he returned to the U.S. and indicated that he planned to turn Howard into a "factory" to churn out publications.[118]

[115] "Forgotten Genius."
[116] "No Energy for Jewish Virgin."
[117] "Dates Feature Letters."
[118] Ibid. In the same letter, he likewise dismissed Shohan's accomplishments in chemistry as "child's play."

Hence, his dismissal of Shohan for "inefficiency" may not have been wholly political; his standard of efficiency had changed. Ousted from Howard, he put his plan into effect at DePauw: he integrated three separate courses into the senior training program and assigned each student a research project. His students produced thirty theses in four years, with eleven leading to publications in the *Journal of the American Chemical Society*.[119] And perhaps unlike a strict Germanic professor, the charming Julian was popular with students and fellow faculty members alike.[120]

He also had a research triumph that put him unquestionably at the top of his profession: the synthesis of physostigmine, a derivative of the calabar bean used in treating glaucoma. This was a high-profile endeavor, the moreso since Sir Robert Robinson, the dean of organic chemists in England, was also attempting to make physostigmine from scratch – and at one point seemed to have won the race. But in a series of papers, Julian had the boldness to assert that Sir Robert's chemical was not identical to the natural product – the melting points were different – and then to subsequently produce the correct compound himself. In one dramatic account, he and Pikl – who had accompanied him to DePauw – heated the natural and synthetic substances separately, until Pikl shouted, "I'm melting!" and Julian shouted, "Me too!"[121] All of this was not enough to win Julian a full professorship at DePauw, however. This was in part because of the vocal opposition of the American Legion, who were outraged by President G. Bromley Oxnam's removal of the ROTC from campus and his subsequent dismissal of chemistry professor Ralph W. Hufferd, a veteran who had

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[119] Tishler, 105.
[120] "Dr. Julian Makes Good at Depauw, Ind., University," *Afro-American*, 14 July 1934, 14; "Forgotten Genius."
[121] "Forgotten Genius"; De Kruif, 115.

spoken out against him. The *Chicago Defender* quoted one Legionnaire as saying, “Oxnam is a communist, who kicked out a white man to hire a Negro.”[122]

His funding running out, Julian looked to the growing sector of industrial laboratories for employment. DuPont agreed to interview him, along with Pikl, but hired only the Austrian – who remained with the company for the rest of his career – explaining to Julian, “We didn’t know you were a Negro.” Other companies likewise explained that they had never hired a black chemist before and thought it might damage morale.[123] The Institute of Paper Chemistry of Appleton, Wisconsin, was interested in Julian – it had already hired some of his DePauw students – but was informed by the city attorney that an “old statute” made Appleton a sunset town, where “no Negro should be bedded or boarded . . . overnight.” W.J. O’Brien, attending a board meeting at the Institute (a reflection of Glidden’s interest in paper coatings), heard of these troubles and, in need of a top-notch organic chemist to get the soybean work on a profitable footing, decided to hire Julian himself. By his account, he slipped out of the meeting to interview Julian over the phone – so as to later be able to deny knowing that he was black – and offered him on the spot the position of Assistant Director of Research of the Soya Products Division.[124] According to one legend, Julian was so surprised by the offer that he took several days to prepare his acceptance, at which point Joyce and O’Brien, assuming that he was holding

[122] "Withdrawal of R.O.T.C. from Depauw U." *Hammond (IN) Times*, 25 Jan. 1934, 5; "Oxnam Criticized: Dismissal of Chemistry Professor Is Cause of Attack," *Hammond (IN) Times*, 5 June 1934, 4; "Dr. Oxnam is Accused by Legion," *Hammond (IN) Times*, 27 Aug. 1935, 6; "Color Issue in Faculty Raised at DePauw U.," *Afro-American*, 5 May 1934, 3; Brooks.
[123] “Forgotten Genius.”
[124] Tishler, 109.

out, offered him a higher salary. And by the time he arrived, he was the full, not assistant, Director of Research.[125]

Thus by a process of progressively diminishing options did Julian become, for the next eighteen years, a renowned "soybean scientist." As early as 1938, the *Afro-American*, which had done so much to destroy his career, reported with pride that he earned an annual salary of $8,000 and directed a million-dollar laboratory.[126] In 1944, in a letter to the *Washington Post* that angrily denounced an article claiming that American blacks demonstrated little "thrift [or] ingenuity," the writer put "Dr. Percy Julian, soya-bean plastics authority" at the top of a list of African-American notables that included plasma-pioneer Charles Drew and architect Hilyard Robinson.[127] He largely avoided comparison, however, to another famous black scientist – George Washington Carver[128] – despite the shared devotion to deriving a myriad of substances from a single crop and the iconic status that both of their respective crops held in the chemurgical imagination. Perhaps Julian was too urbane to be paired with Carver, who, whatever his caliber as a scientist, projected a rustic charm. In any case, Carver's imaginative uses for the peanut, which numbered in the hundreds and included face cream and a purported polio treatment, rarely found commercial success, whereas Julian was driven from the outset to develop products with immediate market value.

[125] "House That Joyce Built," 99; Tishler, 109. The name of the first Director of Research for the Soya Products Division, Eric Wahlforss, appeared on a Glidden patent application as late as August 1936. Eric Wahlforss, "Soya Bean Product," U.S. Patent 2284700, 2 June 1942 (filed 6 Aug. 1936).
[126] "Makes Paint from Beans," *Afro-American,* 12 Nov. 1938, 13.
[127] Dutton Ferguson, "Letters to the Editor: Negro Contribution," *The Washington Post*, 15 April 1944, 4.
[128] Until 1947, it seems, when he was compared to his fellow Springarn Medal winner. Drew Pearson, "Drew Pearson on the Washington Merry-Go-Round," *Florence (SC) Morning News*, 29 June 1947, 4; Albert Barnett, "Dr. Carver or Dr. Julian: Which Would You Choose?" *Chicago Defender (National Edition)*, 15 Oct. 1949, 7.

Julian's first task was to improve Alpha protein. He examined the rebuilt pilot plant and, when asked by Glidden executives what he thought of the process, reportedly responded, "Gentlemen, it's lousy."[129] In his patent application for an improved method, he was more specific about the shortcomings of the current product. It left a "high dispersion residue"; that is, it did not dissolve completely in the alkaline solutions used to make paper coatings. Even when well dispersed, the resulting solutions were "highly viscous" and prone to becoming "stiff gels even at relatively low concentration of protein." To paper manufacturers, this meant more energy expended in stirring the liquids and, when they gelled, a "considerable expense in bringing them back to working consistency." Even more damning for what was supposed to be a casein substitute, the soybean coatings had "relatively poor adhesive qualities as compared to milk casein."[130]

Up to this point, Alpha protein had been extracted by soaking oil-free soybean flakes in strong alkalis such as lye, the reasoning being that this was the best way to end up with a protein that readily dissolved in weak alkalis. It was a sign perhaps of Julian's genius – or at least his experimental boldness – that he did exactly the opposite, first treating the flakes with hot acid. It took Julian and his team more than a year to perfect this method, and his patent application hinted at the endless trial-and-error required to get desired reactions in organic chemistry: "If the acid concentration is too high, the time too long, or the temperature too high, the treatment is too severe and results in a fundamental change in the protein," he noted, making it altogether too soluble in alkaline solutions. As it was, while the correct procedure did not result in a "fundamental" change, Julian emphasized that the result was a "derived" protein that was distinct from the soybean's "native"

[129] De Kruif, 116

[130] Julian and Engstrom, "Derived Vegetable Protein," 1.

glycinin – although he could only make an educated guess as to exactly how, surmising that "linkages are cleaved, . . . rendering free carboxyl groupings."[131] As in past methods, the altered protein was then extracted with alkali. Acid was added to the "alkaline liquor" to curdle the protein, allowing it to be separated out and pressed into cakes. This last step was not unlike the process of making tofu, except that the result was a true protein isolate, whereas traditional soybean curd contained carbohydrates and fats caught up in the protein matrix.

Julian's method resulted in an Alpha protein that was finally a viable substitute for high-quality casein, producing low-viscosity coatings which showed no tendency to gel and which were highly adhesive.[132] The relatively high cost of its production made it less of an immediate financial success, however, as sales were sluggish until World War II, when the Navy requisitioned nearly all that Glidden could produce as an ingredient in a fire-fighting foam that servicemen dubbed "bean soup."[133] While Julian did not invent the foam, the critical role played by Alpha protein in its performance was cited by the NAACP when it awarded Julian the Springarn Medal in 1947.[134]

Prior to the war, the division's profits derived more from cheaper, less highly purified protein, including the soybean meal that went into animal feed. Two members of Julian's lab, Arthur Levinson and James L. Dickinson, received a patent on a process for remedying the defects of solvent-extracted soybean flakes as feed. Unlike the cake resulting from oil expellers, solvent-extracted flakes were loose and dusty, and they retained the bitter and beany flavors that all edible soy products had to contend with.

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[131] Ibid., 2.
[132] Ibid., 3.
[133] Produced by National Foam Systems, its official name was Aer-O-Foam. "History of Glidden's Soya Products Division."
[134] "House That Joyce Built," 99.

Levinson and Dickinson addressed these problems by sending the flakes through an expeller, using lower temperatures and pressures than when expelling oil. The result was a uniform cake, easily broken into dust-free bits, that was sufficiently toasted to remove most of the disagreeable flavors. They also pointed out that the amount of fat in the meal could be precisely regulated by adding any desired amount of oil to the fat-free meal before sending it through the expeller.[135] Once the bitter flavor was eliminated, soybeans accounted for an increasing share of the protein in "Red Heart Dog Food," a higher value use for the meal; according to one account, Julian conducted studies that involved tasting the dog food every hour.[136]

More than from the protein products, Glidden earned revenue from the soybean oil used in margarine and paint – and from a particularly valuable fraction of that fraction, soybean lecithin. Lecithin, first isolated form egg yolks at the turn of the century, had found use as an emulsifier, binding water to oil, in such foods as margarine and chocolate. It was removed from soybean oil as a gummy waste during refining. When soybean oil was pressed or expelled from the meal, the lecithin was damaged by the heat; with solvent extraction, however, it could be recovered in a usable form. Julian, aided by his knowledge of German, oversaw and improved the extraction process at Glidden; and he and a member of his lab patented a way to recover more lecithin from the oil. In the early years of its marketing in the U.S., German and American patents were pooled for

[135] Arthur A. Levinson and James L. Dickinson, "Method of Preparing Feed Material," U.S. Patent 2162729, 20 June 1939 (filed 8 June 1938); "History of Glidden's Soya Product s Division."
[136] Tishler, 109

use by members of the American Lecithin Corporation – which included Glidden and Archer-Daniels Midland.[137]

Julian organized the Soya Products Laboratory as he had his courses at DePauw, following the model of Späth. His researchers later described him as a "blur" in a white lab coat "that might swoop down at any moment" who "would pester you at many times" and "expected you to tell him something different every time he came in there, something that was favorable."[138] His team eventually filed 100 patents, comparable to the 100 papers that Späth had published as part of a similarly collaborative effort.[139] Glidden advertised that its soybean products were used in paints, shortenings, paper coatings, dog food, confections, baked goods, alcoholic beverages, cosmetics, automobiles, packaging, and plastics.[140] Julian ultimately "itched to get away from dog foods, paint and oleomargarine,"[141] however, and return to the investigation of a topic that had fascinated him before joining Glidden. While working with the calabar bean at DePauw, he had accidentally precipitated a white substance that he discovered was rich in sterols, the building blocks of hormones. He knew from the literature that soybeans were rich in sterols, and had written a letter to Glidden requesting a five-gallon sample of soybean oil when he received the surprising phone call from W.J. O'Brien.[142]

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[137] Percy L. Julian and Andrew G. Engstrom, "Preparation of Vegetable Phosphatides," U.S. Patent 2249002, 15 July 1941 (filed 8 June 1938); Soyinfo Center, "History of Soy Lecithin - A Special Report on the History of Soy Oil, Soybean Meal, & Modern Soy Protein Products: A Chapter from the Unpublished Manuscript, *History of Soybeans and Soyfoods: 1100 B.C. to the 1980s* by William Shurtleff and Akiko Aoyagi," last modified 2007, www.soyinfocenter.com/HSS/lecithin2.php.
[138] "Forgetton Genius."
[139] Tishler, 110
[140] "History of Glidden's Soya Products Division."
[141] "Forgotten Genius."
[142] Tishler, 108

The problem was that he could not recover the sterols without destroying the oil, and the oil was worth more than the sterols. A production accident at Glidden alerted him, however, to a possible method of extracting a sterol-rich sludge as a byproduct of the oil – and arguably improving the oil in the process.[143] This discovery eventually led to a valuable business for Glidden in synthetic hormones, exemplifying perfectly Joyce's philosophy of functional diversification. Julian's pursuit of hormones, which would win him new levels of fame, would eventually push beyond even Glidden's willingness to diversify, and at that point push him to leave both Glidden and the soybean behind. But this would be over a decade in the future, during which time the soybean was transformed not only by chemists, but also by financiers located nearby in downtown Chicago.

The Board: The Chicago Board of Trade

On Friday, October 2, 1936, members of the Chicago Board of Trade voted, 633 to 23, to establish a futures market in soybeans. The ballots included 125 sent in by out-of-town members. The rest cast their ballots inside the 45-story Board of Trade Building, then the tallest in Chicago, which anchored the financial district. Like the Empire Trade Building, it was an art-deco edifice whose dramatic set-backs accentuated its height; and, like its companion in New York City, it rose at the tail end of the twenties boom to accommodate the heavy demand for office space, only to have that demand erode with the onset of the Depression.[144] The building's owners were fortunate at least that many members of the Board itself – firms that bought and sold grain, as well as floor traders –

[143] Tishler, 110

[144] Carol Willis, *Form Follows Finance: Skyscrapers and Skylines in New York and Chicago.* New York: Princeton Architectural Press, 199, 121-23.

rented offices there.[145] But the activity on the twelfth floor of the building, where the Board's trading room was located, had also declined in recent years. This was particularly true of the octagonal pits where futures contracts were traded, and which saw a drop in trade volume after 1930 that would not recover for decades. This was not only the result of the Depression itself, but of New Deal policies which, by providing support prices for grains like wheat and corn, undermined the need for grain dealers to use futures as a form of insurance against price changes.[146] But volume was key to the incomes of many Board members, who often charged fees to trade on behalf of others, as well as to the Board as an institution. Thus, soybean futures were the outcome of an active search for new business, a search which focused on soybeans for a number of reasons: they were being grown and sold in increasing quantities; they increasingly found a market in Chicago itself, at companies such as Glidden, or passed through Chicago in transit to other markets; and their price was not supported by federal programs. As American agriculture became more highly regulated, soybeans showed promise as a free-market crop.

The Board of Trade was founded in 1848 and was initially little more than an occasional meeting place for businessmen and city boosters. It rose to prominence during a boom in wheat exports during the Crimean War and in conjunction with new technologies – the railroad, the telegraph and, more specifically, the grain elevator – which revolutionized grain marketing. As William Cronon points out, these changes made it impractical to track each farmer's sacks of grain as they passed from farm to railcar to elevator to barge. Instead, removed from sacks, grain flowed like a river

[145] The National Soybean Processors Association was headquartered there as well.
[146] William D. Falloon, *Market Maker: A Sesquicentennial Look at the Chicago Board of Trade* (Chicago: Board of Trade of the City of Chicago, 1998), 184-86.

through marketing channels, differentiated by standard grades and tracked by elevator receipts that gave their holders the right not to a specific lot of grain, but to a given quantity of a specific grade. The Board of Trade became the place to buy and sell these receipts, enabled by the new system to be a very small physical space where vast amounts of wheat and corn, now transformed into bulk commodities, could be traded efficiently.[147] In fact, grain was not entirely an abstraction on the trading floor, where as late as the 1920s commission merchants, whose agents in the countryside obtained grain from small dealers, brought small sample packets of their offerings: hundreds of millions of bushels of grain were bought and sold each year in this manner.[148] But this was away from the pits, whose traders dealt in grain that did not yet exist.

Futures contracts, like the grain they represented, were a bulk commodity.[149] They had their origin in the individual "forward" contracts between various handlers of grain, which established a price for grain to be delivered on a given date in the future. For those who hoped to reap the gains of storing grain – the supply of which glutted the market during harvest times, whereas demand was much more even throughout the year – these contracts provided some security against external price shocks that might rob their stock of value. Likewise, millers could lock in the cost of grain even in advance of its harvest. But these face-to-face contracts – the equivalent of individual sacks of grain – were limited in their effectiveness. There was not always a buyer for every seller. Moreover,

[147] William Cronon, *Nature's Metropolis: Chicago and the Great West.* (New York: W.W. Norton & Co., 1991), 114-119.
[148] E.S. Rollins, *Things You Should Know about the Chicago Board of Trade* (Chicago: Board of Trade of the City of Chicago, 1920), 3-5.
[149] The following discussion of futures is drawn from Gail L. Cramer and Walter G. Heid, Jr., *Grain Marketing Economics* (New York: John Wiley & Sons, 1983), 171-212; similar points were also made as early as 1931 in G. Wright Hoffman, "The Hedging of Grain," *Annals of the American Academy of Political and Social Science* 155 (May 1931): 7-22.

as market conditions changed, either party could renege on the prior agreement, suppliers most easily by claiming poor harvests when they wanted to instead sell their grain to higher bidders. Futures contracts, on the other hand, were standardized, specifying delivery of a given amount of a certain grade of grain by the last day of a given month (limited to the months of May, July, October and January in the case of wheat). Very few of these contracts were settled by actual delivery, however: because they were interchangeable, traders could settle their accounts by selling back to the market the futures they had bought, or vice versa, either making or losing the difference in the price. For a speculator, buying and selling futures was a process of betting on future prices, without any intention of handling grain.

Actual handlers also bought and sold futures, but, like speculators, they rarely considered them contracts to actually deliver grain. Rather, they were a means to hedge their sales (or purchases) of physical grain. Both the current cash price of a grain and its futures price fluctuated depending on market conditions, giving speculators ample opportunity to gamble. But when a grain merchant bought a certain quantity of physical grain, and simultaneously sold the equivalent amount in futures, what concerned him was the difference on any given day between the two prices, known as the "basis." This was far less volatile. Over the short term, in fact, cash and futures prices often fluctuated in sync, so that the basis did not change at all. In this case, when a merchant eventually sold his grain and simultaneously bought an equivalent amount in futures – which canceled out his previous sale of futures, thus "lifting the hedge" – he would have made no money on the deal. For handlers who processed the grain into higher-value products, this insurance against any price change was what they sought.[150]

But over the long term, the basis did change. On the delivery date, when the futures contract expired and could theoretically be fulfilled by delivering cash grain purchased that day, the basis automatically hit zero. This allowed those who stored grain to ensure their return through hedging – that is, to make actual money. In placing a hedge, a merchant bought cheap (the cash price) and sold dear (the futures price); settling a futures contract by later making the opposite transactions, selling the grain and "buying" the future when the prices were the same, allowed him to lock in that profit. This was a forward contract, except with the collective market rather than with an individual. Even before the basis hit zero on the delivery date, it would typically "weaken" toward zero as cash and futures prices converged. One might interpret this convergence as meaning that, as the delivery date approached, the factors determining the current and future price of grain also converged; or that the basis represented the market's best guess on the return for storing grain, and this return naturally declined as the delivery date approached.[151]

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[150] In a standard textbook example, a merchant might buy cash soybeans on October 15 for $3.30 per bushel, at the same time selling an equivalent amount of December soybean futures for $3.38 per bushel; in this case, the cash price is "8 cents under basis." If they sell the cash beans on November 15 for $3.25 per bushel and sell the futures for $3.33 per bushel, the cash price is still 8 cents under basis, although both the cash and futures prices have changed. Taking the cash transactions alone, the merchant has lost 5 cents; in the futures trade, they have gained 5 cents, meaning that the net loss/gain is zero. This has insured the merchant against catastrophic short-term loss, but equally would have taken away any short-term gain if the cash and futures prices had gone the other way. This means, at a deeper level, that there was no value added by such short-term storage. Cramer and Heid, 188-89.

[151] In another textbook example, a merchant might buy beans in November for $1.97 per bushel and sell July futures for $2.96, and then in May sell the beans for $2.31 and buy futures for $2.82. In that time, the cash price drops from 99 cents under basis to 51 cents under basis. On the first transaction, they gain 99 cents and in the second they lose 51 cents, meaning an ultimate net gain of 48 cents per bushel. Another way to see this is that the market's best guess in November is that storing the beans until July would add 99 cents in value; by May, this has gone down to 51 cents, the amount foregone by the merchant by selling early. Ibid., 194.

Whatever the explanation, this mechanism effectively separated out the returns on a quantity of grain into different grades of risk, high-risk for the speculators and low-risk for the hedgers. This was much like the effect of taking grain out of sacks and mixing it together, which allowed it to be separated out according to its inherent characteristics into different grades. Or, for that matter, much like the effect of bringing together a large enough quantity of soybeans to make it economical to separate it into meal and oil, and the oil into refined oil and lecithin. This was a general principle of commodities: the greater the bulk, the more economical it became to separate out smaller and smaller fractions.

Futures introduced some novel risks to the market, however. Buyers of futures traditionally had the right to demand that the contracts be fulfilled with the delivery of actual grain rather than a settling of accounts. If the holders of these contracts were able to simultaneously buy up the lion's share of physical grain, they could work a corner: in essence, they could demand a high price for the grain from traders desperate to settle their contracts and maintain their standing in the market. This was not a risk for actual holders of grain, who might benefit, if they had not hedged with futures, from the artificially high prices; and if they had hedged, the basis still fell to zero on the delivery date, whatever the cash prices were doing. Corners distorted the price of grain, however, causing ripple effects that might be felt far and wide. They moreover undermined the legitimacy of the market even further among those inclined to distrust it, as most farmers instinctively did. The Board of Trade attempted to protect itself by monitoring traders who simultaneously bought large amounts of cash grain and futures, as legitimate hedgers should theoretically buy one and sell the other. In the 1930s, for instance, they took action against Cargill, a major miller and grain merchant based in Minnesota, in what became a notorious, drawn-out legal battle.[152]

In general, it was the Board's mission to encourage greater volumes of futures trading – even if this meant creating a new futures contract for a new crop. Soybeans were a good prospect in part because more potential hedgers – country merchants, elevators, and processors – were storing and using them; and in part because recent publicity increased interest among possible speculators. They also had good storing properties, though there were worries about their high oil content. This differentiated them from cottonseed, which went bad quickly; hence while there was a futures market in cottonseed oil, there was none in the seed itself. While a legume from the botanical point of view, the soybean was thus capable of becoming a grain from the commercial point of view. All of this notwithstanding, it took almost five years of exploring the possibility before the soybean futures market was created.

The idea was first floated by Roland McHenry, a managing director of the Star Grain Company, in a letter to Board President J.C. Murray in September 1931. McHenry recounted a visit by twelve members of the exchange to the Funk Bros. Farm in Bloomington, mainly to glean information about the corn breeding. "In the course of our discussions," McHenry reported, "the question of soy beans was brought up by Mr. Funk" – most likely Eugene Funk, Sr. – who believed "that a very great enlargement of the soy bean crop would come into play" not only in Illinois, but in Indiana, Missouri and Iowa as well. "In this discussion, we discovered that the producer is very greatly handicapped by not having an open market, and it occurred to us that there is a real

[152] Falloon, 193.

opportunity for the Chicago Board of Trade to develop a futures market in soy beans." McHenry proposed that a half-cent commission per bushel "would be satisfactory," and also that "the minimum unit traded should be 1,000 bushels" as "soy beans can be stored in bulk satisfactorily and shipped in this manner." It was the "unanimous opinion" of those who discussed the question that "a committee should be appointed by you to give this matter some study, with the hope that a futures market can be put into operation before the movement of the new crop which will shortly be harvested."[153] McHenry's recommendation was forwarded to the Grain Committee, which seconded it, and Murray duly appointed the committee at the November Directors meeting.[154] If McHenry hoped for a soybean futures market to emerge in 1932, however, he would be disappointed.

At the end of 1932, Burlison and several other authors at the University of Illinois Agricultural Experiment Station released a bulletin, *Supply and Marketing of Soybeans and Soybean Products*, which noted that the soybean crop was different from "numerous other crops in that it has been handled with a minimum use of organized exchanges. None of the exchanges have made provision whereby hedging transactions could be undertaken directly in soybeans, in soybean oil, or in oil meal." Some elevators attempted to hedge their soybeans by selling flaxseed futures[155] – and processors likewise hedged soybean oil and meal with futures in analogous cottonseed products – but "except for the shortest

[153] Roland McHenry, Chicago, to J.C. Murray, Chicago Board of Trade, 25 Sept. 1931, Correspondence Re. Soybean Futures 1931, Archives of the Chicago Board of Trade, Box II.1.128, Folder 3091, Daley Library Special Collections, University of Illinois at Chicago (henceforth "Soybean Futures Correspondence 1931.")

[154] Fred Clutton, Chicago, to John E. Brennan, Chicago, 1 Oct. 1931 and responses, 5 and 18 Nov. 1931, Soybean Futures Correspondence 1931; Chicago Board of Trade Directors Meeting Minutes, 17 Nov. 1931, Directors Meeting Minutes 1931-1935, Archives of the Chicago Board of Trade, Box II.1.128, Folder 3091, Daley Library Special Collections, University of Illinois at Chicago (henceforth "Directors Meeting Minutes.")

[155] Other sources cite corn futures as a more important hedge, but with similar shortcomings. Forest Glen Warren, "Economic Significance of the Futures Market for Soybeans," Ph.D. Diss., University of Illinois, 1945, 70.

of periods, the movements of prices of these two types of products have not been sufficiently parallel" to make this creative hedging work. The bulletin outlined four conditions that a commodity needed to meet, however, before "hedging transactions could be successfully carried on." It must have a "fairly large annual commercial volume" which is "fairly well spread thruout the marketing year"; it must be "easily transferred from one marketing position to another" if "cornerings and congestions are to be avoided"; it must be "fairly free of entanglements and surprises where deliveries are made in pursuance of contracts"; and it must be "known and its value understood" by both the general public and specialized traders so that "it will attract investment and speculative buying and selling."[156] In other words, a large crop had to meet a large number of speculators willing to gamble on it. In the case of soybeans, these conditions did not exist in 1932; and in fact acreage of soybeans harvested for beans declined slightly from 1931 to 1932 and was stagnant in 1933.[157]

The Agricultural Adjustment Act (AAA) was passed in May 1933, too late for farmers to change their mix of crops that year. The AAA initially accomplished its goal of reducing the supply of certain basic commodities – which at first included only wheat, cotton, field corn, hogs, rice, tobacco and milk – through destruction, plowing under cotton and tobacco fields and slaughtering pigs. Contracts beginning in 1934 obliged farmers to reduce their acreage of these crops by a certain amount, usually with the proviso that they could not be diverted to other products except food for home

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[156] University of Illinois Agricultural Experiment Station, *Supply and Marketing of Soybeans and Soybean Products,* by C.L. Stewart, W.L. Burlison, L.J. Norton and O.L. Whalin, Bulletin 386 (Urbana, IL: University of Illinois, 1932), 529.

[157] Warren, 9.

consumption and soil-improving crops.[158] As the latter category included soybeans, farmers began planting them on former corn acres. In March 1935, for instance, an agent for a commission house reported that "the Stoddards, who have possibly 5000 acres scattered over Illinois are going to take the full 30 per cent reduction of corn acreage allowed by the Govt. and plant it all in soy beans. This idea is general."[159] Another observer noted somewhat acerbically that in "Illinois, Iowa, Indiana and Missouri, almost all of the acreage forced out of production of bread and feed grains" under the "AAA 'prosperity through scarcity' contracts" was planted in soybeans.[160] Other factors pushed farmers to plant soybeans in 1934 as well: the continued decline of demand for oats as farms mechanized;[161] the soybean's resistance both to dry conditions and to the chinch bug, which plagued both corn and oats;[162] and, above all, the growing demand for soybean oil, making soybeans not just a "soil-building" crop but a cash crop as well.

The increased demand for soybean oil was also created in part by federal policy. In the 1930s, two bitter adversaries – the butter lobby and the margarine interest – united momentarily to oppose a third product, "cooking compounds" that, although labeled as substitutes for lard, were the color and consistency of butter. Since 1902, a 10-cent per pound tax had applied to yellow margarine, forcing most producers to supply housewives with color to mix in by hand. In 1929, the law had expanded to define these new

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[158] Edwin G. Nourse, Joseph S. Davis, and John D. Black, *Three Years of the Agricultural Adjustment Administration* (Washington, D.C.: The Brookings Institution, 1937), 86, 89.
[159] Dean Dorhees, Fairbury, IL, to C.S. Beach, Chicago, 13 March 1935, Soybean Committee Materials 1935-36, Archives of the Chicago Board of Trade, Box III.937, Folder 5, Daley Library Special Collections, University of Illinois at Chicago (henceforth "Soybean Committee Materials 1935-36.")
[160] L.B. Breedlove, "Soybean - The Magic Plant, Article I: Picturing Its Multiple Industrial and Economic Possibilities," *Chicago Journal of Commerce and La Salle Street Journal*, 2 June 1936, 12.
[161] George H. Primmer, "United States Soybean Industry," *Economic Geography* 15 (April 1939): 205. Oats were not covered by the AAA, but oat acreage declined much more than corn acreage between 1929 to 1934: corn fell from 47.2 percent to 44.5 percent of Illinois acres, where oats fell from 22.3 to 14.8. Soybean Crop of Illinois 143.
[162] Dorhees to Beach, 13 March 1935, Soybean Committee Materials 1935-36.

compounds as margarine as well, at which point producers shifted to palm oil from Java, which they argued lent their products a "natural" yellow color without the use of dye. That loophole was closed in 1931. In 1935, all foreign oils were additionally subjected to a ten percent tariff (in addition to taxes levied by individual states).[163] After this, domestic oils, mainly cottonseed but a growing quantity of domestic soybean as well, dominated the margarine market.[164] Whereas the AAA "prosperity through scarcity" policies were anathema to the likes of Henry Ford and others in the chemurgy movement – the resulting growth of soybeans being proof that the entrepreneurial energies of farmers would always find an outlet – they were generally supportive of protectionist tariffs which fostered self-sufficiency in key resources. Still, it was arguably anti-market legislation that bolstered a free market in soybeans.

From 1933 to 1934, harvested acres of soybeans jumped nationally from 847,000 to over 1.1 million acres, and the amount of beans harvested increased even more markedly from under 12 million to almost 18 million bushels.[165] The increase in Illinois was particularly dramatic: from 4 million bushels in 1933 to 11 million bushels in 1934. The trend was durable, as production again doubled in 1935 to 22 million bushels.[166] Moreover, a larger percentage of the beans harvested were crushed rather than sold for seed: from 30 percent in 1930, to 40 percent in 1934, to almost 70 percent in 1936.[167]

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[163] Arthur Evans, "Processing Tax Sought by Dixie on Foreign Oils," *Chicago Daily Tribune,* 29 Oct. 1933, 9; "Hearing on Oleo Is Attended by Groups of the Farm Interest," *Oshkosh (WI) Northwestern,* 16 May 1935, 3.
[164] George F. Deasy, "Geography of the United States Cottonseed Oil Industry," *Economic Geography* 17 (Oct. 1941): 351Ruth Dupré, "'If It's Yellow, It Must Be Butter': Margarine Regulation in North America Since 1886," *Journal of Economic History* 59 (June 1999): 360-61.
[165] Soybean Committee Report, 15 March 1935, Exhibit 3: Soybean Production Tables, Soybean Committee Materials 1935-36.
[166] Crompton, 142.
[167] George F. Deasy, "Geography of the United States Soybean-Oil Industry," *Journal of Geography* 40 (Jan. 1941): 2.

The Board of Trade took notice. In late 1934, it instituted cash trading in soybeans on the same terms as wheat, corn, oats, rye and barley.[168] And it once more appointed a committee to take up the question of futures trading in "Soya beans," again headed by McHenry.[169] In the early months of 1935, this committee sent out questionnaires to the largest handlers and crushers of soybeans and held a hearing that invited Board members to give "facts, figures and reasons for and against trading in soybeans." The hearing was poorly attended and the survey results mixed, leading the committee to recommend against soybean futures in its March 1935 report. The crux of its findings was that, even with the growth of the crop in 1934, there were still too few surplus beans in marketing channels.[170]

The McHenry committee sent questionnaires to, among others, Glidden, Staley, Purina, and Funk Bros. Seed Company. The survey asked ten questions, three about whether the futures or hedging market would be beneficial to specific groups: "producers" (farmers), "those engaged in storing and holding beans" (merchants and elevators), and "industries which process beans." They were also asked whether there was a "broad enough public knowledge and interest in soybeans on which to base a future market"; that is, would there be speculators? Some of the remaining questions were more specific about whether the recipients themselves would make use of soybean futures and whether, in the event that the contract ended with actual delivery of soybeans, whether they could either deliver or take delivery of the beans in Chicago.[171] The responses thus hinged largely on geography, despite the fact that futures normally did not involve the

[168] L.B. Breedlove, "Soybean - The Magic Plant, Article XIX: Trading in Futures Next Development in Perfecting Market Facilities," *Chicago Journal of Commerce and La Salle Street Journal*, 16 July 1936, 12.
[169] Chicago Board of Trade Directors Meeting Minutes, 4 Dec. 1934, Directors Meeting Minutes.
[170] Soybean Committee Report, 15 March 1935, Soybean Committee Materials 1935-36.
[171] Ibid., Exhibit No. 1: Questionnaire.

actual movement of grain. The fact that buyers could demand delivery meant that those with the best access to Chicago were the ones most in favor of futures.

The questionnaire to Glidden was forwarded directly to Adrian Joyce because, he said, “as President, I am most familiar with this particular subject.” He was unequivocally enthusiastic, indicating that Glidden would take advantage of futures, that “public knowledge and interest in the soy beans is growing very rapidly,” and that Glidden could deliver and take delivery in Chicago.[172] Archer-Daniels-Midland was similarly enthusiastic about their own use of the Chicago market, but mentioned that “it would be distinctly to [the] disadvantage” to most of the mills located in the heart of the soybean producing areas” to take delivery in Chicago.[173] Purina Mills, a poultry freed company based in St. Louis, was highly negative, on the other hand, emphasizing that speculators were “absolutely necessary for any futures market to function properly,” that speculation was “at about the lowest ebb it has been for many years,” and that “public knowledge of soybeans at the present time is extremely narrow.”[174] Funk Bros. was unenthusiastic, despite the idea for soybean futures having originated there years earlier: “we do not know much about the proposition,” wrote its representative, “and are not sufficiently well informed to express an intelligent opinion”; but he was certain that they would not take delivery in Chicago.[175] And A.E. Staley, answering for his company, while in favor of an eventual futures market, estimated that the crop would “have to be ten times its present

[172] Adrian Joyce, Cleveland, to Soybean Committee, Chicago, 23 Feb. 1935, Soybean Committee Materials 1935-36.

[173] Archer-Daniels-Midland Co., Minneapolis, to Soybean Committee, Chicago, 18 Feb. 1935, Soybean Committee Materials 1935-36.

[174] J.H. Caldwell, St. Louis, to Soybean Committee, Chicago, 11 March 1935, Soybean Committee Materials 1935-36.

[175] H.H. Miller, Bloomington, IL, to Soybean Committee, Chicago, 19 Feb. 1935, Soybean Committee Materials 1935-36 .

size" before there would be enough beans in circulation to "prevent an absolute corner being created." Moreover, he insisted that delivery to Chicago, on the northern fringe of soybean country, would be as "impracticable as for a Minneapolis wheat miller to take delivery at Buffalo." The only really satisfactory delivery point was his own base of Decatur.[176]

The response from commission house Beach, Wickham & Co., whose agent had reported that many farmers were diverting from corn and oats to soybeans, was nonetheless negative, as the growth in the crop had failed to produce a large marketable surplus. The reason for this presaged the doubling of the crop in 1935, however: farmers were saving or selling the beans for seed.[177] The explosive growth in 1935 enabled by those seeds meant that, less than a year after McHenry's committee issued its report, Board President Robert Boyland appointed a Special Soybean Committee, with all new personnel, in January 1936.[178] It was headed by Austin Sturtevant, of the commission house Bartlett Frazier Co. – and, incidentally, the newly appointed chair of the soybean committee of the National Grain & Feed Dealer's Association, based in St. Louis – and Sturtevant in turn appointed fifteen committee members who represented "the different interests in the soy bean trade." Of their firms, five were commission agents, eight operated terminal elevators, three crushed beans, six received beans, and six engaged in floor trading (with most of the firms combining two or more of these roles).[179] The investigation of this committee was much more expansive than that of the prior year: it

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[176] A.E. Staley, Jr., Decatur, IL, to Soybean Committee, Chicago, 14 Feb., 1935, Soybean Committee Materials 1935-36.
[177] E.H.G., Pontiac, IL, to Beach, Wickham & Co., Chicago, Soybean Committee Materials 1935-36.
[178] Approval of Soybean Committee, 28 Jan. 1936, Soybean Committee Materials 1935-36.
[179] Austin Sturtevant, Chicago, to Robert P. Boylan, Chicago, 27 Jan. 1936, Soybean Committee Materials 1935-36.

sent out 1,500 questionnaires to country shippers, of which 384 came back with signatures; and it held four different hearings between April and June, each getting feedback from a different group.[180]

Of the 384 questionnaires, 331 (or 87 percent) were in favor of establishing a futures market. A similar consensus held at the four meetings. Fifteen terminal elevator operators, operating mainly in Chicago, attended the first hearing and reassured the committee that large quantities of soybeans were being stored in Chicago, that "soybeans are no more difficult or dangerous to store, handle, dry, etc., than other grains" and that "there are no special dangers or problems inherent in handling soybeans." At the second meeting, representatives from fourteen of the largest cash-grain receiving houses informed the committee that "the country" – that is, grain dealers in the countryside – "favored establishing a market" and that "a futures market should increase the cash soybean business in Chicago." At the last meeting, the principal officers of several large commission houses related that they had received many inquiries about a soybean futures market, including from exporters and "users abroad" at a time when demand from Europe was spiking. Thus the prospects seemed good that, if offered, soybean futures would find a market among both hedgers and speculators.[181]

The only group to express some reservations (at the third hearing in May) were eight processors – including six of the largest crushers – who indicated that, as late as March of that year, most processors had been against the idea. And while they were now for soybean futures in principle as a valuable hedging tool, they were still divided as to

[180] Second Draft of Report, 18 Aug. 1936, Soybean Committee Records 1936, Archives of the Chicago Board of Trade, Box IV.16.599, Folders 1-3, Daley Library Special Collections, University of Illinois at Chicago (henceforth "Soybean Committee Records 1936.")
[181] Ibid.

whether they should be offered immediately or at some later, unspecified date.[182] Their hesitancy may have been rooted in lingering concerns over corners. Unlike grain dealers, they used soybeans as a raw material, and an artificial run-up in prices could hurt their bottom lines; on the other hand, prices typically dropped sharply following a corner, allowing processors to recover their losses. Their opposition more likely reflected their unique position in the market, as the ones who made the first split of soybeans into products of higher value. This ability helped mitigate their price risk, lessening their need for a futures market and also giving them a strategic advantage in their dealings with farmers. When the glut of beans hit the market following the harvest, the processors were often the beneficiaries of low prices. They feared that futures, by enabling others to store beans with less risk, would ultimately lower their profits.[183] By March, it seems that most concluded that a robust futures market would be more to their advantage than disadvantage – but some still wanted to delay its implementation until after that year's harvest, with its windfall for crushers.

Overall, the consensus was in favor of an immediate futures market, and this is what the Special Soybean Committee recommended in the report it delivered to the Directors in August. The committee made a number of other recommendations as well: that, the desire of some processors notwithstanding, Chicago be the only delivery point for futures contracts; that the unit of trading be 1,000 bushels; and that the contract price refer to #2 Yellow Beans while allowing #3 Yellow Beans to be delivered in their place at a 2-cent discount; and, finally, with respect to other matters, that the soybean contract conform to

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[182] Ibid.
[183] Warren, 72.

the contract for corn futures.[184] The Directors accepted these recommendations – although soybeans would be traded in both 1,000-bushel "job lots" and 5,000-bushel "round lots," just like corn[185] – and notified Board members of the October ballot. The membership also voted on a rule change that included soybeans in the list of commodities covered by trading limits: soybean, like corn, futures could not be traded for more than 4 cents per bushel above or below the previous day's closing price.[186] The membership had already voted in July to include soybeans in the "to-arrive rule" that prohibited Board members from overbidding the "last posted" market price.[187] In short, individual transactions between buyers and sellers, for both cash soybeans and futures, were strictly tied to the prices established by the collective market, achieving the transformation of the soybean's value, like the soybean itself, into a bulk commodity.

Trading in soybean futures began modestly. In 1937 it amounted to under 30 million bushels, compared to the 2.5 billion bushels of corn and almost 11 billion bushels of wheat futures. During 1940, stimulated by the outbreak of war in Europe, trading had expanded to 135 million bushels, even as trade in other futures had shrunk in the wake of federal price supports. Only 784 million bushels of corn and 3.8 billion bushels of wheat futures traded in 1941, when the trade in soybean futures mushroomed to almost a billion bushels.[188] This shift made it necessary in 1939 for the Board to build a new soybean pit on the trading floor, where previously traders had "been dealing in the beans near the

[184] Second Draft of Report, 18 Aug. 1936, Soybean Committee Records 1936.
[185] "Pit Starts Soy Bean Futures Trading Monday," *Chicago Daily Tribune*, 3 Oct. 1936, 31. In addition to hedgers and speculators, a third type of trader, "spreaders," took advantage of arbitrage opportunities, including anomalies between the prices of job lots and round lots. Warren, 78.
[186] Amendment to Rule 1823, 21-23 Sept. 1936, Archives of the Chicago Board of Trade, Box II.2.139, Folder 3337, Daley Library Special Collections, University of Illinois at Chicago.
[187] Proposed Amendment to Rules, 2 July 1936, Archives of the Chicago Board of Trade, Box I.1.18, Folder 16/26, Daley Library Special Collections, University of Illinois at Chicago.
[188] Warren, 85.

corn pit at considerable inconvenience";[189] the rising status of soybeans was confirmed when later the Board switched the pits assigned to corn and soybeans.[190] And this expanding market in soybean futures seemed to perform its intended role, allowing grain handlers to hedge their risk in the absence of government price supports. An analysis by the Commodity Exchange Authority of one day of trading, May 14, 1940, indicated that hedgers traded mostly with speculators, not other hedgers. Hedgers, moreover, bought more futures (369,000 bushels) than they sold (127,000 bushels). Every buyer was able to find a seller only because of the activity of speculators, from whom hedgers bought 348,000 bushels and to whom they sold 106,000 bushels worth of futures. The speculators, in turn, traded mainly among themselves: hedging transactions made up less than a third of all trades .[191] The ability of handlers to lower their risks – ultimately at the expense of whichever speculators were on the losing end of trades – allowed them to lower their costs.[192]

For all its success, the futures market in soybeans at the Chicago Board of Trade ended, at least for the duration of the war, in February 1943. Government price controls on soybeans in 1942 had already caused a collapse in trading from almost a billion bushels to less than 200 million. On February 18, 1943, the USDA issued an order directly restricting the trade in soybean futures, compelling the Board of Trade to suspend the market entirely.[193] Thus the war that had bolstered soybean futures eventually undermined them, adding to the unpredictable effects that the wartime emergency had on

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[189] "Board of Trade Pit Ordered for Dealing in Soy Bean Futures," *Chicago Daily Tribune,* 14 Dec. 1939, 43.
[190] Warren, 86.
[191] Ibid., 103.
[192] For example, the difference in price between a bushel of soybeans and the products – oil and meal – made from that bushel dropped in the late 1930s, indicating lower costs of handling. This may have been in part because of the futures market. Warren, 44.
[193] Ibid., 85.

the dreams of the 1930s: killing Ford's dream of a plastic car, creating a market for Glidden's Alpha Protein. But while the soybean would again emerge after the war as a "free market" crop, the idea of the chemurgy movement and Julian alike – that the future of the soybean lay in nonfood uses – was not fulfilled. Its use of soybean protein as a foaming agent notwithstanding, the war would reinforce the actual trend of the Depression years: the increasing presence of soybeans in the American diet.

The Missionary

In 1936, on one of his furloughs from the Shanghai Sanitarium, Harry Miller ventured one day to the U.S. patent office in the company of his attorney. He carried several samples of soy milk, some canned as a liquid and others converted into a powder. He had submitted a patent application at the end of 1935 for a "process of making vegetable milk," and matters had progressed to the point of a face-to-face meeting with the examiner, typically an indication that there were issues with the patent that needed to be clarified or resolved. As Miller later recounted in a promotional brochure, he went before the "commissioner of patents," who assured him "that there were many patents on making a milk out of the soy bean and that as far as he knew none had ever netted their originator very large returns." Invited to respond, Miller countered that no other patent "gives a method for debittering the soy bean" and making the soy milk palatable. The commissioner and his expert taster "admitted having tasted many soy products, and this was the first time there had come to them a truly debittered soya milk." Miller's lawyer was confident at that point "that the case was won" and Patent Number 2,078,962 was issued in May 1937.[194] The patent commissioner was not alone, however, in voicing skepticism about Miller's sideline in soy milk. As he later recalled, some of his colleagues "thought I was out for a losing game, that this would never get anywhere," and they "began to criticize me [for] wasting valuable time working with the soybean."[195] Miller was not easy to discourage, however, and the challenge presented by the soybean seemed to spur him on. What underlay his determination to devise a substitute for liquid milk – increasingly venerated in America as a wholesome, nearly perfect food – was a combination of factors: circumstances in the Chinese mission field, religious convictions about diet and God's providence, and undoubtedly a fair amount of ambition, both for himself and for his church.

It was true that during these years Miller was a man who hardly seemed in need of a time-consuming sideline. He was overseeing the remarkable growth of Adventist medical work in China and the rest of the Far East Division while helping to fund it with fees from his busy surgical practice. He was charged in 1925 with opening a hospital in Shanghai, and he was determined to replicate the Washington Sanitarium, which he had done so much to build up. Here again he met with some skepticism from fellow Adventists, who counseled that this vision was too grand, that among the poor people of China something along the lines of small dispensaries was more appropriate.[196] He was not deterred, and set about deploying the techniques he had learned over the previous twelve years. In addition to $10,000 from the church's Board, he garnered a pledge of $20,000 from Henry Harrower, a pioneering endocrinologist in Los Angeles who had

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[194] Harry W. Miller, *The Story of Soya Milk* (Mt. Vernon, OH: International Nutrition Laboratory, 1941), 22.
[195] Harry W. Miller, typewritten memoir transcribed from voice recordings, ca. 1958, Department of Archives and Special Collections, Del E. Webb Memorial Library, Loma Linda University, Loma Linda, CA, 255 (henceforth "Miller Memoir.")
[196] Ibid., 168.

been trained at the Battle Creek Medical College.[197] In Shanghai, he set up his surgical practice and a small hospital in rented space. He was leaving the U.S. just as Morton was iodizing its salt on a national scale, helping to prevent goiters thereafter, but there would be abundant demand for Miller's skills in Asia for decades to come. Word spread rapidly that a specialist in thyroid surgery, who might be expected to ply his lucrative trade in better-paying regions, was in China. Because he was medical secretary for the Far East Division, which included Japan and the Philippines, he also traveled regularly to Manila, where – after becoming licensed by taking a grueling exam some twenty-five years after leaving medical school – he also earned surgical fee which he plowed into the construction of a fifty-bed sanitarium on the outskirts of Shanghai which opened its doors in 1928.

As with the Battle Creek and Washington Sanitariums, the Shanghai establishment soon drew a clientele of well-to-do, in particular the generals and other high officials of the Nationalist government in Nanking. Madame Chiang Kai-shek – wife of the Generalissimo and the most powerful and fashionable lady in China – became a regular visitor, in particular for weight-loss steam treatments. While Miller had charged on a sliding scale in Washington, in China he kept his fees low for even his wealthy patients: in part, this was because he was a missionary in China, and mission hospitals should not be seen as gouging the local population. In part, this was in deference to Chinese sensibilities. Madame Chiang Kai-shek in particular was known to get furious when charged more than the going rate. When Miller performed an appendectomy on her, he therefore billed her $200; before she returned to Nanking, she handed him a stack of

[197] Ibid., 153. Harrower was rather controversial at the time for prescribing the oral ingestion of homeopathic doses of ground animal organs, his background in vegetarian Adventism notwithstanding.

Chinese money worth $3,000. He found, in general, that wealthy Chinese, once treated fairly, would give large gifts along these lines.[198] And thus he was able to fund the Shanghai Clinic, a 200-bed hospital for the poor in the middle of the city. Among Miller's staunchest patrons was Zhang Xueliang, the Little Marshal of Manchuria whose father, the Old Marshal, was assassinated by the Japanese in 1928. When two Adventist ladies solicited funding for medical work in Manchuria, he spontaneously offered $100,000 to establish a sanitarium in Mukden, his capital; Miller traveled to Mukden to meet with him personally. Madame Chiang Kai-shek's pressure may have prompted the offer, but the Little Marshal was also addicted to opiates and seemed to think that he might find a cure at an Adventist sanitarium.

As it happened, the Little Marshal was forced to flee Mukden in 1931 when the Japanese invaded, and he subsequently lost control of Jehol province, surrounding Peking, as well. (Remarkably, the Adventists were able to recover the funds he had left in a bank for them to finish construction of the sanitarium.) He fell out of favor with the Generalissimo and retreated into drug addiction in Shanghai. His advisor, the Australian W.H. Donald – a former newspaperman influential in Nationalist circles[199] – arranged for Miller to cure Zhang and his two wives' of their addiction. Miller, who had assisted at the Lifeboat Mission in Chicago decades earlier and was familiar with the power of opiates, reluctantly accepted the job, provided that he be given full power over the Little Marshal and his household, an arrangement whose wisdom was proven when Zhang, in the throes of withdrawal, commanded that Miller be shot. The Little Marshal kicked his habit and went on to become an important general under Chiang Kai-shek until he

[198] Miller Memoir, 173.
[199] He was styled "Donald of China" by his biographer.

kidnapped the Generalissimo for two weeks in 1936 to compel him to unite with the Communists against the Japanese at a time when Mao Zedong and his followers might very well have been crushed by Nationalist forces.[200] Zhang was subsequently imprisoned for most of the remainder of his life, but prior to this, he helped establish Adventist sanitaria wherever he lived and gave Miller, who eventually became the President of the China Division – in addition to being Medical Secretary and head of the Shanghai Sanitarium – use of his private plane and pilot to travel throughout China. Ultimately, with great effort and through patrons such as Zhang, Miller was able to oversee the establishment of fourteen Adventist medical institutions in China, as well as sanitariums in Japan and the Philippines.[201]

And in the midst of this frenetic activity, Miller developed his soy milk. This had its origin in a number of practical concerns. The nursing school at the Shanghai Sanitarium, established even before the sanitarium itself in order to train its staff, eventually drew students from throughout the Far East Division. They spoke diverse regional dialects and languages, which the school addressed by teaching them all English. They also were accustomed to a diverse array of regional cuisines, but, noting that many of the students were thin and emaciated, Miller gravitated toward a "universal diet" of wheat bread and milk reminiscent of his own diet when he was a medical student at Battle Creek.[202] Animal milk, however, was scarce and expensive to come by. This was one impetus to

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[200] Jonathan Fenby, *Generalissimo: Chiang Kai-shek and the China He Lost* (London: The Free Press, 2003), 13.

[201] Harry Miller, M.D., transcription of taped interview by Keld J. Reynolds, 3 August 1972, Department of Archives and Special Collections, Del E. Webb Memorial Library, Loma Linda University, Loma Linda, CA.

[202] As he had in Washington, Miller took pains to serve excellent food to the paying clientele, in this instance dishes inspired by vegetarian chefs at Buddhist temples that his cook, Ed Meister, observed long enough to learn how to imitate, as they did not follow explicit recipes. They typically used tofu and yuba, layered and pressed to approximate the texture of meat. Miller Memoir, 165-66.

the development of soy milk. And, indeed, when the school began serving the universal diet with milk provided by a small production unit, Miller found that "every class that came in made a very substantial gain in weight and also the physical ability to carry on the strenuous work of nursing" which included administering massage treatments.[203] He felt that a reliable supply of milk would also benefit the sanitarium and hospital's child wards and baby clinics, where they held newborns and orphans "sometimes quite a while." In later decades, when kwashiorkor was a well-publicized problem, he recounted that he noticed the phenomenon in the 1920s: children would frequently die as soon when they stopped maternal nursing, often when the next sibling came along, because of a lack of adequate weaning foods. Soybean milk, when not curdled into tofu, was not customarily used this way: rather, it was served as a hot spiced breakfast soup or as a warm, unsweetened beverage.[204] And for Miller, whose goal was to fatten up nurses and infants, it was deficient in both sugars and fats when compared to either mother's or cow's milk, as well as having a bitter taste and tendency to cause intestinal discomfort that made it difficult to consume in large amounts.[205]

Miller set about remedying these problems in an incremental, experimental fashion, incorporating new technologies into the process as he crossed their paths. His first attempts involved little more than adding sugar to it, which covered up the bitter taste but did not help make it more digestible. At one point, having consulted agricultural experiment station bulletins which showed that soy protein was absorbed better by animals, and that other digestive problems disappeared, if soybeans were cooked under pressure, he experimented with cooking his soy milk longer than was customary in

[203] Ibid, 164.
[204] William Shurtleff, "Dr. Harry Miller: Taking Soymilk Around the World," *Soyfoods* 1 (Winter 1981): 31.
[205] Miller Memoir, 252.

China, where overcoming these problems instead by making it into tofu helped conserve scarce fuel.[206] On the other hand, according to A.A. Horvath, a Russian chemist who worked for the Chinese government, much of the commercial soy milk sold in China at this time suffered from the opposite problem: it was a byproduct of yuba making, whereby skins forming on boiling soy milk were successively skimmed and dried, leaving the remaining milk with a burnt flavor in place of a bitter one and with even less fat.[207] In any case, Miller found that more prolonged cooking resulted in better digestion and less gas, although the off flavors and nutritional deficiencies remained.

A breakthrough occurred when he was on a ship returning to China from a furlough. Whether through greater experience on the seas – he would ultimately cross the Pacific nineteen times by boat, and the Atlantic three times – or through improvements in ocean travel, he seems to have conquered his seasickness. He took an active interest in shipboard food and was often disappointed with the quality of the milk which, unless it was thin and watery, spoiled quickly; usually they resorted to canned cream and Pet or Carnation milk. On this voyage, however, fresh cream and whole milk continued to be available. Miller discussed this with the steward, who showed him the small homogenizer with which they reconstituted dry skim milk with water and melted butter, added in varying amounts to produce milk or cream. Miller realized that by similar means he could add any amount of any oil to his soy milk and not have it separate out. To this end, he purchased a colloid mill, which broke up particles in a liquid so that they would remain in suspension, from a New Jersey inventor and used it to incorporate

[206] Miller, *Story of Soya Milk,* 20.
[207] A.A. Horvath, *The Soybean as Human Food* (Shanghai: Bureau of Industrial and Commercial Information, Ministry of Industry, Commerce and Labor, National Government of the Republic of China, 1927), 62.

several pounds of “cereal sugar” and vegetable oil, together with a small amount of salt, into his milk.[208]

Generally speaking, there were two ways to initially split the soybean: into fibrous pulp and milk or into meal and oil. The first was more typical of the East, which used the milk to produce tofu, while the latter was more widespread in the West, although Manchuria had long separated meal, used for fertilizer, from oil, used mainly for non-edible purposes. Miller was now combining fractions from these two splits: milk and oil. This idea was not original with him. In 1916, British inventor William Melhuish received a U.S. patent for a process that centrifuged the soy milk to remove the oil, which he identified as the source of objectionable tastes, and then homogenized the milk with a more palatable oil, such as sesame, in proportions that approximated cow’s milk; Seattle inventor Albert Moses obtained a patent in 1920 for a similar process (both also added sugar).[209] (Nor was this concept unique to soy milk: the dairy industry perceived so-called “filled milk,” skim cow’s milk homogenized with vegetable oil, as a fraud on par with yellow margarine.)[210] But Miller’s aim was not to replace his soy milk’s natural oil, which he considered wholesome, but to supplement it. But retaining the oil, and in fact augmenting the oil content, retained the bitter and beany tastes that Melhuish and Moses were eager to eliminate, and there was still a tendency for babies fed soy milk to get diarrhea. As he would sometimes later tell the story, God intervened with the solution one

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[208] Miller Memoir, 254; Pierce Mason Travis, "Dispersion Mill," U.S. Patent 1851071, 29 March 1932 (filed 30 June 1923).; Harry Willis Miller, "Process of Making Vegetable Milk," U.S. Patent 2078962, 4 May 1937 (filed 3 Dec. 1935).

[209] William J. Melhuish, "Manufacture of Vegetable Milk and Its Derivatives," U.S. Patent 1175467, 14 March 1916 (filed 1 June 1914); Albert Barnes Moses, "Process of Making a Substitute for Milk," U.S. Patent 1332562, 20 Mar. 1920 (filed 19 May 1919).

[210] In general, dairy interests preferred using skim milk, a waste product, along the industrial lines advocated by the Chemurgy movement rather than in edible competitors.

day as he was working in the kitchen with soybean slurry, prior to straining out the okara: "I heard a divine voice behind me that said, 'Why don't you cook it longer with live steam?'"[211]

In other tellings, there were more worldly inspirations for this step. In the refining of vegetable oils, including soybean oil, steam was commonly forced through the oil to deodorize it. The advantage of steam was that, as it mixed turbulently with the oil, it lowered the temperature at which numerous volatile organic chemicals would evaporate, allowing them to dissipate as fumes or be carried off by the steam itself.[212] Thus more of the substances responsible for off tastes and smells were eliminated without cooking the oil. Soybean flour and meal were similarly "toasted" with steam to improve their flavor, and the technique could even be applied to whole soybeans. Miller saw this in action not in soybean oil refining, as it happened, but in coconut oil refining during one of his trips to the Philippines, where he toured a copra processing plant and discovered that, while a mass of dried copra "smelled like a slaughterhouse," steam distillation removed the disagreeable odors from the oil. "This was a thought to me so I came back and began to process our soy milk more," resulting in a "bland liquid."[213] He had a ready supply of steam, as steam treatments were a regular part of the sanitarium's regimen. He did not mention steam in his U.S. patent application, writing instead that the slurry should "be placed in a suitable kettle and stirred or agitated while being heated to the boiling point," and likewise that, after being strained and supplemented with additional oil and sugar, "the mixture is then heated to a boiling point and during this heating and cooking the

[211] Shurtleff, "Miller," 30.
[212] For this reason, steam distillation is often used to recover volatile organic chemicals for use in perfumes, etc., without destroying them with excess heat.
[213] Miller Memoir, 256.

fluid is agitated . . . for a period of time to cause the entire taste of the milk to be changed from a beany flavor to what may be termed a 'nutty' flavor."[214] In practice, it seems that he was already using steam to "agitate" the fluid and reach a boiling point at a lower temperature to prevent a burnt taste. In his retrospective accounts, he never specified the source of the oil he added to the milk, or whether it was crude or refined, both presumably available from Manchuria, but even if he used crude oil, he essentially deodorized it within the milk before sending it through the homogenizer.

By the time Miller returned to China from his furlough in 1936, having made the case to the U.S. patent office for his soy milk, his vision for soy milk had expanded beyond simply meeting the practical needs of the Adventists' sanitariums and hospitals. In 1932, he had established the Vetose Nutritional Laboratory, and in 1935-36 he carried out feeding tests in which he fed hundreds of small children at the Shanghai Clinic his formulated soy milk – in some cases, as the sole food for six months starting from birth – with control groups consuming cow's milk and various American and European baby foods. Results were printed in the English-language *Chinese Medical Journal* in April 1936 which showed, according to Miller, that "soy bean milk was second only to mother's milk in the feeding of infants" from birth on.[215] To provide the milk more widely to residents of Shanghai, he and his oldest son, Willis (now 24), imported the equipment for a soy milk factory to be located within Shanghai and to produce Vetose Soya Milk. They had obtained an "in-bottle sterilizer" so that they could distribute milk that would keep indefinitely in bottles that were returned and reused. They set up delivery routes throughout Shanghai, covered by boys on bicycles pulling carts. They

[214] Miller, "Process of Making Vegetable Milk," 1.
[215] Miller, *Story of Soya Milk,* 25.

expanded their offerings to include chocolate milk and milk acidophilus-soured milk (for which J.H. Kellogg held the patent in the U.S.). Vetose was popular enough, with deliveries of 3,000 quarts and 4,000 half-pints per day, that they expanded the plant to include spray-drying equipment to produce a powdered milk that could be delivered throughout China. Thus Miller envisioned having an impact on childhood nutrition throughout China, providing an alternative for the majority of families too poor to afford dairy milk.[216] If Miller were trying to live up to the example of J.H. Kellogg, his checklist was now virtually complete (excepting Kellogg's popularity as a nutrition writer): Miller was a highly-respected specialist in a difficult and delicate surgery, he was a prolific founder of sanitariums, and he had invented what promised to be a popular and lucrative food product. He had done it all moreover while staying within the Adventist fold as a trailblazing missionary and talented administrator.

In August 1937, however, Japanese bombs began to undo Miller's work. Just eight months after it started production and in the midst of expansion, the Vetose factory was destroyed during a Japanese attack on Shanghai. Miller, by this time, was devoting his energies to constructing a sanitarium in Hankow, the "Chicago of China" further up the Yangtze River, but he soon found himself caring for 20,000 refugees on its grounds, doing his best to protect and feed them as the Japanese army took over the city. By the beginning of 1939, he was forced to evacuate China, the Shanghai Sanitarium by this time also having become a refugee center.[217] Not one to be long discouraged, Miller settled in Ohio and, earning money as a surgeon and taking a loan from his brother, purchased a farm near Mt. Vernon, where he had attended boarding school forty years

[216] Miller Memoir, 257; Miller, *Story of Soya Milk*, 24; Shurtleff, "Miller," 30. This was before "lactose intolerance" was recognized as a condition limiting dairy consumption among the Chinese.
[217] Miller, *Story of Soya Milk*, 26.

earlier. He had decided to focus on his sideline, founding the International Nutrition Laboratory and building a factory out of bricks salvaged, truckload by truckload, from a recently demolished local high school. His son Willis had returned to the U.S. following the bombing of the Shanghai factory, establishing Miller's Soy Foods first in Utica, New York, and then in Washington, D.C. He now joined his father, bringing his equipment. (Miller's younger son, Clarence, would also leave his job in Washington to join the family business, eventually becoming its treasurer and accountant.) Willis had produced wheat-gluten cutlets for an Adventist and health-food market, and this was the mainstay of the Mt. Vernon business until they were able to buy a spray dryer, after which they exported tinned soy milk powder to the Philippines and the Shanghai International Settlement, which had not yet been invaded.[218] When these outlets were cut off by the Pacific War, Miller was faced with a somewhat unexpected challenge: selling soy milk to the American public.

In this case, the pitch was not to bring the benefits of milk to a region that could not afford it, as with China, but to prove the superiority of soy milk over cow's milk where the latter was held in high regard. In a 1942 pamphlet issued by the International Nutrition Laboratory, *The Story of Soya Milk*, Miller took several tacks to promote his product. He cited its low cost, made possible by the efficiency of its production: echoing Ford, he urged that "nothing is perhaps more spectacular than to watch this milky bean juice being converted into a palatable, readily digested milk . . . in quantities as much as is often secured from the aggregate milkings of several thousands of cows." To this end, his factory in Mt. Vernon had its stainless steel cookers, vacuum pans, grinders,

[218] Miller Memoir, 258-59.

centrifuges, spray dryers and sterilizers arranged in a series so that soaked beans started at one end and came out the other as a dehydrated powder ready for tinning in air-tight cans. He emphasized that it had a "definite standard formula" which could always be maintained. He also emphasized the hygienic virtue of "a colloid milk bacteria free, being made from the things the cow eats yet not passing thru her body but instead made in a sanitary laboratory."[219] But the timing was not good for these arguments: incomes, and fluid milk consumption, soon rose during wartime; milk meanwhile was now universally pasteurized and tubercular cows culled from dairy herds.

Beyond sanitary considerations, Miller also made a more positive case for the healthfulness of soy milk rooted in the vitalism that underlay Adventist nutritional doctrine. In the nineteenth century, vitalists argued that life force, and the process that converted food into living tissue, could not be reduced to mere chemistry. Miller actually pushed back against this notion when dairy milk was presented as having a mysterious vital quality imbued by the cow's body. "A milk without a cow caused by colleagues to shake their heads and question, you might make something that looks like milk, but will it have those living properties that fits the requirement[s] of a growing life?" He reminded these putative colleagues that, until recently, vitamins were also assumed to "living principles that evaded analysis," but now were encompassed by chemical formulas and readily synthesized. But core vitalist concerns remained at the center of Miller's arguments. One was that food be digestible, in the sense of draining a minimum of energy in its conversion to living tissue: Miller emphasized that while a calf's four stomachs could handle the "heavy curd of cow's milk," infants had trouble fully

[219] Miller, *Story of Soya Milk*, 28-29, 33.

assimilating its protein. Soy protein, which contained “all of the amino acids [of] known value in human nutrition” and was fully substitutable for milk and eggs, was more easily digested; in fact, unlike animal protein, it became more digestible and available the more it was processed.[220] Miller also echoed J.H. Kellogg’s focus on the vitality of the intestinal tract, the place where inert food was transformed: cow’s milk was constipating “because of its acid reaction and bacteria-growing character.” Miller’s soy milk was, by contrast, “a definitely alkalinizing food” – of value in treating arthritis, ulcers or intestinal diseases like the sprue that took Miller’s first wife – and, when soured by acidophilus cultures, “of known therapeutic value in intestinal disturbances.”[221]

Like many of the steps in his process for making soy milk, these arguments were not entirely original. During the 1930s, a number of other Adventists – as well as J.H. Kellogg, no longer an Adventist – had taken up the cause of soy milk. The Adventist tradition did not offer a clear message about cow’s milk. Sylvester Graham had considered dairy products, butter in particular, as little better than meat, though he did not rule out fresh milk or mild, unaged cheese. Russell Trall, a water cure advocate turned Adventist influential for a time in Ellen White’s circle, argued against all animal products, including milk. White herself vacillated over the years – often ruling out butter, sometimes ruling out eggs, and infrequently ruling out fresh milk as well – but stating in 1902 that “milk, eggs and butter should not be classed with flesh-meat.”[222] In practice, dairy and egg products were a mainstay of the sanitarium diet. As early as 1903, on the other hand, J.H. Kellogg argued that cow’s milk, forming “large, tough

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[220] Ibid., 12-13, 32-34, 20.
[221] Ibid., 33.
[222] Ronald L. Numbers, *Prophetess of Health: Ellen G. White and the Origins of Seventh-day Adventist Health Reform* (Knoxville: University of Tennessee Press, 1992), 175.

curds," was adapted to a digestive apparatus intended for grass, twigs and leaves; and that, given the risk of harmful germs, a preferable alternative was "milk or cream made from crushed nuts," almonds in particular.[223] By 1916, he was praising "milk fresh from the bovine font, with its rich store of vitamines and enzymes" and "the finest quality of protein for brain and muscle building," but he still cautioned that when "swallowed rapidly as a beverage," it formed large, hard curds in the stomach; he urged that it be sipped slowly and "chewed" instead.[224]

If he had modified his opposition to fresh milk, Kellogg was unequivocally in favor of soured milk, shown by Metchnikoff to provide the intestine with beneficial bacteria that crowded out putrefactive bacteria.[225] This turned out to be the key to Kellogg's conversion to soy milk. His initial interest in the soybean was in using soy flour in diabetic regimens, a practice increasingly common in Europe. His enthusiasm for the soybean grew during the 1920s, but he had reservations about its taste. This was not only improved to something rather tangy by culturing, but he found that his preferred bacteria, *L. acidophilus*, grew much more readily and vigorously in soy milk than in cow's milk, with five to ten times more organisms per unit volume in the former.[226] He reported in 1935 that the Dionne Quintuplets had successfully recovered from bowel troubles after their attending physician treated them with Kellogg's acidophilus soy milk, and by 1936

[223] J.H. Kellogg, *The Living Temple* (Battle Creek, MI: Good Health Publishing Company, 1903), 149, 159.
[224] J.H. Kellogg, "Be Sure to Chew Your Milk," *Washington Post*, 8 Oct. 1916, ES4.
[225] Elmer Vernon McCollum, *A History of Nutrition: The Sequences of Ideas in Nutrition Investigation* (Cambridge, MA: The Riverside Press, 1957), 167.
[226] John Harvey Kellogg, "Method of Making Acidophilus Milk," U.S. Patent 1982994, 4 Dec. 1934 (filed 14 June 1933); Soyinfo Center, "Dr. John Harvey Kellogg and Battle Creek Foods: Work with Soy - A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/john_kellogg_and_battle_creek_foods.php.

both Battle Creek Foods and Miller's Shanghai plant offered it for sale.[227] Even as it changed and adapted, vitalism retained its central insight: that healthy, living processes – whether in the form of life force or beneficial bacteria – could, if properly nurtured, displace disease. This insight also informed Miller's contention that soy milk, unlike cow's milk, was "alkanizing," shifting the pH balance of bodily fluids so that they were inhospitable to disease. Jethro Kloss, an Adventist in the American folk herbalist tradition – unlike the medically trained Kellogg and Miller – likewise argued in his 1939 book, *Back to Eden*, that the bloodstream, "if pure and alkaline, will dissolve and carry away all poisons." He considered the soybean "king of the beans," in part because "it is a fine alkaline food," and he used it in more than fifty recipes in his book.[228]

Strictly abjuring dairy products and eggs, Kloss also included two methods for making soy milk that were rather simpler than Miller's process: to "remove the soybean taste," he recommended simply changing the water a couple of times while boiling the beans, and then boiling the milk for twenty minutes after squeezing it from the pulp.[229] Although Kloss had earlier operated sanitariums in Wisconsin and Minnesota, and operated an Adventist food factory in Tennessee that later became part of Madison Foods, he did not produce soy milk commercially. But by the time Miller entered the field, other Adventist food companies did have soy milks on the market: La Sierra Foods in California, near Los Angeles, and Madison Foods in Tennessee both produced soy

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[227] William Shurtleff and Akiko Aoyagi, *History of Soy Yogurt, Soy Acidophilus Milk and Other Cultured Soymilks (1918-2012): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2012), 6.

[228] Back to Eden 160, 269. A food was considered alkaline or acid according to whether it shifted the body's pH in a given direction, not according to its own acidity or alkalinity, which helps explain Kloss's statement on page 68 that fruits' "natural acids are highly alkaline."

[229] Jethro Kloss, *Back to Eden: A Human Interest Story of Health and Restoration to Be Found in Herb, Root and Bark.* (Coalmont, TN: Longview Publishing House, 1939), 611.

milk as early as 1929.[230] While all promoted it in terms similar to Miller's – it was an economy food during the Depression, a sanitary alternative to cow's milk, a digestible and alkalinizing food – they found, as he would during World War II, that they supplied mainly a niche market of people, mainly babies, allergic to cow's milk. Miller produced two products, Soy-a-Malt for adults and Soyalac formulated for infant feeding. Even though he had mellowed the taste from "beany" to "nutty," however, American adults still objected that it did not taste like cow's milk, causing Miller to conclude "that it takes more than the scientific fact that a thing is good nutritionally to put it across." Infants did not mind the taste, and Miller sought the endorsement of the American Medical Association for Soyalac as fully the equivalent of cow's milk in infant feeding, an endorsement he only later received when he restricted his claim to use in infants allergic to dairy. During the war, however, his bestselling product was Miller's Cutlets, a meat substitute made with wheat gluten, with his canned green soybeans also doing a good business. [231]

In the postwar world, the fortunes of Miller's soy milk in Asia diverged from its narrow, albeit increasing, success as a non-dairy infant formula in the United States. Prior to the outbreak of war, Miller had trained a number of manufacturers in his process: Paul Sycip in Manila, whose factory he was helping to set up when the Japanese attacked the Philippines (yet another brush with war); and Adventist Howard Hoover, who set up a food factory in Canton in 1938, and who subsequently helped a Mr. K.S. Lo establish a similar plant in Hong Kong in 1940 which produced both plain and chocolate soy milk in

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[230] Soyinfo Center, "History of Soymilk and Dairy-like Soymilk Products - A Special Report on the History of Traditional Non-fermented Soyfoods - A Chapter from the Unpublished Manuscript, *History of Soybeans and Soyfoods: 1100 B.C. to the 1980s* by William Shurtleff and Akiko Aoyagi," last modified 2007, http://www.soyinfocenter.com/HSS/soymilk3.php.

[231] Shurtleff, "Miller," 32-33.

half-pint bottles. By the end of the war, the Manila plant had been ransacked and the Hong Kong company had gone bankrupt, but a foreman from Miller's Mt. Vernon factory reestablished the former in 1948, while the latter reopened in 1945 with a new product, Vitasoy. Marketed as a soft drink rather than a substitute for milk, it surpassed sales of Coca Cola by 1974 when it sold 150 million bottles a year.[232] Miller meanwhile sold his Mt. Vernon company in 1950, after the death of his second wife. Despite her failing health, they had returned to Shanghai in 1949 to resuscitate the sanitarium, only to have to evacuate again as the Communists swept into power. At this juncture, he wanted to devote more of his time to research. Worthington Foods, another Adventist company in Ohio, bought the recipes, trademarks, patents and equipment for his gluten meat analogs: Miller's Cutlets, Miller's Burger, Miller's Stew, Vege-Links, and similar products. He sold his soy milk factory to Loma Linda Foods at book value – they continued operations there to supply the Midwest – and moved his laboratory near their headquarters in Riverside, California. While Loma Linda had put out its own soy milk as early as 1936, Miller helped improve their formula for Soyagen, a fortified soy milk for adults. He subsequently divided his time between laboratory work in California and, with his third wife, traveling the world helping out at sanitariums and establishing soy milk plants. He helped his son set up a plant in Java in 1957 under the auspices of the World Health Organization that produced Saridele, a spray-dried soy milk; and, while heading up the Tokyo Sanitarium for seven months, he helped Japanese Adventists set up small plants which would spur the creation of a commercial soy milk industry in that country.[233]

[232] Ibid., 34.
[233] Ibid., 35.

As he refined his soy milk, Miller sought to eliminate the last vestiges of the beany taste that put off Western consumers. This turned out to be the work of decades, not just on the part of Miller, but on the part of numerous other researchers. But Miller kept faith, as did other Adventists, that the soybean was providential. He maintained that God designed human digestion for the vegetarian diet of Eden, and with the postdiluvian habit of meat-eating, human lifespans accordingly diminished from a thousand years to under a hundred. Although such Methuselan longevity may still be out of reach, Miller believed in the health benefits of directly eating vegetation, the ultimate source of nutrients available second-hand in meat.[234] With a growing global population and increasing world hunger, such a diet was increasingly imperative. Full nutrition, including sufficient protein, could be obtained through a combination of cereals – wheat, rye, barley, oats – nuts, and vegetables such as peas, string beans, spinach. People "don't need meat, don't need cow's milk." In fact, people "don't need the soybean," but it had the advantage of not only having "the highest percentage of protein . . . of anything produced in nature," but of being amenable to processing into "all of the products . . . that simulate the dairy products" such as milk, cheese, ice cream and desserts. . . . In other words, it has a much greater flexibility in building up the dietary and giving variety by combination with other foods than any other particular food in nature."[235] God had provided the means not only for an Edenic diet, but for a vegetable-based alternative to humans' postlapserian tastes. Such an alternative did not come without work, however, work that Miller retrospectively estimated as more important than his medical work – because it helped prevent disease – and which he felt was always guided by God's hand (or, in the case of using steam to

[234] Miller Memoir, 241-42.
[235] Ibid., 249-50.

deodorize his milk, God's voice). He later described this as "experimenting with the precepts of God" – indicating that the soybean's resistance to being transformed into a substitute milk was itself providential, an invitation for human participation in fulfilling God's promises – though he admitted that such a concept might make "some intellectuals wonder" if you had your "head screwed on straight."[236]

[236] Raymond S. Moore, *China Doctor: The Life Story of Harry Willis Miller* (New York: Harper & Brothers, 1961), 108.

Chapter 5: Wartime Substitute

During the 1930s, Henry Ford had generated a good deal of attention for the soybean as an industrial raw material, while soybean oil increasingly entered the American food chain in a fairly inconspicuous way. During the wartime emergency, the tension between publicity and hiddenness would play out within the realm of food. Nutrition reformers, grappling with a shortage of meat, saw an opportunity to put the American diet on a new, vegetable-based footing. Jeanette McCay and the New York State Emergency Food Commission issued pamphlets and bulletins extolling the soybean as a meat substitute, for instance, though their biggest publicity coup came with Governor Thomas Dewey's famous soybean luncheon and its ensuing national coverage in magazines such as *Life*. Her husband, the famous nutritionist Clive McCay, took a more mixed approach, on the one hand promoting soybean sprouts as fresh winter vegetables that could be grown from dried beans and developing an "open-formula" bread that listed its ingredients on a label, soy flour prominent among them. On the other hand, his bread was simultaneously an attempt to insert the protein – and other nutrients – into what people already ate in large amounts, rather than convince them to change their ways: enrichment in place of reform. Working for the Navy, he would take a similar approach to candy bars. As it turned out, the publicity died down after the war, while soybeans – soybean oil in particular – became a larger and largely unremarked upon part of the American diet. This too had its roots in the war, as Americans shifted from butter to margarine and as a researcher, Warren Goss, journeyed through Germany shortly after VE Day to find a remedy for what the former enemies of the U.S. called "Umschlag": the tendency for off flavors to emerge in processed soybean oil, thereby limiting its role as a salad oil and in margarine.

Finally, the most avid consumers of soy foods during the war years were themselves pushed to the margins, confined in camps but not free from the malicious publicity of hostile politicians and newspapers. As they had wherever they settled, the Japanese in America ultimately produced tofu for their own consumption, a feat that this time required overcoming a hostile physical environment and addressing the objectives of a rather less hostile bureaucracy. Whatever their other virtues, tofu, miso and shoyu were expressions of Japanese identity that – unlike language classes and Buddhist worship – were beneath the notice of a hostile public, as well as foods made primarily from an unrationed ingredient, as opposed to the foods that Americans cared about and accused the camps of hoarding to the point of causing shortages.

The Picture Bride

On December 7, 1941, Tsuru Yamauchi was tending her tofu shop on Aala Street with one of her sons. She was frying age when a taxi driver yelled, "Hey, don't you folks know? War came!" "Huh?" she responded in confused disbelief, and did not stop frying age despite the taxi driver's repeated insistences. Cars passed in a rush, and she later remembered seeing bombs dropping over Punchbowl crater. "We have to go home quickly!" she told her son. The family, including Shokin, who still worked on Sundays, gathered on the second floor of their rented house, from which they could see the smoke rising over Pearl Harbor. They huddled together, concealing themselves with blankets, until nightfall, telling the children not to move. Tsuru fretted about her business, which they had left hurriedly without having made room for the large order of rice that was scheduled to arrive the next day; she now worried that the order would not come at all, and they would be left without rice amidst the uncertainty of wartime.

As it happened, while rice was rationed, they managed to reopen the tofu shop after three weeks. And war created opportunity. With other foods in short supply, the tofu business was good; Japanese consumption of tofu typically varied inversely with their consumption of fish. In addition, taking advantage of a wartime ban on roadside noodle stands, in the afternoons they cleared away the tofu equipment and converted the space into a *saimin-ya*, or noodle shop, where they served cone sushi and barbecue meat. They stayed open on Sundays, when Filipino women and their children would come from the countryside to eat saimin; and they stayed open during the week until 6:00 p.m., despite having to start tofu work at 2:00 the next morning. Her establishment might be modest, but Tsuru was a hard-driven businesswoman: "We cannot relax," she told her children. "We might not have this kind of chance again. For now, even if others may relax, we have to be diligent."[1]

Yamauchi had only entered the tofu business a little over a year before the bombing of Pearl Harbor, in July 1940. Prior to that, she worked to support her children – she ultimately had six – at a variety of menial jobs. In 1923, when she and her husband moved to Honolulu, both found jobs at the Honolulu Military Academy, where she helped "bathe, feed, and take care" of the 80 to 100 primarily white children who attended; both she and her husband mainly worked in the kitchen. They worked every day including Sunday, when they would get a half-day off after lunch. They stayed

[1] Tsuru Yamauchi, interview by Michiko Kodama, ed. Marie Hara, trans. Sandra Iha and Robin Fukijawa, in *Uchinanchu: A History of Okinawans in Hawaii* (Honolulu: Ethnic Studies Oral History Project, Ethnic Studies Program, University of Hawaii, 1981), 506-07.

because their housing at the Academy was rent-free. She eventually supplemented her income by cleaning the houses of the white staff, who invited her to rest her children on their beds while she went about her work. She also began taking in laundry to do at home, using a charcoal iron and earning five cents for undershirts, 15 cents for pants.[2] In 1937, she made a transition to factory work at a Libby's cannery, where she put pineapples "on one thumb and turned and trimmed them." She later recalled, "the next day I could not even comb my hair. I could not raise my arms or hands to my head. Still, I stuck at it and worked hard. I went every day. For only 30 cents an hour. But I was thankful. Even then I happily worked."[3] On the off-season, she worked at a tuna factory skinning fish for 20 cents an hour, sometimes to 9:00 at night during the peak season. Mostly, she hated the smell: "I brought clothes to change into, but I didn't have too many clothes. It could not be helped. It smelled so bad that I could not walk in front of people." Though Japanese was the only language spoken at the factory, Yamauchi was joined by many other Okinawans who during the 1930s had similarly moved to the city and found domestic and factory work; when they were together, they would speak Okinawan. When there was no work at either factory, on many days she cleaned houses from 8:00 a.m. to 6:00 p.m.[4]

When she made the next transition to becoming a small entrepreneur, what remained constant was the hard work involved. In buying the tofu business, she and her husband borrowed money from "friends who cared about us," restaurant owners who counseled her that it was better to have her own business then to go from job to job. They advised

[2] Ibid., 500.
[3] Ibid., 501.
[4] Ibid., 502.

her that a tofu shop on Aala Street would soon be for sale.[5] It was, in fact, at the same address as the first tofu shop ever listed in the Honolulu City Directory, back in 1923; since then, it had changed hands at least twice, most recently to Mrs. Haurko Uyeda, a Japanese woman, in 1937. That year, the Honolulu City Directory listed eight other tofu shops in the city (and two on the island of Hilo), six of them, including Uyeda's, for the first time; the *Hawaiian Japanese Annual & Directory* meanwhile listed over twenty shops in Honolulu and over fifty in Hawaii in 1936-37, the first (and seemingly last) year it was published.[6] As they always had been, these were small, intensely local operations that required relatively little capital to start; the chief benefit of buying a going concern, such as the one on Aala Street, was its place in the shopping habits of its customers. Beyond that, tofu shops required a commitment to waking up at 2:00 in the morning and engaging in hot, wet hand labor. "Although tofu work is a simple thing," she would later say, "it takes determination."[7] It had been decades since Yamauchi had made tofu as a girl, and she noted differences in the process: in Hawaii, the soybean puree was boiled before the milk was squeezed out, whereas the custom in Okinawa was to squeeze the puree without having boiled it. In any case, Mrs. Uyeda taught her how to make the tofu and run the business before handing it off.[8]

Yamauchi entered the business just as many of her fellow Okinawans were likewise moving from wage labor to opening their own small businesses, primarily restaurants, often with the help of *tanomosbi*, or mutual-aid credit groups. By 1941, approximately

[5] Ibid., 503.
[6] William Shurtleff and Akiko Aoyagi, *How Japanese and Japanese-Americans Brought Soyfoods to the United States and the Hawaiian Islands - A History (1851-2011): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 99, 137, passim.
[7] Yamauchi Oral History, 505.
[8] Ibid., 504.

80 percent of the cafes and eateries in Honolulu were owned by Okinawans, most of them one-family operations like Yamauchi's.[9] She was thus in a good position to increase her business by supplying restaurants. Her husband had a job as a gardener, so it was her son Shoan, still in high school, who helped out, delivering tofu by cart to a dozen clients. Business was best when fish was scarce for whatever reason. They also produced konnyaku, a gelatinous ingredient in Japanese cooking made from the powdered corm of the *konjac* plant;[10] during the war, they diversified into saimin until Shoan was drafted into the army – as Japanese-American men were after January 1944[11] – at which point Yamauchi's husband helped out making tofu, but had no interest in running a noodle shop. Despite martial law and shortages, war was good for business for Yamauchi and her fellow Okinawans; it also largely brought to an end the rift between them and the Naichi, immigrants from mainland Japan. In the eyes of whites, they were all "Japs."[12]

Yamauchi was later thankful that during the war, conditions eventually returned to something like normal in Hawaii: Japanese speakers continued to use their language, and Japanese and Okinawans were not "gathered together somewhere, taken away from home."[13] This was not entirely true: in early 1942, the majority of Japanese rounded up as potentially dangerous were in Hawaii. Ultimately, over 3,000 would be confined either in Hawaii or shipped to camps on the mainland,[14] and there had been plans by army

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[9] Sakihara, Mitsugo, "Okinawans in Hawaii: An Overview of the Past 80 Years," In *Uchinanchu: A History of Okinawans in Hawaii* (Honolulu: Ethnic Studies Oral History Project, Ethnic Studies Program, University of Hawaii, 1981), 113.
[10] Yamauchi Oral History, 504-505.
[11] Dept. of the Interior, War Relocation Authority, *WRA: A Story of Human Conservation* (Washington, D.C.: Government Printing Office, 1946), 121-122.
[12] Mitsugo, 114; Yamauchi Oral History, 507.
[13] Yamauchi Oral History, 507.
[14] Greg Robinson, *A Tragedy of Democracy: Japanese Confinement in North America* (New York: Columbia University Press, 2009),121.

commanders for a mass evacuation of around 20,000 residents – perhaps to a concentration camp on Molokai, the location of Hawaii's leper colony – until it was successfully scuttled by Hawaii's military governor (reflecting, among other things, the economic interests of local whites).[15] As Yamauchi well knew, Japanese on the west coast of the United States were not so fortunate. More than 110,000 would be confined in camps during the war. As it had since their arrival in America, however, tofu would follow them there. In their case, however, the small-scale entrepreneurialism that had always ensured its presence wherever they settled – as showcased by women like Yamauchi – was short-circuited. In the camps, tofu required the approval of a white bureaucracy.

In the spring of 1942, less than four months after the bombing of Pearl Harbor, the Japanese on the west coast of the U.S. – "aliens" and "non-aliens" alike, in the terminology of the army – found themselves in a cruel double-bind. On March 2, authorized by Executive Order 9066, the Commanding General of the Western Defense Command, Lt. Gen. John L. DeWitt, announced the designation of the western halves of California, Oregon and Washington as Military Area No. 1, from which people of Japanese ancestry would be eventually removed. He encouraged their voluntary migration in Military Area No. 2 (the eastern halves of the states) and points further inland. Vocal protests from leaders in the mountain states – and violence against voluntary migrants in inland communities – led DeWitt to issue a freeze order on March 29, trapping the Japanese in the area where they would soon be prohibited from living. DeWitt had privately contemplated confining the Japanese in concentration camps – as

[15] Robinson, 116-120.

many leaders in California were loudly demanding – but had vacillated even after issuing his March 2 order. Evacuation would be orderly, conducted only when well-provisioned assembly centers, two of which were being constructed in California and Arizona, were ready. Their ultimate destination was uncertain: perhaps rural communities that could benefit from their skilled labor.[16]

By the time of the freeze order, however, their eventual relegation to guarded camps – under the fiction of being refugees from an evacuation – was all but a foregone conclusion. DeWitt issued 108 separate evacuation orders in quick succession, and the two assembly centers under construction soon proved inadequate. A wide array of structures – most notoriously, the Tanforan race track near San Francisco – were hastily retrofitted into barracks. Over the course of the next six months, over 110,000 men, women and children of Japanese ancestry – the majority of them (although not the majority of adults) American citizens – were gradually transferred to camps run by a civilian agency, the War Relocation Authority (WRA). Laid out like army barracks, there were ten of these "relocation camps" scattered throughout the western U.S., for the most part in isolated and inhospitable desert regions, with two as far east as Arkansas. The largest ones, Poston and Gila River, both in Arizona, held more than 15,000 people and were divided into units; the others typically held between 10,000 and 15,000.[17] By the time they were disbanded, nine of the ten were producing their own tofu.

Tofu appeared earliest in Poston, in part perhaps because of that camp's unique institutional arrangement. It was located within the Colorado River Indian Reservation, near the border with California, and operated by the Bureau of Indian Affairs (BIA),

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[16] War Relocation Authority, 25-30; Robinson, 93.
[17] War Relocation Authority, xiv-xv, 22.

whose head, John Collier, had a vision of the camp as a model community based on irrigated agriculture by skilled Japanese farmers, who would be invited to remain (or at least be compensated for the assets they created) after the wartime emergency. The WRA agreed in March to let the BIA to take over much of the administration. Collier, a New Deal progressive who over the previous decade had pushed for tribal self-government on reservations – and who had ambitions to head the WRA himself – promoted similar ideals at Poston: community planning and self-government, economic self-sufficiency, cooperative farming, and the use of social scientists such as psychiatrist Alexander Leighton to help resolve conflicts.[18] The first contingent of "colonists" arrived in early May. By early June, the Department of Factory Planning, part of Poston Community Enterprises, issued a proposal for a tofu factory; an inmate, Harry M. Kumagai, ran the department under the supervision of H.A. Mathiesen, Chief of Agriculture and Industry.[19] This was one of several proposals for camp industry, including soda-water and noodle factories to supply food for the 20,000 inmates, in addition to a camouflage-net factory operated by an Army contractor that would be the camp's chief manufacturing enterprise until the WRA discontinued it in May 1943.[20]

By September, tofu was still under discussion by various inmate committees – Unit III's Industry and Manufacture Group and a camp-wide Advisory Group of Industry –

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[18] Robinson, 154-55.

[19] Harry M. Kumagai, memos to H.A. Mathiesen, 10 June 1942 and 12 June 1942, Record Group 210, Records of the War Relocation Authority, Records of Relocation Centers, Subject-Classified General Files 1942-1946, Colorado River, Box 114, National Archives, Washington, D.C. (henceforth "Colorado River Box 114"); Harry M. Kumagai and H.A. Mathiesen, memo to Wade Head, 30 June 1942, Record Group 210, Records of the War Relocation Authority, Records of Relocation Centers, Subject-Classified General Files 1942-1946, Colorado River, Box 106, National Archives, Washington, D.C. (henceforth "Colorado River Box 106").

[20] War Relocation Authority, 99

which revealed some of the constraints limiting the development of manufacturing at Poston. Camp enterprises could not, for example, "make products which would compete with commercial firms outside of this camp." Although the camp's wage scale – $12, $16, and $19 per month, depending on the skills required – would make such production competitive, "political expediency dooms this type of enterprise." The camps were also not a priority for shipments of raw materials, compelling planners to "use what is on hand." Some suggested carving curios from the ubiquitous local mesquite trees, to then be sold through the WRA, with the waste wood used to make charcoal for camp consumption. But there was uncertainty about whether there was permission to cut mesquite trees. The advantage of food production – not just tofu, but miso, shoyu, moyashi (bean sprouts), and noodles – was that it not only did not compete with local companies, but it reduced the cost to the Army of providing subsistence to inmates, rather than increase the need for supplies. With an assured outlet and relatively low capital requirements, food also seemed simplest to produce in the near term, "the most practical standpoint from which to begin" and something "tangible to show the public" while other industries were in the planning stage.[21] Mr. Togasaki, who chaired the Poston III meeting, announced that permission had already been granted to make tofu and that production could begin as early as October.[22]

As it happened, there was no tofu production in any of Poston's units until January 1943. There were numerous reasons for the delay. Some was due to a lack of

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[21] "Minutes of the Meeting of Advisory Board of Industry," 28 Sept. 1942, Camouflage Net Factory, Reels 256-57, *Japanese-American Evacuation and Resettlement Records, 1930-1974 (bulk 1942-1946),* BANC MSS 67/14 c, Bancroft Library, University of California, Berkeley (henceforth "Camouflage Net Factory Minutes"), available online at http://content.cdlib.org/view?docId=ft6j49n9ck&brand=calisphere&doc.

[22] "Minutes of Industry and Manufacturing Meeting," 12 Sept. 1942, Camouflage Net Factory Minutes, available online at http://content.cdlib.org/view?docId=ft4779n8km&brand=calisphere&doc.

construction material, in particular the fire bricks required for furnaces; in Unit II, the maintenance and construction departments “collaborated in this time-consuming task.”[23] There was the difficulty of obtaining equipment: electric motors necessary to grind soybeans and copper kettles were in short supply. Along with other specialized equipment used in tofu production, these could be obtained from the inmates themselves, as Kumagai proposed in a June memo, but “since the equipment of each colonist was not primarily packed and stored in order for shipment” in the frenzied weeks leading up to the evacuation, “but stored with no intent of future use for the duration, it is positively necessary that the owners accompany delivery or be sent to the location of the equipment.” Kumagai recommended sending the owners in trucks “under proper government protection.” [24] It is not clear that this was ever permitted, although while awaiting a modern grinder on order by the WRA, Unit II managed “to obtain the loan of a hand grinding tofu outfit” from a Mr. Miyakawa in mid-November; because of shortages in materials, however, they had to comb the “scrap pile for metal to make the shafts and wood to make the pulleys.”[25] Another requirement was that the “great quantity” of water used in tofu production be “free from alkali and impurities,” something to be determined by “thorough analysis.”[26] In the event, the camp’s water turned out to be hard – and was, furthermore, chlorinated – compelling the purchase of a water softener.[27] Production may also have been set back by the “opinion of [an unnamed] ‘expert’ who claimed that

[23] "Unit II Tofu Industry Delayed by Lack of Construction Material," *Poston Chronicle,* 22 Dec. 1942, 7.
[24] Kumagai and Mathiesen to Head, 30 June 1942, Colorado River Box 106.
[25] Works Project Committee to H.A. Mathiesen, 7 Nov. 1942, Colorado River Box 114.
[26] Kumagai to Mathiesen, 10 June 1942, Colorado Box 114.
[27] "Indy. Dept. Expected Tofu Production Within Fortnight," *Poston Chronicle*, 16 Jan. 1943, 3.

hardness of water, lack of humidity in the air, and other obstacles would cause failure of proper coagulation of bean paste particles."[28]

Finally, on January 19, the first tofu was produced in Unit III. By early April, all three units at Poston were making tofu. Production was lower than originally desired. The June 1942 report stated that the "consumption needs of 20,000 people," each eating half a cake of tofu per week, would be 10,000 cakes, or 1,400 cakes per day.[29] In line with this, planned production at each unit was between 500 and 700 cakes per day.[30] By February 1943, however, Unit III was in fact producing 200 cakes daily (although the addition of a second mixer pot promised to double production); and in April, Unit I was producing 300 cakes per day, Unit II less than half that amount.[31] Even so, the factories were deemed to be successes. Ben Yamaguchi, the supervisor of the subsistence department, declared that "we had seemingly unsurmountable obstacles but we have conquered all of them"; and the members of the Poston III Industry Group, who served camp tofu at a farewell party for two of its members transferring to other camps, agreed that it was excellent.[32] The news also spread to the other camps in items that appeared in their respective newspapers: the *Granada Pioneer* cited the "mass production of soya bean cakes" at Poston on April 17 and the *Minidoka Irrigator* reported on May 1 that "The quality of the 'tofu' [at Poston] is said to be of extra fine grade."[33]

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[28] "Production of Tofu Starts in Unit I," *Poston Chronicle,* 14 April 1943, 1.
[29] Kumagai to Mathiesen, 10 June 1942, Colorado River Box 114.
[30] "Daily Output of 500 Tofu Planned for Poston III." *Poston Chronicle*, 2 Oct. 1942, 1; "Tofu Within Fortnight."
[31] "Tofu Production to Be Doubled Soon," *Poston Chronicle*, 2 Feb. 1943, 5; "Tofu Starts in Unit I"; "Tofu Production." *Poston Chronicle*, 18 April 1943, 4.
[32] "First Tofu Produced by Poston III Industry," *Poston Chronicle*, 19 Jan. 1943, 1.
[33] "Poston Starts Tofu Factory," *Granada Pioneer*, 17 April 1943, 3; "Mass Production of 'Tofu' Begun by Poston Factory," *Minidoka Irrigator,* 1 May 1943, 2.

Plans for tofu production at other camps predated reports of Poston's success. In February, "pursuant to suggestions voted by a number of residents that soy bean cake ("tofu") be included in the diet of Topazans," the chief steward at Topaz (Utah) procured 50 tons of soybeans from the Army quartermaster corps, which supplied the camps. The assumption that soybeans could be instantly transformed into tofu was optimistic, however. The construction of a tofu plant did not become a priority until the widespread complaints of inmates over unsuitable meats served during the foods shortages of 1943 – in particular, organ meats such as hearts, livers and kidneys which the Japanese considered abhorrent – prompted the formation of a Food Advisory Board to work with the camp administration to acquire "more palatable foods and a variety that could not have been obtained by caucasian personnel alone." The Board also pushed for the building of the tofu factory, "not only to supplement the milk and meat supply, but for diet and for health."[34] Construction finally got underway in January 1944, and tofu was delivered to mess halls in April.[35] By that time, tofu had arrived at all but one of the other camps. The exception was Tule Lake, in northern California, which by then had become a "segregation center," reserved for individuals deemed to be troublemakers – including those who refused to sign a loyalty oath – and their families. This included a population of unabashed supporters of Japan, organized into "patriotic societies," who pressured others in the camp to renounce their American citizenship and request

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[34] "Community Government Closing Report," 1945, Topaz Final Reports, Folder 9 of 15, Reels 14-17, *Records of the War Relocation Authority, 1942-1946: Field Basic Documentation,* BANC FILM 1932, Bancroft Library, University of California, Berkeley, available online at http://content.cdlib.org/view?docId=ft9b69p234&brand=calisphere&doc.

[35] "To Manufacture Soy Bean Cakes for Topazans." *Topaz Times,* 16 Feb. 1943, 2; "Construction of Tofu Plant Begins," *Topaz Times,* 4 Jan. 1944, 1; "1800 Cakes of Tofu Distributed to Mess Halls," *Topaz Times*, 12 April 1944, 3.

repatriation to their homeland.[36] Despite the heightened Japanese nationalism at Tule Lake, inmates did not produce Japanese food there. The lack of community input at Tule Lake, compared to the limited forms of democracy permitted at the other camps, may have been a factor; as at Topaz, tofu typically arrived at the other camps after inmates demanded it.[37] Tofu production was not simply the result of inmate agitation, however, as the WRA had its own reasons for promoting it.

From the beginning, the agency struggled with conflicting imperatives. Called upon to implement, on a day-to-day basis, an unprecedented abrogation of the rights of American citizens for reasons, it was said, of military security, the WRA was a civilian agency managed largely by New Deal liberals pulled from such places as the BIA and the USDA's Farm Security Administration, which had helped resettle farmers impoverished by the Depression and Dust Bowl.[38] The WRA's two directors, Milton Eisenhower and his longer-term successor, Dillon Myer, came from the USDA, and they in turn sought staff members who were "objective" about the "Japanese problem," with no "marked antipathies against all persons of Japanese descent" (as well as no tendencies to "excessive emotionalism about the plight of the evacuated people.")[39] As they became acquainted with their inmates, many camp administrators came to view the evacuation as an injustice, the product of vested agricultural interests and wartime hysteria, and came to see the WRA as a buffer against hostile forces that wished the Japanese population to

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[36] War Relocation Authority, 70-73.
[37] Jane Dusselier, "Does Food Make Place? Food Protests in Japanese American Concentration Camps," *Food and Foodways* 10 (Sept. 2002): 155.
[38] The FSA had floated a plan in early 1942 for Japanese resettlement without confinement, but was never put in charge of the process as an agency; it did, however, subsequently provide the land for the two Arkansas camps. Robinson, 83; War Relocation Authority, 22.
[39] War Relocation Authority, 1.

suffer an even harsher fate.[40] As critical as they were of it, however, WRA administrators did not believe that public opinion could simply be defied; they argued, along with the Nisei-led Japanese American Citizens League (JACL), that Japanese-American citizens and their parents had to demonstrate their loyalty to America in part by cooperating with their confinement.[41] WRA staff were charged, moreover, with running orderly camps, and even those who sympathized with the Japanese viewed dissenters as mere troublemakers; although Myer himself initially opposed creating a segregation camp at Tule Lake, camp directors saw it as a way to keep the peace in their camps, especially in the wake of mass protests at Poston and Manzanar which, in turn, further inflamed hostile public opinion.[42]

In addition to this central contradiction – of administering an injustice in a humane manner – the WRA grappled with several practical conundrums. Early on, Myer and others abandoned Collier's idea that the camps could become normal, self-governing, perhaps even permanent, communities; the circumstances were simply too abnormal and demoralizing. Myer shifted, instead, to a policy of resettling as many Japanese families as possible in communities, primarily in the Midwest, that would accept them. By the end of 1944, the WRA succeeded in resettling 35,000 inmates, more than one third of the

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[40] The hostile forces admittedly included a fair number of their fellow camp officials, characterized by Alexander Leighton "stereotype minded," who viewed the inmates as a homogeneous threat and wished to see the relocation centers operated as straightforward "concentration camps." Alexander H. Leighton, *The Governing of Men: General Principles and Recommendations Based on Experience at a Japanese Relocation Camp* (Princeton, NJ: Princeton University Press, 1945), 82-85.

[41] With this strategy in mind, Myer himself was the chief advocate for Japanese-American participation in the armed forces. He supported the formation of the 442nd Regimental Combat Team, although it was a segregated all-Nisei unit, and the eventual reinstatement of the draft for Japanese Americans, though many Nisei felt this an injustice while they were still confined in camps. His strategy arguably worked, as public opinion had shifted by the beginning of 1944. War Relocation Authority, 110, 121-122.

[42] War Relocation Authority, 61. The Poston protest, involving a mass strike, was resolved peacefully without calling in the military guards surrounding the camp; the Manzanar incident turned violent, however, with the military killing two young men and wounding ten other people. War Relocation Authority, 48-50.

camp population.[43] This process undermined the social stability of the camp communities themselves. It also created a drain of skilled workers from camp industries, which already faced other problems. Early industries had attempted to make use of the camps' otherwise squandered labor force for wartime production – in particular, camouflage netting and model ships, which required exacting hand labor but little capital – as well as commercial ventures sponsored by private companies. These operations eventually proved unworkable: the Issei were barred from the well-paying war work by the Geneva Convention, and even among the Nisei, the problem of wages was divisive.[44] Gradually, industries were restricted to those that supplied the camp population's own needs. In addition to lessening the burden on taxpayers, the work these industries provided addressed another persistent problem: sustaining camp morale in the face of isolation and enforced idleness.

From the standpoint of the WRA, the production of tofu and other Japanese foods helped allay some of these problems. Food served at the camps, for instance, often became the focal point of criticism by the public, press, and politicians, who accused the WRA of coddling inmates and causing regional shortages of staples such as meat and milk. Expressing a typical sentiment, one California resident wrote to the Office of Price Administration in October 1942 that "I am reliably informed that government trucks have just returned from a trip through Nevada and Arizona with six tons of ham and bacon for the Japs in Manzanar where they are interned for the duration . . . while none of us can buy it at any price. It makes one's blood boil and some of us feel like taking a tommy gun

[43] War Relocation Authority, xiv.
[44] War Relocation Authority, 97-100. Several payment plans, from paying the going wage to individuals, to putting their wages in a community trust except for incentive bonuses, to paying them only the standard camp wage but allowing them to work fewer hours, were attempted before the industries were abandoned.

and cleaning that lot."[45] Reports in 1943 in the Denver *Post* accused the Heart Mountain camp in Wyoming of hoarding food; similar stories appeared in the Memphis *Commercial Appeal* and Scripps-Howard papers nationwide about the Jerome camp in Arkansas. Criticisms of hoarding were also aired during Congressional hearings – conducted by the House Un-American Activities Committee in the House – which considered, but ultimately rejected, transferring the camps to the War Department.[46] Thus, these stories were also an attack on the bureaucratic competence of the WRA itself. In fact, the WRA deliberately ignored the Geneva Convention, which strictly speaking would have required that the Issei (interned foreign nationals) receive the same rations as American soldiers, by feeding inmates according to civilian rations, generally limiting the cost to 45 cents per person per day.[47] Overzealous stewards sometimes skimped further in an attempt to save the government money, helping to spark protests among the inmates.[48] Tofu had the advantage not only of being a familiar and nutritious food, but an inexpensive one made from an unrationed food, soybeans, which the government at the time was somewhat vainly encouraging Americans to eat in greater quantities. There were some efforts to grow soybeans at the camps themselves – at Rohwer, in Arkansas, where the climate favored soybeans, and at Poston, where they would require irrigation – but no indication that they were a major part of the camp's agricultural programs, which, on the other hand, provided inmates with an estimated $50 million worth of vegetables,

[45] War Relocation Authority, 100.
[46] War Relocation Authority, 111-12; "Member of Dies Committee Raps Majority Report," *Minidoka Irrigator*, 28 Aug. 1943, 1; "Denver Post Article Censured by WRA," *Manzanar Free Press,* 5 June 1943, 1.
[47] War Relocation Authority, 101-02. This figure varies among reports, including estimates of only 31 cents per person per say. Miné Okubo, *Citizen 13660* (Seattle: University of Washington Press, 1983), 143.
[48] Leighton, 115-16.

poultry, pork, beef and milk. [49]

In addition to the economic benefits of producing their own food, tofu production helped diversify employment opportunities for inmates as options for other viable industries dwindled, and thus improve morale. In memos to H.A. Mathieson, the Director of Industry and Manufacture at Poston, inmates involved in factory planning emphasized that "to give work to those people unable to do work than that which they had been trained for is a great boost to general morale," as well as a way to give everyone "an equal opportunity to demonstrate, in a very concrete way, their loyalty and willingness to serve their country." More broadly, "to keep folks busy is of paramount importance in order to sustain the morale of evacuees who have suffered mentally, spiritually, and financially" and to "instill the virtues of perseverance, initiative, industriousness, public resourcefulness, and good citizenship."[50] The tofu factories were supervised, it seems, by men who had pre-war experience in the trade, giving them an opportunity to do work "they had been trained for."[51] It also provided work for crews ranging from eight to nineteen men – no women are mentioned in the camp newspapers – working in shifts starting, as tofu making always did, early in the morning. As observed by three reporters from the Manzanar *Free Press* who were "overcome by curiosity," the

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[49] Agriculture Department, Camp II, to E. Sakaguchi, 16 July 1943, Colorado River Box 114; "Agriculture Program: Soy Bean May Be Grown on Land Now Being Cleared by Lumberjacks," *Rohwer Outpost,* 14 Nov. 1942, 4; War Relocation Authority, 97. There are some reports of soybeans being shipped to the camps from places such as LA ("Steps for Tofu Production Near Completion," *Poston Chronicle,* 24 Oct. 1942, 5), Virginia, and North Carolina ("Reporters Learn Process in Tofu Making Tedious," *Manzanar Free Press,* 16 Oct. 1943, 4).

[50] Harry M. Kamagai, "Organization Plan and Policies of the Department of Factory," report to John Evans, 16 Sept. 1942, Colorado River Box 106; Industry Dept., Poston III, to H.A. Mathiesen, 10 Nov. 1942, Colorado River Box 114.

[51] For example, Tomoji Wada and Masayoshi Yamaguchi at Poston ("Tofu Production Within Fortnight," "Tofu Starts in Unit I"); S. Okugawa at Manzanar ("'Tofu' Manufacture Given Approval," *Manzanar Free Press,* 5 June 1943, 3); Kichizo Umeno at Heart Mountain ("Tofu Factory in Operation," *Heart Mountain Sentinel*, 8 Jan. 1944, 8); Gonshiro Harada at Denson ("Manufacturing of 'Tofu' to Start Here Soon," *Denson Tribune*, 30 March 1943, 4; Shurtleff and Aoyagi, "Japanese and Japanese-Americans," 140).

process of making tofu was "tedious" and required patience, although, in line with modern practice, the traditional Japanese grindstones were operated by electrically-powered belts.[52] Thus there was plenty of scope to practice perseverance and industriousness.

Tofu was not the only Japanese soy food produced at the camps. In addition to non-soy noodles and bean sprouts (which were more often made from mung beans),[53] by mid-1943 miso was produced at three camps, while shoyu was being made at Manzanar. There were proposals for making soymilk (or "tofu milk") at Poston and Topaz, given national milk shortages and the difficulty of establishing dairy herds at the camps, but by the latter half of 1944, only 3,000 quarts, valued at under $100, were produced at the camps versus 172,000 cakes of tofu valued at over $9,000.[54] The production of shoyu at Manzanar was greeted with much fanfare, including a community-wide naming contest: Manza! won, with Manyo and MM ("Made in Manzanar") taking the second and third prizes.[55] Unlike tofu, which was perishable, the plan was to supply all of the camps with

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[52] "Reporters Learn Process in Tofu Making Tedious"; "1,500 Tofu Cakes to be Made Daily," *Minidoka Irrigator*, 20 Jan. 1945, 1; "These Fellows Know Their 'Soybeans.'" *Denson Tribune*, 29 June 1943, 3. There are other indications that some in the Japanese community were unfamiliar with how tofu was actually made: one report found it necessary to mention that it was made from ground soybeans and prepared with "ni-ga-li" ("Large Scale Production of Tofu to Start." *Granada Pioneer,* 20 Nov. 1943, 1); another stated that "mango beans" (probably a misspelling of mungo, or mung, beans) were "the basic substance for tofu" ("Tofu Equipment Arrives for Poston III," *Poston Chronicle,* 13 Oct. 1942, 1).

[53] A memo requesting seeds for planting at Poston mentions both soybeans and mung beans. Tomio Takesaima to E. Sakaguchi, 16 July 1943, Colorado River Box 114.

[54] "Semi-Annual Report, July 1-Dec. 31, 1943: Industry Section," Record Group 210, Records of the War Relocation Authority, Washington Office Records, Washington Document, Box 5, National Archives, Washington, D.C.; "Poston May Get Soybean Milk," *Poston Chronicle,* 22 Oct. 1943, 3; War Relocation Authority, 96; "Semi-Annual Report, July 1-Dec. 31, 1944: Industry Section," Record Group 210, Records of the War Relocation Authority, Washington Office Records, Documentary Files, Semi-Annual Reports, Box 5, National Archives, Washington, D.C.

[55] "Name Selected for Local Shoyu," *Manzanar Free Press*, 3 Dec. 1942, 1.

shoyu from Manzanar, which had the advantage of high-quality water.[56] Cost savings were a paramount concern; unlike tofu, shoyu purchased from suppliers was provided at the outset of confinement.[57] But to increase production, Manzanar shoyu was a "chemical" soy sauce rather than a traditional fermented product; it was produced by using hydrochloric acid to break down the soy and wheat proteins and then adding caramel coloring and sugar.[58] The process greatly reduced the time it took to make shoyu and had been pioneered in Japan in the 1920s, where the output was "blended" with traditional shoyu, prompting Japanese journals to publish several articles on methods for detecting such adulteration. Chemical soy sauces were manufactured in the 1930s in America as a health food (sold largely to Adventists), chop suey ingredient, and precursor to monosodium glutamate, but Japanese Americans generally disliked its lack of complex tastes.[59] Manzanar shoyu was no exception. After the resignation of the original factory supervisor and the selection of a new recipe, by early 1944 a new batch was being produced by the traditional "malt method."[60]

Tofu was ostensibly welcomed by the "tofu lovers" and "tofu-hungry residents" among the inmates, although its impact on general morale and its specific cultural

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[56] "Shoyu Project Ready," *Manzanar Free Press*, 10 Oct. 1942, 1. Manzanar was located in the Owens Valley, from which Los Angeles famously obtained its drinking water.

[57] "Shoyu, Rice Arrive," *Manzanar Free Press,* 22 April 1942, 2. The Japanese Red Cross also sent shoyu and miso, mainly to internment camps reserved the Japanese suspected of disloyalty, rather than the relocation camps (Japanese Red Cross Sends Shoyu, Miso). In contrast, there is only one report of a camp buying tofu from a merchant before supplying its own. "Tofu Merchant Arrives Here," *Granada Pioneer,* 24 Dec. 1942, 3.

[58] "Record Output of Shoyu Made," *Manzanar Free Press*, 21 Nov. 1942, 1.

[59] William Shurtleff and Akiko Aoyagi, *History of Soy Sauce (160 CE to 2012): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2012), 865, 896, 927, 1088.

[60] "Malt Method Used in Shoyu," *Manzanar Free Press*, 23 Feb. 1944, 6. A similar story would later play out in occupied Japan, where American advisors convinced Kikkoman to make chemical shoyu for a time, before they abandoned it for domestic consumption in the 1950s. W. Mark Fruin, *Kikkoman: Company, Clan, and Community* (Cambridge, MA: Harvard University Press, 1983), 263.

meanings are hard to gauge.[61] As had been the case for Tsuru Yamauchi as she confronted the alien landscape of Hawaii, tofu was a comforting reminder of home adapted to a harsh new environment. But in this case, the longing was not so much for Japan (or Okinawa), but for California. As Topaz inmate Toyo Suyemoto later recalled, "I had not expected such a desolate place . . . Despite the degradation of being penned in horse-stalls, Tanforan was still California. There we had viewed the grass and trees, as well as the gardens that the evacuees themselves had planted. Here was not a single blade of grass or even a stunted bush."[62] Or as one anti-evacuation pamphlet recounted, one small child at a camp cried, "Mother, I don't like Japan. Let's go back to America."[63] If it were an expression of Japanese culture or identity, eating tofu had the advantage, from the standpoint of WRA administrators, of not triggering a hostile public reaction, as did accounts of inmates learning the Japanese language or practicing Buddhism (State Shintoism, associated with emperor-worship, was disallowed). But there is little indication that tofu was heavily imbued with such symbolism: Tule Lake, the camp that held the most militantly pro-Japan inmates, including those who renounced their American citizenship and demanded to be "repatriated" to Japan following the war, was the one camp not to produce tofu or other soy foods. Rather, it seems that tofu was once again something that the Japanese in America worked hard to adapt to a new environment because it provided a taste of home, whatever home had come to mean.

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[61] "'Tofu' Lovers!" *Manzanar Free Press*, 15 May 1943, 1; "Large Scale Production of Tofu."

[62] Toyo Suyemoto and Susan B. Richardson, ed., *I Call to Remembrance: Toyo Suyemoto's Years of Internment* (New Brunswick: Rutgers University Press, 2007), 74.

[63] Caleb Foote, *Outcasts! The Story of America's Treatment of Her Japanese-American Minority* (*n.p.,* 1943), in Special Collections and Archives, The UC Irvine Libraries, online at http://content.cdlib.org/view?docId=hb2c60042p&brand=calisphere&doc, 11.

If the story of WRA camp tofu was a story of adaptation – thereby sharing continuity with the pre-war course of Japanese-American tofu, as much as the camps themselves were a radical discontinuity – it was also necessarily a story of insularity. The camps were the most extreme measure yet to limit and isolate Asian immigrant communities, and tofu remained an aspect of Japanese culture largely invisible to the wider society. There were a number of exceptions to this, however. The WRA's resettlement program dispersed a population that had been concentrated on the west coast to communities in the east, primarily in the Midwest. As they created nuclei in these new communities, Japanese food followed: in July 1945, the *Colorado Times* reported that Mr. and Mrs. Toraji (Tom) Hayano, who had been confined at Heart Mountain, were establishing a tofu factory in Minneapolis to supply three Japanese restaurants, "as well as for resettlers," in the city. Prior to that, the only source of tofu was Chicago, which did not ship it during the warm summer months.[64] Ben Yamaguchi, who helped make tofu at Poston, settled in Cincinnati with his wife and started Soya Food Products Co. in 1945, where they made mung bean sprouts and, starting in 1949, tofu (made with a stone mill).[65] Despite this centrifugal effect of wartime, however, most of the movement of the evacuees was back to their former homes once DeWitt's order was lifted in early 1945.[66]

Another instance in which insularity was breached rather than reinforced was the case of Grace Lawson, camp dietitian at Gila River in central Arizona. Gila was already unusual in that the initiative for producing tofu, and the research that went into setting it up, was carried out by white staff members: Steward H.E. Keadle, Supervisor of Industries Hoyt Martin, and even Director Leroy H. Bennett, who arranged the purchase

64 "Tofu Factory Set Up in Minn.," *Colorado Times,* 19 July 1945, 1.
65 Shurtleff and Aoyagi, "Japanese and Japanese-Americans," 182, 191.
66 Robinson, 256.

of equipment during a trip to California. By January 1944, the factory – located in the larger Butte unit, which housed 10,000 people – was producing over 3,500 cakes a week. A second factory was established in the Canal unit (population 5,000), but struggled until reopened under the supervision of an inmate who had made tofu at the Jerome camp.[67] Lawson arrived in August 1943 and was described in the camp newspaper as "a colorful figure" who was a "personal friend of Eleanor Roosevelt," had traveled to "about 56 countries," and spoke five languages.[68] (Roosevelt had in fact visited the camp herself in June and had remarked in a letter to her daughter that the food in the camp was lacking, so perhaps Lawson had taken the assignment at her behest.)[69] Her cosmopolitanism notwithstanding, the energetic Lawson spent her spare time in an ambitious program of "practical Americanization": she taught a weekly class based around the government's "Basic 7 Nutrition Program" in which she trained three hundred students and produced an "American-Japanese Cook Book," to which "many American manufacturers contributed material." She also provided vocational training in domestic work, teaching students "elementary cooking, American style food, menu making, setting the table . . . and use of electrical household appliances."[70] But Lawson was also open to Japanese foods: in July

[67] "Tofu Manufacture Contemplated Here," *Gila News-Courier,* 23 March 1943, 3; "Tofu for Rivers a Possibility." *Gila News-Courier*, 24 June 1943, 1; "'Tofu' Manufacture in Rivers Soon." *Gila News-Courier,* 13 Nov. 1943, 1; "Mess 45 To Be Turned into Tofu Factory," *Gila News-Courier,* 20 Nov. 1943, 5; "Tofu a Dream No More," *Gila News-Courier*, 23 Nov. 1943, 3; "Keadle Gets Facts on Tofu Delivery," *Gila News-Courier,* 2 Dec. 1943, 4; "Tofu Factory Shifts to High," *Gila News-Courier,* 15 Jan. 1944, 1; "Tofu Factory To Open Again," *Gila News-Courier*, 5 Aug. 1944, 3.

[68] "Lawson Joins Hospital Staff," *Gila News-Courier*, 19 Aug. 1943, 5. This description, along with the frequent items in the paper about Lawson, may have been provided by Lawson herself.

[69] Robinson, 158. The First Lady was a staunch supporter of the Japanese community in America from the start.

[70] Grace Lawson, "The Dietary Department," 15 Aug. 1945, Gila River Final Reports, Folder 22 of 31, Reels 40-43, *Records of the War Relocation Authority, 1942-1946: Field Basic Documentation,* BANC FILM 1932, Bancroft Library, University of California, Berkeley, 9. It is not clear whether the Cook Book contained American or Japanese style recipes, or a combination of both.

1944 she delivered a talk at the American Women's Home Association conference in Chicago on "Tofu for the Hungry World," and on her way back from her trip she stopped at a Pittsburgh hospital to demonstrate to a "world renowned authority on peptic ulcers" the use of tofu in curing ulcers.[71] Thus in this small way did the camps help transmit Japanese soy foods to a wider culture, but there is no indication of lasting impact.[72] For the most part, the pattern of adaptation and insularity held.

As the Japanese returned to the west coast, tofu makers resumed their work. The evacuation had cost some food producers their niches: for instance, fortune cookies, which had their origin in Japan, had been made by Japanese companies prior to the war, but Chinese and American companies afterwards.[73] In the case of tofu, however, the customers returned with the producers, who reestablished their businesses or started new ones. The former owners of Tomoye Tofu Shop in Los Angeles – Mr. Tomoe and possibly S. Okugawa, tofu supervisor at Manzanar – founded Hinode Tofu in 1947, after Tomoye was, it seems, bought out by Matsuda Tofu Co. in 1946. Hinode, producing 1,500 cakes of tofu a day, was in turn purchased by Shoan Yamauchi and his wife in late 1947.[74] After serving in the army and helping with his the family tofu shop in Honolulu, Shoan took a vacation to Los Angeles – "intending to play," as his mother later recalled –

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[71] "Dr. Lawson: Tofu for Peptic Ulcers," *Gila News-Courier*, 11 July 1944, 5. Even when in short supply, tofu was regularly reserved at all of the camps for inmates on special diets, in particular those suffering from ulcers, which were epidemic – "a condition which was most frequently attributed to the extreme nervous tension of many of the residents and the generally frustrated and unsettled state of their minds." War Relocation Authority, 107.

[72] Lawson went on to host an early cooking show on Los Angeles TV.

[73] Jennifer 8. Lee, *The Fortune Cookie Chronicles: Adventures in the World of Chinese Food* (New York: Twelve, 2008), 264.

[74] Shurtleff and Aoyagi, "Japanese and Japanese-Americans," 86, 168.

but saw a business opportunity and stayed.[75] It was an opportunity created not by the evacuation, but by a generational shift as Issei gave way to Nisei as the leaders of the Japanese-American community. Yamauchi would diversify Hinode's line of products to include specialties common in Hawaii but not yet widely available in Los Angeles – silken tofu and deep-fried tofu pouches – and within twenty years, he would modernize and expand its production to make it the largest tofu producer on the mainland, surpassing the hopes of the young picture bride who had arrived in Hawaii half-a-century earlier.[76]

The Nutritionists: Clive and Jeanette McCay

On a Monday afternoon in the middle of June, 1943, New York Governor Thomas E. Dewey hosted a well-publicized lunch, billed as a "war-diet luncheon," in the massive Executive Mansion in Albany which, its shadowy corridors an oxblood red, had once reminded Franklin Roosevelt's children of a Hollywood haunted house. The formal State dining room, said to be big enough to seat thirty-two, held sixty-seven guests on this day, including newspaper, magazine and radio journalists. The proceedings lasted two hours as various members of the New York State Emergency Food Commission made speeches and the press was given the opportunity to ask participants what they thought about the menu, which was dominated by what the *New York Times* called "the humble soy bean" in "seven different forms," though it only listed three – chicken and soybean-sprout soufflé, sprouted soybeans and onions, and soybean bread – accompanied by apple juice,

[75] Yamauchi Oral History, 504.
[76] Soyinfo Center, "History of Tofu: A Chapter from the Unpublished Manuscript, *History of Soybeans and Soyfoods: 1100 B.C. to the 1980s* by William Shurtleff and Akiko Aoyagi," last modified 2007, www.soyinfocenter.com/HSS/tofu4.php.

tossed green salad (which may have included soybean sprouts), assorted spreads, milk and, for those who did not want to eat the featured food in any form, soybean-free strawberry shortcake. Only one (male) guest refused the soybean dishes, the remainder, "half of them women, pronounced the menu tasty and filling. Most of them did justice to their full portions, although the majority never before had eaten soy beans." The meal was prepared by the mansion's staff, and Dewey told reporters that he and his family had been consuming soybeans in increasing quantities since he had taken office in January – "we had some soy bean gingerbread the other night; it was excellent" – and hoped to set an example for other New York families. Change "is being forced upon us by the war and [we are] seeking to develop new and palatable foods which will maintain health and energy. That is the purpose of this luncheon."[77]

Dewey was at the beginning of what would be twelve years in office, having arrived in Albany earlier that year as a reformer determined to reduce state expenditures and fight corruption, while at the same time combatting his own party's moribund rejectionism. The Emergency Food Commission, and the soybean luncheon, had several political purposes: to demonstrate that government could actively and efficiently promote the welfare of citizens, while at the same time providing a counterweight at the state level to Washington's centralized control of the war effort, so reminiscent in Dewey's mind of the bureaucratic excesses of the New Deal. Frustrated by the way the War Production Board, for instance, had allotted only one manure spreader to the 2,100 farms in Albany County, he charged the Emergency Food Commission with addressing logistical problems – implementing a system to rush tractors and trucks wherever they were most

[77] "Governor Is Host at Soy Bean Lunch," *New York Times*, 15 June 1943, 24.

needed, for instance, or locating millions of bushels of barley and coaxing chickens to eat it – in addition to advising citizens on how they could best conserve food.[78] Beyond present scarcities, the Commission foresaw the coming of an acute crisis. A report submitted to Dewey a week before the luncheon projected that “there will not be available enough food in this country to feed both its human and its present animal populations. Therefore much of the animal population will inevitably be liquidated.” The commission listed four objectives to help New Yorkers conserve and find alternatives to the “animal products (milk, eggs, meat, butter and lard)” that were at risk: these included importing grain to boost the milk supply, issuing bulletins to let citizens know what foods were in short supply, and researching new foods, soybean sprouts and soybean bread in particular.[79] These measures were active, positive, and largely devoted to encouraging voluntary citizen action at the same moment that the federal government was implementing a widely resented rationing program.[80]

Dewey had national stature. The New York governorship was frequently a stepping-stone to a presidential nomination – and occasionally to the White House itself, as in the case of its occupant at the time – and Dewey was widely expected to eventually run. New York State, aside from the size of its population and economy, was also home to the nation’s leading media outlets, ensuring that the Governor’s soybean lunch would receive widespread coverage, besting even Henry Ford’s ability to generate publicity for a similar event nine years earlier. *Life* magazine featured photos of Governor Dewey and his wife mid-bite, Dewey “practicing what he preaches” by lunching on sautéed Cayuga soybean

[78] Richard N. Smith, *Thomas E. Dewey and His Times* (New York: Simon and Schuster, 1982), 367-68.
[79] H.E. Babcock, "Report of State Food Commission," *New York Times*, 11 June 1943, 8.
[80] Harvey Levenstein, *Paradox of Plenty: A Social History of Eating in America*, Revised Edition (New York: Oxford University Press, 1993; Berkeley, CA: University of California Press, 2003), 83.

sprouts at Mrs. Dewey eating "all of her soybean soufflé" before having "a second helping of soybean-flour muffins." Praising Dewey's initiative, the accompanying article informed readers that the Commission would send a free pamphlet on how to sprout soybeans to anyone interested; several pages of photos followed showing the process of growing sprouts and preparing them into such dishes as aspic of soybean sprouts, "a cool and nutritious summer dish" that was also visually striking, the sprouts seemingly captured in mid-swim within the transparent mold. A final photo showed Lassie, a healthy Cairn-Scottie who had never been fed any meat, eating from a bowl of sprouts, demonstrating the degree to which meat was dispensable, although the image may have carried a different, less positive message about substitution to some readers.[81]

Not all press was as favorable as the *Life* spread. *The New Yorker*'s Russell Maloney, savaging the Comission's report and the very notion of a food crisis, was overt in his disdain for soybeans as a substitute. He derisively quoted an item from the *Herald Tribune* on the appointment of "well-coiffed club-lady" Mrs. Roger W. Straus as the Commission's director of nutrition education for the New York area. Mrs. Straus advised that "it is a food crisis and it will be one for the next ten years. . . . We on the home front have got to use food substitutes." The *Herald* reported that she "advanced the soy bean as an adequate substitute" and "will try to get the soy bean on the market while convincing the consumer of its food value." Maloney professed to being puzzled by the notion of a food substitute: it "isn't meat, and it isn't potatoes, and it isn't butter, and Mrs. Straus will be damned if she knows what it is, unless it's soy beans." And regarding soybeans, Mrs. Straus had the problem of convincing "people that all this nasty stuff

[81] "Soybeans: Governor Dewey Sponsors Them As Partial Solution to Food Crisis," *Life*, 19 July 1943, 45-47.

they're buying is really only making them hungrier and hungrier and that the only thing for hollow civilian legs is soy beans. . . . [M]y delicatessen man sells soy beans, but the trouble is you go in to buy some soy beans and you're distracted by a lot of – well, pardon the expression, but *food* – br--d, ch--s-, p--n-t b-tt-r, m-c-r-n-, gr--n v-g-t-bl-s, -ggs, and so on." He professed to having served guests his "favorite soybean recipe" recently, salted soys served with martinis and highballs – this use was also suggested by the *Life* article – followed by a dinner of cold tomato soup, brook trout, green peas, zucchini sauté, green salad, cheese, and coffee.[82]

Three weeks later, the magazine's "Talk of the Town" (possibly Maloney again) took a kinder stance as, presumably in response to reader interest, "we immediately sent out our man with instructions to get the soy story and spare no expense doing it." What followed was a fairly standard recitation of the soybean's uses, likely gleaned from a Commission or USDA bulletin, enlivened by a lingering humorous tone reminiscent of Ring Lardner's account of the Chicago Patriotic Food Show. The author could not resist a dig at the governor: "In the first place, it is true that a diet of soy beans and water will sustain life indefinitely; Governor Dewey could live on soy beans and water until he becomes President." And, reflecting the virulent anti-Japanese racism of the war years, the author noted, not entirely accurately, that the "bean curd, which various war correspondents have told us constitutes an important item of the Japanese soldier's field ration, is simply a preparation of soy-bean flour. Good for the little rats, too, since its caloric value is twice that of beef and its waste products have less tendency to poison the system and cause fatigue." By October, Sheila Hibbens, writing in the magazine's

[82] Russell Maloney, "The Food Crisis," *New Yorker,* 10 July 1943, 58-59; "Governor Dewey Sponsors," 48.

"Markets and Menus" column, voiced weariness with soybean promotion: "I have as much respect for for the soy bean as any nutritionist has, but I also have a certain respect for the intelligence of the average marketer, and I assume that unless a woman is blind and deaf, she has by this time learned all there is to know about soy beans and that she can take them or leave them alone without any advice from me." She proposed instead a less strictly literal substitute food: eggplant.[83]

It was not only urban sophisticates who were skeptical of the soybean message. When Marvin Jones, the new federal War Foods Administrator, suggested in late August 1943 that Americans might substitute soybeans for meat, he received numerous irate letters. A Missouri farmer, sounding a rustic note, complained that "if those experts in Washington who are trying to force the soy bean upon the American people had brains of croton oil there wouldn't be enough to physic a flea." A Brooklyn woman argued that the "propaganda that . . . soy beans are just as nutritious as a T-bone steak, while probably true, is laughable. You can't place a flock of soy beans in front of persons who are accustomed to thick steaks, and then tell them that they're deriving exactly the same nourishment out of the beans as they would from the steak." Reflecting the fact that fish and poultry were still considered substitutes as well, a New York businessman wrote, "I relatively dislike yeast, soy beans, fish, chicken, and pork in the order named, but I do love roast beef and sirloin steak."[84]

Skepticism and even hostility were not necessarily fatal to the soybeans' prospects as a wartime substitute, but they did indicate that an alternate strategy for introducing more soy into the U.S. diet might be more effective, a quiet strategy of using soy products to

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[83] Sheila Hibbens, "Markets and Menus: Substitutes and Other Things," *New Yorker,* 76-79.
[84] Quoted in Levenstein, 84-85.

enrich familiar foods without much fanfare. During the war, these two strategies coexisted in complicated ways. It was not only a distinction between soybean-enriched bread versus hard-to-ignore sprouts – the two featured foods of the Dewey lunch – but a gendered distinction reflected in the work of the married couple, Clive and Jeanette McCay, who were largely responsible for the soybean's inclusion in the Emergency Food Commission's recommendations. But here again the distinction was not simple: even when adding soybean flour discreetly to bread or candy, Clive wished to promote that fact, at least to the housewives responsible for feeding their families. It was not until after the war that soy would recede from notice even as it became an ever more common ingredient in American foods.

The marriage of Clive and Jeanette McCay was a partnership of different, yet ultimately complementary, temperaments. Clive was born in 1898 – his middle name, Maine, derived from the ship that famously sank that year – to an Indiana farm family of Scotch-Irish descent; his father, like Harry Miller's, was a schoolteacher who instilled a love of books in his son and two daughters. Born of active, thrifty, self-confident, industrious people, Clive likewise did well in school, kept a careful account of his expenditures and activities in journals, developed a lifelong love of the outdoors from scouting, worked hard during the summers mowing lawns or working on farms, and was regarded as a leader by his peers. One boyhood friend later recalled that "to an unusual degree McCay combined the dreamer and the doer."[85] There were inklings of his future career during these years: when he learned about calories from a government bulletin, there "was never a calm meal thereafter," one of his sisters later recounted, because he

[85] Jeanette McCay, *Clive McCay, Nutrition Pioneer: Biographical Memoirs by His Wife* (Charlotte Harbor, FL: Tabby House, 1994), 32.

"always sat down and counted the calories in potatoes and bread."[86] The tempo of his life barely slowed in the face of wrenching family tragedy: first the death of his mother of stomach cancer when he was eleven, then the death of his father, who had remarried and taken a job as an engineer on the Pennsylvania Railroad, in a train accident when he was sixteen. Whether it was a family trait, the result of his upbringing, or a response to these events, the adult McCay could be unsentimental in a way that maintained a distance between him and others. After his high-school graduation in 1916, he moved with his sisters and step-mother to Champaign, where he attended the University of Illinois (in the years just prior to the soybean's rise in prominence there). By the following year, he was alone, working his way through school as a steward of the Cosmopolitan Club – beginning his lifelong association with foreign students – and gaining a B.A. degree in chemistry and physics in 1920. In the midst of all this, he managed to become a proficient violinist. After a year teaching at Texas A&M, he worked toward his M.S. in biochemistry at Iowa State College in Ames, where he met Jeanette Beyer.

If Clive was forced to adapt to the loss of his family, Jeanette struggled to break free of the protective warmth of hers. Born in 1902, she was the daughter of S.W. Beyer, a geology professor and eventually the Dean of Science at Ames, where she and her sisters grew up in the cocoon of campus life. Graduating from high school in 1919 with "no honors and no defaults," she was "granted an escape from family and home," as she later put it in a memoir, at Rockford College, a women's college in Illinois where she delved into courses on composition – sparking an interest in writing – gained lifelong friends, and had her first experience of a "man dance," an event about which her parents, in letters

[86] J.K. Loosli, "Clive Maine McCay: A Biographical Sketch," *The Journal of Nutrition* 103 (Jan. 1973): 3.

from home, expressed trepidation. She completed her undergraduate work back at Ames, where she gravitated toward English courses and her scientist father pushed her toward physics and organic chemistry. She was intrigued by economics, but only to the extent that it was "not just a matter of making money," but of returning value to society, an aim that inclined her toward home economics. "Since I was a female," she further reasoned, "why not specialize in being a good one?"[87] But a college degree – and even a summer working in New York City – failed to bolster her self-confidence, and that she needed to get "far, far away" to a "strange country, among strange faces" and do difficult work. Only then could she "conquer my weakness and gain fortitude." The strange country, as it turned out, would be Minnesota, where in 1924 she was hired by the Washburn-Crosby Company, precursor to General Mills, to demonstrate Gold Medal Flour.[88]

Under the tutelage of a Mrs. Sweat, she learned how to attract shoppers and keep up a steady patter while baking cookies and cakes with what was then the novelty of general-purpose flour. "It doesn't make the cake dry as does cake flour; the gluten, you know, holds the moisture," Mrs. Sweat would tell her audiences with unflagging enthusiasm as Jeanette nervously handed her egg whites. On her first solo flight, "stage-fright struck. struck. I felt all the blood in my body flood to my head. How could I have failed to noticed that my hands were so enormous? How could I bend my colossal fingers to crack an egg? The woman and the little girl must know that I couldn't cook. Why didn't they go away?" When she asked the woman how she made cookies, and learned that she always bought them, Jeanette "began to relax. Indeed, I would teach that woman to make cookies. When my focus shifted from me and my clumsy fingers to her I started talking

[87] McCay, *Nutrition Pioneer*, 51-52.
[88] Ibid., 76.

naturally without strain. I sensed that I had won her interest and knew THAT was to be my job – to win the interest of women." Through countless more demonstrations in grocery stores and food shows, and in cooking schools that she operated in Zanesville, Ohio and Great Falls, Montana sponsored by local mills affiliated with Washburn-Crosby, she "went on to win the interests of hundreds of women. Over the next few years I did it again and again."[89] As an extension of her interest in writing –which she would pursue in creative writing courses whenever she had the opportunity – she also produced a "Table Talks" column for local papers.[90] It was this commercial experience, ultimately very much a matter of making money, that provided the basis for her ability to promote soybeans during the war.

During these years, she and Clive conducted a long-distance courtship through letters and brief periods together, usually spent outdoors hiking or canoeing, while he pursued his Ph.D. in biochemistry at the University of California, Berkeley, and then worked with renowned nutrition researcher L.B. Mendel at Yale on a National Research Council fellowship.[91] He wrote to Jeanette in 1925 that "I believe you're the best woman I've met to date and I've met a good many" and that she "may be 'the woman,'"[92] revelations that both exhilarated her and filled her with an anxiety too meet his high expectations that would persist even after they were married in 1927. That year, they moved to Ithaca, New York, where Clive had gained a assistant professorship in Cornell's Department of Animal Husbandry. He would be promoted to Professor of Nutrition in 1936. Jeanette meanwhile carried on her "Table Talks" column in the Ithaca *Journal-News* and took

[89] Ibid., 83.
[90] Ibid., 118.
[91] Loosli, 3.
[92] McCay, *Nutrition Pioneer*, 101.

graduate courses in nutrition and childhood development at Cornell, where she earned an M.S. degree in 1934 and a Ph.D. in 1939, accomplishments motivated in part by her desire to be worthy of her spouse and conversant with his interests.[93] By then, they had moved to a small farmhouse three miles out of town, a bargain they had happened upon while hiking and which they furnished inexpensively with treasures gleaned from the Depression era's frequent farm auctions.[94] Clive became a well-informed hobby farmer, drawing on the knowledge of his fellow faculty, and at least one of the academic pursuits for which he became well known – his study of the dog nutrition – began with raising animals on what he and Jeanette came to call Green Barn Farm.

Prior to World War II, soybeans were not a central concern of Clive's, but the soy foods that eventually appeared on Governor Dewey's banquet table nonetheless had roots in his prewar research. In particular, there were two lines of inquiry that informed his later promotion of soybean bread and sprouts. One, rather conventional for nutritionists at that stage, was the search for better animal feeds. The other, much less conventional, was his discovery of, and subsequent efforts to build a research program around, a link between calorie deprivation and extended lifespan. Both of these lines of investigation began with fish.

Clive had been fascinated as a boy with the marine life inhabiting Indiana ponds and streams, but his formal work began during his Berkeley years, when he studied the effects of water pollution on fish and established that they faced oxygen deprivation even before sewage made water "offensive in odor."[95] His study of fish feeding began at Yale, when

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[93] Loosli, 5; McCay, *Nutrition Pioneer*, 169, 344-45. Early on, she later recalled, "he said it was up to me to amount to something if I wanted to stay married."
[94] McCay, *Nutrition Pioneer*, 192.
[95] Ibid., 275.

he was assigned by Professor Mendel to do summer work – for pay, an indication that nutrition was a science that still had to pay its own way – for the Connecticut State Board of Fisheries and Game, which had successfully reintroduced brook trout into the state's waters for the benefit of fishermen. The fish were grown at hatcheries, fed on a diet consisting mainly of beef liver, and then released into streams. A crisis threatened in 1926, when the well-publicized finding that eating liver remedied anemia made what was formerly a denigrated food into a hot commodity; luckily the fisheries had a three-year contract with a supplier, but there were worries about what to subsequently feed the trout. Clive designed feeding experiments that were carried out for the most part by his assistant, Franklin Bing, at the Burlington Hatchery. Clive continued to direct fish studies for Connecticut even after he took up his position at Cornell and would contribute to thirty articles on the subject over the next seventeen years.[96] The goal in finding substitutes, as it had been for Atwater and Langworthy decades before, was to economize without sacrificing vitality. Clive estimated that a million dollars were spent annually by U.S. hatcheries to feed fish, with prices on the rise, but that this figure could be halved or quartered by substituting dried skim milk – in combination with peanut or cottonseed meal, in later studies, but not linseed meal, which proved poisonous, or soybean meal, which was poorly assimilated – for a portion of the liver.[97] The trout in fact thrived better on the skim-milk diet, ensuring that "the most outrageous fisherman's tale" could come true even at the lower cost.

Cost effectiveness was less central a goal when Clive turned his attention to the feeding of dogs, whom he had loved since boyhood when his step-mother had given him

[96] Ibid., 139-142, 279.

[97] Although not all of it, because of a mysterious Factor H in raw meat that McCay and his fellow researchers finally determined to be a combination of three B vitamins. Ibid., 281-282, 302.

a collie puppy to win his affection. In his preface to *Nutrition of the Dog*, first published just as he entered the Navy in 1943, he stated that “the purpose of this work is to improve the health and happiness of my favorite pet, the dog.” Thus, as with humans, the animals’ wellbeing was foremost in his mind when he elegantly voiced his faith in the principle of substitution when carried out scientifically: “When the farm dog catches a rabbit, he devours it entirely; even the head and fur may be eaten. A dog can be maintained in just as good condition upon a modern diet of dry feeds; instead of the bones of the rabbit, such a diet provides calcium and phosphorus in the form of bone meal. The proteins of the muscles of the rabbit are replaced by protein in the form of meatscraps, milk products, or soy beans. . . . The vitamins of the liver of the rabbit are replaced by cod-liver oil or by concentrates mixed with the dry feed.”[98] He also touched on a theme that he would reiterate when insisting on better nutrition for people: “The dogs of this country are, as a whole, probably better fed than the children, and this is particularly true of dogs kept in kennels where good mixed feeds are used.”[99] It was natural, then, that he might contemplate creating something roughly equivalent for humans.

The other line of inquiry, concerning longevity, originated when Bing pointed out to him that one group of fish, stunted by a low-protein diet, was still alive and in good condition while their peers had largely died off, as if the delay in development had also delayed the winding down of life-force. Other researchers, including his mentor Mendel, had demonstrated that many animals retained the ability to grow after a period of stunting, but none had connected this with the animals’ subsequent lifespan. Clive determined that he would study longevity, and though he would not have fish to work

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[98] Clive M. McCay, *Nutrition of the Dog* (Ithaca, NY: Comstock Publishing Company, 1943), 5.
[99] Ibid., 84.

with at Cornell, he felt he could do it with rats.[100] This he famously did in an experiment, reported in landmark papers in 1934 and 1935, where a group of rats fed a calorie-restricted diet lived up to 1,200 days (with a mean of 883 days) versus the mean lifespan of 509 days in an unrestricted group. He also featured photos of two white rats side by side on their 900th day, one with scraggly fur and one, the calorie-deprived one that grew to full size more slowly, still looking sleek and alert.[101] Similar results were later duplicated by Clive and others in dogs, worms, flies and yeast.[102]

Interpretations of these findings were complicated. Not all systems were affected: bones, for instance, aged at a normal rate in the restricted rats.[103] And it was less clear that a restricted diet slowed the aging of mature animals to the same extent, or whether the benefit came from delaying development. The application to humans was similarly uncertain, and difficult to achieve in ethical experiments. Despite these ambiguities, the lesson that became a part of popular lore was that "thin rats, whether by exercise or diet, always survived fat ones," reinforcing what since the turn of the century had become common wisdom.[104] Clive himself came to similar conclusions, not just that the "ancient theory that slow growth favors longevity" was correct, but that remaining thin prolonged life.[105] This led him to insist that in one respect human food be different from the typical mixed feed for animals which, after all, was designed to maximize bulk with no regard

[100] McCay, *Nutrition Pioneer*, 143.
[101] C.M. McCay and Mary F. Crowell, "Prolonging the Life Span," *The Scientific Monthly* 39 (Nov. 1934): 412, 407; Hyung Wook Park, "Longevity, Aging and Caloric Restriction: Clive Maine McCay and the Construction of a Multidisciplinary Research Program," *Historical Studies in the Natural Sciences* 40 (Winter 2010): 88-90.
[102] Roger B. McDonald and Jon J. Ramsey, "Honoring Clive McCay and 75 Years of Calorie Restriction Research," *The Journal of Nutrition* 140 (July 2010): 1205.
[103] C.M. McCay, "Effect of Restricted Feeding Upon Aging and Chronic Diseases in Rats and Dogs," *American Journal of Public Health* 37 (May 1947): 525.
[104] McCay, *Nutrition Pioneer*, xvi.
[105] McCay and Crowell, 406; McCay, *Nutrition Pioneer*, 488.

for a lifespan that would be cut short in any case: human food should provide complete nutrition with as few calories as possible – or, in terms he would coin following the war, food should contain "full" rather than "empty" calories.[106]

In retrospect, Jeanette saw a clear link between Clive's research with animals and his development of soy foods: "Clive had been researching optimum diets for animals, so it was natural for him to visualize an ideal food for man," she wrote years later.[107] And indeed, in a speech in November 1942 in front of the State Federation of Home Bureaus, he urged that "the housewife should be as particular about what she feeds her family as the farmer is concerning the feed for his livestock," and that bakers should make this easier by printing the "percentage composition" – the proportion of each nutritional component – on the label, much as formulated feeds sold to farmers were labeled. (In the same speech, indicating his disdain for what he was not yet calling "empty calories," he remarked favorably on the wartime decline in sugar use, which he disparaged as "just a fuel, and a very poor fuel at that. It contains no vitamins, no proteins, no minerals.")[108] Whatever the links to his long-term thinking, however, his turn to soybean research was instigated by the war emergency. Indeed, the original impetus for his analysis of the nutritional content of bread in Ithaca – which he reported in his speech – came from Carl E. Ladd, dean of the agriculture school. Initially, they examined the bread for percentage of milk solids, which correlated with protein and vitamin content, and found twenty-eight of the twenty-nine varieties chemically analyzed to be deficient.[109] Perhaps remembering the use of soybean flour in bread during the previous war, Ladd also urged Clive and his

[106] Ida Jean Kain, "Full Calories Boost Health with Nutrients," *New York Times*, 24 Jan. 1952, B5.
[107] McCay, *Nutrition Pioneer*, xix.
[108] "Housewife Urged to Buy Best Food," *New York Times,* 12 Nov. 1942, 28.
[109] That is, less than 6 percent of milk solids. Ibid.

colleagues to study how the addition of soy flour would improve the food value of even white bread; indeed, the committee Ladd established was the “bread and soybean committee.” The Cornell team found that white rats grew better on white bread enriched with five percent soy flour, even if it already contained the optimal level of milk solids.[110] This was in the fall of 1942.

In short order, Clive asked Lucille Brewer, a Home Economics professor who had been developing bread recipes for decades, to devise a loaf enriched according to his specifications. He insisted, as he had in his speech, that the percentage of each ingredient be printed on the label of any commercial bread made according to the formula and that the recipe be widely available to home bakers. Thus the bread was variously called Lucille Brewer’s Open-Formula Bread (again, a nod to animal feeds) or Open-Recipe Bread.[111] This would be the bread served at the Dewey luncheon, and the *Times* duly published its recipe: “Six cups sifted enriched flour, one cake yeast, three and a half tablespoons dry skim milk, two cups water, three teaspoons salt, two and half tablespoons sugar, nine tablespoons high fat soybean flour and one and half tablespoons shortening.”[112] The goal was to approach as close as possible to providing complete nutrition, to devise a “loaf of bread which will in itself largely furnish an adequate diet,”

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[110] This did mean not five percent of the weight of the finished loaf; rather, the dry weight of the flour used in the loaf provided the basis for comparison. The dry weight of the soy flour was five percent as heavy as the dry weight of the flour. William Shurtleff and Akiko Aoyagi, *Clive M. McCay and Jeanette B. McCay - History of Work with Soyfoods, The New York State Emergency Food Commission, Improved Bread, and Extension of Lifespan (1927-2009): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2009), 29; Cornell University Cooperative Extension, *Soybeans: An Old Food in a New World,* Cornell Extension Bulletin 668 (Ithaca, NY: Cornell University, 1945), 44-45; “Open Formula Bread,” food label, n.d., Clive McCay Papers 1920-1967, Box 1, Division of Rare and Manuscript Collections, Carl A. Kroch Library, Cornell University, Ithaca, NY (henceforth “McCay Box 1.”)

[111] McCay, *Nutrition Pioneer*, xx; “Open Formula Bread,” McCay Box 1.

[112] “Governor is Host.”

without without substantially changing the nature of the bread, which – despite Clive's appreciation of the virtues of the sort of whole-wheat bread that Sylvester Graham championed – was made with white flour (albeit vitamin-enriched).[113] His strategy was not to convince people to eat a new food, but to add nutrients to the foods they were already eating in increasing amounts during wartime. "When a nation runs short of food its people usually have to retreat to eating more cereals," read the label on Open-Formula Bread, and the "most practical way to take up the decline in the nutritional value of the diet . . . is to fortify the quality of bread – the principal cereal food."[114]

The Cornell committee were not the only researchers during the war to pursue a nutritionally complete food for military or civilian use, and, as in the biscuits that Edsel Ruddiman concocted for Henry Ford, soybeans were a common ingredient in these attempts. John MacMillan, Jr., heir to the grain giant Cargill in Minneapolis, invited a dog-food maker in early 1943 to formulate what MacMillan called "man food." Various combinations of malt powder, yeast, rice flour, corn flakes, rye and barley flours, bread flour and soy grits were tried. The "objectionable taste" of the soy turned out to be a problem, despite various techniques for reducing it. MacMillan speculated that one could "start out with babies and build up their taste for soybeans" until they liked it; in the meantime, "I'm afraid that the soya bean is out." The project died away after 1945.[115] A

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[113] Earlier, in a bulletin issued in June 1942 encouraging housewives to pack hearty lunches for their factory-working husbands, McCay et al included a recipe for "Graham Bread" using a mix of white and whole-wheat (Graham) flour; "soybean bread" appeared only in a list of various types of bread that housewives might try, as "one kind of bread gets tiresome." Clive McCay, Christine A. Heller, Theresa Wood, and Linnea Dennett, *Eat Well to Work Well: The Lunch Box Should Carry a Hearty Meal,* Cornell Bulletin for Homemakers 524, War Emergency Bulletin 38 (Ithaca, NY: Cornell University, June 1942), n.p.

[114] "Open Formula Bread," McCay Box 1.

[115] Wayne G. Broehl, Jr., *Cargill: Trading the World's Grain* (Hanover, NH: University Press of New England, 1992), 664-665.

more successful venture was that of Clifton Clinton, a Los Angeles cafeteria owner, who in 1944 commissioned biochemist Henry Borsook at Caltech to develop a food that offered a complete protein and the full complement of vitamins, to be added to starchy staples, that would cost no more than three cents a meal. Borsook took up the challenge, combining soy grits with dehydrated vegetables (onions, potatoes, green pepper, celery, garlic, leeks) and seasonings, which apparently camouflaged any objectionable taste. The recipe evolved into what Clifton named "multi-purpose meals" and then "multi-purpose food"; he served it at his cafeterias, but its enduring success in the postwar period would be feeding the hungry of Europe and then the world.[116] The relatively small amounts of soybean flour in Open-Formula Bread apparently did not adversely affect the taste; in fact, a 1944 study conducted by the Soya Foods Research Council, based in Chicago, found that when offered in the cafeterias of mental hospitals in Illinois over a thirty-day period, breads containing as much as 7 percent soybean flour were actually consumed more avidly than standard bread.[117]

Clive continued to use soybeans in his program of food enrichment after he volunteered for the Navy and moved to Bethesda, Maryland in July 1943, not long after the Dewey lunch. There, as a Lt. Commander, he created a Mobile Nutrition Unit consisting of himself, an enlisted man, and four Waves trained as nutritionists and home economists. Under the auspices of the Naval Medical Research Institute, they would visit naval bases such as Quantico to gather samples of the meals served to sailors, using

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[116] William Shurtleff and Akiko Aoyagi, *History of Meals for Millions, Soy, and Freedom From Hunger (1946-2011): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 8, 21.

[117] Soya Food Research Council Organoleptic Committee, *Report on Tests of Continued Flavor Acceptance of Soy Flour in Bread* (Chicago: Soya Food Research Council, 1944), 4.

precise methods to estimate exactly how much food each ate and, collecting samples of garbage, how much they threw away. Freezing and later chemically analyzing these samples, Clive and his “chow chemists” – as they were informally known – concluded that the typical man consumed 3400 calories a day (causing a typical gain of 10 pounds in the first few months of service). Combing canteen records, he also noted that, while about 10 percent of the calories on each recruit’s plate was thrown away – mainly fat trimmed from meat – they recovered this using their own money to purchase sugar-laden candy.[118] While Clive made recommendations to cooks for making the food more appetizing and preserving more of its vitamin content, he also experimented with enriching candy bars: “It is possible to manufacture candy bars of excellent flavor which incorporate such food items as brewer’s yeast, wheat germ, milk, corn germ, soy flour, and also nuts which will give them extra nutritive value.” In a letter to Jeanette in late 1944, he mentioned that in “making candy bars with soy flour, ‘My Man,’ Grelek of Baltimore, is cooking by dropping it into the host mix. He gets a good flavor. High fat-soy flour works nicely into candy bars.” [119] It is not clear if these ever progressed beyond prototypes.

Clive also continued his work with soybean sprouts at the Institute. This work had originated at Cornell through the influence of a student from China, Dr. Peng Cheng Hsu, who received his doctorate in nutrition in 1942, but who was stranded at Cornell by the war. With Dr. Hsu as a guide, Clive toured New York City to observe sprouting methods in Chinatown cellars.[120] They then experimented with different varieties and sprouting methods, including a system in their laboratory that watered 100-pound lots of sprouting

[118] McCay, *Nutrition Pioneer*, 361-66.
[119] Ibid., 365, 358.
[120] "Meat Substitute." *The Science News Letter* 43 (22 May 1943): 326.

soybeans.[121] They began test-marketing sprouts at the Ithaca Food Co-op, a Depression-era self-help venture that – in part because of the influence of the McCays – presaged the health-food oriented co-ops of later decades. It was also an important outlet for Open-Formula Bread, as well as soy flour. They also offered sprouts in the university's cafeteria and meat shop.[122] Clive envisioned that commercial sprouting operations could be set up in canneries and creameries.[123] When at the Naval Medical Research Institute, he developed a "simple method" compact enough to be suitable for ships that consisted "of a five gallon pickle jar with a half inch hole drilled in the bottom" capable of converting four pounds of dry beans into sprouts for 100 men, providing them with a fresh vegetable high in vitamin C.[124] It is not clear if this scheme ever went beyond the trial phase. Prior to his naval service, most of his energy went into publicizing home methods; the *Life* article offered a step-by-step guide, with photographs, using milk bottles and chlorinated lime water (to prevent the growth of mold).[125]

Sprouts represented a rather different strategy for introducing soybeans into the American diet than the bread, that of persuading people to try a novel food that they could not help but notice on their plates. Clive's optimism rested in part on the fact that Americans were familiar with sprouts from eating chop suey at Chinese restaurants and even at home, using ingredients marketed by companies such as La Choy.[126] These were

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[121] McCay, *Nutrition Pioneer*, 332; "Old Food in a New World," 29.
[122] McCay, *Nutrition Pioneer*, 332.
[123] "Meat Substitute."
[124] C.M. McCay to Captain D.G. Hakansson, 5 Jan. 1944, Clive McCay Papers 1920-1967, Box 3, Division of Rare and Manuscript Collections, Carl A. Kroch Library, Cornell University, Ithaca, NY (henceforth, "McCay Box 3.")

[125] "Governor Dewey Sponsors," 45.
[126] La Choy was founded in Detroit in the early 1920s by two friends from the University of Michigan, Wally Smith and Ilhan New, a Korean. They began by growing mung-bean sprouts, and gradually

typically mung-bean sprouts, however, which aside from being faster growing, were smaller and more vegetable-like; in contrast, the bean remained a conspicuous part of the soybean sprout. The argument for turning to soybeans was that, unlike mung beans – or even the garden-variety green soybeans that could be eaten as fresh vegetables – field-variety soybeans suitable for sprouting were widely available.[127] With wartime shortages as a spur, Clive also hoped to persuade people through the force of nutritional information: as he detailed in bulletins and interviews with the press, soybean sprouts kept better than mung sprouts and contained substantially more protein, as well as an abundance of calcium, vitamin C, niacin and riboflavin.[128] Easy to pan fry or boil, they were "bland in flavor, waxlike and non-mushy in consistency," although Clive admitted to his Navy superiors that they were "easily spoiled by poor cookery."[129]

The tension between promoting soybeans and concealing them – between encouraging people to eat them as a novel food like sprouts or in a familiar food like white bread – was resolved in part along gender lines. As indicated by Clive's speech before the State Federation of Home Bureaus, it was the housewife who was in the position of the farmer, responsible for knowing the nutritional value of feeds and for ensuring their avid consumption. As Mildred Lager wrote in *The Useful Soybean* in 1945, although the "average American male" was "not the least bit interested in soybeans, does

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expanded into soy sauce and other ingredients for homemade chop suey. Shurtleff and Aoyagi, *History of Soy Sauce*, 849. Mung beans were also used for sprouts in the Japanese Relocation Camps, despite an apparent national shortage.

[127] The dry-bean varieties most suitable for cooking as a table bean – Easycook and Hahto – were also less common than varieties grown for crushing, just as they had been less common than hay varieties during the previous war.

[128] C.M. McCay, *Sprouted Soy Beans* (Ithaca, NY: New York State Emegency Food Commission, April 1943), n.p., McCay Box 1.

[129] Jane Holt, "News of the Food: Soya Flour Is Added to Bread to Make it Richer in Protein and More Tasty," *New York Times*, 13 Sept. 1943, 16; McCay to Hakansson, 4 Jan. 1944, McCay Box 1.

not even want to try them, and feels he can get along nicely without them," such "a rebelling male can get his beans without suspecting their presence."[130] Housewives were then the intended audience of most soybean promotion, and though Clive often spoke to the press as a nutritional expert, it was Jeanette who was central to this work. In 1942, she was working with colleagues in the Child Development and Nutrition departments writing articles, radio addresses and bulletins when she was offered a full-time position as an extension professor. "What exciting vistas this opened," she later recalled feeling. "It would be like reliving my youth when I demonstrated and sold Gold Medal Flour."[131] Soybeans were a frequent topic of her lessons and demonstrations; in 1943, she was put in charge of publications for the new Emergency Food Commission, and she was soon the Chairman of its Soybean Committee.[132]

The Dewey lunch was a major catalyst for public interest in the soybean. The Soybean Committee logged over 22,000 letters inquiring about soy recipes in the months that followed the lunch, peaking in July (the month the *Life* piece came out) with almost 10,000. Although the largest number came from New York residents, they arrived from every state in the union (plus Hawaii, Alaska and Washington, D.C.), as well as Canada, Mexico, and a smattering from England, Cuba, Puerto Rico and other countries.[133] In response, Jeanette and her team produced and distributed over 90,000 leaflets about soybeans by the end of 1943 – some sent in bulk to home demonstrators and nutrition

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[130] Mildred Lager, *The Useful Soybean: A Plus Factor in Modern Living* (New York: McGraw-Hill Book Company, Inc., 1945), 175; also quoted in Amy Bentley, *Eating for Victory: Food Rationing and the Politics of Domesticity* (Urbana, IL: University of Illinois Press, 1998), 100.
[131] McCay, *Nutrition Pioneer*, 332.
[132] Shurtleff and Aoyagi, *McCay*, 7; "Old Food in a New World," 2.
[133] Soybean Committee of the New York State Emergency Food Commission, Report to H.E. Babcock and L.A. Maynard, 20 Dec. 1943, Table: "Soybean Letters Received," n.p., McCay Box 3.

teachers – and around one million by the end of the war.[134] These included *The Miracle Bean*, which featured recipes using whole soybeans or grits as meat extenders, such as "Chile Con Carne with Soybeans" and "Peppy Meat Loaf," as well as recipes for baked goods such as "Soy Grit Cookies," "Helen's Birthday Spice Cake," and, of course, "Lucille Brewer's 'Open-Recipe' Bread." She also issued a special pamphlet on sprouting written by Clive, *Soybeans for Fifty* for restaurants and cafeterias, and *Desserts with Soy*.[135] These efforts culminated in *Soybeans*, a 63-page Cornell Extension Bulletin issued in February 1945. All of these publications were enlivened by the drawings of Kenneth Washburn, an art professor at Cornell, and other artists who devised striking pictorial graphs to chart soybean production figures and nutritional data, as well as more whimsical illustrations: for instance, of a quartet of sprouts in top hats and bowties singing "a song of soy sprouts" on the cover of Clive's pamphlet.[136] The Governor's lunch also inspired imitation throughout the state. As Jeanette reported in *The Food Commentator*, a newsletter distributed to home demonstrators and teachers, similar meals were held in nearly every county. Over 250 community soybean dinners attended by over 7,500 people were held in churches, grange halls and Masonic halls.[137]

As Mildred Lager observed from Los Angeles, "the sudden limelight [on] the sprouted soy" as a result of the Dewey lunch "is enough to make the soy pioneer and some of the slighted nutritionists rub their eyes in amazement"; she also knew all too well that "it is never easy, however, to change food habits."[138] In the case of soybeans, the

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[134] Ibid., 1; Shurtleff and Aoygai, *McCay*, 28.
[135] McCay, Jeanette, *The Miracle Bean* (Ithaca: n.d.), McCay Box 1; Shurtleff and Aoygai, *McCay*, 28.
[136] McCay, *Nutrition Pioneer*, 375; C.M. McCay, *Sprouted Soy Beans* (Ithaca: New York State Emergency Food Commission, n.d.), McCay Box 1.
[137] McCay, *Nutrition Pioneer*, 376.
[138] Lager, 80, 175.

wartime excitement had a limited long-term impact on these habits. Soybean sprouts never became an American staple, as Clive hoped. And as Jeanette reflected in a 1947 article, "now that America is settling into her postwar stride, many a homemaker will find a forgotten package of some soybean product in her kitchen [and] may wonder, 'Why was there such as wartime furor over soybeans anyway?'" As the food crisis envisioned by Dewey's commission failed to materialize – meat remained relatively plentiful in the U.S., despite grumbling over rationing – "interest in soybeans gradually declined."[139] In May 1944, *The New Yorker* ran a cartoon in which a lady pushes a grocery cart past a meat counter and, in response to the butcher offering her a large cut of meat with a smile, apologizes, "I'm sorry, Mr. Groff, but my family has come to prefer soybeans." Her comment was both an accurate gauge of the publicity soybeans had received and something deemed laughingly unlikely for someone to actually say.[140] But Jeanette was not mistaken, on the other hand, when she wrote in 1947 that "soybeans are here to stay." She noted the increasing use of soy flour by commercial food manufacturers for what would come to be called "functional" purposes: because soy flour retained water, it helped keep baked products fresh longer; it made an effective binder in sausage and other comminuted meats; and it was indeed finding a place in the manufacture of candy bars and other confectionery as an emulsifier, much as soy lecithin had been used since the 1930s.[141] As it faded from American awareness, soy was becoming an important ingredient in the American diet. The tension between promotion and concealment was resolved, but the act of concealment was not on the part of the housewife, but on the part

[139] Jeanette B. McCay, "Soybeans Are Here to Stay," *Journal of Home Economics* 39 (Dec. 1947): 629.
[140] "I'm Sorry, Mr. Groff," *The New Yorker,* 27 May 1944, 26.
[141] McCay, "Soybeans Are Here to Stay," 630.

of the processors who would supply her and her family with an ever greater share of their food.

The seeming inevitability of this outcome was presaged by a study by the National Research Council's Committee on Food Habits on the effectiveness of advertising appeals. During the summer of 1943, researcher Patricia Woodward and her colleagues designed a number of posters that extolled the virtues of soybeans in various ways: one emphasized the variety of foods that could be derived from the soybean, another its nutritional benefits, and so on. These were posted in a number of government cafeterias, while at the same time, soybean-enriched dishes – meatloaf, muffins, macaroni and cheese, split-pea soup – were offered on the menu and their popularity gauged. Little enough soy was added to these dishes so that it was the idea of soybeans, not their taste, that determined the outcome. The findings were striking: except in the case of the muffins, consumption of the soy foods dropped when they were first labeled as such, after the first week of the study; and, of the posters, the one with the nutrition appeal seemed actually to discourage people from eating the soy products, indicating that the McCays' faith in nutritional arguments was somewhat misplaced. Surveys revealed another interesting fact, however: some of the respondents, having apparently heard of Ford's industrial use of soybeans, objected to the idea of eating "paint or steering wheels."[142] By late 1945, however, another *New Yorker* cartoon showed a man at a trade show in front of a booth for "Soyzic: The Soybean Plastic," which, according to the pitchman, could be "bored, punched, stamped, sawed, and in an emergency eaten with a

[142] Patricia Woodward, "A Practical Study in Nutrition Education," *Journal of Home Economics* 37 (Jan. 1945): 19.

light sauce."[143] At least the joke was now once again that plastic could be made from something considered food, rather than the other way around.

Open-Formula bread meanwhile had an afterlife in New York: after settling back in Green Barn Farm, Clive was asked by the New York State Department of Mental Hygiene to help improve the diet of psychiatric hospital patients. Finding that, like wartime populations retreating to a cereal diet, the older patients consumed bread in disproportionate amounts – fifty percent above the national per capita average – he developed a new high-protein bread recipe, again using full-fat soy flour and dry skim milk. It was served in the state's mental hospitals for the next twenty years. In the meantime, by popular demand, it reappeared at the Ithaca Co-op as Golden Triple Rich Bread (the "triple" referring to protein, vitamins and minerals) and in New York City as Cornell Bread ("the bread with a college education") until a lawsuit by the university over the name and labor troubles put the bakery that made it out of business in the mid-1950s.[144] It was only with the revival of interest in home-baked bread, natural foods, and vegetarianism in the 1970s that Cornell Bread would find new popularity in the form of recipes and booklets written by Jeanette, culminating in *The Cornell Bread Book*, published in 1980. This was more than a decade after Clive, having retired from Cornell and retired to Florida with Jeanette, died in 1967 at age 69.[145]

The Investigator: Warren H. Goss

As an informant, Warren Goss found Conrad Mohr, the Managing Director of Norddeutschen Olmuhlenwerke G.m.b.H in Hamburg, boastful and generally not very

[143] "Soyzic," *The New Yorker,* 15 Sept. 1945, 31.
[144] McCay, *Nutrition Pioneer*, xxii-xxiii.
[145] Shurtleff and Aoyagi, *McCay,* 8-9.

helpful. The intelligence report indicated that Mr. Mohr, speaking through an interpreter, "talked at some length about the virtues of synthetic fatty acids" – that is, edible fat produced from soap stock and other inedible sources – used to make the margarine produced at his brother's neighboring factory. Mohr claimed to like the taste better, though he admitted that he was "greatly in the minority . . . in this respect." Goss reported that "this investigator subsequently tasted some of said synthetic margarine," which the Nazis had tested on prisoners, "and found little basis for Mr. Mohr's opinion." When the topic turned to soybean oil, however, Mohr indicated that he possessed some valuable information. Though "not a technical man," he was "quite conversant with the phenomenon of reversion in soybean oil" – whereby off tastes appeared in bland, refined oil after a short period of time – "and stated that his company had overcome the difficulty." He described a method commonly used at other German refineries, "obviously giving second-hand information," until he mentioned that "his firm has developed an even better cure for reversion by means of which refined unhardened soybean oils can be made that will keep a year before there is any trace of reversion." The report did not go into the body language of the interaction, but one can readily imagine Mohr leaning toward Goss when divulging this information, and Goss staring expectantly at him, waiting for further information. Unfortunately, while Mohr "was very enthusiastic about the process," he "parried all attempts to elicit details" about what was after all a valuable trade secret. "It was necessary, therefore," Goss indicated, "to resort to other means for obtaining the detailed information." This presumably meant a follow-up conversation that day with the plant's chief engineer, Herr Bull, also listed in the report as an interview subject.

This was in late August 1945, some three and a half months after VE Day and about seven weeks into Goss's tour of occupied Germany. Goss was himself a technical man, a graduate of the University of Washington who began his career at the U.S. Bureau of Standards in the early 1930s, then conducted research on the soybean at the University of Illinois beginning in 1937 as part of the U.S. Regional Soybean Industrial Products Laboratory. By 1944, he had moved on to USDA's Northern Regional Research Laboratory in Peoria, where he was Senior Chemical Engineer. That year, as a leading expert on soybean processing, he published *Soybean Chemistry and Technology* with Klare Markley, a former colleague from the Industrial Products Lab and Principal Chemist at the Southern Regional Laboratory in New Orleans. Markley also joined Goss on his mission in Germany, where he took photos for Goss's reports and helped conduct interviews (though he was not with Goss when he spoke to Mohr).[146] Both men were thoroughly familiar with every variety of crushing, refining and processing equipment, as well as the variations in quality of finished soy products, and thus could turn highly educated eyes onto the German industry.

Goss, who was commissioned an army major for his work, was part of a far vaster enterprise which had its origins with the Combined Intelligence Objectives Subcommittee (CIOS) of the U.S. and British militaries. CIOS had originally been established during the war to gather industrial intelligence that could benefit the Allied military effort, but it soon responded to pressures by private industry groups to include in its list of intelligence targets sites of purely scientific or economic interest. "Such information," one official argued, "would not only further our war effort against Japan but also help American

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[146] Allie Shah, "Obituary: Warren H. Goss, 86, Noted Pillsbury Co. Scientist," *Minneapolis-St. Paul Star-Tribune,* 16 July 1998; W.H. Goss, *The German Oilseed Industry* (Washington, D.C.: Hobart Publishing Company, 1947), n.p.

industry to maintain its place in world trade and provide employment opportunities for discharged veterans of the war." [147] The U.S. created the Technical Industrial Intelligence Committee (TIIC) to coordinate the industry experts who would fan across liberated Europe beginning in 1944 to targets recommended by the TIIC's nineteen subcommittees, each representing an industrial sector such as rubber, chemicals, metals and minerals, machinery, textiles, solid fuels, aeronautics, communications, and shipbuilding.[148] By the end of 1944 there were almost 200 investigators, and by the beginning of 1947 almost 400 had toured Germany, many of them technicians from major American companies – "an American Industrial Who's Who," as one report put it – which continued to pay their salaries during their stints. The TIIC's work would also eventually include dozens of "technical people" scouring the German Patent Office in Berlin, microfilming up to 4,000 patent applications per day, a marked expansion of the confiscation of German patents following World War I, which was restricted to American patents issued to German companies.[149] The ultimate goal was no less than the transfer of "a modern nation's complete technology," which would suffice as "the only tangible German reparations that the United States may ever receive as a result of World War II."[150]

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[147] John Gimbel, *Science, Technology and Reparations: Exploitation and Plunder in Postwar Germany* (Stanford, California: Stanford University Press, 1990), 5.

[148] Ibid., 7.

[149] John C. Green, "Activity Report for August, 1946," Record Group 40, General Records of the Department of Commerce, Subgroup: Records of the Office of Technical Services, Series: Industrial Research and Development Division Subject File, 1944-1948, Box 65, National Archives II, College Park, MD (henceforth "Records of the OTS.")

[150] Office of Technical Services, Technical Industrial Intelligence Division, "Purpose and Activity Summary," Jan. 1947, Records of the OTS.

The presence of Goss within this massive effort indicated the growing importance of soybeans to America, both in strategic and economic terms. Tariff laws during the Depression had favored domestic over imported vegetable oil, the supply of which the war then effectively cut off. Soybean oil was a key to achieving what this era thought of as oil independence: from 1939 to 1943, its share of total fats and oils produced in the U.S. – including butter, tallow, and lard, as well as other vegetable oils – more than doubled, from 5.6 to 11.4 percent. Of this, 80 percent was used for edible purposes, mostly in shortening or margarine.[151] Demand and government price supports had sparked a boom in both acreage and processing. Driven mainly by expansion in the Corn Belt states, acres planted in soybeans had increased from four million in 1943 to sixteen million a decade later, and the amount harvested for beans, rather than hay, made a particularly dramatic jump from six million acres in 1941 to ten million in 1942.[152] The beans used as seeds for the following year's crop increased to keep up with this expansion – from fourteen million to twenty million bushels between 1940 and 1945 – while the beans fed directly to livestock on farms held steady at between five and six million bushels. The dramatic increase was in the number processed into oil and meal, which more than doubled from sixty-four million bushels in 1940 to 142 million bushels in 1944.[153] Happily, this level of production did not produce a glut of meal, because demand for high-protein feed was also strong. Contrary to the predictions of the New York State Emergency Food Commission, there was no mass slaughter of livestock for lack of feed. In 1945, in fact, record-high numbers of cattle, hogs and chickens went to

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[151] Department of Agriculture, Bureau of Agricultural Economics, *Soybean Production in War and Peace,* by Edwin G. Strand (Washington, D.C.: Government Printing Office, Sept. 1943), 24.
[152] Ibid., 15.
[153] Ibid., 17.

slaughter – with production of beef topping ten million pounds for the first time – and an increasing number of these were fattened on formulated mixed feeds, which in turn increasingly used soybeans as their source of protein.[154]

World War II spurred the growth of a soybean industry that had slowly matured during the 1930s, led by pioneers like Staley, Glidden, and Swift in Illinois, Ralston Purina in Missouri, Central Soya in Indiana, and Archer-Daniels Midland in Minnesota. During the war, these were joined by smaller concerns, which contributed to the 100 mills specializing in soybean processing by the beginning of 1944. (An additional 100, mainly cottonseed mills, crushed soybeans during part of the year.) As an indication of the boom, by the middle of 1944, the number had grown to 137, with a capacity to crush 172 million bushels per year (in anticipation, it seems, of future growth).[155] Much of this new investment was in newer technology: hydraulic presses were being phased out, accounting for around three percent of the soybeans processed in 1941, whereas the more advanced expellers, or screw presses, accounted for 74 percent. Solvent extraction, with plants having dealt with safety concerns, accounted for the remainder, and was the method that grew most rapidly during the war.[156] The larger of these companies carried out research, but this was supplemented to a significant degree by the universities and federal agencies that had nurtured soybean production from the start, something reflected in Goss's own background, which included time at both the University of Illinois and at a USDA regional research laboratory. In addition, the American Soybean Association began publishing the *Soybean Digest* in 1941 and the National Soybean Processors

[154] Beef, Veal, Pork, and Lamb Production; Chicken, Turkey and Egg Production; "Soybean Production," 22, 27.
[155] "Soybean Production," 20.
[156] Ibid., 19.

Association ran various research and promotional projects out of the Chicago Board of Trade Building. All of this informed Goss's mission in Germany. He was sponsored by the TIIC's Subcommittee of Food and Agriculture, which, like the other subcommittees, canvassed university departments, private companies and government agencies to determine intelligence goals.[157] The soybean industry, and its allies in government and the academy, had its say.

Goss's charge was both broad and narrow. At its broadest, it was to determine how Germans had coped with wartime shortages of fats and oils, of importance in a postwar world that might possibly be facing such shortages on a global scale. "The methods employed in meeting the shortages are worthy of study from both a technological and economic standpoint," he commented. There were dark rumors, of course, about the nature of at least one of those substitutes. When the Germans distributed bars of soap with the initials "RIF" stamped into them, some misread the letters as "RJF" and conjectured that they stood for *Rein Judisches Fett* or "pure Jewish fat." Others witnessed mass burnings of bodies and concluded that they were being rendered for their fat.[158] During the Nuremberg Trials, a research assistant at the Danzig Anatomical Institute in Poland would testify, "I boiled the soap out of the bodies of women and men . . . During two manufacturing processes, in which I directly participated, more than 25 kilograms of soap were produced."[159] Mohr's description of margarine made with fat synthesized from soap stock might have suggested an even grimmer reality, but there is no evidence that human fat was ever used on a mass scale. Goss, in any case, did not

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[157] W.H. Goss, "Processing Oilseeds and Oils in Germany," *Oil and Soap* 23 (Aug. 1946): 241.
[158] Michael Shermer and Alex Grobman, *Denying History: Who Says the Holocaust Never Happened and Why Do They Say It?* (Berkeley: University of California Press, 2002), 114-117.
[159] Nuremberg Trial Proceedings Vol. 7, SIXTY-SECOND DAY, 19 February 1946, Morning Session, http://avalon.law.yale.edu/ imt/02-19-46.asp.

discover – or even seek – such evidence. Rather, he found more prosaically that the "question of where the German people obtained their fats during the war may be answered partly by the observation that they 'did without.'" The weekly ration of butter and margarine decreased to 200 grams per person, then 50 grams. German margarine, used as an all-purpose fat for frying, baking and spreading on bread, was moreover diluted with water and air and would unlikely "merit extensive consumer acceptance in the United States." The "rest of the answer to the question is careful planning, use of reserve stocks, subsidized production of oil crops" – mainly rapeseed – and, last on the list, the "technological substitution of substitutes."[160] Still, the widespread rumors point not only to the Nazi reputation for cruelty and inhumanity, but also to an underlying unease at where the technological ability to substitute anything for anything else might lead.

In any case, Goss was concerned predominately with technology that could directly benefit the U.S. soybean industry. The terrain was promising. As Goss noted, oilseed processing had long been a major German industry and that "much of the oilseed technology practiced throughout the world is of German origin."[161] This was certainly the case with Glidden, which obtained rights to German patents, as well as other large American crushers. In the event, however, Goss was unimpressed by what he saw, concluding that German technology during the previous decade had come to lag behind that of the United States, mainly due to the "vastly greater quantity and quality of scientific research conducted on fats and oils in the U.S." by researchers such as himself,

[160] Goss, *German Oilseed Industry*, 3.
[161] Ibid., 3.

not to mention Percy Julian.[162] Goss acknowledged, on the other hand, that the war itself had greatly affected what he was able to observe. Soybeans had not been available for a number of years, the last shipment of Manchurian soybeans having been delivered by way of Russia early in the war. Existing stores of whale, coconut and palm kernel oil were eventually exhausted as well, leaving only domestic rapeseed for processing.[163] This prevented Goss from seeing any processes firsthand.[164]

Another factor was Allied bombing. One plant in the Hamburg-Harburg area – which "suffered the misfortune of being next to a gasoline refinery" – received between 2,000 and 3,000 bomb hits during the last nine months of the war, destroying everything but the hydrogenation plant and leaving "hardly anything left to investigate. The premises are simply a horribly churned mixture of sandy soil and fragments of buildings and equipment, and the drifting sand is gradually covering the debris in the countless craters."[165] (Its sister plant was less battered, but one direct hit on the air-raid shelter killed almost its entire staff in March.) The photographs that accompany this report are mainly of rubble and twisted metal, their past functions identified by crisp captions: "the batch extraction plant," "the Tyca Continuous Extractor." Until he gained some distance from Hamburg and found plants that were in better shape, Goss relied on schematic diagrams and interviews with technicians to evaluate the German state of the art.

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[162] Ibid., 14.

[163] Ibid., 10.

[164] And, in fact, much of his information was not only second-hand but out-of-date, referring to prewar conditions in the present tense. For instance, when he interviewed Conrad Mohr's brother, who ran the margarine factory next door, he learned that 15-20 percent of the plant's output consisted of "kosher margarine" and that its palm-oil shortening, Palme, "is used to a considerable extent by Jewish consumers." Goss, *German Oilseed Industry*, 60.

[165] Goss, *German Oilseed Industry*, 17.

As his investigation narrowed, one area where he suspected that German might have surpassed American expertise was in addressing the problem of flavor reversion, which the Germans called “Umschlag.” Though plant operators differed in their accounts of how to combat Umschlag, Goss found that they agreed with each other on a number of points. Most theorized that lecithin was in some way the culprit, and that thoroughly removing and deactivating it was the key. They emphasized, however, that the quality of bean made a notable difference, an advantage America already enjoyed: one operator recalled being amazed at the high quality of oil produced from American soybeans, some of which had somehow made it to Germany during the first year of the war.

To fully solve the problem, however, required a fastidiousness sometimes lacking in American processing: “The Germans consider soybean oil to be one that must be prepared and handled with the utmost care and gentleness.” They insisted on solvent extraction, which was still less prevalent in the U.S. Screw presses tended to burn the oil and cause the lecithin to “set.” Even during solvent extraction, precautions had to be taken against momentary overheating. They also redoubled the degumming process, which removed lecithin and other emulsifiers by agitating the oil with water and then separating out the sludge with a centrifuge. U.S. processors “washed” the oil in this fashion once, if that. The Germans insisted on two washings. Finally, to neutralize the traces of lecithin that remained, the Germans added 0.01% citric acid to the deodorizer (which removed volatile components of the oil with steam).[166] This was more or less the consensus viewpoint of German operators on how to handle Umschlag. The alternate method used at Conrad Mohr’s plant, a description of which Goss was ultimately able to

[166] Goss, “Processing Oilseeds,” 244.

obtain, entailed subjecting whole beans to a high-pressure steam treatment while they were pushed through a closed metal trough by a screw conveyor. If successful, this raised the moisture content of the beans by four percent within 90 seconds; if it took even as long as 120 seconds, the method failed to prevent reversion. The excess moisture was removed, and the beans were then treated in the normal manner, except that there was no need for citric acid in the deodorizer.[167]

Ultimately Goss provided details about both methods in his more than forty intelligence reports from Germany. The Commerce Department's Office of Technical Services (OTS), which would house the reorganized Technical Industrial Intelligence Division (TIID), made the reports available through its Bibliographic and Reference Division, whose mission was to organize all war-related technical research into a "vast cafeteria of physical knowledge" in which the "world's most significant studies and reports" would be collected, catalogued, publicized in bibliographies, and "made available to all in inexpensive reprints."[168] Each report was available separately to all askers, but "popular interest in certain of the subjects treated, especially the German remedies for flavor instability in soybean oil," prompted Goss to compile them into a book published in 1947, as he explained in its preface.[169] In a letter to the head of OTS in late 1946, Goss estimated that losses due to reversion cost the soybean industry $50 million a year "under present prices" and that, once operators had invested in the equipment required by the German methods, "the large losses occurring because of reversion will be eliminated as a result of these discoveries" resulting as well in "a great

[167] Goss, *German Oilseed Industry*, 56.
[168] Office of Technical Services, Bibliographic and Reference Division, "Purpose and Activity Summary," Jan. 1947, Records of the OTS.
[169] Goss, *German Oilseed Industry*, n.p.

enhancement in the quality of the products retailed to the customer."[170] An excerpt from this letter was read aloud at a House Appropriations Committee hearing to demonstrate the value of the program, as well as the interdepartmental cooperation between Commerce and Agriculture, prompting complaints from soybean processors about his estimates. Goss, who by then had left government service to become director of research for Pillsbury Mills in Minneapolis – where he would work until his retirement 22 years later – responded in a letter to OTS that American manufacturers, both of soybean oil and processing equipment, were "very close-mouthed about what they are doing with the German data" and would "probably deny using the German data if they are asked."[171]

In fact, Goss overestimated both the immediate impact of his findings, as well as the secrecy of the companies involved in producing soybean oil. Solving the reversion problem would require decades and the cooperative efforts of researchers in both government and private industry. This was indicated in April 1946, when the first Conference on Flavor Stability in Soybean Oil was convened at the Bismarck Hotel in Chicago by the National Soybean Processors Association. Edward J. Dies, the NSPA's President, opened the conference with a plea for a joint effort: "Any advantage to an individual or a corporation in attaining a solution before the answer were generally known generally would be of only temporary and transitory value. It would appear to be a problem of general interest, and one whose solution could be brought about speedily through the composite talents of the group, and by reason of free and open exchange of

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[170] House of Representatives, *Department of Commerce Appropriation Bill for 1948: Hearings before the Subcomittee of the Committee on Appropriations, H.R.,* 80th Congress, First Session, Feb. 1947 (Washington, D.C.: Government Printing Office, 1947), 131.
[171] Gimbel, 98.

ideas and recommendations."[172] Dies' background was as a journalist and publicist. He had done a stint at the Associated Press in the teens, headquartered in Minneapolis, and with a background in economics, he covered the commodities beat. Eventually starting his own public relations firm in Chicago – whose commodity exchange was the topic of his first boosterish book, *The Wheat Pit*, in 1925 – he had been brought in by the NSPA in 1936 to deal with adverse publicity, and became its president not long after. In 1941, he wrote *Soybeans: Gold from the Soil*, an upbeat survey of all that the miracle bean had to offer. The task at hand, however, was an unusual one for a publicist. He was calling on the top chemists in the field – and there were representatives as the conference from Staley, Glidden, Swift and Company, and Archer-Daniels Midland, as well as Goss and others from the USDA – not to raise the profile of soybeans, but to render them more nondescript, and ingredient that could be included in the nation's food in ever greater amounts with nobody noticing.

The worry was that, as much as national emergency had spurred soybean production, the end of the war might undermine it.[173] Refined, bleached and deodorized, soybean oil was as pleasingly bland as cottonseed oil, then the gold standard for edible oils. But in a matter of days or weeks at room temperature – and sometimes immediately if heated in a pan or deep fryer – it had a tendency to "revert,"[174] a term deplored by some researchers because it implied the reappearance of tastes particular to the soybean. As these researchers pointed out, the off tastes that developed were new, most often typified as

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[172] Edward Dies, "Introductory Remarks," in *Proceedings of the Conference on Flavor Stability in Soybean Oil* (Chicago: 22 April 1946), 3.

[173] H.E. Robinson, "The Economic Significance of Soybean Oil Flavor Stability," in *Proceedings of the Conference on Flavor Stability in Soybean Oil* (Chicago: 22 April 1946), 1; O.H. Alderks, "Soybean Oil," *Oil & Soap* 21 (Sept. 1945): 233.

[174] H.J. Dutton, "History of the Development of Soy Oil for Edible Use," *Journal of the American Oil Chemists Society* 58 (1981): 235.

"fishy" (or "mariny"), "painty," or, in the case of hydrogenated oils, "grassy." One author speculated that the term originally referred to fish oils, in which the development of fishy flavors was indeed a return. Tasters who evaluated the flavor of soybean oil, on the other hand, sometimes did list "beany" as a reversion flavor, and there may have been deeper associations at play in the concept. Soy was linked to the high-fish diets of Asia, as well as industrial uses in America. Though it could pass as a bland, refined oil for a time, it soon revealed embarrassing signs of its origins.

For most edible uses, soybean oil was blended with other edible oils, mainly to lessen the noticeability of reversion flavors. During the war, some margarines contained up to 30 percent soybean oil, normally considered risky, except that reversion problems were masked in part by the high turnover on store shelves: there was less time between production and consumption for the off tastes to become much of an issue.[175] And the limits placed on soybean oil's market expansion revealed the conundrum soy faced as a "joint product." The feed business was booming, but that absorbed only the meal left over after the oil was extracted – feed made from whole beans led to constipated cattle and soft pork. The risk, however, was that a boom in the one product would produce a glut in the other, dragging down the crop's overall value. As the soybean had been refracted into an ever greater number of sub-products during the 1930s, the value of the whole complex of uses had to be maintained.

A key player in both the Flavor Stability Conference and in subsequent research was Goss's former employer, the USDA Northern Regional Research Center (NRRC) in Peoria, Illinois. Its main role, aside from helping to coordinate research, was to evaluate

[175] Alderks, 233.

its results through “organoleptic” testing. For instance, the NRRC evaluated one of the German methods – not the one that Mohr was reluctant to divulge – by presenting two samples to tasters, one of which was “washed-citrated,” referring to the second washing and the use of citric acid. The other, a control washed only once and not deodorized with citric acid, was designated “unwashed.” Both were stored at room temperature for several weeks, with samples periodically submitted to a taste panel for scoring on a scale from 1-10. Both samples began life at 8 or 9. By day 15, both hovered around 3-4. The decline of the wash-citrated sample was less precipitous, however, especially in the early days: on day three, it was still at 8, while the unwashed sample had fallen to 4. The panel also identified component tastes and charted their presence. “Buttery” and “bland,” desirable flavors, declined at a similar rate in both samples. “Beany” peaked after a day – more dramatically in the washed-citrated sample, it turned out – and then declined. “Rancid” began a steady climb in both samples after three days. The key difference was “painty,” which skyrocketed in the unwashed sample, but was suppressed for a week in the washed-citrated oil. (Some minor flavors, including “grassy” and “burned,” were not plotted.) The German methods were thereby validated, although the key to their effectiveness remained a mystery.[176]

One of the most time-consuming tasks in conducting this research was creating a reliable taste panel.[177] As the NRRC researchers explained in a follow-up paper, two contrasting types of panels were used to perform “organoleptic evaluations” – that is, taste tests. One type was akin to the proverbial Peoria theater audience: designed to

[176] Herbert J. Dutton, Helen A. Moser, and John C. Cowan, “The Flavor Problem of Soybean Oil. I. A Test of the Water-Washing Citric Acid Refining Technique,” *The Journal of the American Oil Chemists’ Society* 24 (Aug. 1947): 261-64.

[177] Helen A. Moser, Carol M. Jaeger, J.C. Cowan and H.J. Dutton, “The Flavor Problem of Soybean Oil. II. Organoleptic Evaluation,” *The Journal of the American Oil Chemists’ Society* 24 (Sept. 1947): 291-96.

gauge consumer acceptance of a product, they consisted of randomly selected panelists with “normal variations in prejudices and sensitivities.” The accurate and reproducible detection and measurement of reversion flavors called for the second type, one in which “the selection, training, sensitivity, and consistency of individuals comprising a panel are of paramount importance.” The pool of potential members came from other labs in the NRRC. Of the 35 who were given preliminary acuity tests, 14 made the cut. After a second battery of tests, and due consideration to certain less tangible factors – such as “past experience on organoleptic panels, interest in the oil problem in general, and the desire to participate” – eight made it onto the regular panel, with five others designated as alternates. During the following year, they “were given oils in many combinations, with the tasters trying to standardize their numerical and descriptive scores.” With turnover, not all of the ultimate panelists had been given acuity tests, but all underwent the extensive taste training. The goal was to make them into connoisseurs of blandness.

The researchers also paid close attention to the conditions of testing. Panelists sat in individual booths, to minimize distractions and to “discourage audible comments,” in a temperature-controlled laboratory kept as free as possible from foreign smells. Because odors and flavors were better detected in warm oils, the samples were presented in beakers set into a specially designed warming-table. Each member was limited to testing one pair of samples, as acuity dropped off with further tasting, and water heated to body temperature was provided to rinse the mouth between swigs of oil. Under no circumstances was any oil swallowed.

Afterwards, the panelists were allowed to mingle and compare notes while munching on “reward” cookies that helped remove the taste of badly reverted samples. The researchers recognized that "the successful conduct of a taste panel is frequently as much a matter of human relations as it is a scientific problem" and worked to cultivate high morale, or what they called "panel euphoria." They shared research results and plans for future experiments – the panelists were NRRC scientists themselves – and informed members as to how their tasting scores compared with the panel average. These averages were tracked with careful statistical methods, occasionally prompting the removal of outliers from the panel.

At the same time, the chemists hoped to find a physical property in oil that could reliably predict the appearance of reversion flavors. They confirmed that a high peroxide value, a measure of lipid oxidation, correlated well with lower taste scores, and it was used as a proxy in some routine experiments. But the researchers concluded that, while "the hope of all research workers in the field is to replace the erratic human senses with objective physical and chemical analytical methods, it must be remembered that the ultimate evaluation of flavor is subjective. As long as human beings are the final judges of flavor, organoleptic evaluation will probably be required in flavor problems." In this spirit, the NRRC participants brought 3-day-old samples of unwashed and washed-citrated soybean oil to the Flavor Stability Conference, where they assembled a taste panel that confirmed the results they had obtained in Peoria.

It required nine more conferences and twenty more years to decisively deal with flavor reversion. In retrospect, the testing of German methods was a breakthrough, although the German theories were exactly wrong. Oxidation of fatty acids was the culprit, and by 1950 experiments had established that citric acid worked by scavenging traces of "prooxidant" metals. Lecithin, it turned out, was also a metal scavenger: far from causing reversion, it delayed it. These discoveries prompted a search for the best metal scavengers, as well as the elimination of brass from processing equipment and the practice of keeping soybean oil blanketed in inert gas, especially at high-temperature steps.[178] In the early 1950s, linolenic acid was identified as the fatty acid whose oxidation caused the off flavors. Because oils high in this acid were the ones prone to reversion – not just soybean, but also linseed, rapeseed, and fish oils – this was long suspected, but a 1951 experiment proved it by infusing cottonseed oil, normally bland and stable, with linolenic acid. Taste panels mistook it for reverted soybean oil.[179] The challenge was then to most economically remove linolenic acid from the oil. Solvents that, during the extraction process, selectively removed the acids most prone to oxidation was one approach; it had the advantage of fractionating soybean oil into slow-drying and fast-drying components, the former good for food, the latter for paints and varnishes. A more effective solution was to selectively hydrogenate linolenic acid, which could then be filtered out by "winterization" – a process by which the temperature of the oil was lowered so that only the hydrogenated fats became solid. This method finally produced a soybean oil with no linolenic acid in it at all.[180]

This was a major technical achievement and a substantial boon to the soy industry. In 1946, Warren Goss estimated in a letter to the Office of Technical Services (OTS), the agency that published his reports after they were declassified, that reversion resulted in

[178] Herbert J. Dutton, Arthur W. Schwab, Helen A. Moser, and John C. Cowan, "The Flavor Problem of Soybean Oil. IV. Structure of Compounds Counteracting the Effect of Prooxidant Metals," *The Journal of the American Oil Chemists' Society* 25 (Nov. 1948): 385-88; Dutton, 235.
[179] H. J. Dutton, Catherine R. Lancaster, C. D. Evans, and J. C. Cowan, "The Flavor Problem of Soybean Oil. VIII. Linolenic Acid," *Journal of the American Oil Chemists' Society* 28 (March 1951): 115-18.
[180] Dutton, 236.

losses of $50 million per year due to spoilage.[181] His reports on German techniques proved so popular that he compiled them and published them as a book in 1947; previously, each report had to be ordered separately through the OTS.[182] This indicated use of the information by private companies, beyond the joint effort coordinated by the NRRC. Whatever the immediate gains, however, the long-term significance was soy's ultimate predominance as an edible oil. By 1969, Americans were consuming an average of 30 pounds per person of soybean oil, more than all other oils and fats – including cottonseed, butter and lard – combined; in 1949, Americans had consumed eight pounds, less than a fifth of the total.[183] Even when used to fry potato chips, properly processed soybean oil – solvent extracted, washed, bleached, deodorized, hydrogenated and winterized – gave barely a hint of its origins.[184]

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[181] Gimbel, 96.
[182] Goss, *German Oilseed Industry*, n.p.
[183] J.P. Houch, "Domestic Markets," in *Soybeans: Improvement, Production, and Uses*, ed. B.E. Caldwell (Madison, WI: American Society of Agronomy, Inc., Publisher: 1973), 606.
[184] J.C. Cowan, "Key Factors and Recent Advances in the Flavor Stability of Soybean Oil," *Journal of the American Oil Chemists' Society* 43 (July1966): 300A.

Chapter 6: Hidden Ingredient

The postwar period would see the most spectacular expansion of the soybean to date on American land and in the American diet. But as the percentage of farmers in the population fell dramatically and as the food chain grew longer – with a greater number of intermediaries and intermediate ingredients – Americans generally did not actually see this expansion. There were times when the soybean made news, as a key player in the tussle over yellow margarine, for instance. But soybeans were still a junior partner to cottonseed in margarine politics, as they were in margarine production itself: the leading voices in Congress were Southerners like William Poage. The upshot of the contest, moreover, was to fit margarine more seamlessly into U.S. food consumption, giving Americans a table spread in the buttery color they had come to expect, one that more effectively hid margarine's distinctive origins.

The rather flamboyant Dwayne Andreas, who became rich processing soybeans, also made the news on occasion, as when he sought to sell the nation's surplus butter – the outcome, in part, of the success of yellow margarine – to the Soviets, or when he gained a measure of fame as presidential contender Hubert Humphrey's confidant. But in the main he expanded his worth by working in the obscure middle of things: creating soy-based intermediate ingredients, such as the feed to be converted into meat, particularly pork and poultry; supplying the link between farmers and food manufacturers; hedging through the commodities market, itself increasingly the hinge of the food system where profit was secured; and quietly influencing American policy through contacts in both major parties. The market forces he helped generate meanwhile fostered a long-awaited soybean industry in the South, where an almost entirely hidden soybean landscape – of soybean varieties named after Confederate generals – emerged.

Finally, Percy Lavon Julian gained fame for making cortisone out of soybeans, a gloss on his accomplishment that was not entirely accurate. Ultimately, soybeans would provide intermediate ingredients in the production of corticosteroids and synthetic hormones, but would struggle to do so against a cheaper and more plentiful substitute, wild Mexican yams – a struggle that gained visibility briefly in the 1950s before becoming an obscure chapter in the history of American drug production.

The Congressman: William R. Poage

In the first days of March 1949, the best place to glimpse the challenges facing the soybean in postwar America was in the chambers of Congress during hearings before the House Agriculture Committee on several proposed bills regulating margarine. Some of these challenges were persistent and technical. August H. Andresen, a Republican Representative from Minnesota, entered into the record an editorial from the January *Soybean Digest*, "Soybean Oil Is Losing Margarine Market," which blamed flavor reversion for the decreasing use of soybean oil in margarine. Long second-place to cottonseed oil, it now provided only 35 percent of the oil used in margarine, down from almost half during the war years. "This development gives point to the need for pushing ahead with basic research on the cause and cure of soybean-oil reversion, which is its chief handicap with margarine." Margarine was a high-value use for soybean oil, the editorial emphasized, and "the high-value markets are the ones that will support a good price for soybean oil – and soybeans. Once lost, they will be much more difficult to regain."[1] Margarine was the lynchpin in the marketing of soybeans: the demand it provided for the oil was what made it economical to produce the meal, which was rising in value as an ingredient in feeds. The reversion problem would take another decade to largely overcome, however: the last of eleven annual conferences on flavor stability would take place in Memphis, Tennessee, in 1958. This limit on demand could be partially overcome in the meantime, however, if the market for margarine continued to grow vigorously. This expansion faced another sort of challenge, however, political rather than technical. There was a determined anti-margarine faction in Congress supported by a powerful dairy lobby, and Andresen's insistence that the *Soybean Digest* piece appear in the record was one signal that the soybean faced something new. After decades of generally good press, lauding soybeans for their many uses and their contribution to soil fertility, there were now those who were intent on thoroughly discrediting its reputation as a worthy American crop.

Some of the most adamant testimony during the hearings came from Louis Bromfield of Lucas, Ohio, a self-described "adviser to certain industries and banks in the United States on agriculture," a director of the U.S. Chamber of Commerce, and a lecturer on soil conservation. His criticism of margarine was broad and civilizational, a "question of big business and tacit monopoly versus small enterprise and the small businessman": business concentration had led to socialism and communism in Europe, Bromfield argued, making it unwise to give any advantage to the margarine industry, where "there are 28 manufacturers . . . of which 5 percent produce 65 percent of" a product "as much mass produced . . . as Ford automobiles." But when it came to his area of expertise, his

[1] House of Representatives, *Oleomargarine: Hearings before The Committee on Agriculture, March 1-5, 1949,* 81st Congress, First Session (Washington, D.C.: Government Printing Office, 1949), 54.

criticism was specific: both cotton and soybeans were soil-depleting crops, despite any testimony committee members might hear to the contrary. He described "a city in Illinois called Decatur" where "some years ago they put up a soybean processing plant and got all the farmers in the neighborhood to produce soybeans. I wish all you gentlemen could fly over that area today. In order to get water, they put up a dam. Within less than a generation, that dam is virtually silted up with the top soil of the farms which produced soybeans." Bromfield then cited towns in Oklahoma, formerly home to "10 to 12 or 15 thousand," that were now ghost towns due to cotton agriculture.[2] The tendency of soybeans to lead to erosion was well known – it was one reason that soybean cultivation jumped over the hillier country between North Carolina's coastal plain and the flat Midwest – but discussion of the soybean's effect on soil had long centered on its contribution of nitrogen. More jarring, in light of the past promotion of the soybean as an alternative to cotton in the South, was the way Bromfield paired the two, sometimes with a mention of corn as well, in his attacks.

This conjunction of soybeans and cotton was political as well. For this reason, one of the congressmen who challenged Bromfield – somewhat disingenuously arguing that, since Bromfield himself advocated growing cotton more intelligently and intensively on fewer acres, a rise in cotton production in response to margarine legislation would not necessarily lead to an expansion of soil-depleting acreage – was William R. Poage, a Texas Democrat who represented the Eleventh District, which included his home of Waco. Poage was widely acknowledged as the ringleader of the pro-margarine bloc, which was pushing for the elimination of federal excise taxes, and he was the sponsor of

[2] Ibid., 148-49.

the main contending pro-margarine bill, H.R. 3, one of thirty proposed bills on both sides of the issue. He was thus a major ally of soybean interests – if indeed expanding margarine sales would lead to a higher demand for soybean oil – who himself had little interest in the crop aside from rhetorical nods. Poage represented a cotton district, and it was the interests of cotton farmers that motivated him. Born in 1899, he had some claim to rural roots, having spent his boyhood on a ranch before moving to Waco with his family as a teenager, where he received college and law degrees from Baylor. He followed his father, who died in 1923, into the Texas legislature and became a candidate for the U.S. Congress for the first time in 1934, losing his first race. When his opponent in 1936 claimed to "know what it is to hoe the long rows of corn and pick the long, long rows of cotton" and to be able to "pick my 400 pounds along with the best of them," Poage demurred that he himself was "not much of a cotton picker" and offered to withdraw from the race if his opponent succeeded in picking "400 pounds from sun to sun" two days hence. Tirelessly campaigning on the dusty back roads of his district, Poage won his seat that year.[3]

Like his fellow Texan, Lyndon B. Johnson, who joined Congress the following year, Poage would fight to improve the quality of rural life, co-authoring bills to fund programs patterned after the Rural Electrification Authority that extended telephone, water and waste disposal systems to remote areas; his own McLennan County was the first to build a water system under the Poage-Akin Bill.[4] On racial issues, he was a Dixiecrat, joining a caucus of Southern representatives who protested Truman's civil rights platform in

[3] W.R. Poage, *My First 85 Years* (Waco, TX: published by Baylor University, printed by Texian Press, 1985), 57-58.
[4] Ibid., 92-93.

1948.[5] He first squared off with August H. Andresen in 1941, the same year he joined the Agriculture Committee. Andresen, a Republican from Red Wing, in Minnesota's dairy-centered First District, had been a member of the committee for over a decade and was a veteran of battles over margarine. In September 1941, a radio program sponsored by the USDA suggested that "many people are finding out they can save quite a bit of money by using margarine instead of butter" and that, now that margarine was legally required to be fortified with vitamin A, there was little nutritional difference between the two. This provoked Andresen to decry the government's nutrition program on the House floor as "government sponsored propaganda," "virtually a conspiracy against the farmers," and part of the "subversive work of lavender lawyers, pink economists, and mauve home economic ladies." He demanded an investigation and that the USDA end its "scuttling of American dairy farmers." Poage rose to remind House members that there were other farmers who benefitted from margarine sales such as livestock men and soybean growers.[6] Andresen, soon after made the head of an anti-margarine steering committee by forty dairy-state senators and congress members,[7] was well known for his fierceness and severe rectitude. Both he and Poage were part of the Herter Committee, which visited Europe after the war to review implementation of the Marshall Plan, and Poage later recalled that when flying into Pisa, Harold D. Cooley of Tennessee pointed out the Leaning Tower to Andresen, who continued to stare straight ahead. Cooley urged that it was one of the seven wonders of the world, to which Andresen replied, "Mr.

[5] Drew Pearson, "The Washington Merry-Go-Round: Rayburn Tries to Stem Revolt," *Washington Post,* 26 Feb. 1948, B15.
[6] Sigrid Arne, "Washington Daybook," *Corsicana [TX] Daily Sun*, 13 Sept. 1941, 6.
[7] "Dairy States Join to Protect Butter," *Twin Falls [ID] News*, 24 Sept. 1941, 2

Cooley, we are not on a sight-seeing trip."[8] In 1949, as leader of the butter bloc, Andresen introduced the main anti-margarine bill, H.R. 1703, and would be Poage's chief antagonist.

By 1949, political battles over margarine had been going on for over half a century. Margarine had its roots in France, where it was patented in 1869 by Hippolyte Mège-Mouriès in response to Napolean III's call for a low-cost butter substitute.[9] Mège-Mouriès felt that he had not only duplicated butter's taste and appearance, but the process by which cows themselves transformed their body fat into butterfat – his original formulated included bovine mammary glands, soon discarded as unnecessary. He called his invention "oleomargarine" – "margarine" after "margaric acid," itself a neologism derived from the Greek word for pearls, and "oleo" for the beef fat that was the product's source. Even as vegetable oils gradually supplanted animal fats following the discovery of hydrogenation, "oleomargarine" remained the term of choice for decades to come – and the association with the abattoir, and the troubled reputation of meatpackers, continued to haunt the product. Producers ground up beef suet, separating out its constituent fats through a high-powered steam treatment; they removed excess stearine, which settled to the bottom of vats, and for taste churned the remaining fats with milk solids – and sometimes with butter itself. Dyed daffodil yellow, it was difficult to

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[8] Poage, 97-98. On the other hand, this may have been an example of what Andresen's colleagues, during a memorial service after his death in 1958, eulogized as his extremely wry sense of humor. *Memorial Services Held in the House of Representatives and Senate of the United States, Together with Remarks Presented in Eulogy of August H. Andresen, Late a Representative from Minnesota,* Eight-fifth Congress, Second Session, Jan. 1958 (Washington, D.C.: Government Printing Office, 1958).

[9] The history of margarine and its legislative travails is oft told: See William H. Nicolls, "Some Economic Aspects of the Margarine Industry," *The Journal of Political Economy* 54 (June 1946): 221-42; S.F. Riepma, *The Story of Margarine* (Washington, D.C.: Public Affairs Press, 1970); Ruth Dupré, "'If It's Yellow, It Must Be Butter': Margarine Regulation in North America Since 1886," *Journal of Economic History* 59 (June 1999): 353-71; and "Pink Margarine and Pure Ketchup," 152-212 in Bee Wilson, *Swindled: The Dark History of Food Fraud, from Poisoned Candy to Counterfeit Coffee* (Princeton, NJ: Princeton University Press, 2008).

distinguish from butter even in the 1880s. The federal tax, imposed in 1886, paid for an inspection system that verified that all margarine was properly labeled at the factory and, it was hoped, not fraudulently diverted to the channels that marketed butter.

In 1902, an amendment to the federal law levied a 10-cent per pound tax on the manufacture of yellow margarine. Diminishing its production at the source, proponents argued, would prevent fraud downstream by retailers who would repackage it, or restaurants that would serve it, as butter. The law survived challenges in the Supreme Court, and underwent a series of further revisions at the end of 1920s through the 1930s. These revisions responded in part to pressure from the dairy lobby, coping with a glut of butter during the Great Depression, and in part to new developments in the production of margarine. Beginning in the mid-1920s, coconut oil from the Philippines became not only the major oil used in margarine – in part because of its superior melting qualities – but a component in new “cooking compounds” that, although labeled as substitutes for lard, were the color and consistency of butter. The law expanded in 1929 to define these as oleomargarine and subject them to the same taxes and regulations – a move supported by both the butter interests and the margarine producers. Palm oil, from Java and Sumatra, became prevalent in the early 1930s, not least because it lent a yellow color to margarine without the use of added dye – thereby exploiting a loophole of the 1902 amendment that only penalized “artificial” coloring with the ten-cent tax. That loophole was closed in 1931, and all foreign oils were subjected to an added tariff in 1935, after which domestic oils – cottonseed and soybean – came to dominate margarine. This cemented an alliance between Midwest farmers and Southern cotton-growers. Advertisements in *Soybean Digest* in 1940-41 by the National Margarine Institute appealed to them directly. One ad, using the language of scientific agriculture, proclaimed, "Soybeans cannot grow in bound soil. So consumption cannot grow in a bound market. YOUR MARKET IS BOUND!" A map of the United States, with symbols showing various kinds of anti-margarine legislation in the offending states, accompanied the copy. Soybean farmers were advised to write their senators.[10]

The Second World War saw a sea-change in legislative attitudes toward margarine. While the amendments to the margarine law expanded its scope throughout the 1930s, in the 1940s there were repeated attempts to repeal it altogether. There were hearings in both the House and Senate in 1943 and 1948, all with over sixty witnesses, either testifying or submitting letters, and transcripts running to hundreds of pages. Under the Republicans, repeal was killed in the Agriculture Committee in early 1948, but pro-margarine forces gathered signatures to discharge the bill from committee and bring it up for vote by the full House, where it passed 260 to 106.[11] Its passage was then stymied in the Senate, not by pro-butter Republicans but by largely pro-margarine Southern Democrats who filibustered against anti-poll tax legislation that made up part of Truman's civil rights agenda. Viewing the spectacle, Republican Representative Edward A. Mitchell of Indiana voiced the hope that the Senate could eventually conduct enough business to give "the consumers at least one break by getting rid of these unfair, un-American and silly anti-margarine laws."[12] But the session ended before action was taken, setting up a repeat in 1949, when the butter bloc led by Andresen countered a new tax repeal bill with a proposal of their own to do away with the tax, but also to enact an

[10] *Soybean Digest* 1 (Aug. 1941): 11.
[11] John Ball, "House Oleo Battle Only a Starter," *Washington Post,* 4 April 1948, B8; "Housewives' Victory," *New York Times*, 29 April 1948, 22.
[12] Samuel A. Towers, "Senate GOP Maps Final Move to End South's Filibuster," *New York Times*, 2 August 1948, 1.

outright national ban on yellow margarine. Margarine advocates protested that this was simply evidence that the tax had always been less about equalizing production costs and more about permanently devaluing their product.

Throughout margarine's tangled legislative history, the nature of yellowness, which was now the crux between Poage's and Andresen's bills, had continually been at the center of debate. The two sides differed not only on whether they would allow margarine to be yellow, but on what yellowness, at its core, really meant. It should be noted that, throughout, there were odd echoes of racial politics: Southerners like Poage protested the unjust discrimination of margarine on the basis of color, while Andresen expressed outrage over "colored" margarine passing as butter. This inverted subtext aside, at its simplest – and this was where margarine tax proponents wanted to keep the debate – the yellow of margarine was a false signal, a party to outright fraud. During House hearings, margarine manufacturers disparaged their own product, insisting that there were other ways to detect the fraud and that a merchant or restaurateur passing off yellow margarine as butter would have angry customers to deal with once they put the stuff in their mouths. Margarine of the higher grades, churned with butter, were more difficult to detect by taste, but by the late 1920s even the coconut-oil cooking compounds – which were churned with water – were able to fool even an expert. Andresen, presented with unmarked samples during the 1929 hearing and asked to identify the butter, chose one "because it looks the best, but it might not be butter." Invited to taste them, he still could not tell.[13] Given the much lower cost of the compounds – which, at that time, were not

[13] House of Representatives, *Oleomargarine: Hearings before The Committee on Agriculture on H.R. 10958 by Mr. Haugen, April 17-20, 1928.* 70th Congress, First Session (Washington, D.C.: Government Printing Office, 1928), 60.

subject to the 10-cent tax on yellow margarine – the temptation to commit fraud was great, its scope limited only by restricting the national availability of the imitation products.

Lowering the supply of already-yellow margarine was not a guarantee against fraud, however, as margarine was customarily sold with packets of color that could be mixed in – and it was retailers and restaurants that had both the labor to make this task less onerous and the motivation of increased profits. During the lead-up to hearings in 1948, a senator discovered that twelve eating places within a few blocks of the Capitol were serving margarine as butter.[14] Donald Creswell, representing the Pennsylvania Secretary of Agriculture in a 1949 hearing, testified that a "spot check" to test a recent law in Pennsylvania outlawing yellow margarine entirely – and requiring all restaurants that served it to be licensed and to post signs to notify their customers – found that 153 out of 500 eating places were selling yellow margarine as butter. All of these were unlicensed to sell margarine at all, he added, while the licensed establishments rarely committed fraud. Poage scored some one of his more impressive hits when he pointed out that this widespread fraudulence was in fact an argument against extending colored-margarine prohibition nationwide, as the bill proposed by Andresen proposed to do: "What you complain about is that H.R. 1703 is impractical of enforcement and that our experience with a law identical to the provisions of H.R. 1703 has been the most unfortunate of any experience that has been brought before this committee." Andresen jumped in to ask Creswell, "Do you think it would be much easier to find out when you go to restaurants, assuming the bill introduced by my friend from Texas passes permitting the coloring of

[14] House of Representatives, *Oleomargarine Hearings* (1949), 306.

margarine yellow in imitation of butter, to discover fraud if they should serve this yellow colored oleomargarine in restaurants?" Creswell responded, "It would be much more difficult" – as more yellow margarine could be purchased across state lines.[15]

The central issue with yellow margarine was seldom outright fraud, however. Even when sold in clearly labeled packages, opponents argued, its color signaled that its food value was comparable to that of butter, widely regarded as highly nutritious. Colored margarine, they contended, attempted to "ride into favor on the coat tails of butter or the reputation of butter" without providing the same benefits.[16] The yellow color itself was a direct indicator of vitamin A in butter (which eventually prompted the vitamin-enrichment of margarine) – though this was problematic, as butter varied in both its color and vitamin content depending on the season. Butter churned during the summer, when cows ate fresh grass, was both very yellow and rich in vitamin A. Winter butter, on the other hand, was low in vitamins and paler.[17] In addition to blending butter from different seasons for a more uniform product, butter producers also, to the outrage of the margarine industry, regularly added artificial color. (The amount of coloring added also varied by region, the South being accustomed to darker butter.)

Oleo foes argued that even winter butter was richer in natural vitamins than margarine, but this was hardly the point either, as the health-giving qualities of butter had not been fully identified. As Cyrenus Cole, Representative from Iowa, argued in 1929, "There is something in butter that is all of its own kind and its own nature, and none of these imitative products is a substitute for butter," something that "all dieticians and all

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[15] Ibid., 304-306.

[16] House of Representatives, *Oleomargarine Bill: Hearing before The Committee on Rules on H.R. 10958, Jan. 18, 1920,* 70th Congress, Second Session (Washington, D.C.: Government Printing Office, 1929), 20.

[17] House of Representatives, *Oleomargarine Hearings* (1949), 236.

doctors and chemical authorities will certify."[18] Rep. Charles Adkins from Illinois – in 1928, before soy was either a leading crop in Illinois or a leading ingredient in margarine – agreed: If oleomargarine "supplanted the use of butter, then the recognized essential to animals, children, invalids, and so forth, would be discouraged, and if we found ourselves living off of a tree or cotton stalk or the oil of peanuts, why the first thing we know we would have to go back and build up the dairy industry."[19]

By 1948, the margarine industry had its own roster of dieticians and doctors to defend it. H.J. Deuel, from the University of Southern California, recounted an "experiment undertaken by my laboratory, under my personal supervision, which involves the feeding of several generations of rats. . .[T]his experiment has continued through the twenty-fourth generation. For your information, this approximates between 700 and 800 years of human life. I want to state that at the twenty-fourth generation the animals are in fine condition, the growth rate is similar to that of the original group, [and] no failures have occurred in pregnancy or lactation."[20] If rats were not an adequate proxy, Rep. L. Mendel Rivers, of South Carolina, quoted a study conducted by the American Medical Assocation on "267 children, mostly orphans," with one group eating exclusively butter and the other exclusively margarine: "It is evident from the tables that growth of the group fed margarine, as determined by increases in height and weight, was comparable to that of the children fed butter…Furthermore, it was noted that in the margarine group there was no increase in the amount of illness." Vitamin A was not an issue, because all

[18] House of Representatives, *Oleomargarine Hearings* (1929), 17.
[19] House of Representatives, *Oleomargarine Hearings* (1928), 10.
[20] House of Representatives, *Oleomargarine Hearings* (1949), 68.

of the margarine was enriched with 15,000 units of the vitamin per pound.[21]

But this vitamin A, like everything about margarine, was the product of artifice. As Milton Button, Director of the Wisconsin Department of Agriculture, wrote in a letter submitted to Rep. Reid F. Murray of Wisconsin (whose margarine laws were the most restrictive in the country), "The oleomargarine industry has sought and received permission to imitate, synthetically or otherwise, the desirable qualities of butter."[22] The claim was rarely that margarine was inherently harmful to health, though in an exchange with J.W. Calland, of the National Soybean Crop Improvement Council, Rep. Murray insinuated as much:

> Mr. Murray: Would you be willing to have this legislation…include a provision that you could not use benzoate of soda or any other preservative or embalming fluid or whatever you call it in connection with oleo?...
>
> Mr. Calland: Would you care to make a statement that they are using embalming fluid in [margarine]?
>
> Mr. Murray: You can call it embalming fluid or a preservative, whichever you want, but it cannot be used legally in the manufacture of butter. I want to know if you would be willing in this bill to eliminate its use in the manufacture of oleo?
>
> Mr. Calland: I would not want to tamper with Mr. Poage's bill.[23]

Director Button also argued that it would do harm to the cause of preserving "the priceless heritage of soil fertility" to "change our Nation's agriculture from a grassland

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[21] House of Representatives, *Oleomargarine Tax Repeal: Hearings before The Committee on Agriculture, March 8-12, 1948,* 80th Congress, Second Session (Washington, D.C.: Government Printing Office, 1948), 38.
[22] House of Representatives, *Oleomargarine Hearings* (1949), 308.
[23] Ibid., 41-42.

animal husbandry structure to a row crop soil-depleting type of agriculture that will inevitably destroy our irreplaceable topsoil."[24] Calland in fact spent most of his testimony defending the soybean as the least soil-depleting of row crops.[25] Rep. Walter Granger of Utah, however, pointedly asked, "Why would alfalfa and clover to feed to dairy cattle not be more advantageous to the farmer and also a greater measure of soil conservation than to raise a row crop such as soybeans?" He added, "Your testimony here is to find a place in the scheme of things for soybeans, is that right?"[26] If the yellow color was a symbol of butter's natural healthful essence, butter was in turn a synecdoche for management practices considered natural and healthy for the land – despite the fact that the dairy industry itself was using an increased amount of mixed feeds consisting of corn and soybean.

For proponents of margarine restriction, these linkages were so strong that even artificially colored butter was more natural than naturally yellow margarine. In 1902, the Senate had changed the wording of the amendment to the Margarine Law to tax only margarine using "artificial coloration" – rather than any ingredient, artificial or natural, that made margarine yellow – a revision accepted by the House because it was "not believed that oleomargarine can be given a considerable or even a very perceptible shade of yellow by the use of any known [natural] ingredient."[27] Margarine makers had since sought to evade the ten-cent tax by discovering such a natural ingredient. In *McCray v. United States* (1904), the Supreme Court ruled that using butter as an ingredient that had itself been artificially colored – as opposed to naturally yellow summer butter –

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[24] Ibid., 308.
[25] Ibid., 36.
[26] Ibid., 39.
[27] House of Representatives, *Oleomargarine: Hearing before The Committee on Agriculture, Jan. 21-23, 1931,* 71st Congress, Third Session (Washington, D.C.: Government Printing Office, 1931), 6.

constituted artificial coloration. Artificiality was transitive. By the late 1920s, meatpackers were saving the yellow body fat of old dairy cows for use as a coloring agent, a practice tolerated by the dairy industry because the supply of such fat was so limited. Imported palm oil, refined to preserve its yellow color, was "sufficient to make almost an unlimited quantity of colored oleomargarine."[28] Although the refinement method was secret – causing suspicious that it altered the oil's natural chemical makeup – the IRS ruled that, because it was a substantial ingredient, and not simply an added dye, the resulting margarine would be taxed at the quarter-cent rate. This prompted the new legislation, which levied the ten-cent tax on the basis of color alone, whatever its source.

The IRS ruling had originally been on the use of dark soybean oil, which Staley had begun producing in 1930. Soybean oil presented less of a threat, however, because of its flavor stability. Hydrogenation improved flavor stability, but simultaneously made the oil a paler yellow. This could be dealt with by bleaching the oil to a lesser degree, but this failed to remove enough of the chlorophyll: the resulting margarine would be slightly greenish.[29] Unhydrogenated palm oil could be blended with harder oils to produce margarine without off flavors resulting. As late as 1949, it was still a matter of debate as to whether soybean could "naturally" color margarine. Ralph Wells, a soybean processor from Illinois, testified that soybean oil was bleached for use in margarine only to avoid the ten-cent tax – perversely resulting in a product that was artificially white. Andresen did not delay long to attack, challenging the idea that it was technologically possible to produce margarine with unbleached soybean oil. Wells referred to a "Mr. Hopkins, president of the Mrs. Tucker Foods at Sherman, Tex.," who claimed that he

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[28] Ibid., 8.
[29] Ibid., 24.

could do so through an unspecified method; and also that "another of the large food industries, which I do not feel at liberty to give you the name of, are perfecting a process by which they can retain a considerable amount of yellow color [in] the process of hydrogenization [*sic*]." Andresen sniffed, "I have heard of that, but at the present time that scientific process has not been discovered." He added that hydrogenation itself changed the chemical structure of soybean oil – so that whatever the resulting color, the product itself was inherently artificial.[30]

If the dairy industry and its allies considered yellow to be not only the natural color of butter (even when artificially enhanced), but the very symbol of butter's naturalness, the margarine industry argued that the color's value was entirely psychological – based on long-held expectations about what a table spread should look like – and that butter had no right to monopolize it. Legal decisions had established that colors could not be trademarked: only fraudulent intent could justify barring a color's use in any product. Margarine producers had no such intent: they were proud of their product and sold it openly for what it was. As Rep. Rivers proclaimed, "Margarine is no longer a substitute for butter . . . Margarine today is the coequal of butter, and ere long gives prospect of being butter's superior . . . Margarine not only demands, but is entitled to its place under the sun. It has been tested beneath the white and searching light of criticism, trial, and error. Its healthfulness is not a theory."

It suffered under an ingrained stigma, however, embodied by its white color. In the AMA experiments, "It was interesting to observe how the children accepted margarine. When it first made its appearance on the table – in its white form – and the study was

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[30] House of Representatives, *Oleomargarine Hearings* (1949), 297.

explained to the children, the younger children promptly accepted it. The children in the older age group did not take to it too kindly. Very shortly thereafter, however, a shipment of colored margarine came in. This was cut up into the usual pats and all the children then ate it readily and liberally."[31] A year later, Donald Creswell, reporting on the "spot check" of margarine-law compliance in Pennsylvania, reported that "more than 30 school cafeterias were found to be coloring and serving oleomargarine…Some of the teachers advised that when they put up signs that oleomargarine was being used the children refused to purchase the lunches. They even ground carrots to put in the sandwich spread in an effort to disguise the use of oleomargarine."[32]

If young children displayed such prejudice, adults could not expect to act differently. In 1929, J. Charles Linthicum, a Representative from Maryland, where a major coconut cooking-compound company was headquartered, argued rather implausibly that the psychological appeal of yellow extended even to products ostensibly intended to replace lard and other shortenings: "Well, we make it as attractive as possible: yes, we try to produce a product which is good to look at as well as to eat."[33] The argument, however, when applied to table spreads, was unassailable: as the Food Habits research had shown during World War II, expectations – cued by words and visual signals – had an effect on taste, and taste was conservative. Some have concluded that margarine was a victim of its own attempts to imitate the sensual qualities of butter – unlike vegetable shortening, which differentiated its product as a superior, more hygienic alternative to lard[34] – but shortening was an ingredient in other foods, whereas margarine was visible on the table.

[31] House of Representatives, *Oleomargarine Hearings* (1948), 37-38.
[32] House of Representatives, *Oleomargarine Hearings* (1949), 303.
[33] House of Representatives, *Oleomargarine Hearings* (1929), 11.
[34] Nicolls, 225.

If it were to be accepted as unremarkable by those eating at the table, it – like soy foods and organ meats – would have to be disguised. And the work of disguising it fell, as with soy foods, to women.

The eventual repeal of the margarine tax was touted in newspapers as primarily a victory of housewives. And, indeed, representatives from an impressive array of women's groups testified at the hearings in the 1940s. In 1949, Mary McLeod McCune submitted a letter on behalf of the National Council of Negro Women. "Among our major purposes are those of integrating Negro women into the political, economic, and educational life of our country, and of providing a channel…for them in matters pertaining to their welfare as housewives and consumers of the Nation…The housewife feeding her family is overwhelmingly the one who deserves to be served by this legislation."[35] Thus she supported the bill from the conservative Democratic Representative from Texas. The most impassioned plea came from Jean Whitehall of the Consumers Union, who replied to one of Louis Bromfield's statements of the day before:

> I will not bother you with astronomical statistics of the woman-hours of toil or pounds of material waste which are involved in [coloring margarine by hand]. Being a housewife and living in a State where I cannot now buy colored margarine, I am in a pretty good position to recognize the difficulties involved even when one uses the so-called "easy-coloring" bag. I will not comment at length on the hazards of possible bag breakage nor on the 2-cent premium which is levied on consumers for such a bag. I will merely mention the fact that margarine to be colored by any method must be bought hours in advance of use so that it can be allowed to soften, be

[35] House of Representatives, *Oleomargarine Hearings* (1949), 260-261.

> colored and then refrigerated before it can be served. Mr. Bromfield, in testifying yesterday, is quoted as having said, "If 2 minutes spent in the kitchen coloring margarine has become such a great burden, all that I can say is that the pioneer qualities of our ladies certainly have gone down the drain." I, for one, am not particularly anxious to be a pioneer woman and I would say that what has gone down the drain is not the pioneer qualities but probably some of that margarine which gets wasted in the bowl.[36]

But more than a victory of the consumer over the producer, the repeal was a victory of one producer group over another. During the 1930s, the margarine industry had become consolidated in the hands of diversified manufacturing companies, such as Glidden, largely as a result of a shrinking market. Even though margarine was the poor man's butter, its market tended to shrink during contractions even as butter's expanded, for the reason that while butter was the lowest use for milk – and thus more of it glutted the market when fewer people bought fresh milk – margarine was among the highest uses for vegetable oils. Poor people tended to shift to shortenings and lards as table spreads during bad times, their white color notwithstanding. While the dairy industry, fearful of using an important outlet for its product during hard times, resisted competition from margarine, the margarine industry – optimistically touting increasing prosperity – urged a general shift to higher uses: margarine freeing more dairy to be sold as milk and cheese. Noting further the interdependence of the two sectors – cows ate an increasing amount of soybean meal, which in turn increased the amount of available oil, while margarine still

[36] Ibid., 228.

included skim milk, its fat having been churned into butter – it argued for the mutual benefit of competition.

Ultimately, the potent alliance between cotton and soybean farmers won the day, but not without an enormous amount of legislative wrangling. The Agriculture Committee defeated Poage's bill, favoring instead an amended version of Andresen's which achieved a compromise: instead of barring yellow margarine, it would only bar its interstate shipment, in effect leaving the decision up to states – but also making it impossible for yellow margarine to be shipped into a neighboring state that also allowed it. Before voting on Andresen's amended bill, the Democrats on the committee swapped in an identical measure offered by Rep. Walter K. Granger, a Democrat from Utah, which was then passed on to the House.[37] The interstate prohibition was defeated in the full House, but a new requirement was added that margarine served in public eating places be cut into triangular pats, "like a baby's diaper" (as one congressman put it), and that large signs inform patrons that they were being served margarine. The bill passed 287 to 89.[38] A repeat of the House debate then played out in the Senate, where J.W. Fullbright of Arkansas and Guy M. Gillette of Iowa, both Democrats, adopted the respective roles of Poage and Andresen. Hugh Butler, Republican of Nebraska, warned that after margarine gained equal status with butter, it would pave the way for "ersatz milk and cheese, such as were developed by Hitler."[39] After numerous amendments were defeated – including civil rights amendments against lynching and poll taxes that were offered by William Langer of N. Dakota as a final poison pill for Southern cotton interests – the bill passed

[37] John W. Ball, "House Group Votes Repeal of Oleo Tax," *Washington Post,* 10 March 1949, 1.
[38] John W. Ball, "House Passes Bill to Remove All Taxes on Oleomargarine," *Washington Post,* 2 April 1949, 1.

[39] John W. Ball, "'Ersatz' Food Threat Seen in Oleo Bill," *Washington Post,* 11 Jan. 1950, 5.

56 to 16, with an added provision that margarine sold in stores also be cut into triangles in packages of no more than a pound.[40] This last provision was removed in conference, and in February 1950, margarine producers – and, according to the rhetoric, housewives – had their victory.[41] The repeal of federal taxes would sound the death knell for margarine regulations in twenty-seven states, including twenty-three that had prohibited yellow margarine altogether.

As the next decade unfolded, the butter industry's fears were largely borne out. In 1949, butter production was roughly double margarine production, 1.7 billion versus 9 billion pounds; by 1955, they were running roughly even, at 1.5 and 1.4 billion pounds, and by 1958 margarine production surpassed butter production, which continued a slow slide even as American consumption of table fats increased. Per capita annual consumption followed a similar trajectory: 10.5 pounds of butter versus 5.8 pounds of margarine in 1949, 8.3 and 9.0 pounds respectively in 1958. By 1969, both production and consumption of margarine would be roughly double that of butter.[42] As early as 1953, Gallup found that the number of households exclusively buying margarine had surpassed that of those exclusively buying butter, 45 percent to 41 percent. The blow for butter was cushioned by its continuing political influence, but this in turn created problems for the federal government which, under the price support system, was obligated to buy and store millions of pounds of the dairy fat[43] – a glut which a young

[40] John W. Ball, "'Senate Votes to End Oleo Taxes, 56-16," *Washington Post,* 19 Jan. 1950, 1. Though Langer was genuinely in favor of civil rights, this move was motivated by his opposition to the margarine bill, not a tactic to get civil rights legislation through; the NAACP voiced opposition to his amendments.
[41] John W. Ball, "'Oleo Issues Are Settled at Meeting," *Washington Post,* 22 Feb. 1950, 15.
[42] Riepma, 148-151.
[43] George Gallup, "The Gallup Poll: Half of Families Would Use Butter at 45c Lb," *Washington Post*, 15 May 1953, 19.

businessman named Dwayne Andreas would seek to sell to the Soviet Union, but which prompted most others to call for a lower support price, which in turn would make it more competitive with margarine. One columnist summed up the situation as a dialogue between characters from *Alice in Wonderland*: "'Everyone loves [the price support] program,' said the Mad Hatter. 'Soy bean farmers have a good market for soy beans for soy bean oil [and] oleo. The dairy farmers sell more milk and keep their cows longer. Cattle men are pleased because fewer cows go to slaughter. And, of course, oleo manufacturers love it most of all. They sell more oleo.' 'But what about butter?' The Dormouse again! 'Butter, butter, why worry about butter? . . . In a few years, people will ask, "what's that?" and it will be stored in the Smithsonian Institution.'"[44]

Meanwhile, as indicated by the Mad Hatter's speech, the big winner in margarine production was soybean oil. Yellow margarine had broken through the legislative logjam in 1949 through an alliance of cotton and soybean growers, a year when 257 million pounds of soybean oil went into margarine versus 431 million pounds of cottonseed oil. By 1958, with advances in solving the reversion problem and continuing government efforts to limit cotton acreage, more than a billion pounds of soybean oil went into margarine versus 145 million of cottonseed oil. By 1969, the figures would be 1.3 billion and 75 million pounds respectively. Poage – who would meanwhile would move up to the chairmanship of the Agriculture Committee until 1975, when the House Democratic Caucus flouted the seniority system and placed someone less conservative in the position – would seem to have not made a meaningful gain for his constituency after all. Soybean expansion would not benefit McLennan County: at the end of Poage's chairmanship,

[44] J.A. Livingston, "Mad Hatter Picks Smithsonian as Storage Place for Butter," *Washington Post*, 5 March 1953, 20.

there would only be 261,000 acres of soybeans harvested in all of Texas (compared to 8.5 million in Illinois).[45] Further east, soybeans were becoming a Southern crop on land that had been cotton land, with the effect of displacing the small farmers whose standard of living Poage had sought to raise. Perhaps, in the long run, their standard of living would improve, but not as the sort of farming people that had elected him.

The Breeder: Edgar E. Hartwig

February 4, 1975 was a rainy day in Bolivar County, Mississippi, a fact made much of by a *Delta-Democrat Times* reporter who began his story, “Ever wonder what farmers do on rainy days? They plan for the sunny days ahead.” Specifically, farmers from all over the Delta region made their way to the Agricultural Expo Center – “trampling through a mud soup from their cars and pickups” – where they listened to experts on cotton, soybeans and rice to help determine what to plant for the upcoming year. It was a continuation of the farmers’ institute tradition that extended back to the turn of the century. There was a standing-room-only crowd for the cotton discussion, which stuck around for the soybean question-and-answer, thinning only when the topic turned to rice. The soybean talk was dominated by one speaker, Edgar E. Hartwig, cited by the newspaper as the “father of the Delta soybean,” the individual perhaps most responsible for the soybean having an equal footing to cotton at meetings such as this one. “A colorful speaker, Hartwig . . . quietly chided farmers who couldn’t get better yields than the Delta average of 22 bushels per acre. ‘You ought to get 35,’ he said, grinning.” A

[45] A.H. Probst and R.W. Judd, "Origin, U.S. History and Development, and World Distribution," in *Soybeans: Improvement, Production, and Uses*, ed. B.E. Caldwell (Madison, WI: American Society of Agronomy, Inc., Publisher: 1973), pn.

Marketing Specialist informed the crowd that the economic prospects for soybeans were not great that year – "processors have soybean meal running out of their ears" – which would perhaps suggest that higher yields would not pay off. That was beyond the scope of Hartwig's concerns, however. For decades, he had not only bred higher-yielding and disease-resistant varieties for the South, but he had encouraged the adoption of what he called better "cultural practices" to take advantage of their genetic potential. He dispensed his advice over the years in writing – in bulletins and contributions to newspapers and magazines such as *Soybean Digest* – and doubtlessly at countless events such as the Bolivar County meeting, though they were seldom covered in the press. He also promoted new varieties and the new culture that went with them – not just a matter of improved practices for raising soybeans, but of switching to soybeans in the first place from the South's traditional mainstay – by alluding to an older culture. As the article mentioned, "Hartwig named his soybean varieties after Confederate generals."[46]

This was not a case of Southern pride. Hartwig was born in Minnesota in 1913 and attended the University of Minnesota, where he met his future wife, a home economics major. Like Warren Goss, he moved on to graduate school at the University of Illinois at a time when soybean research was a well-established and growing field. Hartwig attended the Graduate School of Agronomy from 1937-1941, receiving an M.A. and Ph.D. In the early 1930s, C.M. Woodworth, the plant scientist appointed at the same time as J.C. Hackleman, created the first chromosome maps of the soybean to better understand the genetic underpinnings of and linkages between traits. The establishment of the U.S. Regional Soybean Industrial Products Laboratory at Urbana in 1936, one of

[46] Ed Issa, "Farmers Take Advantage of Rainy Weather," *Delta Democrat Times,* 5 Feb. 1975, 2.

the culminations of the chemurgy movement, included a research program to improve soybeans through breeding.[47] In 1941, Hartwig moved on to the USDA, where he worked under Morse, about whom he would many years later say, "I would not classify [him] as a soybean breeder, but rather as an agriculturist."[48] The new varieties Morse had developed were the outcome of the painstaking sorting out of lineages that self-pollination had made genetically pure, with the occasional selection of genetic crosses that occurred naturally in the field. This approach had proven productive because of the amazing richness of imported material. Hartwig represented a new generation that sought to "artificially" breed soybeans to produce novel varieties embodying desired set of traits. This was not just a matter of greater knowledge of genetics and sophistication of technique: such a program would be necessary for modern soybean agriculture, aimed at producing oil and meal rather than hay, to take root in the South, as Morse had long predicted and desired.

Up to this point, Morse, who "seemed to have an ability to hear of anyone who was interested somewhat in soybeans" – as Hartwig later put it – had relied on cooperating farmers with an exceptional interest in soybean improvement to develop new varieties. For instance, on the coastal plain of South Carolina, John E. Wannamaker was a farmer and seed dealer who mainly bred cotton but also had an interest in soybeans. At Morse's request, Hartwig would visit him while he was stationed in Raleigh. Hartwig later recalled him as a "keen observer" who would tag any plant that looked different or

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[47] Edgar E. Hartwig, "Soybean Varietal Development 1928-1978," in *Fifty Years with Soybeans,* a compilation of invited papers presented during the Advisory Board meeting of the National Soybean Crop Improvement Council, Hilton Head, S. Carolina, 26-28 Aug. 1979, 2; William Shurtleff and Akiko Aoyagi, *William J. Morse - History of His Work with Soybeans and Soyfoods (1884-1959): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 366.

[48] Ibid., 390.

promising and later harvest it separately to plant it for increase the following year. Thus, like Morse, he was a selector, not a breeder. By this method, he discovered a variant of the Clemson variety that he named Clemson Non-Shattering, or CNS, because its pods burst less readily, better preserving the seed for harvesting harvesting. He also developed several varieties that he named with his own initials: J.E.W. 45 and J.E.W. 46.[49] At the same time, indicating the advent of newer methods, in 1943 the Tennessee Agricultural Experiment Station released Ogden, created through artificial breeding by crossing the Tokyo variety with an unnamed strain designated by its plant introduction number, PI 54610, gathered in 1921 near Changchun, in far northern China.[50] As Hartwig would assess it in an article in *Soybean Digest* in 1954, it was superior to older varieties in its yield of beans, which moreover had an "oil content comparable to the better Cornbelt varieties," but though less prone to shatter than its predecessors, it was still "weak in this character," with heavy shattering losses in the Delta region of Arkansas and Mississippi.[51] Ogden was but a small first step.

In 1943 Morse initiated a cooperative research program for the South under which USDA breeders make their headquarters at two experiment stations in the region, one at Stoneville, Mississippi – where Paul Henson, father of the future Muppeteer, was stationed until returning to work with Morse in Beltsville, Maryland in 1948 – and Raleigh, North Carolina, where Hartwig was originally assigned until he transferred to

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[49] Ibid., 362-363.

[50] Varietal information from GRIN NPGS database search, available online at USDA Agricultural Research Service. "Germplasm Resource Information Network (GRIN): National Plant Germplasm System (NPGS)," http://www.ars-grin.gov/npgs.

[51] Edgar E. Hartwig, "The New Varieties for the Southern States," *Soybean Digest* 14 (Oct. 1954): 8.

Stoneville to replace Henson.[52] By 1943, the U.S. Regional Soybean Laboratory in Urbana had also established a cooperative breeding program with agricultural experiment stations in twelve Southern states – or, more precisely, the eleven states that had joined the Confederacy plus Oklahoma.[53] Because of this arrangement, Ogden was rapidly tested and subsequently planted throughout the region as far south as Georgia and Florida. Another important institutional underpinning for the new program of artificial breeding was the creation in 1949 of the soy germplasm collection, dedicated to preserving viable seed of all surviving introductions; estimates were that up to a third of Morse's introductions from his expedition with Dorsett had been lost. A northern collection was established in Urbana under J.L. Cartter, who had worked under Morse at the USDA, with a southern counterpart in Stoneville, which Hartwig curated beginning in 1951.[54] The collection's extensive tabulation of genetic traits enabled breeding that would resemble, as David Fairchild put it decades earlier while observing the work of Luther Burbank, "adding ingredients to a pie."[55] Hartwig himself would be credited with developing a method of "backcrossing" soybeans to achieve something like this ideal. Straightforward in principle – it involved repeatedly breeding one variety with successive generations of crosses between it and another until the latter's genetic contribution was

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[52] Soybean Varietal Development 3. In 1955, a third location for breeding research was established in Gainesville, Florida.

[53] Hartwig, "New Varieties," 8. The "industrial products" work had already been spun off to the USDA Northern Regional Laboratory in Peoria, which was engaged in such projects as the elimination of flavor reversion in soybean oil.

[54] Edgar E. Hartwig, "Varietal Development," in B.E. Caldwell, ed., *Soybeans: Improvement, Production and Uses* (Madison, WI: American Society of Agronomy, 1973), 193; Shurtleff and Aoyagi, *Morse*, 409.

[55] David Fairchild, assisted by Elizabeth and Alfred Kay, *The World Was My Garden: Travels of a Plant Explorer* (New York: Charles Scribner's Sons, 1938), 265.

reduced to a single desirable trait – it was particularly challenging in self-pollinating plants like soybeans.[56]

Because of the extensive testing involved and the slow process of increasing the store of seed, development of a new soybean variety could take as long as twelve to fifteen years from the initial cross to the official release to farmers.[57] Thus, the contribution of Hartwig and his colleagues and their new methods emerged only in the early 1950s. Dorman, developed by Hartwig and Leonard Williams of the University of Missouri, was released in 1952. Adapted to the heavy clay soils of the Mississippi Delta, its beans, like that of Ogden, had a high oil content; it was, on the other hand, far less prone to shattering. The first variety developed by Hartwig alone, beginning when he was in North Carolina but not released until 1953, when he had transferred to Stoneville, was Jackson. It represented a substantial enough advance that Florida's Department of Agriculture was compelled to warn farmers in early 1954 against seed fraudulently sold as Jackson, which the state's experiment station had not yet released. Its chief advantage, aside from a high oil content and increased disease resistance, was its height. In general, a variety's height diminished the further south it was planted; even as far south as the Gulf Coast, however, Jackson averaged 32-34 inches, the threshold for being easily harvested with a combine.[58] Hartwig would later list Jackson among the varieties named after Confederate generals, although upon its release the source of its name was perhaps ambiguous.[59] The Lincoln soybean, a cross developed by C.M. Woodworth and Leonard

[56] "Hartwig to Get Award," *Delta Democrat-Times*, 9 Oct. 1975, 8; N.W. Simmonds and J. Smartt, *Principles of Crop Improvement* (London: Blackwell Science, 1979), 159.
[57] B.E. Caldwell, "Engineering Soybean Varieties," *Soybean Digest* 27 (Sept. 1967): 34.
[58] "Farmers Given Warning Upon Soybean Fraud," *Sarasota Herald-Times*, 29 Jan. 1954, 7; Hartwig, "New Varieties," 9.
[59] E.E. Hartwig, "Hill, a New Early Maturing Soybean for the South," *Soybean Digest* 19 (Aug. 1959): 21.

Williams, had been released a decade earlier and had become the major variety in Illinois. Jackson may have plausibly been a reference to Andrew, Lincoln's closest Southern counterpart. The soybean was also adapted to those very areas, in Georgia and in the Gulf states, from which Andrew Jackson laid claim to removing Indians and repelling the British.

Hartwig's next release – the Lee soybean – lacked this ambiguity and firmly established the convention of naming new varieties after Confederate generals. The origins of Lee predated the germplasm collection, but already pointed to future methods. Its parents had been preserved for their commercial potential, but each had proven to be disappointing. One, designated S-100, was a naturally occurring cross between two Manchurian varieties. It was released as an oilseed variety in Missouri, but its oil content proved to be rather low, so crushers soon discouraged farmers from planting it. Lee's other parent was CNS, the shatter-resistant selection from the Clemson variety discovered by Wannamaker. Clemson had arrived in 1927 as part of a shipment of three hundred lots of soybeans presented by the University of Nanking in southern China. CNS had also failed to be adopted widely, but it in addition to being non-shattering, it had a highly desirable trait: resistance to bacterial pustule disease. Lee was a decade in the making. In 1948, still in North Carolina, Hartwig isolated a third-generation cross of S-100 and CNS which combined resistance to bacterial pustule disease with "good agronomic qualities." Testing it over three years, he then handed it over to experiment stations in the twelve Southern states cooperating with the Soybean Laboratory, which conducted field tests from 1951-53 in 40 different locations. Lee was released to commercial growers in 1954, a year after Jackson. Lee was "the most shatter-resistant variety developed to date" and both its yield of beans and their oil content was superior to Ogden. It was also less likely to lodge – that is, tip over under the weight of its pods, a trait measured on a scale from 1 (erect) to 5 (prostrate). Lee was later maturing than Dorman or Jackson, which meant that it was well suited to be grown further south where the growing season was longer. All three of these new releases shared the advantage of permitting "a larger acreage to be harvested per combine, which should help reduce production costs." [60]

After Lee, new varieties named after Confederate generals rapidly appeared over the following decades: Hood (1958), Hill (1959), Hampton (1962), Stuart (1962), Bragg (1963), Hardee (1963), Dare (1965), Pickett (1966), Davis[61] (1966), Semmes (1966), Ransom (1970), Forrest (1973), Tracy (1974).[62] Some varieties were released multiple times, with a year appended to their name, when bred to resist specific diseases: Lee 68, Pickett 71. These soybeans were related to each other by more than a naming practice. A small number of varieties having valuable traits appeared repeatedly in the pedigrees of these new varieties: Dorman, Lee and Jackson are the direct ancestors of some; many used "sister lines" of Lee similarly parented by S-100 and CNS. This degree of shared ancestry – not just of these soybeans, but of all soybeans, as well as of major American farm crops more generally – would raise concerns by the early 1970s of "genetic vulnerability," the risk that one disease could wipe out a substantial fraction of a soybean crop that had too little genetic diversity. A study released in 1972 by the National Academy of Sciences pointed out that of all the soybean introductions from overseas, a small number showed up disproportionately in the ancestry of current varieties. These included the introductions that led to Lee: Clemson, from which CNS was selected, was

[60] Edgar E. Hartwig, "Lee – A Superior Soybean For the Midsouth," *Soybean Digest* 14 (June 1954): 14-15.
[61] Jefferson Davis was not, strictly speaking, a Confederate general, but his nephew Joseph Davis was.
[62] Hartwig, "Varietal Development," 201; GRIN NPGS database search.

an ancestor to 68 percent of Southern varieties, while a variety called AK, from which S-100 was selected, showed up in the ancestry of 63 percent. That Lee and Bragg (Jackson x (S-100 x CNS)) together constituted 58 percent of all soybean acreage in the Delta magnified this effect, which was itself an outcome of Hartwig's success in isolating desirable traits and backcrossing them into varieties already viable in the South.[63]

The spread of these varieties was graphically depicted in a series of U.S. maps published annually in *Soybean Digest* from the mid-1950s through the mid-1960s which showed the "best adapted varieties" of each state. In the 1956 map, Lee and Jackson were already making headway in many parts of Southern states, but Ogden, Dorman, Dortchsoy, Roanoke, J.E.W. 45, Bienville, Improved Pelican, CNS. 4 were liberally scattered throughout; by 1966, the Confederate generals had crowded these varieties out, except for the occasional J.E.W. 46 or Bienville. The maps revealed two other aspects of soybean varieties. One was that they were highly stratified as to latitude, the outcome of the marked effect of day length on the flowing and maturation of soybeans such that any given variety was best adapted to a band not more than 150 miles from north to south. Planted too far north, they would mature too late and risk being victims to frost; planted too far south, they would mature before achieving the maximum number of pods.[64] For this reason, the Confederate generals petered out rather abruptly above 36° 30' – the border between Arkansas and Missouri that became the Missouri Compromise Line in the mid-nineteenth century – except for incursions into Missouri and Virginia and a

[63] National Academy of Sciences, National Research Council, Division of Biology and Agriculture, *Genetic Vulnerability of Major Crops* (Washington, D.C.: National Academy of Sciences, 1972), 211-213.
[64] Hartwig, "Varietal Development," 188. As described in Chapter 2, research performed in part on soybeans had established this "photoperiod sensitivity" as a botanical fact some forty years earlier.

smattering of Hoods and Hills in Maryland and Delaware. This property is what made it possible to talk of Southern soybeans in the first place.

The maps also revealed how otherwise diverse varietal names tended to be, and had been since the practice of usually-one-word proper names had been adopted in 1907. The only practices that rivaled the Confederate generals was a tendency in the North to name varieties after Indian tribes and American presidents: Chippewa, Blackhawk, Ottawa, Wabash, Adams, Madison, Monroe, Lincoln (plus Lindarin, a portmanteau of Lincoln and Mandarin). But there were also names like Acme, Comet, Harosoy, Ford, Hongkong, Renville, Capital, Clark, Kent, plus at least one identifiable Union general, Grant, which by 1966 was consigned to Minnesota and South Dakota. In the history of naming soybeans, there was no other convention as longstanding and consistent. This was in part a measure of Hartwig's impact: most names were idiosyncratically chosen by their developers, and this was his idiosyncrasy. Indeed, when *Progressive Farmer* named Hartwig its 1962 Man of the Year, it estimated that four of his varieties constituted 99 percent of the soybean acreage in Mississippi.[65] But the practice spread somewhat to other breeders as well: York was released by the Virginia State University and both Stuart and Hampton were created by a private grower, Coker's Pedigreed Seed Company of Hartsville, South Carolina, which in its announcement of Hampton noted that it was named "in honor of General Wade Hampton, distinguished southern statesman and famed cavalry leader of the war between the States."[66] This indicated some commercial appeal. Thus, while Hartwig never recounted exactly why he adopted this practice, there was likely more to it than idiosyncrasy. Rather, there were strategic considerations that

[65] "Dr. Hartwig Named Farm Mag's 'Man of the Year,'" *Delta Democrat-Times,* 10 Dec. 1962, 1.

[66] "Coker offers for the Southeast: New Hampton Variety," *Soybean Digest* [1962]: 34.

indicated much about the agricultural transformation of the South during the most active period of Hartwig's career.

As Hartwig introduced the Confederate generals, the Mississippi Delta became the fastest-growing soybean region in the country. Hartwig attributed this growth, unsurprisingly, to the improved varieties that he had introduced. While northern China and Manchuria – occupying roughly the same latitudes as Illinois – had the most productive oilseed varieties, the soybeans of southern China, the source of varieties suited to the American South, were lower in oil content and better suited for animal forage. (Although, it should be noted that expeditions such as Morse's never made it far south, as originally planned, to perhaps discover little-known varieties high in oil.) Thus the economically valuable characteristics of the Northern varieties had to be painstakingly bred into soybeans suited to Southern day lengths. Soybeans also suffered from a wider variety of diseases in the South, requiring breeders to seek a large number of disease-resistant genes. Enthusiasm in the South for soybeans during World War II had in fact faltered on their susceptibility to disease and insects.[67] Indeed, the traits being sought to create a soybean industry in the South comparable to that of the corn belt – a high yield of beans, increased resistance to disease, a tall, erect habit suitable for harvesting by combine – perhaps brought to mind the masculine ideal of a warrior sitting atop his horse, an ideal that may have similarly inclined breeders in the North to name their seeds after Indian tribes and chiefs. But while these traits undoubtedly enabled the spread of a soybean industry in the South, there were broad economic shifts that made soybeans a viable cash crop in the South in the 1950s in a way it had not been in the 1910s.

[67] Harry D. Fornari, "The Big Change: Cotton to Soybeans," *Agricultural History* 53 (Jan. 1979): 251.

The superiority of its soybeans aside, the North had, prior to the 1950s, enjoyed other advantages as a soy-growing region. Midwest manufacturers, in particular paint and varnish producers such as Glidden in Chicago, were the strongest market for the oil. Feedlots and meatpackers, the strongest market for the meal, which was increasingly used as a protein supplement in mixed feeds, were also concentrated in the Midwest. In the postwar period, the demand for soy changed. Due to overseas promotion, in part by the federal government, exports increased – and all of the exports to the growing European market went through New Orleans, which became the largest soybean port in the nation. This did not necessarily give Delta planters a huge advantage – as the first leg of transportation remained the most costly – but did level the playing field for them. At the same time, industrial production of meat and especially poultry became significant in the South, creating local demand. But the increasing value of soybeans lay not only in newfound demand for soy products, but in the need to find an alternative for the South's traditional cash crop: cotton.

Both the region and the federal government had been battling against surpluses of cotton for decades. In 1931, the average price of cotton was lower than it had been at almost any time since the end of the Civil War. The original Agricultural Adjustment Act of 1933 plowed enough under to raise prices; when the AAA was ruled unconstitutional, farmers got around the acreage restrictions of the law that replaced it by intensifying cultivation on the acreage permitted. The second AAA of 1938 established a system of acreage allotments, marketing quotas, price adjustment and soil conservation payments, and crop-storage loans. During the war years, cotton production again soared, even as acreage diminished due to a lack of labor.[68] Allotments reappeared whenever cotton stocks reached critical levels, as in 1950 and again in 1954, following the Korean War. The remaining acreage shifted west, where larger farms made use of irrigation and mechanical harvesting. In the Mississippi Delta, where smaller farms could not as efficiently employ the new methods, cotton acreage declined from a peak of over 1,200,000 acres to less than 200,000 in 1960, while acreage in soybeans shot up.[69] Soybeans did not displace cotton alone, but as part of a rotation with small grains, oats or winter wheat, using the same combine to harvest them all.[70] But the soybean was the major cash crop of the rotation, the crop filling the void left by cotton. King Cotton had long been a symbol of Southern identity. There was perhaps an element of overcompensation in the soybean's adoption of the names of Confederate heroes. In the North, there was talk of the Americanization of the soybean and of it having become an "all-American crop." In the South, its exoticism was masked by fervent regionalism. Given the increase in cotton acreage in the early 1950s, before both new allotments and the new Lee soybean were introduced, the use of Confederate generals may also have been a strategy of persuasion to encourage farmers to make the substitution: relinquishing cotton did not mean relinquishing Southern heritage.

The soybean displaced more than cotton: it was part of a process that displaced millions of tenant farmers and disproportionately displaced those who were black. Demand for farm labor fell dramatically with the adoption of mechanized agriculture, as

[68] Ibid., 250.

[69] Richard H. Day, "The Economics of Technological Change and the Demise of the Sharecropper," *The American Economic Review* 57 (June 1967): 434.

[70] Fornari, 251.

the output per man hour increased by threefold for cotton alone.[71] The replacement of cotton by soybeans in the Delta region was automatically a move to a more labor-efficient, mechanized agriculture; as a Louisiana State University bulletin pointed out in 1943, cotton required 183.6 hours of labor, while an acre of soybeans required only 9.6.[72] Lee and its fellow generals reflected these requirements. Lodging and shatter resistance were both crucial for the successful mechanized harvesting of soybeans. Hartwig theorized that shattering was so prevalent in soybeans in the first place because "the Asiatic farmer…would usually have less than one acre as his total crop, which could be cut slightly green"; with the "shattering characteristic, it was easier to tramp out the seed." A combine, on the other hand, cut and "tramped" in one process, making premature shattering a pure loss. Hartwig also emphasized the importance of a complete fertilization program for areas of the South outside of the Delta region with its rich soil. This meant an investment in lime, potash and phosphates (though not in nitrogen fertilizers, as this nutrient was provided by properly inoculating soybean fields with the bacteria that produced root nodules). In all cases, improved "cultural practices" geared toward high yields were necessary to garner the benefit of the new varieties: there was little difference between improved and unimproved varieties when other inputs limited them to 15-20 bushels per acre. With practices geared to produce higher yields, however, an improved variety could yield 45-50 bushels per acre, compared to 28-30 for an unimproved variety.[73] The new varieties were intended as only one element in a suite of new technologies – what some have called the "technological treadmill."

[71] Day, 428.
[72] Fornari, 251.
[73] Hartwig, "New Varieties."

Sharecroppers were first pushed from their shacks scattered across the countryside, as a decreasing demand for labor coincided with an increased need to provide clear paths for machines. They moved first to rural hamlets – staying nearby to provide labor for the remaining peak periods – and finally to cities both in the region and out.[74] It was no coincidence that this process led to the whitening of Southern agriculture. African Americans, poorer to begin with, also suffered from discriminatory practices on the part of both private and public lenders. In 1920 there were 920,000 nonwhite farms in the South, making up 15 percent of U.S. farm operators; by 1950, the total U.S. number had dropped to 560,000 (10 percent). The process accelerated after 1950. By 1997, the number was down to 19,000 (less than 1 percent).[75] At the same time, the proportion of non-white farms in the South that were fully owned by their operators rose from fifteen percent to 60 percent, the same proportion as with white farms: the transition to commercial farming and the technological treadmill occurred for the remaining African Americans as it did for whites, but at far lower numbers.[76]

The Confederate variety names ostensibly appealed to whites. Coinciding with the whitening of Southern agriculture, however, the symbolism is again ambiguous: instead of safeguarding a system of black subordination, these Confederate generals chased African Americans off the land and out of the South, replacing them with machines in the fashion of the despised industrial North. The symbolism once more seems to overcompensate, masking capitulation with a show of noble Southern manhood. What is

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[74] Day, 442.

[75] Bruce L. Gardner, *American Agriculture in the Twentieth Century: How It Flourished and What It Cost* (Cambridge, MA: Harvard University Press, 2002), 95.

[76] Ralph D. Christy, "The Afro-American, Farming, and Rural Society," In G. Johnson and J. Bonnen, eds., *Social Science Agricultural Agendas and Strategies* (East Lansing: Michigan State University Press, 1991), III-105.

more certain is that the names would have held little appeal to black farmers. This is not to say that the continuing presence of large numbers of African Americans, either as sharecroppers or as independent farmers, would have prevented the use Confederate symbolism: they likely would not have been in a position to protest. It was not until the 1980s, after all, that the Confederate battle flag became a focus of civil rights opposition. The history of protests against other Confederate symbols highlights the strangeness of this case. In 1988, the NAACP opposed University of Tennessee plans to hold ceremonies in a newly renovated Forrest Park, in midtown Memphis. Named after Nathan Bedford Forrest – bold cavalry leader, commander of the Fort Pillow massacre, and first Grand Wizard of the Klu Klux Klan – the park also held his gravesite and featured a monumental statue dedicated to him. The University canceled its plans.[77] But how to protest a field of Forrest soybeans? Neither an official landscape, though authorized by a federal government agency, nor a vernacular landscape, the Confederate soybeans constituted a hidden landscape, fully visible only on paper, and then only to the readers of *Soybean Digest.* It did not provide a focus for African-American resistance, although the totality of social and economic forces that it signified arguably had a major role in pushing African Americans into towns and cities – spaces where protest was more effective.

Thus when Hartwig bred new disease and nematode-resistant genes into Forrest, he dubbed the results Bedford (1978) and, working backward through the name, Nathan (1982). By this time, the Confederate generals had seen their heyday, signaling a shift in

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[77] J. Michael Martinez and Robert M. Harris, "Graves, Worms, and Epitaphs: Confederate Monuments in the Southern Landscape," in J. Michael Martinez, William D. Richardson, and Ron McNinch-Su, eds., *Confederate Symbols in the Contemporary South* (Gainesville, FL: University Press of Florida, 2000), 167-168.

the organization of plant breeding in the U.S. The Plant Variety Protection Act (PVPA), which went into effect in 1971, extended patent protection to novel varieties (although farmers could still save their seed and even sell to neighbors), helping to entice more commercial seed companies into varietal research. The impact was limited during the 1970s: Hartwig estimated that by 1979 there were seventy-five federal, state and private plant breeders engaged in soybean research, but that the bulk of the nation's soybeans had been developed by the twelve to fifteen breeders active since the mid-1960s.[78] However, by the 1980s, there was a marked shift in variety development toward the commercial breeders, many of which were divisions of multinational corporations, one of which, Monsanto, would introduce genetically modified soybeans in the 1990s. By the mid-1980s, the USDA's Agricultural Research Service (ARS), to which Hartwig formally belonged, was largely abandoning the development of finished cultivars.[79] Hartwig continued his own work into the 1990s, when he released his last Confederate general, Lyon – Hylan Lyon was a brigadier general who led a daring cavalry raid into Kentucky – on his eightieth birthday and was developing a new variety when he died in 1996. During his life, he had been widely honored, receiving multiple awards from the USDA and the title of Distinguished Professor at Mississippi State, as well as the highest honor: the Hartwig soybean was released by Missouri breeders in 1991 and included Forrest in its ancestral line.[80] By 2000, the era of proper names had itself largely ended,

[78] Hartwig, "Soybean Varietal Development," 5.
[79] Jack Ralph Kloppenburg, Jr., *First the Seed: The Political Economy of Plant Biotechnology* (Cambridge: Cambridge University Press, 1988; Second Edition, Madison: University of Wisconsin Press, 2004), 153.
[80] MSU Cares, "MAFES Research Highlights - Gift to MSU Coninues Work by the 'Father of the Soybean,'" last updated Spring 1997, http://msucares.com/pubs/highlights/6002.htm.

replaced by varietal designations such as AG2702 and 5344STS, ensuring that nobody else would ever have a comparable impact on the hidden landscape of soybeans.[81]

The Middleman: Dwayne Andreas

Once, when delivering a talk on "Commodity Markets and the Processor" to a group of professors from business schools and agricultural colleges, Dwayne Andreas demurred that "it is very difficult for a business man to find himself surrounded by a group of experts." The occasion was the Chicago Board of Trade's Symposium on Commodity Markets, held each year in September at the Union League Club with the goal of educating educators about the workings of the market and its benefit to the public at large, lest they further spread misunderstanding about an institution that often felt itself to be widely misunderstood.[82] Never hindered by a lack of confidence, Andreas' difficulty was not that he was cowed by expertise, but that he felt "the urge to expound on personal economic theories" to an audience that might appreciate them. For the time being, he pledged to avoid theory in order to relay practical knowledge, "a description of just how, at the working level, the merchandising operations of a modern soybean crushing plant are managed." His first task was to dispel popular notions about the economic importance of the myriad products made from soybeans – "everything from houses to babies' diapers," as he had put it in an earlier speech's mocking tribute to chemurgists. Rather, the practical crusher was concerned with only two products, oil and meal. And, noting that most "of the weight of the bean is consumed right on the farm in the form of

[81] Fae Holin and Kate Fisher, "Cream of the Crop: Here Are 2001's Top New Soybean Varieties," *Corn and Soybean Digest* (Nov. 2000): 33-34.

[82] "Board of Trade Is Host to Educators," *Cedar Rapids [IA] Gazette*, 9 Sept. 1955, 2; "Board of Trade Will Tell Educators How Market Helps Public," *Chicago Daily Tribune*, 2 Sept. 1951, A7.

meal," he argued that, for the most part, "a crushing plant simply serves as the conduit through which soybeans move in their natural journey from farm to farm. . . . In the economic sense it is only the oil that moves off the farm."[83] Although his remark was limited to the case of soybean meal, it pointed to a larger picture: that in 1955, farmers were ever more reliant on intermediaries for their inputs, including livestock feed (which, in an era when farms were becoming more specialized, was less likely to return to the same diversified farm from which it had come). Middlemen like Andreas were growing in importance not just in the farm sector but as key figures in a lengthening American food chain. And as many of these middlemen grew rich – as Andreas himself would – it raised a perennial question: did they truly create value or simply capture it?

The creed of the middleman as broker of win-win deals ran deep in Andreas, whose father Reuben once expressed it this way when he was a boy: "Here is a farmer over here with three horses and no cows. The first horse is worth six hundred dollars because it does all the work. The second horse is worth three hundred dollars because it works about half the time. And the third horse is worth nothing to him because it eats oats and doesn't work." He then pointed to a farmer with three cows who faced a similar situation, with the third cow worth nothing because he had no way to market the milk. "Now I as a trader get these two farmers together. The farmer with three cows trades his worthless cow to the farmer with three horses, who gives his worthless horse to the farmer with three cows. Now the farmer has two horses and a six-hundred-dollar cow because it is his

[83] Dwayne Andreas, "Commodity Markets and the Processor," speech, Chicago Board of Trade Commodity Markets Symposium, Union League Club, Chicago, Sept. 1955. E.J. Kahn Papers, Box 14, Subject File: Andreas, Dwayne, Articles and Speeches, New York Public Library Manuscripts and Archives Division, New York, 1.

first cow. The other farmer is ahead by the fact that he has a six-hundred-dollar horse because it is his first horse. Now each farmer is six hundred dollars richer and I hope I make fifty dollars in the trade." When recounting the parable years later to his biographer, Andreas added, "I always remember that story and I have found that almost every business transaction I know of turns out just like that."[84] His father's parable reflected Andreas' rural roots. His parents, from strict Mennonite families who emigrated to the Midwest from Prussia in the 1870s,[85] moved from Minnesota to a sixty-acre farm in Lisbon, Iowa in 1922. They were both forty years old at the time and Dwayne, the next-to-last of six children, was four. His family lived frugally, canning its own vegetables and growing its own oats, hay and corn for livestock feed. But Reuben, who indeed took up horse trading, had ambitions beyond self-sufficiency. In 1927, he took over a bankrupt grain, coal and seed business in Lisbon, and soon R.P. Andreas & Son would expand to operating the town's grain elevator. Reuben had become an all-purpose middleman to farmers.[86]

In 1927, he expanded again to provide an input that was growing rapidly in popularity: mixed feeds, also known as prepared or formula feeds. In a notable example of how farmers increasingly relied on middlemen for their inputs, this sector had grown from almost nothing three decades earlier into a $400 million industry comprised of 750 firms by 1929. By 1956, spurred by the increased meat production – in particular, broiler chickens in the South – and advances in formulation achieved by Clive McCay and his colleagues, it would be a $2 billion industry in which six thousand feed manufacturers,

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[84] E.J. Kahn, Jr., *Supermarketer to the World: The Story of Dwayne Andreas, CEO of Archer Daniels Midland* (New York: Warner Books, 1991), 67.
[85] Another variant of the name among Mennonites is Andresen, suggesting some distant kinship between the Andreas family and August Andresen, the Minnesota leader of the congressional butter bloc.
[86] Kahn, 59-61.

and countless feed stores, produced thirty-three million tons annually.[87] Like most of these operations, Andy's Feeds, as Reuben originally called it, started off on a small scale: he would mix the feeds by hand as his sons shoveled the ingredients – corns, oats, molasses, alfalfa and soybean meal – into bins. But his business grew, prompting him in 1934 to purchase a feed-mixing machine that could handle ten tons of ingredients every hour.[88] In 1936, R.P. Andreas and Sons moved its operations to Cedar Rapids and became Honeymead, a name chosen at the family dinner table.[89] The company installed three machines in an old storehouse to manufacture different sizes of hard-pellet feeds, favored by customers over powdered feeds that were blown around freely by the wind. In August 1937, the company's net worth was appraised at $24,200 and the Iowa Securities Commission authorized a public stock offering. Eight years later, when the family sold sixty percent of its Honeymead holdings to the Minneapolis-based grain exporter Cargill, Dwayne Andreas' personal share of the proceeds alone amounted to $1.5 million.[90]

Andreas had grown up with the business. He learned the operations of a country elevator and spent a good deal of time hanging around his father's office shooting the breeze with salesmen. He spent two years studying at Wheaton College in Illinois, responding to his mother's hope that one of her sons would enter the ministry, but dropped out to return to his true calling. He bought a $1,500 stake in the family's

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[87] Alan L. Olmstead and Paul W. Rhode, *Creating Abundance: Biological Innovation and American Agricultural Development* (New York: Cambridge University Press, 2008), 276; Frank B. Morrison, *Feeds and Feeding: A Handbook for the Student and Stockman,* Twenty-Second Edition, Unabridged (Ithaca, NY: The Morrison Publishing Company, 1956), 544.
[88] Kahn, 62.
[89] Lew P. Reeve, Jr., "Dwayne Andreas Today: Long Way from Early Feed Business in Lisbon and C.R," *The Cedar Rapids Gazette*, 1 Nov. 1964, 22A. Why the name of an alcoholic beverage struck the Mennonites' fancy is not entirely clear.
[90] Kahn, 72, 78.

business, borrowed from his father's friends at Lisbon National. He became the company's most aggressive salesman: to increase his territory, he earned a pilot's license and bought a small plane until a tangle with some telephone wires persuaded him to retire his wings. Of more lasting impact was a trip in 1938 to Decatur, Illinois, to buy eight thousand tons of ground soymeal for the feed operation. As he was completing his transaction, he was intercepted by Mr. Staley himself – this was Gus, the son of the legendary salesman who founded the company – and invited to lunch. Andreas admitted many years later to being atypically awestruck: "I felt like I was in the presence of God." And Staley proved both prophetic and benevolent. He predicted that Iowa farmers would increasingly plant soybeans in the coming years and, as Staley had no plans to move beyond Illinois, he suggested that Honeymead make the most of a profitable opportunity by entering the crushing business. For capital, Staley suggested that Andreas contact the Allis-Chalmers company in Milwaukee, an equipment manufacturer which was then developing a new solvent-extraction system for oilseeds. And indeed, after Andreas consulted with his father and brothers and donned a hat to look more mature than his twenty years, he sped off to Wisconsin and obtained the loan.[91] By the end of 1938, Honeymead was in the soybean business, processing one hundred tons a day using an innovative extractor – the first of its kind in the U.S. – built inside what had been a grain elevator.[92]

Honeymead had joined a small group of solvent plant pioneers – including Glidden, after it recovered from the explosion of its original facility, Ford, and Archer-Daniels

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[91] Kahn, 61, 71-74.

[92] Reeve, 22A; Louis F. Langhurst, "Solvent Extraction Processes," in Markley, Klare S., ed., *Soybeans and Soybean Products*, *Vol. II,* Fats and Oils: A Series of Monographs (New York: Interscience Publishers Ltd., 1951), 563.

Midland – in what would rapidly become a dominant technology, mainly because the value of the oil, on a pound-per-pound basis, would remain substantially higher than the value of the meal. With expellers, about five percent of the oil remained in the meal. With solvent extractors, it was under one percent and, as Andreas would explain to a group of Cargill trainees in the late 1940s, the additional revenue from selling that four-percent difference as oil rather than as meal meant that "you could afford to pay twenty cents a bushel more for soybeans to run through a solvent plant than you could to run through an expeller plant."[93] Solvent meal was initially disdained in the feed business, but by this time processors had learned to "toast" it to make it more palatable, something that expellers achieved automatically through the heat of friction. In any case, Andreas' younger brother Lowell handled the technical aspects of processing while Andreas learned the business. Honeymead was not the first soybean crusher in Cedar Rapids: Joseph Sinaiko operated an expeller plant and became a mentor to Andreas. In 1943, Sinaiko sold his Iowa Milling Company to Cargill. In 1945, now the executive officer of the company and anticipating that he might soon be drafted, Andreas also sold the Cedar Rapids plant and a controlling share of Honeymead stock to Cargill (which arranged a three-month draft deferment for him that, as it happened, extended beyond the end of the war) . When the war ended, he joined the Minneapolis company as vice-president in charge of the Vegetable Oils Division which oversaw soybean and linseed oil operations. He stayed for seven years, absorbing more business secrets from a second Jewish mentor,

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[93] Dwayne Andreas, "The Vegetable Oil Industry and Its Outlook for the Future," speech and discussion, Cargill training session, 7 March 1946, E.J. Kahn Papers, Box 14, Subject File: Andreas, Dwayne, Articles and Speeches, New York Public Library Manuscripts and Archives Division, New York, 216-217.

Julius Hendel, the leading commodities trader at Cargill who, just prior to Andreas' arrival, was put in charge of all merchandising activities.[94]

Hendel, whose faith made him something of an outsider at Cargill, was also one of the few to foresee in 1942, when most processors feared that crushing overcapacity would lead to a surplus of soybean meal in excess of two million tons, that demand would outstrip supply. When Andreas met him during this period, years prior to joining Cargill, Hendel predicted that if the government put a wartime price cap on soybean meal at $32 per ton, which it did, "you will see the biggest expansion in the feed business in the next two or three years you have ever seen."[95] Accordingly, Hendel was the one to push Cargill into the crushing business. Andreas highly respected his prescience and business acumen. Above all, what Andreas learned from both Sinaiko and Hendel was mastery of the art of hedging,[96] knowledge that was transmitted at the time by practical businessmen to their juniors, as there was considerable academic confusion on the subject. Most academics treated hedging as a form of insurance against short-term reverses in price – and were then accordingly baffled by the ubiquity of the practice, as it seemed to eliminate the chance for profit at the same time is offloaded risk to the speculative market. As one writer put it in 1899, "it may be asked what profit remains to grain and cotton merchants if they make themselves independent of every change in the market price."[97] Worse yet, many supposed, if the futures price did not track the cash (or "spot") price of grain, merchants might even face loss by hedging – and indeed, as

[94] Kahn, 71; Wayne G. Broehl, Jr., *Cargill: Trading the World's Grain* (Hanover, NH: University Press of New England, 1992), 665, 687.
[95] Andreas, "Vegetable Oil Industry," 219.
[96] "If you call it an art, and I think it is," Andreas would later comment in an aside to Cargill trainees. Ibid., 217.
[97] Henry Crosby Emery, "Futures in the Grain Market," *The Economic Journal* 9 (Mar. 1899): 49.

economist Holbrook Working pointed out in a seminal 1953 paper that finally got a conceptual grip on the topic, in two out of three years examined in a prior study, hedging appeared to lead to just such a loss. Quoting a 1903 letter by William Hood Dunwoody, one of the founders of what would become General Mills, describing the technique to a young man entering the milling business, Working noted that Dunwoody's firm "is as devoted to hedging today as it was fifty years ago" and presumably would not have "reached its present position [by] following a practice that led to heavy losses in two years out of three."[98]

What businessmen knew and academics periodically discovered was that hedging was not simply insurance against short-term reverses in price but a central means to, as the 1899 writer put it, "furnish to the trader his reward as middleman."[99] This was true in the simple case of storage. When a warehouse operator bought cash grain and simultaneously sold the equivalent amount of grain futures, the difference represented the market's collective best guess of the value of storing the grain until the future contract's delivery date. Indeed, operators could lock in that return if they lifted the hedge – selling the cash grain and settling the futures contracts – on the delivery date, when the difference between the cash and futures prices would be zero. Given the general tendency of the two to converge even before the delivery date, there was also a somewhat predictable return for storing the grain for shorter periods. Locking in the market's best guess of the value of processing was rather more complicated, as this involved, in the case of soybeans, the conversion of one commodity into two others, and ideally all three should be hedged. Prior to futures markets in soybean oil and meal – which the Chicago

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[98] Holbrook Working, "Hedging Reconsidered," *Journal of Farm Economics* 35 (Nov. 1953): 544-45.
[99] Emery, 49; for another instance of comprehension before Working, see G. Wright Hoffman, "The Hedging of Grain," *Annals of the American Academy of Political and Social Science* 155 (May 1931): 7-22.

Board of Trade established in 1950 and 1951 respectively – processors customarily hedged with cottonseed oil futures on the New York Produce Exchange and cottonseed meal futures on the Memphis market. The introduction of oil and meal futures at Chicago represented the first time that soybeans and its two products were traded at one market, and a "vast benefit to industry [was] predicted."[100]

In his talk on "Commodity Markets and the Processor" in 1955, Andreas explained this benefit to the assembled academics. As he described it "at the working level," the "merchandising department of a modern soybean operation includes four basic functions which usually are represented by four individuals." First was the bean buyer who purchased soybeans "day by day as the country appears willing to sell," keeping one eye on prices in relation to the futures prices in Chicago, but making sure "above all . . . that there is an adequate supply of beans ahead of the plant to keep it running at capacity at all times" and that the company's warehousing capacity was utilized as profitably as possible. Then there was the oil salesman who tried "to be prepared to quote a competitive price every day, regardless of the crushing margin at the time" in order to ensure "that the entire production of the plant can be shipped regularly." Then there was the meal salesman, who likewise endeavored to quote a "competitive price at all times, even when the crushing margin is unsatisfactory," with an eye in particular on saving on freight charges, as the meal represented the bulk of the soybeans by weight. Like warehousemen, the oil and meal salesmen were alert to signals from their respective futures markets in order to most profitably use the company's warehouse space. As Andreas stressed, each of these three faced separate competitive pressures that forced

[100] Andreas, "Vegetable Oil Industry," 218; "Futures Trade in Soybean Oil Begins Monday," *Chicago Daily Tribune*, 13 July 1950, A9; "Board of Trade Starts Dealing in Soybean Meal," *Chicago Daily Tribune,* 30 Aug. 1951, C5.

them to disregard the crushing margin: that is, the profit from converting the beans into oil and meal at a particular time. Indeed, in cash terms the plant typically crushed at a loss.[101]

Finally, there was the merchandising supervisor – a role that Andreas himself played at times – whose primary job, in addition to looking over the shoulders of the other three, was "fixing the margin between the beans and the products at a time most favorable, in his opinion, to his operation."[102] In other words, he had to track all three futures markets and pinpoint the moments when they aligned such that he could lock in a profitable crushing margin through hedging. Lest this "sound too simple," Andreas emphasized, "I would like to point out that during the last few years an adequate crushing margin has existed only for a few days at a time during the year. Thus, an alert merchandising supervisor might conceivably do a very large share of his year's business in a very short time, in spite of the fact that the cash purchases of beans and the sale of meal and oil are scattered throughout the year."[103] Thus the futures markets enabled the processor to disconnect profitmaking from the flow of actual grain through the plant. The rarity of profitable moments during these years – the source of "the trials and tribulations of the merchandising manager" – was a topic of lively debate, some blaming excess processing capacity (too much competition), others the distorting effect of the futures market itself, as speculators drove the price of beans above their real worth and on occasion used "strong arm" methods in attempts to corner the market. Andreas reviewed the case for

[101] Andreas, "Commodity Markets," 2-4.

[102] See page 235, Note 8 of this study for a reminder on how hedging could lock in a return for storing grain. The trick in this case was locking in three separate returns through hedging with three different futures, such that the return from storing oil and meal exceeded the return from storing beans. Otherwise, the processor would crush at a loss – and not crushing under this circumstance was not an option for an ongoing business.

[103] Ibid., 4-5.

speculative excess and criticized the Commodity and Exchange Administration for lapses in its policing duty, but overall he argued that the narrowing of the crushing margin was salutary, in part the predictable result of offloading risk onto speculators that ultimately allows the more efficient use of capital. Andreas noted “that there has been a marked tendency on the part of top executives in this industry to pay more attention to manufacturing efficiency.” As this lowered the price of finished products, “certainly our economy as a whole benefits to that extent.”[104]

Thus, one might say, the futures market achieved the distillation of the soybean’s value into fractions with distinctive levels of risk suited to various specialists, manufacturers on the one hand and speculators on the other. Andreas complicated this picture, however, when he remarked on the “strange phenomenon” of “several crushers [making] a good share if not all their earnings in the recent past by the unique practice of buying the meal and the oil in the [futures] pit and selling the beans in the pit when the spread between the products and the beans is considerably less than the cost of conversion.” They would then reverse the transactions when the spread increased, buying virtual beans and selling virtual oil and meal, which “in effect gave them additional crushing capacity at less than it would cost to own a plant and operate the capacity.” This was not hedging, but rather a form of speculation, one which Andreas expected other speculators to soon adopt, as they were, after all, just as able as processors to operate this kind of purely financial “crushing capacity.”[105] Partly a product of unique circumstances, this type of practice nonetheless revealed that processors did not leave speculation entirely to the speculators. Andreas’ appraisal suggested disdain on his own

[104] Ibid., 5-9.
[105] Ibid., 6.

part for this development, and Julius Hendel stood opposed to speculation entering into the practice of the hedger: "If a trader is speculating, his mind will not be on business," Hendel would later write in an instructional pamphlet about hedging.[106] But the ambiguity remained: as well-informed, long-term market players, to what degree did processors speculate rather than hedge?

For his part, Andreas regularly subordinated finance to operational concerns, considering the former to be at the service of the latter, and sought to expand by relentlessly pursuing new markets. His aggressiveness and élan put him at odds with some of the other executives in the buttoned-up corporate culture of Cargill, never more so than when he decided in 1952, at the height of McCarthyism, to attend a trade conference in Moscow. He was not to be a formal delegate, but rather accompany a French group, and he obtained a visa in Washington on the condition that he keep a low profile. Still, top management feared that banks would cut off credit when the news got out, and Hendel himself told him, "I am *ordering* you not to go," to which he responded, "Now, Julius, you know you don't mean that." Andreas sensed a market opportunity for vegetable oil in the Soviet Union, and no ideological or geopolitical considerations could deter his pursuit of the deal. After his return, he was forced to resign from Cargill – at a gain of $400,000 in redeemed common stock – but his eyes had been opened by the trip.[107]

Maintaining his residence in Minneapolis to take up the reigns of his family's remaining Honeymead interests – prime among them a thousand-ton soybean processing plant in Mankato, Minnesota overseen by Lowell Andreas and made profitable by a

[106] Kahn, 132.
[107] Broehl, 709-710, 762-63; Kahn, 80.

special freight rate negotiated with The Chicago and Northwestern Railroad – he remained determine to sell to the Soviets, having been told by the Minister of Trade that the communist nation suffered shortages of fats and cooking oils. Soybean oil might have been a logical commodity for Andreas to trade, but he focused instead on the nation's growing stock of surplus butter for strategic reasons: as Vice President Richard Nixon advised him, Wisconsinite Joe McCarthy would not object to the deal. But as he arranged to buy 20,000 tons of surplus butter and 3,000 of surplus cottonseed oil for less than the support price the government had paid to farmers, Secretary of Commerce Sinclair Weeks refused to issue the export license, though he left open the possibility of approving the sale of such "non-strategic" farm goods if they were bought for open-market prices.[108] Andreas' defiance of Cold War norms earned him a fair amount of notoriety: he received one letter simply addressed to "the son of a bitch who wants to sell butter to the Russians." Specifically, the outrage focused on the prospect of the nation's enemies being able to purchase butter at a lower price than American housewives. What Andreas, in typical fashion, envisioned as a win-win deal was perceived by others as treason. Andreas shrugged off the hate mail and instructed his traders in Rotterdam to fulfill the Russian deal with cottonseed and linseed oil from wherever they could obtain it.[109]

His ability to get the butter deal as far along as he did suggested that Andreas had developed valuable contacts in Washington (Secretary Weeks aside). On the one hand, Andreas was a believer in free markets who built his fortune on what had become the most free-market of American crops: the support price for soybeans was typically lower

[108] "Sale of Surplus to Russ Barred," *Wisconsin State Journal*, 11 Feb. 1954, 12.
[109] Kahn, 83-84.

than its market price, which was therefore regulated more by the futures market than government policy. On the other hand, Andreas was pragmatic, realizing that government policy structured all agricultural markets for better or worse – and had to by necessity in a world where other nations openly subsidized their own farmers. As he would put it years later to a group of investment bankers – using one of his homespun farm analogies – if you did not learn to “get along with the government whether you like it or not, you're going to get rolled over, as if you were a pig in a manger with its mother sow. When she rolls over, either you get a teat in your mouth or you get squashed.”[110] His pragmatism, and his bent for being a middleman in politics as in all other arenas of deal making, made him politically ambidextrous. He consulted with Nixon about butter and became fast friends with failed Republican presidential nominee Thomas Dewey, whom he met in 1953 and whose promotion of soybeans while governor of New York impressed him. The two became traveling, fishing and golf companions, and Andreas arranged for Dewey to become special counsel to the National Soybean Processors Association. The two were joined at times by Hubert Humphrey, the Democratic Senator from Minnesota and later Vice President. Andreas would become famously associated with Humphrey as a financial backer and personal advisor. To any who thought his simultaneous connections with Dewey and Humphrey odd, he insisted that they had “a lot in common” when they discussed national or international affairs; “it was amazing how often they were in agreement.”[111]

Humphrey was both the closer friend and the more valuable political connection. While mayor of Minneapolis, Humphrey had heard from many in the agricultural

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[110] Ibid., 60.
[111] Ibid., 106-07.

business community that Andreas was a man to meet, but it was not until 1948, when Andreas got his attention with an unsolicited donation of one thousand dollars to his reelection campaign – "a spectacularly large amount from someone I hadn't met and hadn't asked for help," Humphrey later wrote – that the two met and hit it off. The two did not always agree politically: Humphrey supported farm subsidies, while Andreas opposed them; Andreas wanted to sell butter to the Russians, while Humphrey was a staunch anticommunist. And Humphrey would insist, "contrary to the inevitable gossip," that Andreas never asked him "to fix a contract or introduce legislation that would benefit him specifically or manipulate something in his behalf."[112] Nonetheless, the friendship benefitted Andreas in a number of ways. Humphrey brought him along on overseas trips – Andreas usually paying his own way – which raised his profile as an international businessman. More tangibly, it was through Humphrey that met Myron W. "Bill" Thatcher, the secretary general of the Farmers Union Grain Terminal Association (GTA), one of the Democratic party's most powerful backers in Minnesota. Humphrey had been surprised by Andreas' positive attitude toward farm cooperatives like the GTA – Andreas felt that farmers ought to "organize to protect themselves from the vagaries of the market place" – and in 1960 Thatcher arranged to buy out the Andreas' remaining Honeymead interests for $10 million and hire Dwayne and Lowell as the GTA's vice president and executive vice president.[113] The GTA, which was in the business of pooling its members' crops (largely wheat but increasingly soybeans) to gain market leverage, was essentially forward integrating to capture what Andreas had long understood to be the

[112] Hubert H Humphrey, with Norman Sherman, ed. *The Education of a Public Man: My Life and Politics* (Garden City, NY: Doubleday & Company, 1976), 294-296.
[113] Ibid., 295; Kahn, 116.

most valuable link in the chain from farm to table: the point at which the raw commodity was transformed into its primary products.

But the largest impact on the soybean industry as a whole would be Humphrey's introduction in 1954 of Public Law 480 (PL 480), which, in combination with a smaller direct food-aid program, allotted credits to foreign governments for buying certain American commodities. The aid recipients made arrangements with private exporters, whom the U.S. government then paid in dollars. These loans were repaid in soft local currencies, which U.S. agencies could then use to fund programs in the recipient nations. PL 480 was thus a program built around middlemen like Andreas, who would later claim some of the credit for the idea. As much as Andreas and Humphrey might differ on domestic farm programs, after all, they agreed on the need to expand farm exports and, in more humanitarian terms, to address the growing problem of world hunger. The chief beneficiaries were wheat exporters, but soybean products were included in the program, and it had a marked effect on the price of soybean oil, which was produced in excess of domestic demand – even with the repeal of margarine taxes – as a result of the more rapidly expanding market for soybean meal. (The price of soybean oil was also indirectly buoyed by government price support for its chief competitor, cottonseed oil; when Humphrey succeeded in backing the USDA down from a plan to lower this support, Andreas wrote to say how pleased he was.)[114] In 1959, PL 480 financed four out of every five dollars' worth of wheat exports and nine out of every ten dollars' worth of soybean oil exports.[115]

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[114] Carl Solberg, *Hubert Humphrey: A Biography* (New York: W.W. Norton & Company, 1984), 166.
[115] Dan Morgan, *Merchants of Grain* (New York: The Viking Press, 1979), 101-02, 124.

Addressing one glut resulted in another, however, as soft currencies accumulated in overseas banks. Much of this was eventually written off, but a portion was directed in turn to enlarging markets for American farm products. This was especially significant for the soybean, as PL 480 money funded both the Japanese American Soybean Institute – which coordinated the export of soybeans for Asian food purposes – and the Soybean Council of America, which promoted soybean use in dozens of the 60 countries eligible for soybean credits. One effort was to foster poultry industries in countries such as Iran, thus creating a greater need for meal.[116] The Council's main focus, however, was to promote soybean oil in Mediterranean countries as a substitute for olive oil – though usually the idea was to blend soybean oil with a small amount of the stronger-tasting, and more expensive, olive oil. The Council recommended to Spain that it use more soybean oil for domestic purposes so that it could export olive oil for hard currency;[117] the U.S. government supported this idea by extending Franco's regime credits under PL 480. And, indeed, at the end of 1957, Honeymead could boast that it was the first Minnesota company to ship soybean oil to Spain as a train of eighty tank cars left its Mankato plant to fulfill the first installment of an 8,000 metric ton order. In a news account, Andreas pointed out how local farmers would benefit: "Our sales of this processed product means we can pay the farmer more for his beans, and in turn sell him back the meal at the lowest possible prices."[118] This putative gain to farmers was the outcome not just of private enterprise, of course, but of the various government programs that sustained the value of

[116] Ray A. Goldberg, *Agribusiness Coordination: A Systems Approach to the Wheat, Soybean, and Fllorida Orange Economies* (Boston: Graduate School of Business Administration, Harvard University, 1968), 124-25; Morgan, 125-28.
[117] "Roach in Spain for Soybeans," *Waterloo [IA] Daily Courier,* 5 Dec. 1956, 30; Milt Nelson,"Agriculture's Foreign Trade Promotion," *The Cedar Rapids [IA] Gazette,* 2 June 1962, 10B; Stewart Haas, "Bean Gains Favor on Mediterranean," *The Waterloo [IA] Sunday Courier,* 16 Feb. 1963, 25.
[118] "Mankato Firm Shipping Soybean Oil to Spain," *Winona [MN] Daily News,* 30 Dec. 1957, 3.

soybean oil: research to combat flavor reversion, price supports for cottonseed oil, and PL 480.

If Andreas could claim to be an honest trader, there were also those who used the middleman position strategically to cheat and steal. Such was the case of Anthony “Tino” De Angelis, a Bronx butcher turned self-styled Salad Oil King. Despite a shady reputation with the USDA after one of his companies sold uninspected meat to the School Lunch Program, De Angelis was able to make a fortune selling cottonseed and soybean oil through the PL 480 program through consummate middlemanship. The normal export channel for companies like Staley, Cargill or Honeymead was down the Mississippi through New Orleans: hence the stimulating effect that an expanding overseas market had one Southern soybeans. It was more costly to transport the oil by rail to the east coast. But this threatened to shut giant New York based grain export companies Bunge and Continental out of a lucrative new trade. De Angelis borrowed from these companies to buy a petroleum storage facility in Bayonne, New Jersey, which he refitted to be a salad oil “tank farm” and refinery that sold its output to Bunge and Continental for export. By a magic that failed to raise suspicions among his creditors, he paid higher prices for the crude oil from small Midwest crushers and charged lower prices for refined oil than the competition – despite his higher transportation costs.[119] Eventually even the larger companies – Cargill and Staley – sold through De Angelis’ Allied Crude Vegetable Oil Refining Corporation, which brokered a $42 million PL 480 contract with Spain in 1958.[120] By the late 1950s Allied was responsible for seventy-five percent of the edible

[119] Norman C. Miller, *The Great Salad Oil Swindle* (New York: Coward McCann, Inc., 1965), 13-21.
[120] Ibid., 23. Although De Angelis’ Spain deal coincided with Honeymead’s shipments, they seem to have been separate deals; Honeymead shipped its oil through the Gulf of Mexico, while Allied used the New-York based Isbrandtsen Line. “Mankato Firm Shipping,” 3.

oils shipped overseas. Evidence of fraud soon emerged: falsified shipping papers in the Spain deal, substandard cans resulting in 400 million pounds of spoiled oil sent by the USDA to private relief agencies overseas.[121]

But his biggest scheme involved warehouse receipts, certifications of stored oil that could be used as collateral for loans and futures transactions. Most of these receipts were issued by American Express Warehousing, a small subsidiary whose business was so obscure that top management of the giant financial company only vaguely knew of its existence. An audit of Allied's Bayonne facility at the end of 1963 revealed that tanks that supposedly held $175 million of salad oil – an improbable number to begin with, representing more than the nation's entire stock of salad oil as estimated in monthly government reports – were practically empty. Before now, it seems, De Angelis had used various stratagems to create the illusion that they were full, including the simple one of having his own men undertake the arduous task of taking measurements as a favor to lazy inspectors: deception is a peril of mediation. The repercussions went beyond American Express, which seemed as if it might not survive the claims of De Angelis' bamboozled creditors. De Angelis had also used the warehouse receipts to speculate wildly – as a supposed hedger – in the Chicago soybean and New York cottonseed futures markets, manipulating their rules to create a bubble and revealing the laxity of oversight by the Commodity Exchange Authority. Several large processors, including Cargill and Staley, were also dealt a severe blow: much of the phantom oil had been put in De Angelis' trust before he even purchased it, to "expedite" its eventual sale (which apparently took place without the oil's owners being notified). Eager to justify himself to journalists, De

[121] Miller, 24. By this time, the USDA was highly distrustful of De Angelis; he supplied the oil as a subcontractor.

Angelis blamed his troubles on the monopolistic behavior of Midwest processors; echoing Andreas, he portrayed himself as the someone offering farmers better prices for their beans. He accused the big processors of price fixing and, by way of agents that he said had connections with *Opus Dei*, cutting him out of a lucrative Spanish deal in 1960.[122] After an initial seven-year sentence, he would spend the rest of his life in and out of prison for various frauds. De Angelis' Bayonne tank farm was acquired in 1966 by Archer-Daniels Midland, a company that would before long make another acquisition: Dwayne Andreas.[123]

Archer-Daniels Midland, later simply ADM, was a comparatively small grain export company based, like the larger Cargill, in Minneapolis. It had pioneered in soybean processing a decade earlier than Cargill, operating the nation's first solvent extraction plant in 1934. By the mid-1960s, it had diversified Glidden-like into a wide array of enterprises, including fine chemicals. With profits slipping – through no fault of the Salad Oil Swindle, which left it unscathed – it began to shed these and concentrate on its core businesses, among which soybean processing loomed large and which it brought in the Andreas brothers to help expand. Lowell became ADM president in 1968; ADM acquired Interoceanic Corporation, the holding company in which the Andreas family had invested their gains from the GTA deal, with a stock swap in 1969; and by 1970, Dwayne was CEO, a position he would hold for almost two decades and where his net worth would grow into the hundreds of millions – all derived from the $1,500 he had planted in his family business in the mid-1930s. To underline the renewed focus on soybean processing, he moved the company's headquarters to Decatur, the soybean city A.E.

[122] Miller, 49-51.
[123] "Archer-Daniels Acquires Allied Crude Refinery Involved in Salad Oil Case," *Wall Street Journal*, 22 Nov. 1966, 2.

Staley had built.[124] Andreas, concerned with world hunger, would also embrace an ADM patent for textured vegetable protein, foreseeing a current market in the developing world and a future market in the U.S. when not even its wealth could sustain a meat-based diet. In the meantime, it found its main outlet in the USDA's School Lunch Program as a meat extender. ADM would also prosper with new products made of the region's first crop, corn, in particular ethanol – a dream of the Chemurgy movement that the energy crisis and government policy helped to revive – and high-fructose corn syrup.

In the political arena, when the Kennedy administration retooled PL 480 as the Food for Peace Program, Humphrey and Andreas prevailed on Robert Kennedy to appoint George McGovern director of the program; Humphrey later got Andreas himself appointed to the Food for Peace Council advising McGovern.[125] He continued to criticize domestic farm policies. Addressing a GTA convention, he assailed the "ignoble goals" and "hysteria about surpluses" of the USDA in its continued attempts to cut back farm production, described by Andreas as a "crop-cutting orgy" implemented by "statisticians who would substitute lead-penciled calculations for the judgment of farmers and the needs of humanity."[126] Outraged Secretary of Agriculture Orville Freeman denounced Andreas by name in a report to President Johnson as "someone who has benefitted from the actions of this administration and then turns on the administration [with] a vicious attack," eliciting a letter from Humphrey in turn that reminded Freeman that Andreas had "helped substantially such senators as McGovern, Gaylord Nelson, Bill

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[124] "Archer-Daniels-Midland Names Daniels Chairman and Andreas President," *Wall Street Journal*, 5 Feb. 1968, 16; "Acher-Daniels Holders Approve Acquisition of First Interoceanic," *Wall Street Journal,* 7 Nov. 1969, 26; "Archer-Daniels Designates D.O. Andreas Top Officer," *Wall Street Journal*, 10 Nov. 1970, 26.; Kahn, 71, 75.

[125] Solberg, 231-32.

[126] "Parade of Political Figures on Restrum at GTA Meet," *Austin [MN] Herald*, 17 Nov. 1965, 11.

Proxmire, Gale McGee, Lee Metcalf, Ted Moss – all good Administration votes."[127] Andreas' conflict with the administration revealed some consistency in his attitude toward government: he applauded it when it worked to expand production and trade, lambasted it when it worked against such expansion. He thought like the anti-New Deal businessmen who flocked to Henry Ford's Chemurgy conference, with the anomaly of having close ties to the Democratic administration carrying the New Deal forward. With Humphrey's failed campaign for president (with the soybean magnate often at his side), Andreas cultivated what were perhaps more congruous ties with the Nixon administration and its expansionist, plant-from-fencerow-to-fencerow Secretary of Agriculture Earl Butz; though, even here, Andreas would fall out with Nixon over the president's soybean embargo of 1973. Andreas would garner unwelcome publicity when a $25,000 cashier's check he donated to CREEP was among those found in the bank account of one of the Watergate Seven. But in general, even as he became one of the nation's largest donors to both Democrats and Republicans, he settled into the role of the most influential businessman nobody had ever heard of.[128]

By the early 1970s, Andreas would be firmly ensconced in the middle: of the country, of the American food chain, of the U.S. political system. ADM's products were largely anonymous, ingredients tucked into American foods without fanfare, and while Andreas created a brand-identity of sorts for the company with ads during Sunday morning political shows, he himself would largely avoid the scrutiny that seldom resolves the ambiguity of the middleman. He may have been a discoverer of win-win opportunities within the business landscape; he may have been even more clever at discovering

[127] Solberg, 232-33.
[128] Kahn, 205, 183, 59.

strategic choke points and privileged vantage points as he created his largely hidden empire of soy.

The Chemist

By all measures, 1949 was a banner year for Percy Lavon Julian. During that year, he won acclaim for two discoveries, both related to hormones. The first related to a paper that had been published in the *Journal of the American Chemical Society* at the tail end of 1948 reporting the synthesis of 16-methyltestosterone, an analog to testosterone.[129] The story was picked up by the African-American press in the middle of 1949, first by *Our World* magazine and then by the *Afro-American*, which predicted that soon "the divorce cases flooding the country's courts may be greatly decreased" by the availability of cheap testosterone, as male impotency, in addition to being to blame for most cases of childlessness, was "understood to be one of the main reasons why so many wives have lovers."[130] (In a later story, the paper would report even more bluntly that "weak, sissyish men become more masculine when given male hormones.")[131] But this breakthrough was eclipsed by a *Chicago Tribune* exclusive in September announcing that Julian had developed a method to cheaply manufacture something called Compound S, a substance "chemically analogous" to cortisone. This followed news from the Mayo clinic in April that one or two injections of cortisone (also known as Compound E) had so freed longtime sufferers of rheumatoid arthritis "that they were able to dance a jig." The problem was that it would take the bile of 14,600 oxen, from which the drug was derived,

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[129] Percy L. Julian, Edwin W. Meyer and Helen Printy, "Sterols. VI. 16-Methyltestosterone," *Journal of the American Chemical Society* 70 (Nov. 1948): 3872.
[130] "Dr. Julian's Work May Halt Divorce," *Afro-American,* 2 July 1949, 3.
[131] "Cheap Sex Hormone Result of 'Accident,'" *Washington Afro-American,* 2 Oct. 1951, 5.

to treat one arthritis patient for one year. Compound S was so rare that it had not yet been tested, but researchers thought it was highly promising; "brewed" from soybeans, as the paper put it, it also promised to be available in abundance. Glidden pledged to distribute its entire supply to drug companies, clinics and the public health service for immediate testing.[132]

This was front page news in Chicago and the story of the "Negro scientist" who "amazed the medical world with drugs he developed for the cure of arthritis and rheumatic fever" was immediately picked up by papers across the nation. It was the culmination not just of Julian's career, but of Glidden's policy of functional diversification – of finding tremendous value in the residue of a residue – and of the Julian family's multigenerational pursuit of accomplishment. On the strength of his discovery, readers of the *Chicago Sun-Times* chose Julian from among 180 candidates to be the 1949 Chicagoan of the Year; the paper flew in Julian's parents as surprise guests at the award dinner.[133] His success seems to have emboldened Julian to seek new personal and professional horizons. The next year, he moved his family to the previously all-white suburb of Oak Park, long the bedroom community of other Glidden executives. And he was apparently branching out into other ventures, later justifying the move to his new house by telling reporters that it was "not far from Franklin Park where I have a business of my own."[134] He would become a fully independent businessman in 1953, but under circumstances that were far different, following years of stress and disappointment. And by this time, both he and Glidden would have abandoned the soybean as a source for

[132] Roy Gibbons, "Science Gives Synthetic Key to New Drug," *Chicago Daily Tribune,* 30 Sept. 1949, 1.
[133] "Slave's Grandson Made 'Chicagoan of the Year,'" *New York Times*, 18 Jan. 1950, 18; "Dr. Percy L. Julian Wins 'Chicagoan of the Year' Award," *Afro-American,* 28 Jan. 1950, 12. He was Chicagoan of the Year for 1949, but the dinner was held in January 1950.
[134] Ralph Matthews, Jr., "Dr. Julian Fighting Mad Over Bombing of Home," *Afro-American,* 23 June 1951, 5.

synthetic hormones. Seemingly so full of miraculous potential, it would fall prey to a more economical substitute – at least for a time.

Julian and Glidden's entry into hormones was the result of two happy accidents a decade earlier. One day in 1939 Julian received a call informing him that a 100,000 gallons of refined soybean oil bound for Durkee's Famous Foods had been spoiled by water that had leaked into the tank, a potential loss of $200,000. He found that the tank contained a mass of white sludge that was partially crystalized. Luck favors the well-prepared: Julian noticed a resemblance to sterols that had similarly crystallized by accident in a dish of Calabar bean oil years before at DePauw. He had the entire tank of soybean oil centrifuged and found that the white oily mass contained fifteen percent mixed sterols. Before joining Glidden, he had been interested in deriving progesterone from a sterol, stigmasterol, contained in both the Calabar bean and the soybean. The interest may have been personal as well as scientific: his wife had suffered miscarriages, for which progesterone, discovered in 1934, was thought to be a remedy. He knew that soybean oil was rich in stigmasterol, and by now incorporating a modified version of the accidental procedure into the refining process, he was one step closer to extracting it.[135] He was faced with the immediate problem, however, of efficiently separating the mixed sterols from the white sludge. This was customarily accomplished by making such sludges into soap and then washing out the "unsaponifiable" (or non-soap) portion with a solvent. Unfortunately, the typical gumminess of the soap impeded this process. In what Julian also described as a lucky accident to *Coronet Magazine*, one day he "happened to watch a friend mix a batch of plaster retarder. When quicklime was added, the stuff

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[135] Max Tishler, "Percy L. Julian, the Scientist," *The Chemist* 42 (March 1965): 110; NOVA, "Transcripts: Forgotten Genius. PBS Airdate: February 6, 2007," last modified 2007, www.pbs.org/wgbh/nova/transcripts/3402_julian.html.

foamed up into a porous mass." He soon adapted this idea to his sterol-rich soap, puffing it up into a "porous granular mass which is easily extracted with relatively small amounts of solvent" filtering through it. With more tedious work than serendipity, he and his team then determined the ideal solvent to selectively wash out the sterols, leaving the other waxy unsaponifiables behind.[136]

The next task was to separate out the stigmasterol, which was around twenty percent of the mix, from the other sterols, referred to collectively as sitosterol. This was a substantial obstacle. The sterols did not differ from each other enough to be separated by physical methods, either by distilling them or by shaking them with various organic solvents that might act selectively on the stigmasterol. Instead, the mixture needed to be chemically transformed until the stigmasterol fraction was slightly less soluble. This technique, first developed by German chemists in 1906, was costly and complicated. After the stigmasterol was isolated, the chemical transformations had to then be undone, and ultimately only about forty percent of the stigmasterol was recovered.[137] Julian's team improved this yield by adding an oxidation step, by one account "ozonizing 100 pounds daily of mixed sterol dibromides, the first time so large an ozonizer had been industrially employed for a potentially dangerous explosive reaction."[138] (Though adding to the expense, this step had the side benefit of converting the other sterols into useful

[136] "Cheap Sex Hormone" ; Percy L. Julian, Edwin W. Meyer and Norman C. Krause, "Recovery of Sterols," U.S. Patent 2218971, 22 Oct. 1940 (filed 6 April 1939); Percy L. Julian and John Wayne Cole, "Process for Recovering Sterols," U.S. Patent 2273045, 17 Feb. 1942 (filed 8 July 1940).
[137] John W. Greiner and Glen A. Fevig, "Countercurrent Extraction of Steroids," U.S. Patent 2839544, 17 June 1958 (filed 4 Sept. 1956),1-2.
[138] Tishler, 110.

precursors for methyltestosterone.)[139] Julian now had his starting point, pure crystals of stigmasterol, and could finally engage in the tedious and laborious art of organic chemistry. The conversion to progesterone had been worked out a decade earlier by German scientists, but Julian set about incrementally improving it, removing what he referred to as the "embarrassing multiplicity of distinct operative steps."[140] In 1940, even before these improvements, Julian sent a one-pound package of progesterone to the Upjohn Company in Kalamazoo, Michigan, the first commercial shipment in America of an artificial sex hormone derived from plants; valued at $63,500, it was shipped under armed guard. By one estimate, it took 3,000 pounds of soybean oil – derived from 15,000 pounds of soybeans – to end up with that one pound of progesterone, an indication of the scale of production necessary to make the recovery of vanishingly small fractions worthwhile.[141]

Despite the expense, progesterone proved to be a money maker for Glidden, its 1940 annual report predicting that "the production of hormones and sterols has resulted in constantly increasing sales which should add materially to our profits in the ensuing year."[142] A potential setback emerged in 1946 when the Schering Corporation, a former subsidiary of a German company that was now in the hands of the federal Alien Property Custodian, sued Glidden for patent infringement. Along with three other European-owned companies, Schering was part of a cartel that before the war had monopolized

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[139] Emanuel Hershberg and Abraham Kutner, "Isolation of Stigmasterol," U.S. Patent 2520143, 29 Aug. 1950 (filed 27 Oct. 1947), 1; Percy L. Julian, William J. Karpel and Jack W. Armstrong, "Oxidation of Soya Sitosteryl Acetate Dibromide," U.S. Patent 2464236, 15 March 1949 (filed 8 May 1946).

[140] Percy L. Julian, John Wayne Cole, Arthur Magnani and Harold E. Conde, "Procedure for the Preparation of Progesterone," U.S. Patent 2433848, 6 Jan. 1948 (filed 10 Feb. 1944), 1.

[141] Soyinfo Center, "History of the Glidden Company's Soya Products / Chemurgy Division, A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/glidden.php; Tishler, 110.

[142] Soyinfo Center, "Glidden Soya Products Division."

commercial synthetic sex hormones – including forms of testosterone, estrogen, and progesterone derived from animal cholesterol – setting prices and preserving their lock through a shared pool of cross-licensed patents.[143] Although Julian derived his hormones from a plant source, Schering contended that converting stigmasterol to progesterone could not escape violating on at least one of its patents. This was also a way to halt Glidden's development of testosterone, which was envisioned to have even greater market potential. An exposé the following year in *The American Weekly*, a popular Sunday magazine inserted in Hearst newspapers, juxtaposed a photo of Julian – the "famed Negro chemist [who] found a way to make sex hormones out of soybeans" – with an illustration of a top-hatted plutocrat, seated among bags of money, leered at a bottle of medicine while numerous hands desperately reached through the transom for it. This prompted Attorney General Tom Clark, who inherited Schering after the office of the Alien Property Custodian was shuttered, to pledge to return the company to private hands as soon as possible on the condition that the new owners share its patents with all seekers for low royalties. In the midst of this, Schering and Glidden reached a settlement.[144] With Julian's synthesis in 1949 of Compound S – achieved after six months of working fourteen to fifteen hours a day, including Saturdays and Sundays[145] – the way seemed clear for soybeans and Glidden to become leading providers of new wonder drugs.

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[143] There was also a lively market within the U.S. of estrogens extracted from horse urine. Norman Applezweig, *Steroid Drugs* (New York: McGraw-Hill Book Company, 1962), 23.

[144] "Battle of the Sexes: Negro Scientist Key in New Suit," *The Chicago Defender*, 12 Jan. 1946, 1; Warren Hall, "Millions in Hormones 1: German Cartel Forces Exorbitant Prices," *The American Weekly*, 12 Jan. 1947, 4-5; Warren Hall, "Millions in Hormones 2: Schering, Orphan of the Hormone Cartel," *The American Weekly*, 19 Jan. 1947, 4-5; Warren Hall, "Millions in Hormones 3: And Now Perhaps Hormones for Millions as Attorney General Clark Promises Action on Prices," *The American Weekly*, 26 Jan. 1947, 4-5; Warren Hall, "Millions in Hormones 3: And Now Perhaps Hormones for Millions as Attorney General Clark Promises Action on Prices," *The American Weekly*, 26 Jan. 1947, 4-5.

[145] Bernhard Witkop, *Percy Lavon Julian, 1899-1975: A Biographical Memoir,* Biographical Memoirs, vol. 52 (Washington, D.C.: The National Academy Press, 1980), 21.

Within four years, however, the picture had entirely changed. Julian's Compound S was, first of all, a clinical failure. When fed to patients with arthritis, however, Compound S was not only ineffective, it aggravated rather than relieved symptoms.[146] Noting the natural substance's abundance in the adrenal gland, Julian had mistakenly theorized that the body could easily convert his synthetic product into an active form of cortisone, a supposition buttressed by the successful use of cattle enzymes by Cleveland researchers to convert Compound S into Compounds E (cortisone) and F (hydrocortisone, an even more powerful drug). This research suggested another role for Compound S, as a precursor in the mass-production of cortisone: "manufactured in any desired quantity" from soybeans, it could be converted by the equally abundant enzymes of millions of slaughtered animals.[147] This approach would eventually find success – except with the two key raw materials swapped out for cheaper substitutes. In a revolutionary breakthrough in 1952, scientists at Upjohn fermented Compound S into hydrocortisone using microbes, more abundant even (and markedly easier to obtain) than cattle enzymes.[148] And by then the Mexican hormone industry, initiated eight years earlier by former Penn State professor Russell Marker, was having a major impact. In the late 1930s, Marker had successfully synthesized sex hormones using plant substances called sapogenins; one of these, diosgenin, he discovered was abundant in a wild Mexican yam of the genus *Dioscorea* known locally as *barbasco.* Between 1944 and his retirement in

[146] "Improved Use for New Drug on Arthritics Told," *Chicago Daily Tribune*, 28 Jan. 1950, A8; Applezweig, 26.

[147] "Forgotten Genius"; William L. Laurence, "Rare Cortisone F Made of Soya Bean," *New York Times*, 22 April 1950, 17.

[148] John A. Hogg, "Steroids, the Steroid Community, and Upjohn in Perspective: A Profile of Innovation," *Steroids* 57 (Dec. 1992): 601. Among other things, this process made chemical procedures for synthesizing cortisone instantly obsolete, including Julian's own patent, applied for in 1950 and granted in 1956, the schematic diagram of which – showing with arrows the steps by which certain four-ring sterols are converted into others – looked like a 27-car pileup.

1952, he helped establish two major hormone manufacturers in Mexico, Syntex and Diosynth, which together brought the price of progesterone from $200 per gram in 1940 – when Julian sold his first pound to Upjohn – down to thirty cents per gram in 1955.[149]

Soybean stigmasterol could not compete, and in 1952 Glidden shut down its sterol production, producing Compound S from Biosynth diosgenin instead, a process also covered by Julian's patent.[150] Forced to compete in what the *Wall Street Journal* called a "cortisone war" characterized by dramatically falling prices, and driven to the same source of raw materials as its competitors, Glidden decided in 1953 to get out of the business altogether. "There's no money in it for us," President Dwight P. Joyce – Adrian's son – explained to the *Journal*.[151] Julian had urged in vain for Glidden to set up its own diosgenin plant in Mexico, but this was taking functional diversification further than the younger Joyce was willing to go. Instead, he seemed eager to refocus Glidden on its core businesses: paints, varnishes and processed foods. He licensed Julian's Compound S patent to Pfizer Laboratories, which contracted with Syntex to produce it as a starter material for hydrocortisone. In 1958, citing low profits from soybean crushing, Glidden unloaded its Soya Products Division – now known as the Chemurgy Division – altogether, selling it to Indiana-based Central Soya. In the absence of steroid research, and faced with developing new paint to prevent icing on airplane propellers and new non-

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[149] Applezweig, 23-25; Ray F. Dawson, "Diosgenin Production in North America: A Brief History," *HortTechnology* 1 (Oct./Dec. 1991): 24.

[150] Applezweig, 26.

[151] Sydney B. Self, "Cortisone War," *Wall Street Journal*, 25 Nov. 1953, 1. The story noted that Glidden would continue to make sex hormones, presumably also from Mexican diosgenin, but it seems that the company was eager to get out of the hormone business altogether. See "Forgotten Genius."

spattering shortening, Julian decided to part ways with his employer of almost eighteen years. He left 109 patents, including his synthesis of Compound S, behind.[152]

The years leading up to his departure had been personally trying as well. This was an era when efforts to integrate Chicago neighborhoods typically resulted in violence, and the Julian family's entrance into Oak Park sadly proved to be no exception. When the purchase of the 10-room house was first announced, it caused a furor among white residents and the Julians received threatening phone calls; still, by the end of October, *The Chicago Defender* reported that they had overcome hostility and all was "quiet on the 'Oak Park Front.'"[153] But on Thanksgiving eve, while it was still being remodeled prior to the family moving in, vandals tried unsuccessfully to burn the house down with a gasoline bomb. Twenty of Julian's new neighbors signed a letter in the *Oak Park Leaves* decrying the attempt as a "hoodlum tactic . . . with overtones of Chicago gangsterism."[154] Ann Julian similarly told the press that "we are not going to be intimidated by hoodlums," and the family hired armed guards.[155] Then, on the night of June 12 the following year, while Julian and his wife were en route to Indiana for the funeral of his beloved father, a bomb was tossed from a speeding car which exploded beneath the window of the bedroom where his two children, Percy, Jr., 11, and Faith, 7, were sleeping, tearing a crater in the garden. Julian's anger was white hot. "I am going to fight until I die, with a Winchester rifle in my hand to stop this hoodlumism," he told the *Afro-American*. "If I am killed while protecting my home and family, I hope my race will avenge my death . . . I'm ready to give up my science and my life to bring a halt to this

[152] "Forgotten Genius"; Soyinfo Center, "Glidden Soya Products Division"; Applezwieg, 30.
[153] "Julians Overcome Hostile Neighbors," *The Chicago Defender,* 21 Oct. 1950, 1.
[154] "On Discrimination: Clergy, Laymen Protest Violence," *Oak Park Leaves*, 30 Nov. 1950.
[155] "Guard Dr. Julian's Home: Chicagoan of the Year's House Target of Vandals," *The Chicago Defender,* 2 Dec. 1950, 1.

senseless terrorism."[156] The Julians stayed in Oak Park, supported by sympathetic neighbors, and the acts of violence came to an end.

But racist slights continued: the following month, he was denied a seat at the Union League Club in downtown Chicago, where he was to attend a luncheon with fellow scientists. He commented, "It appears to me that organizations like the Union League Club are as directly responsible as any other agency for such un-American incidents as the bombing of my home in Oak Park and the Cicero riots."[157] Julian's attitude toward racism had long wavered between optimism and outrage. During the war, he had written in the *Afro-American* that "we American colored people should not indulge in wishful thinking concerning our own 'gains'" and recounted his anger upon visiting a pharmaceutical research laboratory facing demand for a higher production of blood plasma, where tanks and kettles were nonetheless idle because they were reserved for "colored blood." "To my scientific way of thinking, these facts of the present are much more impressive than promises for the future."[158] He later cancelled his subscription to *Newsweek* in an open letter criticizing what he argued was the magazine's biased reporting on black troops.[159] But if he had grown more pessimistic about racism, he still preserved his sense – rooted in his own ability to overcome obstacles – that hard work and excellence would ultimately prevail. In profile appearing in the *Chicago Daily Tribune* days after his Union League snub, he gave this advice to African-American youth: "Do your best. Go ahead. There's going to be a place for you. The future is bright. There are more opportunities now than there are men to fill them. It is only a

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[156] Matthews, "Dr. Julian Fighting Mad."

[157] "Racism Spreading in Chicago: Dr. Julian Denied Lunch at the Union League Club," *Afro-American*, 28 July 1951, 1.

[158] Percy Julian, "Victory Is Not Right Around the Corner This Year," *Afro-American*, 27 March 1943, 13.

[159] Percy L. Julian, "Scientist Defends 92nd from Newsweek Attack," *Afro-American,* 24 March 1945, 5.

question of preparation. I do not know of a qualified Negro chemist out of a job. . . . Most Americans believe in the principles of American freedom, and as long as we have that, the chances of any boy in America are far better than anywhere else in the world today."[160]

In early 1954, his faith in American opportunity would be put to the test as he incorporated Julian Laboratories, moving his most loyal researchers into what was at first a rat-infested facility. No longer licensed to make Compound S, he set about making progesterone from Mexican diosgenin and selling it to his contacts in the industry, beginning with a $2 million contract with Upjohn, followed by sales to Ciba, Pfizer and Merck. Turning a profit by 1957, he was able to turn his attention to producing novel steroid compounds, in particular for drug maker Smith, Kline and French of Philadelphia.[161] In the wake of his success, however, Syntex cut off his supply of diosgenin, compelling him to set up his own $300,000 processing plant in Mexico – financed with personal savings and money from private investors, as normal banking channels were largely closed to him – only to face a new kind of discrimination when the Mexican government, which had lucrative connections to existing companies, refused to give him the permit to harvest *Dioscorea* yams. Fortuitously, a German colleague whom he had rescued from Hitler's Germany informed him that suitable yams also grew in Guatemala and offered to mount an expedition to locate them, despite Julian's inability at that point to pay him. Julian was able to stay in business with Guatemalan yams, which he made an attempt to procure more reliably by establishing a *Dioscorea* plantation. As a result of his testimony before the Senate Judiciary Committee in the so-called Wonder

[160] Kermit Holt, "The Untold Story: Science and Life Are Given a Boost by Dr. Percy Julian," *Chicago Daily Tribune*, 29 July 1951, SW1.
[161] Witkop, 22.

Drug Hearings of 1956, the Justice Department took action against Syntex – which had blocked permits in Mexico – allowing him to finally open his Mexican factory. Julian Laboratories – which converted the resulting diosgenin into highly sought prednisone, testosterone, progesterone, and dehydrocholesterol – would put Julian on *Ebony's* 1960 list of wealthiest African Americans. Working long hours, he supervised forty employees, including an integrated team of chemists. He merged his business with Smith, Kline, and French in 1961 in a deal that netted him $2 million. He used his money to fund the Julian Research Institute – allowing him to retire from active administration and, with a few assistants and a laboratory to do research of his own liking, to "really live," as he put it – as well as support civil rights causes throughout the 1960s.[162]

Julian had won his business success by way of Mexican yams, Glidden having also turned to barbasco before exiting the steroid business altogether. But their turn away from soybean sterols did not spell the end of their use to produce the era's wonder drugs. The legacy continued at Upjohn, whose researchers had followed Julian's work closely. At least one, A.W. Schneider, who had previously worked for Central Soya in their Decatur lab, had been hired for his familiarity with soybeans.[163] Building on its microbial breakthroughs, Upjohn developed a method for synthesizing hydrocortisone from progesterone (not, as did Pfizer, from Compound S) and worried about sole dependence on a Mexican supply, purchased in part through Julian's new venture. It

[162] "Forgotten Genius"; Clay Gowran, "Julian Aids Mankind with His Knowledge," *Chicago Daily Tribune*, 6 Jan. 1963, 1; Chemical Heritage Foundation, "Science Alive! The Life and Science of Percy Julian," http://www.chemheritage.org/percy-julian/.

[163] William Shurtleff and Akiko Aoyagi, *Henry Ford and His Researchers - History of Their Work with Soybeans, Soyfoods and Chemurgy (1928-2011): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 298.

therefore maintained a development program for improving the synthesis of progesterone from soybean sterols, which it purchased from a General Mills vegetable oil plant.[164] Yield improved steadily and then took a leap forward when one chemist, J.W. Greiner, taking advantage of a “ten percent free time” policy that allowed researchers to pursue projects that interested them, overcame the obstacle that most limited the use of soybean sterols: the difficulty of separating stigmasterol from sitosterol. His method, aside from extracting high proportions of very pure stigmasterol, did so without first chemically transforming the sterols, markedly cutting the expense of producing progesterone. Largely as a consequence of this new competition from soybeans, even the price of Mexican diosgenin-derived progesterone fell from forty-eight to fifteen cents per gram.[165]

These savings did have one drawback: unmodified, the sitosterol was no longer useful as an intermediate for testosterone, and instead accumulated in metal drums on a barren patch of Upjohn’s property. Greiner urged support for sitosterol utilization research – arguing against those who wanted to simply dispose of what became an enormous stockpile – and finally had his way in the early 1970s. Within ten years, echoing its original breakthrough with cortisone, Upjohn successfully developed a microbial method for converting sitosterol into as effective a starting point for steroid production as stigmasterol, thus immediately finding value in its massive stockpile and, going forward, gaining the ability to utilize its full supply of soybean sterols, not just twenty percent of

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[164] Applezweig, 32.

[165] Hogg, 602-03; Greiner; Applezweig, 32. Greiner’s method was rather ingenious: absent a solvent that would cleanly separate stigmasterol from sitosterol, he designed a battery of partial extractions with a solvent that selectively preferred sitosterol, resulting in the progressive accumulation of a solution high in sitosterol and solids rich in stigmasterol; with enough cycles, he could attain virtually any degree of purity.

them.[166] It was a success story in the grand chemurgical tradition and, by happenstance, it resulted in severing one remaining link to Julian: twenty years earlier, as part of its strategy to hedge its supplies, it had taken over Julian's Guatemalan yam plantation; now flush with soybean sterols, it shut the project down. This punctuated what had already been the decline of the Mexican barbasco industry, which already faced the escalating costs of gathering a wild product typical of extraction industries.[167] On the other hand, highly available soybeans remained a principal, if largely unheralded, source of synthetic progesterone and corticoid hormones into the next century – by which time soybean sitosterol in its raw form would have gained greater fame as a cholesterol-fighting nutriceutical.[168]

Julian succumbed to liver cancer in 1975, having been abundantly honored during his lifetime. He held honorary degrees from fourteen universities and colleges, including Howard University and his undergraduate alma mater, DePauw, both of which had declined to keep him as a faculty member. (DePauw also awarded him the "Old Gold Goblet" in 1951, given to one alumnus annually in recognition of distinguished service.) He was a Fellow of the American Institute of Chemists, the Chemical Society of London and the New York Academy of Science, as well as a member of the National Academy of Science. He had been a Director of the NAACP's Legal Defense and Educational Fund and the Chicago Urban League, as well as a Trustee of the First Congregational Church of Oak Park and the Secretary of the Oak Park Boy Scouts troop. Three American secondary schools would be named in his honor, one in Chicago. In the decades

[166] Hogg, 611-14.
[167] Dawson, 24, 26.
[168] Jane Hidgon, *An Evidence Based Approach to Dietary Phytochemicals.* (New York: Thieme Medical Publishers, 2007), 175-176.

following his death, despite a U.S. postage stamp issued in his honor in 1993, his reputation faded in comparison to the legendary status of George Washington Carver until, in 2007, the broadcast of a PBS documentary of his life, aptly called *Forgotten Genius*, helped revive interest in his life and work.[169]

[169] See Witkop, 29-32 for the full list of the dozens of honors he received; "Forgotten Genius."

Chapter 7: Soytopia

Through the first half of the century, three streams carried soybeans into the land, diet and culture of the United States: the Asian-American and Adventist streams skirted the margins, while the soybean improvement stream, committed to fulfilling the crop's potential as a valuable commodity by discovering and perfecting new uses for it, carried it deep into American life, if not always into American awareness. During the 1960s, a fourth stream emerged based in the era's burgeoning counterculture that, even as it rejected the commodification of the soybean as it did commodification generally, liberally drew from all of the other three. The vitalist nutrition of the Adventists dovetailed with the Buddhist ideas that largely informed a new wave of vegetarianism; and Asian soy foods, finding a greater presence in American cities as immigration increased following the easing of discriminatory restrictions, formed the basis of what was felt to be a more authentic soy cuisine. But without decades of soybean improvement, making the crop ubiquitous on the nation's farmland, the soybean counterculture – sometimes referred to as the "soy dairy" or "soyfoods" movement – would likely have been too impractical to achieve liftoff. After all, if soybeans were to be hippie food, they needed first of all to be cheap food. If the improvement stream, now a full-blown sector of industrial agriculture, had succeeded in making the soybean a key hidden ingredient in American food, it was the counterculture that eventually made it into a cultural icon, paving the way for its successful marketing in the 1980s and 1990s, a feat that before then would elude the corporate producers of soybean products.

The counterculture achieved this in part through addressing deep fears about a future that business leaders foresaw rather blithely. Makers of imitation meat products projected a coming era of increased population and urban density when meat itself would be too costly for most people to consume on a regular basis, even with a meat supply augmented by cheap soybeans. To a businessperson this represented a potential profit opportunity, as did all imperatives to adapt to a changing world. To many, however, this dense, populous future was a dystopia to dread, a dystopia vividly depicted in such works as Harry Harrison's *Make Room! Make Room!*, which included imitation soy meats as an assumed inevitability, and the rather more sensational film, *Soylent Green*, based on his book. This dystopia underlay as well the more hopeful utopian visions of the soyfoods movement, premised on the more hopeful idea that, even with a burgeoning population, a materially and spiritually impoverished future was not inescapable. As forcefully argued by Frances Moore Lappé in her bestselling *Diet for a Small Planet* (1971), by scaling back the industrialization of food – in particular, the mass production of meat – there would in fact be enough for everyone. This notion informed both of what might be glossed as the town and country wings of the soyfoods movement (both of which emerged, at least in part, in the Bay Area): the move by Stephen Gaskin and his followers from San Francisco to rural Tennessee, on the one hand, and William Shurtleff and Akiko Aoyagi's embrace of Japanese artisanship on the other. They proposed, as did business leaders, substituting soy for meat, but more authentic, preindustrial soy foods, traditional rather than newfangled, handcrafted rather than manufactured: tofu and tempeh in place of soylent steak.

The Writer: Harry Harrison

Almost as soon as it premiered in May 1973, *Soylent Green* became one of those films famous for its surprise shock, no surprise for the audiences who would subsequently view it. Directed by Richard Fleischer, the movie is set in 2022 in a teeming New York City – population 41 million – where a police detective, Thorn (Charlton Heston), investigates the murder of a wealthy elite, William Simonson (Joseph Cotton), one of the directors of the Soylent Corporation, which controls half the world's food supply. Thorn is assisted by his "book," Sol Roth (Edward G. Robinson), a former professor who tracks down information relevant to cases with the help of similarly elderly scholars at The Exchange. In the course of the investigation, Thorn falls in love with Shirl (Leigh Taylor-Young), the "furniture," or concubine, who comes with Simonson's apartment. The film reaches its climax when Sol, having discovered the dark secret motivating Simonson's murder, sacrifices himself by entering a euthanasia center, knowing that Thorn will follow. Witnessing his death, Thorn then follows Sol's white-shrouded corpse as it and others are loaded onto a truck and taken to a processing plant on the outskirts of the city – referred to earlier as the disposal plant where Simonson's body was taken. Trailing the bodies through the winding factory until he sees the final product coming off the automated assembly line, he confirms what Sol told him with his dying breath, and which he himself repeats with his dying breath, having been wounded in a final shootout with an assassin (Chuck Connors): "Soylent Green is people!"

Soylent Green only briefly contains actual soybeans, which make a cameo as the main ingredient of "quick-energy Yellow Soylent made of genuine soybean." *Soylent* does not refer to a substance, but to the name of the corporation that produces these variously colored wafers – likened by a *New Yorker* movie reviewer to "unmade ravioli"[1] – made palatable to a degree by the application of margarine (arguably another of the soybean's cameos). Soylent Green, the company's newest offering, is ostensibly made not from soybeans but from plankton harvested from the oceans, though of course Thorn discovers this to be a lie. Thus *soy* in its linguistic form practically disappears into another word, while as a food the soybean is at least two removes from the synthetic foodstuff of the title. In a sense, however, these multiple elisions are altogether fitting: *soy* had always displayed a tendency to becoming a prefix (first, over the course of decades, in the word *soybean* itself); and soy at this stage was largely a hidden ingredient in the American diet. This hiddenness means that it was hard to gauge the soybean's presence in American culture in any direct way. Thus does *Soylent Green* – and the story of its genesis from book to movie – provide perhaps the most precise picture of the web of unconscious associations and dystopic fears that clung to the soybean at this time in an American imagination that only fleetingly acknowledged its existence.

Aside from a disparaging review in *The New Yorker*, which likened Fleischer's films to "a bad spring cold [which] are worst when the sun is shining outside" and pointed out the long-term impracticality of sustaining a population on its own dead – "you can't live on a pressed person day in, day out" – the critical response was muted, acknowledging the movie as a sci-fi actioner with an underlying message. Among those who felt it was rather ridiculous, trotting out "old sf gimmicks" like suicide parlors, was Harry Harrison, the author of the novel, *Make Room! Make Room!* (1966), on which the movie was based. Harrison was well versed in sf gimmicks, having grown up voraciously reading the genre

[1] Penelope Gilliatt, "The Current Cinema: Hungry?" *The New Yorker*, 28 Apr. 1973, 126-132.

before spending years as an unapologetic hack.[2] He was born in Stamford, Connecticut, in 1925 to an Irish father and a Jewish mother who had emigrated from Czarist Russia when she was fifteen and was a grade-school teacher until she married. His father was a master printer who found only part-time work during the Depression as a compositor for the New York *Daily News*; having relocated to Queens, the Harrison family changed apartments frequently, often moving in the dead of night, as their credit with landlords ran dry. Perhaps because of this, Harrison was a lonely child, without friends until the age of twelve. Instead he found company in books, ten or twenty a week from the Queens Borough Public Library. And these library books, a wide-ranging assortment of fiction and nonfiction, with the nautical novels of C.S. Forrester heading the list, only filled the gaps between his opportunities to read the pulps, about which his taste was very specific: no general fiction pulps, no westerns, no straight detective fiction, but instead war, air war, and railroad pulps, and always science fiction. He had discovered the genre at age seven through a 1932 issue of *Amazing Stories*, and he later discovered his first peer group as a charter member of the Queens chapter of the Science Fiction League. His interests in school centered on English and science classes; he was known in high school for is hobby of building model planes and gliders. But his subsequent career would be as an artist, no a writer.

During World War II, he was trained by the Army Air Corps as a technical expert on power-operated machine guns aimed using the Sperry Mark 1, a preelectronic computer consisting of miniature rods and cogs. He was stationed in bases in Denver, Colorado, and Laredo, Texas, where he repaired Sperry gunsights and trained gunners; before his

[2] Leon Stover, *Harry Harrison* (Boston: Twayne Publishers, 1990), 14-37; Harry Harrison, "The Beginning of the Affair," in *Hell's Cartographers: Some Personal Histories of Science Fiction Writers,* ed. Brian Aldiss and Harry Harrison (New York: Harper & Row, 1975), 76-95.

discharge in 1946, he also did a stint as an M.P. The experience left him with a lifelong interest in computer theory and a distaste for war; he would become a good friend of peace activist and "citizen of the world" Gary Davis. After drinking his way through his yearlong, $20 a week pension from the army, he entered Hunter College, where he studied painting, and subsequently enrolled in the Cartoonists and Illustrators School. He became a moderately successful commercial artist, especially in comic books, all the while hobnobbing with science-fiction writers as a founding member of the Hydra Club. He moved from illustrating comic books to "packaging" them – that is, assembling stories into magazines, often writing much of the copy himself – until the 1955 congressional crackdown brought the freewheeling days of the industry to an end. By this time, he had submitted his first science-fiction story to a short-lived magazine, *Worlds Beyond:* "Rock Driver," about a "matter penetrator" who used his power to jump mining claims. He became a free-lance writer for men's adventure and women's confession magazines, which paid better than science fiction, churning out stories with titles like "I Went Down with My Ship" and "My Iron Lung Baby." He would later have no regrets about this: "I learned to write clearly, I learned to communicate with the reader, I learned to write to deadline . . . and I stopped writing this sort of repetitive, unrewarding hack just as soon as I could."[3]

By this time, he had become a world traveler, moving with his wife – and subsequently with his two children – first to Mexico, then to England and Denmark, where he lived six years. His paychecks from science-fiction stories and books – as well as from a ten-year gig writing the daily comic, *Flash Gordon* – went further in Europe,

[3] Harrison, "Beginning," 82.

although he also now considered himself a citizen of the world, having mastered Esperanto and become a believer in what he called Scientific Humanism, the doctrine that ethics can be derived from scientific knowledge and that a brotherhood of man can exist independent of a controlling fatherhood of God. These ideas influenced his writing, though in his early work he emphasized action. His first book was *Deathworld* (1960), originally serialized in *Amazing Science Fiction*, in which a roguish psychic does battle with the flora and fauna of a world where all life has evolved to kill humans. In *Planet of the Damned* (1962), an agency of interplanetary social engineers – the Cultural Relationships Foundation – carries out a program to curb the self-destructive and ecocidal tendencies of alien cultures, mainly by targeting for assassination individuals who are "k-factor amplifiers," the "k-factor" being a quantified tendency to wage war. In the case of the planet Dis, this involved destroying an entire generation of Disans infected by a brain parasite that reduced them to "only one desire – kill! Kill everything, themselves, their planet, the universe if they could."[4] These became popular titles, although Harrison's breakthroughs were the more humorous *Stainless Steel Rat* (1961), the beginning of a series that spanned decades about a master criminal turned interstellar agent in the cause of universal justice, and the openly comic *Bill, the Galactic Hero* (1965), a parody of Robert A. Heinlein's *Starship Troopers* (1960).

In the estimation of Brian Aldiss, the science fiction author, editor and critic with whom Harrison would collaborate in publishing anthologies and a short-lived magazine of science-fiction criticism, the recurring subject of Harrison's work was survival: survival by one's wits, in the *Stainless Steel Rat* books, survival in the face of

[4] Quoted in Stover, 45.

overwhelming threats, in the case of *Deathworld.* As he pushed against genre boundaries and emerged from hack writing with growing literary ambitions, Harrison decided to give this subject a more realistic treatment, an "intelligent estimate" of what the conditions of survival would be in the year 2000, a scant four decades away, near enough so that the reader – and certainly the reader's children – would still be alive. As he engaged in his numerous other projects, he spent five years researching the book in order to "extrapolate every detail of our lives and see that I got it as right as possible." He turned to scientific journals, consulting the work of "the demographers and the petrologists and the agronomists," and "read a great number of very thick books."[5]

The result was a book dense with grim descriptions of life in New York in 1999, when the city's population has hit 35 million. Andy Rausch (changed to Thorn in the movie) is a police detective assigned to riot duty in the sweltering August heat, helping to keep control of Eldsters as they protest for better welfare benefits; one of the few sci-fi gadgets in the book is self-unwinding riot-control razor-wire dropped from helicopters. But Andy soon lands a *bona fide* murder case in an elite apartment building, where he meets Shirl, the girlfriend of a murdered mobster. Because the gangsters who run the city government are worried that the killing is a move by the Paterson mafia to take over lower Manhattan, he is encouraged to actually pursue the case, which ends when he is forced to shoot a young Formosan refugee, Billy Chung, who had committed murder in the course of a bungled robbery. In the meantime, his romance with Shirl is undone by the living conditions under which they suffer when she moves in to his apartment, especially after his elderly roommate Sol dies and is replaced by a family with numerous

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[5] Harrison, "Beginning," 92.

children. The book ends when, on New Year's Eve – on the brink of a new millennium – Andy catches a brief glimpse of Shirl, once again attached to a rich man.

None of the iconic features from the movie appear in the book: there are no euthanasia centers, no riot-control trucks that scoop up protestors, no revelation that soylent green is people – in fact, no soylent green at all, just a meat analog called "soylent steak." Billy's initial crime, in fact, is to steal soylent steaks from a market during a riot. Though intending to sell them for cash, he "was beginning to drool and had to spit away the excess saliva. Soylent steaks, a whole boxful, each flat and brown and big as his hand. He bit into one, choked and wolfed it down, forcing crumbling pieces into his mouth with his dirty fingers until it was so full he could hardly swallow, chewing at the lovely softness . . . Billy ate three of the soybean and lentil steaks that way."[6] Though not the real, albeit scant, meat that the very rich alone are able to procure from "meatleggers,"[7] soylent seems nonetheless to be much better than the diet of fried oatmeal and "weedcrackers" on which Billy usually subsists. The latter are variously colored crackers made from seaweed and are the apparent inspiration for the movie's eponymous wafers.

Harrison has never recounted where the idea of soylent, or the word *soylent*, came from. They were a minor part of the book, and as a verbally inventive writer accustomed to producing 2,000 words a day – although he worked much more slowly on *Make Room* – he likely would not have remembered the exact circumstances of the coinage. In a broad symbolic sense, the portmanteau of *soybean* and *lentil* merged the staple legumes

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[6] Stover, 21.

[7] One of whom, after sexually harassing Shirl, attempts to sell her "leg of dog" before presenting her with "a small piece of meat with a thin edge of white fat." Harry Harrison, *Make Room! Make Room!,* Berkley Medallion Edition, with an introduction by Paul Ehrlich (New York: ACE Books, 1966; reprint, New York: Berkley Medallion Books, 1973), 43.

of China and India, whose own struggles with large populations informed Harrison's vision of America's future. In fact, his extrapolations were not so much a matter of projecting American trends forward as of imagining that the U.S. would simply become like the Asia of the 1960s. This Asian specter was related to but distinct from the longstanding fear of "coolie laborers" immigrating to the U.S. and undercutting American workers. Now, it was a projection of Asia's new megacities, teeming with hungry mouths and idle hands – a projection indicated by the presence of Billy Chung and his family, refugees on the dole living on barges in the East River – that alarmed Harrison. As Paul Ehrlich, whose landmark *The Population Bomb* (1968) was published two years after *Make Room*, wrote in the introduction to the 1973 edition of Harrison's book, "One of the most ominous trends in a world replete with ominous trends is the accelerating growth of urban populations." His examples of the resulting overcrowding are from Asia: "Tokyo Bay is frantically being filled with garbage in order to obtain land for expansion of a city already so crowded that there is a two-year wait for middle class apartments. Calcutta today has hundreds of thousands of people living homeless in the streets. . . . By 2023 *everyone* would live in an urban area, and by 2044 everyone would live in cities with a million or more population." He notes a distinctive pattern in America – decay of city centers, sprawling growth of the periphery – but it is clearly the developing world that provides the model for both Harrison's and Ehrlich's own nightmare scenarios.[8]

In this context, soylent is less akin to traditional Asian foods – some conglomeration of tofu and dal – than it is to foods developed by western technologists to feed

[8] Paul Ehrlich, "Introduction," in Harrison, *Make Room,* n.p.

populations in Asia unable to feed themselves. Among international aid organizations concerned about world hunger and global malnutrition, such as the U.N.'s Food and Agriculture Organization (FAO), the 1960s would be the "protein decade," the FAO's nutrition division concluding in 1962 that "deficiency of protein in the diet," rather than calories or vitamins, "is the most serious and widespread problem in the world."[9] This was due in part to the gradual consensus over the previous two decades that kwashiorkor, a fatal childhood disease especially prevalent in impoverished regions of Africa and Latin America, was due to lack of protein, often triggered by weaning when a sibling arrived. (Indeed, *kwaishiorkor* was a local West African name for the disease, meaning "the deposed child.")[10] In *Make Room*, Shirl encounters a whimpering child in a water queue whose mother explains, matter-of-factly, "He's crying because he's been to see the doc, thinks he's sick but it's only the kwash . . . You can tell when they swell up and get the black spots on the knees." The mother received a peanut-butter ration to alleviate the child's affliction which she gave to her husband instead: "My old man loves the stuff." [11] In 1950, there was some indication that protein deficiency also caused liver damage in adults similar to that which it caused in children, broadening the scope of concerns.[12]

Medical researchers had determined that kwashiorkor could be successfully treated with skim milk, but this was in short supply in many of the worst-affected regions, compelling the FAO's Committee on Nutrition to call in 1955 for greater efforts to take locally-available "protein-rich foods now used for animal feeding only" and convert them

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[9] Kenneth J. Carpenter, *Protein and Energy: A Study of Changing Ideas in Nutrition* (New York: Cambridge University Press, 1994), 160.
[10] Ibid., 147.
[11] Harrison, *Make Room,* 133.
[12] Carpenter, 150.

into viable foods for children.[13] Between 1955 and 1975, the Protein Advisory Group of FAO/UNICEF encouraged the development of several foods rather more exotic than peanut butter: “fish flour” or “fish protein concentrate” in Chile, whose fish-meal exports supplied much of the world with livestock feed; and explorations into “single-cell proteins” from yeasts, bacteria or funguses.[14] Harrison pays homage to such projects when Sol cooks a “new miracle ingredient supplied by our benevolent government” called ener-G – “and how’s *that* for a loathsomely cute name?” Sol gripes – made from plankton gathered by “the newest wonder of science, the plankton whale,” an atomic submarine that sucks in plankton and converts it into high-nutrient bricks.[15] (This was the novel’s other contribution to the concept of Soylent Green, or at least what it purported to be.)

Most PAG efforts centered more conventionally on plant protein derived from oilseeds: peanuts, cottonseed, and soybeans. The Indian government and commercial companies in Nigeria produced weaning foods from peanut flour, but these were plagued by carcinogenic aflatoxins from fungi growing on improperly dried nuts. The Institute for Nutrition in Central America and Panama (INCAP) developed a cottonseed-based powder called Incaparina, which was marketed for several years in a number of Latin American countries. Soybean grits and flour, meanwhile, were the basis for not only the Meals for Millions Foundation’s multi-purpose food, but for Pronutro – which was developed in South Africa for low-income Bantu children, but which rose in price and

[13] Ibid., 158.
[14] Ibid., 163-68, 175-77.
[15] Harrison, *Make Room*, 72-73.

fell in Bantu estimation when whites reportedly began buying it for their dogs – and Fortifex in Brazil, which consumers rejected as tasting too beany.[16]

If Harrison was not aware of these specific projects, he knew well the consensus of nutritionists – rooted in thinking that by this time stretched back to the turn of the century – that a hungry world would eventually have to turn to plants, rather than animals, for its protein. Among the suggested readings that he appended to *Make Room* – which included sociologies of conformity such as Packard's *The Hidden Persuaders* (1957) and Whyte's *The Organization Man* (1956), as well as books about population and hunger – was Ritchie Calder's *Common Sense About a Starving World*, which argued that, since "meat is vegetation at one remove . . . it should be possible in a scientific age to produce protein from plants, in assimilable, concentrated form, without the intervention of animals." This required a technological intervention, because "most leaves and plants contain too much fibre and this can only be removed mechanically – by tougher methods than the human digestion." He cites Incaparina as a hopeful example, while commenting that "soya and groundnuts . . . are not usually a popular diet over a long period."[17]

If inspired by the scientifically formulated high-protein foods that were created to alleviate hunger in Europe and Asia following World War II, and protein deficiency in the Third World more generally thereafter, soylent is nonetheless distinct from these: it is a meat analog, used in steaks and burgers, and something not fed to the poorest, but marketed to those who can afford it. When Shirl, having newly moved in with Andy and Sol, purchases soylent burgers for dinner – "the new ones, they had them on TV, with the smoky-barbecue flavor" – Andy complains, "They must have cost a fortune." Sol

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[16] Carpenter, 168-175.
[17] Ritchie Calder, *Common Sense About a Starving World* (New York: Macmillan, 1962), 131-32.

comments, “chewing happily,” that if he were “drunk enough this would almost taste like meat.” As Sol then explains to Shirl, when she asks about kwashiorkor, “There’s no meat around, lentils and soybeans cost too much, so the mamas stuff the kids with weedcrackers and candy, whatever is cheap . . .” [18] And, indeed, by the time Harrison was researching the book, there was growing interest among large food processors, not just Adventist food companies, in putting soy-based analog meats on the market. These were based chiefly on two innovations: spun soy-protein isolate that was edible and extruded, or textured, soy flour.

Both innovations, as it happened, had their origins with researchers who had formerly developed Henry Ford’s suit of soybean wool and car of soybean plastic. Robert A. Boyer, Ford’s *wunderkind* lead chemist for industrial soybeans uses, realized as early as 1942 that if the process for making the wool were altered, so as not to harden the fiber, the result would be something resembling muscle fiber. Boyer left Ford’s soybean operations after they were sold to the Drackett Company and then to ADM following Henry Ford’s death. He obtained a patent in 1949 and a broader one, including other vegetable proteins, in 1954. Swift employed him for a time, albeit in secrecy so as not to alarm livestock producers; one company produced meatless pork chops using corn gluten, the strong flavor of which ultimately hobbled the project; he also worked with Unilever to incorporate peanut protein isolate in sausages. His break came in 1956 when Worthington, the Adventist food company in Ohio that had bought Harry Miller’s non-soymilk business,[19] licensed Boyer’s patent and hired him as a consultant. Large

[18] Harrison, *Make Room*, 136-37.

[19] By the mid-1960s, Worthington had acquired the assets and patents of Madison Foods and Kellogg’s Battle Creek Food Company as well, dividing the Adventist market with Loma Linda Foods in California, which had acquired and still operated Miller’s soy milk operation in Vernon, Ohio. Worthington Foods.

processors – Ralston Purina, General Mills, and Nabisco – followed suit, and he landed at Purina in 1962, where he worked until his retirement in 1971. In 1963, Purina released Textured Edi Pro, billed in publications such as *Food Processing* as something that could be fashioned into products with the "look, taste and chew amazingly like the meat item[s] they so closely resemble,"[20] although it appears that Harrison, if he read such reports, greeted them with skepticism. Worthington used Edi Pro in its canned Soyameat products, including Fried Chicken, Sliced or Diced Chicken, Sliced or Diced Beef, and Salisbury Steak, for the Adventist market.[21] And in 1965, General Mills began test marketing Bac-o's, imitation bacon bits made from spun soy protein isolate which found broad national success in 1969.[22]

Later Bac-o's would be made from extruded or "thermoplastic" protein, a process developed by William Atkinson, one of Boyer's Ford colleagues who stayed on to eventually work for ADM. When the Andreas brothers acquired ADM, Dwayne was excited by the laboratory results, and pushed to market what came to be the company's trademarked TVP (textured vegetable protein).[23] Unlike Boyer's spun protein – which was a true protein isolate – this involved using defatted soy flour with a protein content of at least 30 percent, mixing it with water under high pressure and temperature so as to produce a "plastic mass," and then forcing this through "flow-restricting orifices into a medium of lower pressure and temperature" so that the water would evaporate as steam.

[20] George H. Kyd, "Edible Soy-Protein Fibers Promise New Family of Foods," *Food Processing* 23 (May 1963): 123-126.

[21] Soyinfo Center, "Worthington Foods: Work with Soyfoods - A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/worthington_foods.php.

[22] Soyinfo Center, "Henry Ford and His Employees: Work with Soy - A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, www.soyinfocenter.com/HSS/henry_ford_and_employees.php.

[23] The name is somewhat confusing, as spun edible protein was also often classed as "textured."

The result, when crumbled, could be expanded by the addition of water into something resembling ground meat.[24] By 1967, TVP was reportedly the star of the Cologne Food Fair, where ADM's manager of soybean specialties, James Sellner, prophesied that it would be the next margarine: "It took margarine 25 years to fill the gap . . . I say, give these soya products two years – and they'll fill the gap."[25] If the analogy to margarine held, Sellner was not referring to the "world protein gap" identified by the FAO, but rather a foreseeable lack of affordable meat for budget-conscious consumers in affluent countries. By 1969, when ADM hosted a press lunch that included ham-and-cheese hors d'oeuvres and main courses of sweet-and-sour pork on rice, quiche Lorraine, and a loaf of corned beef hash – none of which contained any real meat – soybean meats, "long touted as 'the food of the future,'" were appearing in American supermarkets in soup mixes, canned stews and chili, and frozen ravioli and hamburger patties, usually as extenders mixed with real meat, hidden "in the fine-print list of ingredients." One Chicago housewife, interviewed in the *Wall Street Journal*, complained that a "fried chicken style" analog had a flavor that "tasted like it was painted on . . . Underneath was that soybean taste" – an assessment echoing Sol's appraisal of soylent.[26] But it was a commonplace in the mid-1960s that, with a foreseeable rise in meat prices as populations grew, imitations would play an increasing role in keeping meat affordable, perhaps

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[24] William T. Atkinson, "Meat-Like Protein Food Product," U.S. Patent 3488770, 6 Jan. 1970 (filed 7 March 1969, a continuation-in-part of applications filed on 17 Aug. 1966 and 21 May 1964, subsequently abandoned), 1-2.
[25] Clyde Farnsworth, "Versatile Soya Food Star of Cologne Fair," *Chicago Tribune*, 2 Oct. 1967, C7.
[26] John A. Prestbo, "Meatless 'Meats': Several Firms Develop Soybean-based Copies of Beef, Pork, Chicken," *Wall Street Journal,* 2 Oct. 1969, 1.

eventually supplanting it altogether and – in Harrison's vision of the future – gradually becoming too pricey themselves for all but the well-to-do.[27]

Soylent thus had multiple symbolic resonances in *Make Room*: a feat of Western technology made necessary by an increasingly Asiatic population density and standard of living. For those like Sol who remember better times and better food, it is part of the overall degradation of life, albeit less so than ener-G; while for the young the degradation is masked by advertising. But, in all, soylent – and food in general – is a small part of Harrison's portrait of a crowded future, where shortages of living space and electricity loom larger, and where Sol's ire is aimed more at the degradation of people, too numerous to win respect as individuals, than the degradation of food. As the novel began its tortuous journey to becoming a film, however, food in general and soylent in particular would become more central to its plot and its critique of society.

As Harrison later recalled, *Make Room* "came out too early" – that is, before Ehrlich's *Population Bomb* and the rise of the modern environmental movement signaled by the first Earth Day in 1970 – and "vanished with a dull whiffling sound."[28] One of its readers, however, was Charlton Heston, who convinced producer Walter Seltzer to join him in his campaign to turn it into a movie. Heston's politics were "a little too right-wing" for Harrison, but he respected the actor's passion about "the overpopulation problem, pollution, ecology and so on." After years of persistent lobbying, MGM decided that it's large budget was justified only after the cannibalism plotline was devised, "which gives you some idea," Harrison would write, "of how the film industry

[27] Soymilk – available in small bottles and variously poured over agar-agar (seaweed gelatin) for dessert or added to kofee to make that substitute drink more palatable – is similarly a rich man's food. Make Room! Make Room! 41, 110.

[28] Harrison, "Beginning," 93.

thinks!" The sci-fi gimmickry bothered him, and despite being barred by his contract from revising the screenplay, Harrison pestered the filmmakers with letters and, having moved to southern California with his family, visits to the set. There he handed out copies of his book and freely offered advice. Robinson was puzzled about the role of Sol until Harrison explained, "you are *me* in the story. . . . You are the only living connection with the old world – you are the only person in the whole film who lived in a world of plenty – you are the link that connects our world with the world in the film." He corrected small production details, such as a pile of plastic bags in the meatlegger's shop at a time when petroleum was supposed to have been used up. And overall he was happy with how the movie turned out. Despite the nonsense in its plot, it offered a grim portrait of a resource-depleted near future which, at Harrison's prodding, was linked to the American present by an opening photo montage that begins with pictures of pioneers in wide open spaces, accelerates through the industrial development of the twentieth century, and ends, as the music slows, with images of breakdown and decline.[29]

Soylent was now not only in the title – and central to the conspiratorial plot – but the theme of food's degradation played a more central role. Real meat becomes the object of reverence. The meatlegger, more polite in the movie version, opens a refrigerator to reveal "beef, Ms. Shirl, beef like you've never seen before." When Detective Thorn later brings this same meat home, Sol exclaims "Beef!" before the realization of how low life has sunk causes him to weep: "Oh my God! How did we come to this?" Their subsequent meal, improvised by Heston and Robinson without dialogue – one outcome of Harrison's advice to Robinson – is accompanied on the soundtrack by chamber music, a

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[29] John Brosnan, *Future Tense: The Cinema of Science Fiction* (New York: St. Martin's Press, 1978), 204-08.

use of classical music that parallels Sol's later death, when he watches projections of nature scenes – forests, deer, sunsets – set to a medley of Beethoven and Grieg. As in the dinner scene, when Thorn proclaims to have never eaten such food, Sol nostalgically remembers is a revelation to him. Watching Sol's death through a window, he weeps. "How could I know? How could I ever imagine?" Connection to real food – in particular, to meat – equals connection to the natural world. By contrast, the Soylent Green factory, in reality a decommissioned sewage plant, is all pipes, vats and conveyor belts. As with soybeans on their way to becoming protein isolate, the cadavers' first stop is a giant vat of solvent. The end point is blank uniformity – the filmmakers used painted rectangles of wood for the green wafers – the capitalist logic of substitution and the chemurgic imperative to find use in waste products having arrived at a horrifying conclusion. Sol's Jewishness evokes The Holocaust – and the exaggerated, though not entirely false, stories of Jewish bodies being rendered for fat to remedy severe shortages – but, this time, a voluntary Holocaust softened by comforting images and light classical music. Thus, anxieties about modernity are wrapped up in anxieties about food: in the movie, after all, people literally become what they eat.

Despite this unease, newspapers used the release of *Soylent Green* as the occasion to discuss new developments in food fabrication, citing a Reuters dispatch which beagn "Steak a la test tube, chicken a la laboratory – the science fiction menu is coming nearer." Reuters noted that 25 firms in the U.S. were producing artificial meat, "mostly from soya-bean flour," – that is, TVP – and that in Britain, "a major textile group has begun marketing a synthetic meat made from bean protein – the fibrous texture makes it much more realistic and enjoyable than the American product." In this case, Courtaulds Ltd.

extended Boyer's work by producing Kesp (a phonetic acronym for Courtauld's Edible Spun Protein) using field beans (Vicia faba L) suitable for British agriculture rather than soybeans. And on the more exotic end of the spectrum, comparable to ener-G or Soylent Green, was an experimental plant, set up by an unnamed "British combine," that produced two tons a week of "golden fungus" A3-5, a "yellowish-brown substance contain[ing] twice as much high quality protein as good beef steak." Reinforcing *Soylent Green* producer's Walter Seltzer's description of the film as "science-fact" rather than science fiction, the article concludes that fungus A3-5 "could just as easily be colored GREEN!" And indeed, the impetus for this accelerating research and marketing was "meat prices rising everywhere," making the future depicted in *Soylent Green* seem near at hand.[30]

In the United States, 1973 was a year of high inflation even before the OPEC oil embargo in October, with wholesale food prices in June up 19 percent over January, despite Nixon's imposition of a ceiling on red-meat prices, and by summer beef was in short supply, with cattlemen and packing houses holding back their supply in anticipation of even higher prices. Part of the rise in price could be traced back to what was being called the Great American Grain Robbery, a sale of $750 million of American wheat, corn and other grains to the Soviet Union in July 1972 at government-subsidized prices, creating a tremendous windfall for grain exporters such as Cargill and ADM.[31] This grain sale was motivated by the politics of détente at a time when the Soviet Union was attempting to improve the diet of its citizens through the increased use of feed grains for poultry and livestock. The volume of the sale took the public by surprise, indicating the

[30] "Suspense Film and Food." *(Twin Falls, ID) Times-News,* 22 April 1973, 21.
[31] Martha M. Hamilton, *The Great American Grain Robbery (and Other Stories)* (Washington, D.C.: Agribusiness Accountability Project, 1972), 93.

sort of government-business conspiracy in the food sector that *Soylent Green* portrayed. This breach in the wall separating Western and Soviet agriculture – a breach that Dwayne Andreas had been advocating for decades – also created increased world demand for soybeans, which was exacerbated in 1973 by a shortfall in the catch of Peruvian anchovies fed as fish meal to livestock. Soybean prices tripled in a year and a panicked Nixon administration, grappling with the early phases of the Watergate investigation, instituted first a freeze on soybean prices and new controls on exports, and then in June took the drastic measure of a total embargo on soybean exports which lasted several weeks and was not fully lifted until September.[32] One of the few times when soybeans were big news, the embargo was an attempt to stabilize meat prices, not to conserve soybeans for use in meat substitutes, but the specter of scarcity seemed to bode well for soylent's nonfictional counterparts.

As it happened, the market for soy meat fell short of expectations. Production of textured soy protein – spun and extruded combined – had grown from almost nothing in 1967 to thirty million pounds in 1970, and then to over 100 million pounds in 1973, causing one analyst to project that the figure would be 188 million pounds in 1975 and around two billion pounds by 1980.[33] In fact, with the failure of a number of efforts to market imitation meat products, production stalled: still only around an estimated 100 million pounds in 1982,[34] with much of it going into pet food.[35] In Britain, Kesp was

[32] Dan Morgan, *Merchants of Grain* (New York: The Viking Press, 1979), 158-59; Richard Gilmore, *A Poor Harvest: The Clash of Policies and Interests in the Grain Trade* (New York: Longman, 1982), 146-47.
[33] Department of Agriculture, Farm Cooperative Service, *Edible Soy Protein: Operational Aspects of Producing and Marketing,* FCS Research Report 33 (Washington, D.C.: Government Printing Office, Jan. 1976), 42, 46.
[34] T.J. Mounts, W.J. Wolf and W.H. Martinez, "Processing and Utilization," in *Soybeans: Improvement, Production, and Uses,* 2nd ed. (Madison, WI: American Society of Agronomy, 1987), 824.

pronounced such a fiasco by 1977 that, even though it did not use soybeans, its notoriety was blamed for giving all TVP a bad name.[36] In the U.S., Miles Laboratories (makers of Alka Seltzer) acquired Worthington Foods and test marketed a new line of meat analogs in 1972, launching the Morningstar Farms label in 1974 with a national advertising campaign. Its Breakfast Links, Breakfast Patties, and Breakfast Slices – later it would introduce Leanies, Grillers, and Luncheon Slices as well – were the first meat analogs beyond Baco-O's to reach supermarkets nationwide. Although an estimated ten million American families tried the breakfast foods in the first year-and-a-half, sales were disappointing, with Miles taking a pretax loss of $33 million on its meat substitutes.[37] Robert Boyer, when interviewed in 1980, attributed these failures in part to poor quality as manufacturers made compromises in equipment and processing to keep costs down. The marketed products were inferior in taste and texture to what researchers were able to achieve working by hand in the lab.[38] The other problem was that few of these substitutes were significantly cheaper than the products they imitated, especially as meat prices came down.

One bright spot was the use of TVP as an extender in soy-beef blends, which captured around thirty percent of the ground beef/hamburger market in 1973, at the peak of beef prices; by March 1974, however, this had fallen to twenty percent.[39] And in general, this use of textured soy was sustained by the federal School Lunch Program, which changed

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[35] F.T. Orthoefer, "Processing and Utilization," in *Soybean Physiology, Agronomy and Utilization,* A. Geoffrey Norman, ed. (New York: Academic Press, 1978), 223.
[36] Barry Wilson, "Soya Meat on the Threshold of a Boom," *Agra Europe* (Jan. 1977): M/3-M/8.
[37] Soyinfo Center, "Worthington Foods."
[38] Soyinfo Center, "Ford and His Employees."
[39] *Edible Soy Protein,* 50.

its guidelines in 1970 to allow the use of extended meats with up to thirty percent TVP.[40] The program, serving a captive market and under tight budgetary restraints, would come to use forty million pounds of textured protein a year.[41] This was largely a hidden ingredient, although the University of Massachusetts Cooperative Extension Service made an effort to familiarize children with the soybean by issuing a booklet, *Introducing Sammy Soy Bean*, which features a cartoon bean in a cowboy hat and a cane who explains, "With a name like Sammy I felt I'd be more like one of your friends and not just a bean." The illustrated booklet highlights the uses of the soybean with an emphasis on the textured soy protein that will become "an important part of your food experience," as "it has been estimated that by 1980 extenders . . . will replace a significant amount of meat in our diets." There was no reference to tofu or other Asian soy foods, although the booklet closes with recipes for soybean casserole and baked soybean snacks.[42] Despite a superficial resemblance to Mr. Peanut, Sammy Soy Bean never caught on as a mascot for soy protein.

The lackluster performance of ersatz or extended meats made with soybeans may have been largely a matter of quality and cost but, as the Food Habits studies during World War II established, it may also have been because of a web of mental associations encapsulated – and reinforced to a degree impossible to know – by Harrison's coinage of *soylent* and its subsequent prominence in a vision of dystopia. The substitution of soybeans for meat, long viewed with suspicion, now seemed nefarious: not just a symbol of descent to an Asiatic standard of living, but of estrangement from nature – with

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[40] Harry Snyder and T.W. Kwon, *Soybean Utilization* (New York: Van Nostrand Reinhold Company, 1987), 321.
[41] Orthoefer, 242.
[42] Diane Swiss, *Introducing Sammy Soy Bean* (Amherst, MA: University of Massachusetts Cooperative Extension Service, c. 1975), n.p.

populations barricaded in megacities as the countryside is turned over to industrialized agriculture – and from tradition, as the past embodied in elders is consumed to meet the needs of the immediate present. To be billed as "the food of the future" was no longer a blessing, but a grim prospect to be endured with resignation. As Mark Nathan Cohen argued in *The Food Crisis in Prehistory* (1977), offering the cold comfort of historical perspective, "Our prevailing historical optimism about our own progress has been badly shaken by the realization that we are 'suddenly' being asked to make do with less—in particular with less meat—and to substitute foods which are available or can be produced in quantity but which we now define as unpalatable. . . . Perhaps it will aid us in our economic transition to realize that human populations once faced the notion of eating oysters and later the prospect of eating wheat with much the same enthusiasm that we now face in the prospect of eating seaweed, soy protein, and artificial organic molecules."[43]

At the same time, as much as the soybean was an industrial crop converted by advanced technology into modern foods, it had also long nurtured alternative visions of a downscaled, scaled back or decentralized society. In Henry Ford's complicated worldview, its very modernity would enable America to transition through a phase of urban industrialism back to a neo-traditional life in the countryside. Morse and other who encouraged cultivation of green soybeans saw it as a source of abundant, high-quality protein that could be grown in gardens. And even as *Soylent Green* hit the screens, there was a building vegetarian movement that revived this conception of the soybean: as something that could provide sustenance to "voluntary peasants" without

[43] Mark Nathan Cohen, *The Food Crisis in Prehistory: Overpopulation and the Origins of Agriculture* (New Haven: Yale University Press, 1977), 286.

sacrificing protein through foods produced not by modern technology but through venerable craft traditions. The soybean could be a way to reconnect with nature and the past rather than a symbol of those ties being irrevocably severed. As for Harry Harrison, he and his family had moved from Denmark seven years earlier in part because English had become a second language not only to his children, but to himself – a liability in his profession – but by 1975, he was disgusted with the "crimes of Vietnam" and a president "whom Harry Truman called 'a shifty-eyed goddamn liar.'" He was ready to reclaim his status as a citizen of the world by moving to Britain and, having crystallized a nightmare of urban dystopia that would lurk in the background of soybean utopias, he was eager to escape "the arid, sidewalkless streets of Southern California" for the city streets of Oxford or London.[44]

The Guru: Stephen Gaskin

In a 1974 booklet (price $1), formatted like a magazine and titled, *Hey Beatnik! This is the Farm Book*, written in psychedelic letters around the photograph of a man driving a combine, there was a section about a third of the way through – the pages were unnumbered – on "Foodage." The 600 residents of The Farm, located on 1,700 acres near Summertown, Tennessee, were vegetarians, and the section was largely a primer on vegetarian nutrition. Much of the information was derived from the World Health Organization, including a chart showing the protein requirements for different age groups and, in conjunction with a quote from the *Proceedings of the Sixth Annual International Congress of Nutrition* which stated that "it is known today that the relative concentration

[44] Harrison, "Beginning," 94.

of amino acids, particularly the essential ones, is the most important factor determining the biological value of protein," a chart devoted to listing the milligrams of each of the twelve essential amino acids per gram of dozens of food. Soybeans, along with soy flour and soy milk, top the list. As the booklet explains, since "soybeans have such high-quality protein, and so much of it, they should be your main staple. Eat them three times a week, as well as soy milk, soy cheese, and soy yogurt."[45] This is all language, acknowledging some advances in knowledge, that Clive McCay would have readily understood, especially as the passage went on to extol the benefits of wheat germ and nutritional yeast. The following sentence, however, may have mystified him, and even Adventists who were vegetarian for religious reasons: "Since we can get everything we need from vegetable foodage, and since one can't get very telepathic or high eating those who are so close, it seems obvious that being a complete vegetarian [a vegan] is the kind and Holy way to make it." The references to telepathy and getting high indicated that decades-old arguments for eating soy foods had jumped into a new cultural stream, one that would ultimately carry the soybean to widespread American awareness. The soybean had long been modern, but for the first time it was hip.

Though The Farm was located in rural Tennessee, this stream had its origins a continent away in San Francisco. In a sense, it is wrong to pinpoint the Bay Area as the origin point of the hippie movement: the Beats had their start in New York City, the LSD experiments of Timothy Leary in Cambridge, Massachusetts; Zen Buddhism, which became a fad in the late 1950s and steadily attracted American adherents, likewise had bases on both coasts, in New York, Cambridge, and Los Angeles in addition to San

[45] Stephen [Gaskin] and The Farm. *Hey Beatnik! This Is The Farm Book* (Summertown, TN: Book Publishing Co., 1974), n.p.

Francisco. The Civil Rights and antiwar movements – which inspired a widespread desire for revolutionary change and, at the same time, as they struggled and fractured, fed an inclination to drop out – were national phenomena, as was the media that publicized local protests and cultural scenes to national audiences. The wave of youth that energized these movements was national, as was the journey of the white middle-class young people among them from sheltered suburbs to the open, lively, multicultural, dangerous and often seemingly war-torn environs of cities, or at least the mini-bohemias of college campuses. But the Bay Area, in particular the Haight-Ashbury neighborhood of San Francisco, with its cheap Victorian housing, saw a unique confluence of Buddhism, drugs, protest and psychedelic rock that, fed by media exposure, culminated in the Summer of Love of 1967. And it was from this milieu that two of the most influential promoters of soybeans, William Shurtleff and Stephen Gaskin, founder of The Farm, emerged.

Like many leaders of the sixties counterculture, Gaskin was older than many of his followers. Born in 1935 in Denver, Colorado – his father eventually moved the family to California and became a commercial fisherman – he joined the Marines when he was 17 and served in the Korean War. He later recounted that when "I went in I didn't really think about killing anybody. I thought it was like, maybe if I have a uniform like this it will cover up my bony things and I'll get laid, or other abstract things like that." He had one opportunity during the war to engage the enemy, as his patrol rushed to help another that had been ambushed, but as he ran up a hill, surprising himself with his lack of fear, "I ran across somebody who was wounded on a stretcher and needed to be carried away, and I threw away my gun and helped carry the stretcher."[46] That was the same year he first smoked marijuana, while visiting a cousin in California who used the opportunity to mess with his head. He had Gaskin look down as he stood on a curb, telling him to "look *wayyy* down there at the bottom of the canyon, where the rapids are," then pushing him off, jolting Gaskin with the unexpectedly short fall. He told Gaskin, "I can just control you. I can make you high and I can bring you down," and proceeded to tell jokes to get him "stoned and giggling and high," then cutting him off by saying "something to me real gross and unkind." His cousin "violated the Guide position," and the experience – in addition to giving him his first lesson in how people could affect each other's highs – kept him away from pot for the next ten years.[47]

At that point, he was an instructor in English at San Francisco State College, where he had completed his BA and MA and had learned "general semantics" from S.I. Hayakawa, whose approach instilled awareness of the flux of meanings beneath the deceptive stability of words. Hayakawa advocated this as a defense against fascist propaganda, and the habit of continual examination of one's own thought persisted into Gaskin's later mystical phase. But in 1962, despite a longstanding interest in science fiction and the writings of Aldous Huxley, he was a square – until he noticed that his students were dropping out. "I wondered what they were finding better, so I started hanging out" with them and taking "dope, because that's what was happening in Haight-Ashbury."[48] Beginning with pot – a variety called Acapulco Gold – he learned that he could become telepathic with others, creating a group high. He progressed through dozens of hits of LSD – which Ken Kesey, as a volunteer for psychological experiments

[46] Stephen [Gaskin], *The Caravan* (New York: Random House, 1972), pn.
[47] Stephen Gaskin, *Amazing Dope Tales* (Berkeley, CA: Ronin Publishing, Inc., 1999), 7-8.
[48] Gaskin, *Caravan,* n.p.

in 1959, had experienced and then introduced to the wider Bay Area[49] – as well as peyote, psilocybin mushrooms, and numerous pharmaceuticals. He later described the introduction of LSD as providential: "that LSD came down the way it did in this culture and put all that power into spirit in such a way it couldn't be mistaken is a miracle."[50] Whatever the complex array of forces combining to form the counterculture, for Gaskin, personally and in a wider sense, drugs were the catalyst. He started wearing a long fringe coat, long hair and boots and living in illegal squats with his new girlfriend, Margaret.

Once, having taken a righteous hit, he had a transcendent vision of a double-helix and when he emerged, he called to Margaret that he had "just discovered the simplest way to say where it is really at." When he told her the essence of his vision "very cleanly, in one sentence," her "face suffused with a glow" and she looked stoned herself, and said, "*Oh! That's so beautiful!* . . . . What did you say?" By that time, he had himself forgotten.[51] That enlightenment is in the immediate moment was a truth that stuck with him, however, as did a number of other core principles: that the spirit plane was real, that giving something your attention gave it power, that karma was automatic and usually instant, a law of the universe dictating that you got out what you put in. He gradually developed a distinctive lingo, using *stoned* and *high* to refer to spiritual attainment, regardless of the assistance of drugs. He would link *stoned* etymologically to *astonished*, and getting stoned to any experience that induced wonder and absorbed attention.[52] And getting truly high meant to get beyond the *trips*, rooted in unaddressed subconscious blockages, that could bring the whole group down.

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[49] Timothy Miller, *The 60s Communes: Hippies and Beyond* (Syracuse, NY: Syracuse University Press, 1999), 17-18.
[50] Stephen [Gaskin], *Monday Night Class* (Santa Rosa, CA: Book Farm, 1971), n.p.
[51] Gaskin, *Amazing Dope Tales*, 87.
[52] Gaskin, *Caravan*, n.p.

He evolved a philosophy through voracious reading – science fiction, "books on weird mind disciplines," Zen writings, *The Tibetan Book of the Dead*, the Bible – while continuing to teach at San Francisco State. He was also influenced by Shunryu Suzuki, a *roshi* or Zen priest who welcomed non-Japanese Americans – many of whom had wandered from the Haight, seeking grounding to their drug experiences – to the Soto Zen Mission in San Francisco.[53] He created the San Francisco Zen Center to minister to them, and Gaskin caught some of his lectures. Suzuki taught that the essence of Zen was its practice, rather than the centuries of writings, and that to practice was simply to sit *zazen* in the traditional cross-legged pose and approach the world with a "beginner's mind." As Gaskin later quoted him, he taught that to "express enlightenment in each moment is to live each moment afresh."[54] It was likely the influence of Buddhism, and Gaskin's sense that eating animals was not showing reverence for life, that compelled him to become a vegetarian.

In 1966, in the wake of protests, students and some faculty there founded the Experimental College, an ongoing teach-in, and Gaskin signed on to teach a class during a vacant Monday slot. Dedicated to exploring the culture's spiritual awakening, he at first called the course "Group Experiments in Unified Field Theory," then "Magic, Einstein, and God," then "North American White Witchcraft" – and finally, simply "Monday Night Class," initiating a tradition of generic names. Six students attended the first semester, but Gaskin gradually gained a following of two thousand spiritual seekers each week, so many that they moved the proceedings to a rock hall, the Straight Theater. It became a wide-ranging lecture and Q&A devoted, above all, to maintaining the group

[53] Rick Fields, *How the Swans Came to the Lake: A Narrative History of Buddhism in America,* 3rd ed., revised and updated (Boston, MA: Shambala Publications, Inc., 1992), 225-230.
[54] Monday Night Class n.p.

high – “we can all be really stoned in here together” – and creating a positive vibe in the moment. When the Haight-Ashbury scene turned sour, as hordes of newcomers, exposed by the national media to the Summer of Love, overwhelmed the neighborhood and introduced harder drugs, Gaskin decided to embark on a national speaking tour in response to invitations mainly from colleges. Over two-hundred of his followers accompanied him, driving thirty old school buses in a four-month odyssey the called The Caravan. The challenges of the road bonded them into a communal group that made their return to San Francisco in January 1971 a letdown. Thus, one Sunday morning in Sutro Park – Sunday Services had supplanted Monday Night Class – Gaskin announced that the caravan was going to Tennessee to find a farm.

Gaskin and others had publicly discussed a “farm thing” as early as December. Counterculture communes had in fact boomed during the previous four years, fed in part by disillusionment with the cities that had made the gathering together of like minds possible. As Gaskin expressed it that Sunday morning:

> Whatever you put your attention on you get more of. . . . Therefore I can’t put my attention into a city scene anymore. Because the worst thing happening on the plant is the cities. Like the cities are the major cause of warfare, poverty, totalitarian police state, whatnot. All those things are functions of being crowded up in cities. . . . After services the caravan's going to take off to Tennessee and get a farm. Because what you put your attention into you get more of, and I need more trees, more grass, more wheat, more soybeans, more healthy babies, more good-looking sane people, people

> that can work. That's what I really want to see a lot more of and that's what I'm going to put my attention into.[55]

It is not clear exactly when soybeans became something Gaskin wanted to put more of his attention into. Jerry Sealund, a close friend who ran a natural foods store, Far-Fetched Foods, in the Haight, later recalled that as early as 1964, Gaskin had “a great and powerful psychedelic vision of the soybean, in which he saw it as a great provider for all humankind.”[56] Perhaps he was influenced by its role in the Buddhist monastic diet. By the time of the Caravan, he was a “complete vegetarian,” or vegan, explaining to an audience at Princeton that “there’s a place where you get so high that you say, ‘Okay, we’re all one.’ But if you’re eating meat, you hang up there. Like how straight are you with something you’re eating? . . . [A]s far as the karma of it goes, I’ve been to animal killings and I’ve been to rice boilings and rice boilings got better vibes.” In addition, “I don't do dairy products because I feel that's just part of the meat system on another level. I don't do chicken or fish because they're just like cows except they live in different places.” He mentioned that, as an alternative, “we’ve been into a lot of soybeans, soybeans are good for protein.”[57] During the summer of 1971, when the reconstituted caravan camped as guests on an abandoned farm before purchasing their own land, one former members recalls that, having thrown their money (including inheritances) into a common pot, “we spent a ridiculous amount of money” on health-food groceries, including Soyagen milk – “Stephen had once said he liked it” – an Adventist product

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[55] Gaskin, *Caravan*, n.p.

[56] Soyinfo Center, "The Soyfoods Movement: A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, http://www.soyinfocenter.com/HSS/soyfoods_movement_worldwide1.php.

[57] Gaskin, *Caravan*, n.p.

made by Loma Linda Foods from the formula Harry Miller had developed. "It had not sunk in yet that the days of co-op buying and organic veggies were over."[58]

As they settled their land, and weathered the first years of boils, hepatitis, a housing stock that still included a preponderance of old school buses, and the steep learning curve involved in acquiring practical skills, soybeans were a key to succeeding as, in their term, "voluntary peasants."[59] Their first conception of farming involved plowing with Belgian mares purchased from nearby Amish, but they soon acquired a combine and a tractor, and they gleaned know-how from their neighbors.[60] As Michael of the Farming Crew recounted in *Hey Beatnik!*, "Learning mechanics and how the tractors run and how to plant straight rows and plow and disc ten-acre fields expanded our consciousness, because it took more real attention than we were used to putting out." They also made peace with some use of chemical fertilizer, even as they worked to build up the organic matter in the soil; they avoided herbicides, relying on cultivation with hoes instead. Most of their garden and field crops, including sweet potatoes, okra, peas and snap beans, "were just what the neighbors grow. We've found out that if they don't grow it, it probably doesn't grow so well." Fortunately, soybeans were "grown all over, and most anywhere you move away from the city there'll be a half-dozen neighbors who grow soybeans and will tell you exactly how to do it."[61] This of course was true only recently, especially in Tennessee and other southern states, and an indication of how a counterculture use of the soybean depended on the work over the previous quarter

[58] Rupert Fike, ed., *Voices from The Farm* (Summertown, TN: Book Publishing Company, 1998), 13.
[59] Fike, ix; Alice Alexander, "A Commune's Last Stand in The Tennessee Hill Country," *The Washington Post,* 20 May 1979, H1.
[60] Fike, 11; Gaskin, *Hey Beatnik*, n.p.
[61] Gaskin, *Hey Beatnik*, n.p.

century of soybean improvers at the USDA, agricultural experiment stations and private companies.

Thus, in a way reminiscent of Henry Ford's idea that, having learned valuable techniques in cities, it was time to go back to the land, the hippies of The Farm adopted technology they found useful and scaled it down to communal life in the countryside. They communicated through CB radios and an old-style phone exchange, they used passive solar-heating features in their housing, and they eventually branched out into photvoltaics. To be voluntary peasants meant to use appropriate means to improve the too-often degraded existence of involuntary peasants. If Farm residents largely imitated their neighbors in growing soybeans, they were innovative in transforming the crop into food. They coined the term *soy dairy* to refer to an operation that produced 60 gallons of soymilk per day in 1974 with equipment which, like so much of The Farm's technology, was gleaned from diverse sources and creatively adapted to the purpose. After grinding soybeans into grits, they boiled them in a propane-fueled double-boiler made from a restaurant-sized coffee urn – purchased for $15 at an army auction – then separated the milk from the okara in a basket centrifuge jury-rigged from an old front-loading washing machine, $5 at auction, after removing the spinning basket and basin and holding them upright with a stand made from two-by-fours. Aside from the addition of some vitamins and a little salt, there was no evident effort to improve the taste or quality of the milk, as with Harry Miller; it was a straightforward process reminiscent of Jethro Kloss. The milk was distributed throughout the community in cans and milk bottles at an estimated cost of 30 cents a gallon; it was also used to make yogurt, cheese and ice cream.[62]

[62] Ibid., n.p.

The page devoted to the soy dairy in *Hey Beatnik!* featured a photo of a small girl drinking from a mug, her hand resting on a large bottle of soymilk. Much of the reason for the emphasis on liquid soymilk was the presence of numerous children on The Farm, one consequence of Gaskin's teachings against abortion or chemical contraception, which he felt damaged "the fabric of society and so cheapened human life."[63] Each birth was a sacrament, "every birth the birth of the Christ child."[64] *Hey Beatnik!* put out a call: "Hey Ladies! Don't have an abortion, come to the Farm and we'll deliver your baby and take care of it, and if you decide you ever want it back, you can have it"; and in fact half of the babies born on The Farm were to outsiders. They delivered baby according to the principles of "spiritual midwifery," without anesthesia: there are "certain passages in life that are heavy," Gaskin wrote.[65] Ina May Gaskin – his wife and one of the partners in what was, for a while, a "four marriage" that included Margaret and another man – led a group of certified midwives and, as the author of *Spiritual Midwifery* (1977), is now widely regarded as the mother of the modern midwifery movement. They also encouraged breast feeding, but the abundance of babies created the need for a weaning food; luckily, "babies love soymilk," although they counseled that until a baby "is older and has a hearty stomach," mothers should "sterilize it and can it up in the morning" for use throughout the day;[66] a hygiene measure, this extra 30-minute boiling may also have made it more palatable and digestible.

One of the notable innovations at the soy dairy was the production of tempeh, an Indonesian food in which lightly cooked dehulled soybeans were fermented using a white

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[63] "The Plowboy Interview: Stephen Gaskin and The Farm," *Mother Earth News*, May/June 1977, 14-18, http://www.motherearthnews.com/nature-community/stephen-gaskin-zmaz77mjzbon.aspx.
[64] Gaskin, *Hey Beatnik*, n.p.
[65] Ibid., n.p.
[66] "Plowboy Interview: Gaskin"; Gaskin, *Hey Beatnik*, n.p.

mold, *Rhizopus Oligosporus*, that bound the beans into a solid cake that had a meatier taste and texture than tofu. The head of the soy dairy, Alexander Lyon, who had a Ph.D. in biochemistry, learned about tempeh as early as 1971, when he was doing library research in upstate New York, where he was on vacation, trying to learn all he could about the use of soymilk as a weaning food.[67] He came across the work of two groups of American microbiologists done in the 1960s, one at Cornell and one at the USDA Northern Regional Research Center in Peoria. Both groups included Indonesian members, one of whom brought a sample of pulverized tempeh to Cornell, where a researcher cultured the mold and gave the strain, which became widely disseminated, the number NRRL 2710.[68] In 1972, Lyon and his co-worker Cynthia Bates ordered the starter from Cornell and used it to make okara tempeh, one way to make use of the "soy pulp" left over from milk production. Here was another debt of the counterculture soybean to the established institutions of soybean research. In 1974, following a visit by Gaskin to Amsterdam where he was introduced to authentic tempeh – Holland had been the colonial power over Indonesia – he encouraged the production of whole-bean tempeh, which became a favorite on the commune. Lyon transferred to the Motor Pool, but Bates set up a laboratory to make powdered, pure-culture tempeh starter which was sent out or sold through the mail. The first commercial tempeh shops were started by those who learned how to make it at The Farm, and by 1984 the Tempeh Lab would supply more than half of all starter used in the U.S.[69]

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[67] Soyinfo Center, "Soyfoods Movement."
[68] William Shurtleff and Akiko Aoyagi. *The Book of Tempeh: The Delicious, Cholesterol-Free Protein,* 2nd ed. (New York: Harper Colophon Books, 1985), 147.
[69] Soyinfo Center, "Soyfoods Movement"; Shurtleff, *Tempeh*, 151.

Bates oversaw an expansion of the soy dairy, as it moved into the community's canning and freezing building. She helped develop *Yay Soybeans*, a 14-page booklet of recipes that included okara "soysage," soy cheese (fermented tofu), tofu cheesecake, soy ice cream ("Ice Bean"), soymilk mayonnaise, and okara granola. Many of these, along with tempeh recipes, were included in *The Farm Vegetarian Cookbook*, published by The Book Publishing Company in 1975, which became a staple, along with *The Tassajara Bread Book* and *Diet for a Small Planet*, on the shelves of vegetarians and natural foods enthusiasts. By 1978, the soy dairy had expanded commercially as Farm Foods, which not only offered tempeh kits, but bags of whole soybeans and soy flour, Good For Ya Textured Vegetable Protein – they couldn't call it TVP, an Archer-Daniels Midland trademark, on the bag, though they used that term in the *Cookbook* – and nigari.[70] They also started marketing Ice Bean several years before Tofutti hit the market. The food and publishing businesses brought in cash revenue, although the community's willingness to accept the outcasts of society – if they abided by its code of behavior – contributed to debt and growing financial crisis that the businesses were not successful enough to stem.[71]

In any case, money-makers or not, both the food and publishing companies were part of the mission to spread vegetarianism to a wider public. As Gaskin wrote in the introduction, the "thing about our cookbook is we don't want to be faddish or cultish or scare people off," but to let people know that "a vegetarian diet is heavily based on beans. And that it tastes good, looks good, is nice, graceful, that it can be a turn-on." He also emphasized, as he had as far back as the Carvan days, that "if everybody in the world

[70] *Farm Foods: Products Catalogue* (Summertown, TN: The Farm, 1978), Alphabetical Files, SFM-Farm, Soyinfo Center, Lafayette, CA.
[71] Fike, xi.

were vegetarians, there wouldn't be any starving, hungry people in the world" even with a growing population;[72] the nightmare world of *Soylent Green* was unnecessary because peasants, voluntary and involuntary alike, could make enough high-quality, high-protein food to feed themselves. As *Hey Beatnik* put it: "Here's a spiritual reason for being a vegetarian: You can get ten times as much protein growing soybeans than raising beef cattle. If everyone was vegetarian, there would already be enough to go around, and no one would be hungry."[73] This was also the central idea of *Diet for a Small Planet.* It was not long before The Farm put the theory into practice in an especially dramatic way, with soybeans playing a key role.

In 1974, feeling that they were on a strong enough footing, The Farm founded Plenty, a non-profit corporation, whose charter stated that its mission was "to help share out the world's food, resources, materials, and knowledge equitably for the benefit of all"; or, as Gaskin put it in *Mother Earth News*, "We're responsible for each other. That's how we try to be on The Farm and that's how we try to be with our immediate neighbors . . . and the world has become so small these days that *everyone* is our immediate neighbor."[74] Plenty began by distributing food and helping to clean up in the wake of tornadoes and hurricanes in the U.S. The 1976 earthquake in Guatemala, killing 23,000 and leaving hundreds of thousands homeless, compelled Plenty to delve into international disaster relief. Two volunteers, one of whom spoke Spanish and had worked in the Farm Clinic, flew down to Guatemala City to meet several large shipments of medicine and medical equipment – including seven tons of army field hospital equipment – gleaned through a network of sister communities and urban contacts. The Guatemalan army, treating them

[72] *The Farm Vegetarian Cookbook* (Summertown, TN: Book Publishing Company, 1975), 2.
[73] Gaskin, *Hey Beatnik*, n.p.
[74] History of Soyfoods in Mexico and Central America 86; Plowboy Papers: Gaskin.

like foreign dignitaries, drove them around the highlands in military trucks to deliver food and supplies, but they protested when their hosts insisted on diverting a shipment to a military, rather than a civilian, hospital.[75]

They returned to The Farm "completely mind-blown," both by the destruction and poverty they had witnessed and by the grace of the Mayan people, to whom "they felt drawn as if through an aged kinship suddenly revealed." Stunningly attired in rainbow colored fabrics, they were like "long-lost psychedelic cousins." Alerted to the dire need for housing, The Farm sent three of its best carpenters, who were soon hired by the Canadian embassy to make use of seven hundred tons of building materials arriving by freighter which the embassy staff, prior to the hippies' unexpected visit, had no idea what to do with. Over the next four years, rotations of some two hundred Plenty volunteers, with the generous support of the Canadian government, built twelve hundred homes, twelve schools, and a number of clinics, water systems, and CB base stations in two Guatemalan villages, as well as a two-story *municipalidad indigenes* community center which included an FM radio station that broadcast in Cakchiquel Mayan.[76] As the culmination of a program to teach Mayans how to grow and cook soybeans, they also built a village soy dairy.

As soon as they had set up camp outside the village of San Andres Itzapa to build houses, the Plenty volunteers, having brought medical supplies and experienced health workers for their own survival, found themselves providing care to Mayans brought to them for healing (a service that they had to discontinue under pressure from local medical authorities). Many of these were severely malnourished babies, including two-month

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[75] Fike, 74.
[76] Fike, 74-76.

olds who weighed under five pounds, many of whom died, but some of whom they were able to nourish back to health with the Farm's soy-based formula.[77] One of the Plenty volunteers, Darryl Jordan, who had an agricultural background prior to The Farm, felt that the indigenous people, forced to cultivate marginal land, could benefit from "The Noble Bean," but it would be a challenge to find a variety that could thrive in the tropics at 6,000 feet, with its combination of short days and cool temperatures. He thus began trials with seventeen varieties, later expanded to over twenty, with the help of a dozen local farmers. He obtained the seeds from INTSOY, based at the National Soybean Research Laboratory at the University of Illinois, which had conducted soybean trials in the tropics since 1973. Jordan sent his data to INTSOY to compute yields. A variety named Improved Pelican had already shown promise on the coast of Guatemala, but it did not yield well in the highlands. Many of the varieties that Jordan planted had been developed by Hartwig and his colleagues for the American South and included a number of the Confederate soybeans: Davis, Forrest, Ransom, Bragg. Davis and Forrest were among the top four in terms of yield. Thus, as an indication of the debt of the countercultural use of the soybean to the generations of improvers who had commodified it, a hippie recommended that Mayans plant a soybean named after a Grand Wizard of the Ku Klux Klan.[78]

As Jordan set up what was essentially an agricultural experiment station, farmers passing by his fields were curious about the soybeans. The ultimate value of the beans

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[77] Fike, 76; Darryl Jordan and Suzie Jenkins, *Plenty Agricultural Program*, as presented to UNICEF Guatemala (Summertown, TN: Plenty, 1980), Alphabetical Files, SFM-Farm, Soyinfo Center, Lafayette, CA., 29.

[78] William Shurtleff and Akiko Aoyagi, *History of Soybeans and Soyfoods in Mexico And Central America (1877-2009): Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2009), 84; Jordan and Jenkins, 6-8.

would rest on whether the indigenous people were willing to incorporate them into their diet, so Plenty took the opportunity to do extension work as part of what was now the Integrated Soy Project. Suzy Jenkins, a "soy utilization technician," conducted demonstrations for four women at a time in the Itzapan home of a Mayan apprentice, Becilia, who translated from Spanish to Cakchiquel. Students learned simple techniques for making soymilk and tofu using readily available utensils: pots, colanders, spoons, and cheesecloth. After soaking overnight, soybeans were boiled over an open fire and ground, if a mill or blender were not available, on the same stone *metate* used to grind corn for tortillas. The puree was then boiled again and strained into a bowl, which could then be consumed as soymilk. To make tofu, the demonstrators used vinegar as a curding agent and simply strained the curds through the cheesecloth. The result was a mound of soft tofu, rather than a compressed cube; sliced, it resembled local farmer's cheese in appearance, though not in taste. The tofu was then scrambled in a pan with sautéed onions, tomatoes and salt, or eaten plain, with a little salt, on tortillas or bread. The "soy pulp," or okara, could also be fried with onions and vegetables. Students were sent home with a cheesecloth and a small bag of soybeans, initially from a 1,500-pound supply donated by UNICEF; a follow-up session addressed any questions they might have. Suzy and Becilia taught several hundred women this way, then trained eighteen Mayan extensionists, members of health and nutrition cooperatives sponsored by World Neighbors, in soy food preparation. By 1980, more than one thousand men and women in 74 villages had been taught how to make soymilk and tofu; two hundred of these grew small plots of soybeans.[79]

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[79] Plenty International, *Soy Demonstration Program: Introducing Soy Foods in the Third World, A Step By Step Guide for Demonstrating Soymilk and Tofu Preparation* (Summertown, TN: Plenty International, c.

The success of this program led to the construction of a soy dairy for the village of San Bartolo in the summer and fall of 1979. With the help of the Canadian International Development Agency (CIDA), Plenty enlisted local masons to complete the 22 by 44 foot cinder-block building, designed as a split-level so that the strained soymilk could be gravity-fed to the lower floor where it was turned into tofu. The Farm supplied equipment – stainless steel cooking kettles, industrial blenders, and a soft-serve ice-cream maker – while the grinding mill was supplied locally. The cauldrons were fueled by sawdust waste from local sawmills; at one point billed as "solar,"[80] it was fitted with an electrical system to power the machinery. After an inauguration attended by several hundred people, La Lecheria – "The Dairy," continuing the practice of generic names – produced 200 pounds of tofu and 35 gallons of Ice Bean daily; some of the ice cream was handed out free to school lunch programs.[81] The dairy was eventually managed by locals and has remained in operation for over 30 years. Even as the FAO and other international relief organizations moved away from emphasizing protein in favor of adequate calories, Plenty touted the benefits of its soy project in terms of providing high-quality, complete protein to malnourished people – Jordan also experimented with amaranth and quinoa, other crops that promised high-quality protein – and one of the volunteers who helped build the plant commented twenty years later that as it continued to "pump out high-protein food," you could "see the difference in the kids around the village. They are bigger, stronger, more energetic, and bright-eyed."[82]

1980), Alphabetical Files, SFM-Farm, Soyinfo Center, Lafayette, CA., n.p.; Jordan and Jenkins, 28.

[80] Edward Sierra, Preface to Jordan and Jenkins.

[81] Shurtleff and Aoyagi, *Mexico and Central America*, 138; Fike, 79; Jordan and Jenkins, 28; Plenty International, n.p.

[82] Fike, 80.

La Lecheria was a legacy that outlasted Plenty's presence in Guatemala. With the election of Ronald Reagan, an event that effectively drew a curtain on the 1970s, the Guatemalan government's war against guerilla fighters intensified. There were more soldiers in the streets, roadblocks at the entrances to towns, helicopters flying over Plenty's camp in search of guerilla fighters operating in the mountains, killings by death squads. The local people that Plenty worked with began to receive threats; Plenty helped some relocate elsewhere in the country, or even up to Tennessee on student visas. But the volunteers did want to be a magnet drawing the death squads to their friends. On a sad day in 1981, Plenty left Guatemala, and the soybean culture it had implanted there, behind.[83]

The next decade would also see the end of The Farm as a communal experiment: though the land was held in trust, members became responsible for their own incomes and finances, and the population dropped from a peak of 1,500 to around 250. Although the debt was due largely to the altruism of ventures like Plenty – unlike some gurus of the 1970s, Gaskin continued to in the same conditions of his followers – Farm residents began to question their leader's role in setting the spiritual and material direction of their community. Mostly, they grew tired of living in Third World conditions rather than an upgraded version of traditional village life: as one member later reflected, "I think that if at that time we had been able to build the town and been able to live within the graceful standard of living that we had envisioned as "voluntary peasants," a lot of us would not have left. We were so close yet so far."[84]

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[83] Fike, 79-80.
[84] Fike, 146, 157.

The Artisans: William Shurtleff and Akiko Aoyagi

In the spring of 1973, William Shurtleff and Akiko Aoyagi set out to discover farmhouse tofu similar to that made by Tsuru Yamauchi six decades earlier. By the 1970s, it had become the stuff of nostalgic legend in Japan. As Shurtleff and Aoyagi recounted in a chapter of *The Book of Tofu* titled, “The Quest,” for tofu craftsmen, “country-style tofu-making represents both an early and pure stage of their art and a standard of excellence for which they continually strive.” They said, “Once you have enjoyed the satisfying flavor of homemade country tofu, you will never forget it” and that, in the old days, it was made so firm that it could be tied into a package with rice-straw rope. But to find it actually being made, even in remote villages, was difficult. Donning backpacks and “feeling an inevitable kinship with the many wanderers who have fallen victim to the power of Japan’s spring,” Shurtleff and Aoyagi walked and hitchhiked to the picturesque mountain village of Shirakawa-go, feeling that they were traveling back in time as they went. “The roofs on the houses turned from tile to thatch, the windows from glass to paper, the people's clothes from Western-style suits to well-worn farming attire. The air grew radiant, creeks cascaded down the steep mountainsides, flowers and birds were more abundant, and people's faces seemed more and more expressive of the shaping forces of wind, snow, and sun.”

In Shirakawa, however, the closest they could get to the traditional food was the temple’s attic museum, where an energetic old woman showed them the traditional tools and explained how they were used. Nobody under 70 had actually made it, and women over 70, finding the heavy grindstones increasingly difficult to turn and unrefined salt (for making nigari) increasingly hard to obtain, now obtained their tofu from a shop that had opened in a neighboring village. Disappointed, they were tipped off by one of their rides to an old woman in his village who still made farmhouse tofu, but, as she explained when she returned home that evening, she was too busy planting rice to make tofu; she invited them to return during the fall harvest. Finally, they passed a solitary woman working in the fields who directed them to Kaminonomata, a village "so small it wasn't even listed on our map," where they fortuitously happened upon two women making tofu in commemoration of a former member of the village who had died seven years earlier. They had arrived at just the right moment to watch the beans being ground into go, then sprinkled with rice bran to settle the foam as it cooked, then transferred to a pressing sack set on a rack made from tree limbs; the resulting milk was curdled with store-bought nigari, then pressed in a settling box weighted by a large rock. Then, without soaking it in water, the tofu-maker cut it into small pieces for tasting:

> The flavor of this tofu was graced with the faintest aftertaste of woodsmoke. Country-style pressing had given it a firmness and slight coarseness of texture quite unlike the soft, smooth tofu common to the cities. By not placing the tofu in water after it was pressed, a shade of beige and a fine edge of bouquet had been preserved; these we had never seen or experienced before. Beneath the subtle sweetness and fragrance of home-grown soybeans was a faint and even subtler bitterness left by the nigari. Somehow this tofu seemed to embody and share completely in the total configuration out of which it had been born. The wine-sweet morning air, the water drawn from the deep farmhouse well, the pleasure of communal down-home craftsmanship all participated in its essence. Wholesome, rustic, and deeply satisfying, this tofu seemed

> imbued with a genuine warmth that was the heart's warmth; and this was the loveliest flavor of all.[85]

Like Frank Meyer and William Morse before him, Shurtleff ventured to remote areas of Asia to gather encyclopedic information about soy foods; it was only after the publication of *The Book of Tofu* in 1975 that he would learn of the networks of Asian-American tofu makers and their long history. The soybean was enmeshed in a different constellation of meanings for Shurtleff than it had been for his predecessors, however. For them, traditional methods were a starting point, something to be modernized and Americanized if tofu and other soy foods would have any place in the American diet at all. Shurtleff, on the other hand, valued the craft itself precisely as an antidote to the shortcomings of modernity. The end product, as with the taste of farmhouse tofu, embodied the spiritual and communal virtues of the process. Thus Shurtleff sought knowledge of tofu with an attitude that, compared to that of Meyer or Morse, was distinctly deferential: his and Aoyagi's travels took place, in fact, during a year in which he apprenticed himself to a tofu master craftsman. Like many of a generation often typified as rebellious – and certainly in the case of Stephen Gaskin's followers – his quest was not simply to escape authority, but to find a truer and more humane form of it. As it would turn out, these counterculture values – of peace, spirituality, and authenticity – would not only impel Shurtleff and Aoyagi on their journey, but would provide the soybean, and traditional Asian soy foods in particular, with a path into the wider American culture.

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[85] William Shurtleff and Akiko Aoyagi, *The Book of Tofu: Protein Source of the Future...Now! Volume I* (Berkeley, CA: Ten Speed Press, 1983), 271-273.

Shurtleff's family was part of the west-coast establishment. The lineages of his father's parents both had their American roots in the 1630's Puritan migration to Plymouth Colony, as it happened, but only joined in California almost 300 years later. The Shurtleff line, for its part, hewed to the frontier, first moving from Massachusetts to Vermont and New Hampshire, then to Quebec in the early 1800s – not from any Tory sentiment, but for the land – then back into the United States in Illinois and other points west. Thus, by the 1880s, Samuel Shurtleff, Bill's great-grandfather, after a brief period of prosperity as an Illinois farmer, was a stagecoach driver in the remote mining town of Nevada City, California. He died in 1890 when his stagecoarch overturned, leaving behind a two-year old son, Roy. Roy's mother had been widowed once before, in a marriage that had produced two daughters, and the she now lived on an income generated by property and insurance owned by the first husband.

When one of Roy's half-sisters attended the University of California, the family moved to Berkeley, where he began his climb from his straightened circumstances to become a highly successful businessman and paterfamilias. Roy himself graduated from Cal in the class of 1912 – which included Earl Warren, with whom Roy had started a drinking society eventually suspended for its disruptive initiations – and became a bond broker. In 1914, he was a founding partner of Blyth, Witter & Co. in San Francisco, which underwrote bonds issued by California's growing public utilities. In 1929, before the stock market crash, as Vice President and Director of Blyth & Co. – Dean Witter had left the firm to move east – Roy moved to liquidate $7 million of what he felt were overly speculative and marginal accounts, thus likely enabling the firm to survive the Depression and grow in the postwar world (it would eventually underwrite the construction of the Golden Gate Bridge). Lawton, Roy's oldest son, was rather wild as a child – occasioning the frequent use of Roy's razor strop until, adopting an idea from a boarding school that Lawton attended for a time, Roy made him run laps as punishment instead – and radical during the Depression, advocating communism at the family dinner table. By World War II, however, he had entered business, and he enlisted to become a supply officer for the Navy. Like his father, he ultimately became a millionaire, finding success in tool manufacturing and real estate development, and grew conservative in his outlook. Both men were also nature enthusiasts and avid hobbyists – Lawton sailed and, among other things, trained racing pigeons – who lived well into their nineties.[86]

The vitality and of his father and grandfather and the force of their personalities made them role models for Shurtleff and, at the same time, seemed to have impelled him to seek counterweights to their authority as his idealism pulled him leftward during the turbulent 1960s. As a youth, he gained a love of wilderness – "meeting mother nature in her wild state" – at the family's summer cabin on Echo Lake, in the Sierra Nevada mountains, where he learned to swim and water ski and where he assisted Lawton in building a racing hydroplane. Bill made homemade go-carts for himself and his siblings and became an avid Boy Scout, eventually reaching Eagle Scout. In high school in Lafayette, California, he excelled both academically and athletically (in swimming) and, as a senior, was awarded his school's Citizenship Cup.[87] He entered Stanford University, where in 1963 he earned degrees in industrial engineering and honors humanities. In the course of his studies, he had spent six months near Stuttgart in Stanford's Overseas

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[86] William Roy Shurtleff and Lawton Lothrop Shurtleff, *The Shurtleff and Lawton Families: Geneology and History*, 2nd ed. (Lafayette, CA: Pine Hill Press, 2005), *passim.* Lawton passed away in April 2012 at age 97.
[87] Ibid., 222-223, 225, 227.

Campus, where he greatly admired Arno Walter Zimmerman, a dynamic humanities teacher who taught German. [88]

After graduation, he lasted three months as an engineer at U.S. Steel before answering the call of the Peace Corps two years after the program's inception. He spent three months in intensive coursework at Columbia preparing for his assignment in Nigeria. His studies encompassed African history and culture; educational philosophy and practice; language study in Igbo; health and physical education; American civics, history, and values; Communism, the better to counter its influence; and seminars in physics, the subject he was to teach at a village secondary school. He also met Nigerians in New York, whom he learned were radicalized into sympathy with Communism by the racial "discrimination at every hand."[89] He recounted these experiences, and those of the next year, to Zimmerman in a series of insightful, vivid letters that the German professor eventually arranged to have published as a book.

In Lagos, he enthusiastically dived into Nigerian culture; in Okigwa, a small village two hours away, he sought creative ways to break his students out of a tradition of rote learning as they prepared for their examination in physics. At one point, he painted "THINK" in tall white letters on a mahogany board and hung it in his classroom as a reminder; he purposely performed bad experiments, reaching wrong conclusions, to see who would catch on.[90] A six-week trip to Gabon and the end of 1964 brought him face to face with Albert Schweitzer, someone whose writings he had long admired and whose presence was, once again, reminiscent of his grandfather. "For a man of ninety the doctor

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[88] Ibid., 234; Bill Shurtleff, *A Peace Corps Year with Nigerians, e*d. Hans Brinkmann (Frankfurt am Main: Verlag Moritz Diesterweg, 1966) , n.p. ["Introduction"]. It is not clear whether he completed his engineering degree before the Peace Corps, but he was apparently qualified to teach physics.
[89] Shurtleff, *Peace Corps*, 7, 12.
[90] Ibid., 35, 41.

has the physical and mental energy of many men half his age. His hand is still as steady as when he was a young surgeon." Schweitzer's "eyes are unique . . . large and full of wonder, almost childlike, seeming to be near laughter even when his face is stern or tired." One sensed "great kindness and wisdom, and perhaps the iron-willed self-discipline of a man who is occasionally hard on others, always hard on himself." He was entranced by Schweitzer's love and care of animals, to the point that he later credited the doctor's ethic of compassion with influencing his decision to become a vegetarian, but at the same time clear eyed about Schweitzer's evident callousness toward Africans, whom he relegated to dark, unsanitary buildings at his hospital.[91]

After a second year in the Peace Corps, Shurtleff returned to Stanford to pursue an MA in Education. His idealism, beginning with the Boy Scouts and progressing through the Peace Corps, had gradually become more radical, and now he joined his brother, Jeff, as a resident of a group house in the small Palo Alto ghetto which became the Peace and Liberation Commune. David Harris, one of the commune's founders and later the husband of Joan Baez, later recalled that, though other saw them as "alienated kids . . . we saw ourselves as heroes in open revolt." The members, which included two black men and a number of Stanford drop-outs, "spanned the spectrum of interests rampant among our sort of young people that spring. At one end were aspiring Buddhists, with diets of brown rice, meditation as a regular ritual, and various other attempts to fine-tune their karma. On the other end were the organizers, consumed by politics and the expression of moral outrage on a grand scale. In 1967, both ends still got along."[92] Shurtleff and his brother were on the Buddhist end of the spectrum. Jeff had begun

[91] Ibid., 64-66.
[92] David Harris, *Dreams Die Hard* (New York: St. Martin's/Marek, 1982), 183-84; Stewart Burns, *Social Movements of the 1960s: Searching for Democracy* (Boston: Twayne Publishers, 1990), 95.

meditating in 1963, and Shurtleff took a course in Japanese Art in the spring of 1967, traveling to Japan that summer and subsequently directing a branch of the Esalen Institute, a center of east-west awareness and the human-potential movement, at Stanford. After hosting Michio Kushi, a Japanese teacher of macrobiotics, he committed to becoming a vegetarian.[93] Harris and others had meanwhile joined with Berkeley activists to found The Resistance against the draft; Harris would later go to prison for his refusal to serve. It is unclear to what extent Shurtleff joined these protests, but his association with draft resisters was enough to baffle and dismay his Naval-veteran father.[94] By 1967, he had aged out of the draft in any case.

Shurtleff's entry into the counterculture lacked the abrupt rupture that drugs created in the life of Stephen Gaskin. The youthful idealism of a Boy Scout, the love of nature and physical training, the mechanical aptitude and eventual training as an engineer, the dynamic father figures, the closeness of his sprawling extended family, the academic achievement and the continual search for better ways to learn and teach: these elements remained constant, transposed to new settings. In 1968, he entered the Tassajara Zen Mountain Center, an offshoot of the Zen Center in San Francisco, where he practiced meditation as a student of Shunryu Suzuki, who had been so influential in implanting Zen in America. Life at the monastery was both disciplined and liberatory: students followed a busy schedule of meditation, work and meals designed to keep them engaged in their moment-to-moment experience of life and to maintain what Suzuki called a Beginner's Mind, open to fresh possibilities.[95] There were set periods of sitting zazen, but students

[93] William Shurtleff and Akiko Aoyagi, *History of Erewhon – Natural Foods Pioneer in the United States: Extensively Annotated Bibliography and Sourcebook* (Lafayette, CA: Soyinfo Center, 2011), 265.
[94] Shurtleff and Shurtleff, 227.
[95] Rasa Gustaitis, "Zen," *Los Angeles Times,* 9 Mar. 1969, W9.

were to approach every task as meditation; with the 1970 publication of *The Tassajara Bread Book*, by Edward Espe Brown, the preparation of the monastery's simple fare became legendary as a site for care, spontaneity and continual engagement of mind and body in an activity. With his interest in food and macrobiotics, Shurtleff worked in the kitchen as well. In 1969, he wrote and distributed a photocopied book to friends at Christmas called "The Tassajara Food Trip," which included four recipes that called for tofu, as well as those that used miso and whole soybeans.[96]

Tofu was not the focus of Tassajara cuisine, however. Macrobiotics, meanwhile, downplayed tofu except as an occasional treat. The macrobiotic system, developed by George Ohsawa, a Japanese philosopher and self-taught nutritionist, emphasized a whole-grain diet that balanced yin and yang foods. While soybeans were considered one of the sacred grains of China, tofu was not a whole food, the okara having been removed, and it was considered overly yin.[97] For these reasons, Shurtleff only really gained enthusiasm for the food when he attended Tokyo's Christian University in 1971 to study Japanese, with the ultimate aim of assisting Suzuki in establishing a retreat in Japan similar to Tassajara. Living on an austere student budget, tofu – cheap, nourishing and tasty – became a mainstay. Suzuki died in December of that year, leaving Shurtleff without a goal; weeks later, however, he was introduced to his future wife. Akiko Aoyagi, nine years younger than Shurtleff, was an illustrator and clothing designer at the beginning of her career in the Tokyo fashion world. Growing up, she had attended a Quaker school, and its continuing influence may have contributed to her dissatisfaction with her current

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[96] Shurtleff and Aoyagi, *Erewhon*, 265.

[97] Soyinfo Center, "George Ohsawa, The Macrobiotics Movement: A Special Exhibit - The History of Soy Pioneers Around the World - Unpublished Manuscript by William Shurtleff and Akiko Aoyagi," last modified 2004, http://www.soyinfocenter.com/HSS/george_ohsawa_macrobiotics_soyfoods1.php.

work: it was high-paced and exhausting, but above all superficial. As she later explained to *Mother Earth*, "I was always looking for more meaning in my life. I was looking for a way to serve my fellow man." She contemplated traveling to Africa as an international aid worker, and was therefore intrigued when her sister, who attended Christian University, mentioned an America student who had been to Africa in the Peace Corps. They met on Christmas. The next year, he was living with the Aoyagi family and the new couple had embarked on their study of tofu.[98]

Though largely a matter of happenstance – and degree – it was perhaps fitting that the focal soy food of The Farm was tempeh, earthy and pungent, whereas for Shurtleff it was tofu, rarified and pure, especially in its more refined Japanese manifestations. In a way that might appeal to a Western engineer and Eastern mystic alike, and Shurtleff was both, it was a Platonic solid, homogeneous and rectilinear, and highly cost-efficient in its delivery of protein. And, like the soybean itself, it was protean, an elemental food capable of numerous guises. When purchasing tofu as a poor student, Shurtleff was often impressed that a small shop might feature "three kinds of deep-fried tofu, another type that had a texture like custard pudding, still another that was grilled like steak, and so on." He'd think, "Wow! Look at all the different types of tofu."[99] When he and Aoyagi went to a renowned haute-cuisine restaurant one night for a surprisingly inexpensive meal – the total bill was the equivalent of $2.75 per person – and each of the twelve artistically

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[98] "The Plowboy Interview: Bill Shurtleff and Akiko Aoyagi," *Mother Earth News*, March/April 1977, 8-18., http://www.motherearthnews.com/real-food/akiko-aoyagi-zmaz77mazbon.aspx.; Shurtleff and Aoyagi, *Erewhon*, 265; Shurtleff and Shurtleff, 234.
[99] "Plowboy Interview: Shurtleff and Aoyagi."

presented small dishes featured tofu in a different form, they were astounded. "That evening," Shurtleff later recounted, "*The Book of Tofu* was born."[100]

In addition to its inherent appeal, however, the process of producing tofu was a key to its appeal to Shurtleff. Japan still had as many as 38,000 small shops, which he and others would liken to the small bakeries that once dotted Western cities, in which master craftsmen made tofu with traditional tools. They visited their neighborhood tofu shop early one morning, at the invitation of the owner, to witness the process up close, and they "were deeply impressed with the feeling of alertness and care in his work. His movements were precise and graceful, joined in an effortless rhythm that, at times, flowed like a dance." All of this happened in a compact space, twelve by fifteen feet, and all of the tools were "simple and energy non-intensive." After repeated visits, Shurtleff later asked to become a disciple and apprentice and would spend more than a year learning the traditional techniques. His master urged him to "record the methodology and, if possible, the spirit of his art both for Westerners seeking meaningful work and for future generations of Japanese who might someday wish to rediscover the rewards of fine craftsmanship presently obscured by modern industrial values and the 'economic miracle.'"[101] Tofu making was true unalienated labor: meditative in its practice, nourishing in its result.

Shurtleff and Aoyagi initially envisioned a small, self-published booklet on tofu intended, like his book of Tassajara recipes, for friends. When they met the founders of Autumn Press, a small publisher of macrobiotic, zen and related books, they signed a book contract and the project evolved into a large book that took three years to complete.

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[100] Ibid.; Shurtleff and Aoyagi, *Tofu*, 9.
[101] Shurtleff and Aoyagi, *Tofu*, 10.

Shurtleff continued his apprenticeship and wrote a detailed description of traditional methods. His master encouraged him to visit other tofu makers, including factories, to glean as much information as possible, and in the warm months he and Aoyagi would hitchhike the length of Japan, tracking down farmhouse tofu or visiting an ashram on an isolated southern island where tofu was curdled with seawater rather than nigari. They were grateful to observe methods that tofu artisans had traditionally shrouded in secrecy. Likewise, they stood at the elbow of chefs at Japanese restaurants and, through trial and frequent error, replicated recipes at home. Aoyagi, a talented cook, eventually developed western-style dishes: dips, dressings, casseroles, barbequed tofu and deep-fried tofu burgers. They ultimately prepared 1,200 different dishes, but only included the 500 recipes “best suited to Western tastes.”[102] These made use not just of various types of tofu itself – silken, grilled, frozen – but of all of the intermediary foods leading up to tofu: soybeans themselves (“Soybeans in Tortillas”), go (“Thick Onion Soup with Go”), okara (“Okara Croquettes”), soy milk (“Soymilk Mayonnaise Dressing”), and curds (“Warm Soymilk Curds”).[103] In addition to recipes, Aoyagi provided illustrations that subtly evoked Japanese wood prints: black-and-white line drawings of shops, tools, and craftspeople that were highly detailed yet simple and clean, fitting complements to Shurtleff’s precise but lyrical prose.

In Part I of the book, “Tofu: Food for Mankind,” Shurtleff touched on the familiar themes of the soybean’s high protein content and the benefits in terms of feeding the world of shifting from a meat-based to a more heavily plant-based diet. Yet this vision of tofu’s role in addressing world hunger came late in the couple’s work, as they traveled to

[102] Ibid., 11.
[103] Ibid., passim.

Taiwan to investigate Chinese methods of tofu production. Fewer Taiwanese had made the switch to meat, eggs, milk, McDonald's and Kentucky Fried Chicken. "Everyone in Taiwan bases his or her diet on tofu and soy milk," Shurtleff noted to *Mother Earth*. "And even though there are twice as many people per cultivated acre of land in Taiwan as per cultivated acre in Bangladesh, everyone in Taiwan is well fed." Up to that time, Shurtleff "had been thinking more in terms of bringing the Zen of tofu making to the United States," but now he "suddenly realized – click! – this is relevant to everyone." This was the basis of his message, similar to that of The Farm, that there was no population or food crisis. Though he acknowledged the long-term need for slower population growth – for couples to have no more than two children – he blamed world hunger not on scarcity but on surplus. Agribusiness in the United States had promoted resource-intensive foods such as meat precisely to absorb a glut of grain and soybeans, a model that was then internationalized through the Green Revolution, which gradually displaced self-sufficient Third World farmers in favor of commercial crops to sell to the gluttonous West, resulting as well in "the rape of the earth." As with The Farm, soybeans promised abundance without industrial farming and food processing, thus enabling Americans to scale back from the perversity of oversupply without sacrificing taste or nutrition. Although Shurtleff and Aoyagi themselves were not back-to-the-landers, *The Book of Tofu* was the town half of this vision based on the small-is-beautiful technology of the traditional artisan.

Released at the end of 1975, the book was a hit. During its first year in print, it sold 40,000 copies, and did almost as well during its second year. Ballantine later released it as a mass paperback.[104] It hit the market at an opportune time – as the natural foods and vegetarian movements were gaining steam, and during a post-Nixon in China revival of interest in authentic Chinese food – and would inspire many imitators in the years to come. Shurtleff and Aoyagi in the meantime completed a second book, *The Book of Miso*, and in September 1976, embarked on a four-month cross-country tour to promote tofu, miso and their books.[105] They bought a large, white Dodge van with 40,000 miles on it on which Aoyagi painted, in large, bold letters, "Tofu and Miso America Tour 1976-77." They filled the van with copies of their books home tofu-making kits based on designs from *The Book of Tofu* that included a mahogany forming box, a muslin pressing sack, cloths, a packet of natural nigari, and an instruction booklet. They sold the kit for $11.95.[106] (Their laden van caused them some anxiety at several points of their trip, as they hesitated leaving it parked unattended on city streets in New York and Baltimore.) They envisioned their mission as "trying to do for soyfoods what Johnny Appleseed did for apples," and they delivered 70 public programs – lectures and cooking demonstrations – for over 3,500 people in thirty-two states. Many of the events took place in natural foods co-ops, whose number had burgeoned over the last five years; their largest audience, 300 people, was at the Wedge Food Co-op in Minneapolis.

In appealing to these audiences, Shurtleff and Aoyagi plied the art of home-economics demonstration, as perfected by past demonstrators such as Jeanette McCay,

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[104] Soyinfo Center, "History of Tofu: A Chapter from the Unpublished Manuscript, *History of Soybeans and Soyfoods: 1100 B.C. to the 1980s* by William Shurtleff and Akiko Aoyagi," last modified 2007, 5 (www.soyinfocenter.com/HSS/tofu5.php); Lorna J. Sass, "A Couple on a Tofu Mission in the West," *New York Times*, 24 Sept. 1980, C3.

[105] Shurtleff and Aoyagi, *Erewhon*, 118-120. On a sad note, Shurtleff's beloved mother died of colon cancer in Berkeley on October 15 while the couple was halfway across the country holding an event at Famine Foods in Winona, Minnesota.

[106] Soyinfo Center, "History of Tofu," 5.

serving up tasty treats along with a steady patter of information. As Shurtleff explained in an interview in *Mother Earth News* conducted while they were visiting North Carolina – one of many radio, newspaper and magazine interviews they gave during the tour – "we serve the audience two or three kinds of dip, some deep-fried tofu, tofu burgers, and soy milk. And the reaction is always the same: people love them. And then they really become converts when they learn that eight ounces of tofu has as much usable protein as five and a half ounces of hamburger . . . but that the eight ounces of tofu contains only 147 calories, no cholesterol at all, and only a fraction of the pesticides and other harmful chemicals that are now found concentrated in all the animal protein we eat." The *Mother Earth* interviewer voiced skepticism, giving Shurtleff the opportunity to display his wares:

> MOTHER: But what about taste, Bill? Maybe we haven't been eating tofu all these years because we just don't like it.
>
> Shurtleff: Yeah, I'm glad you asked that. Because Akiko and I have brought along one of the tofu dishes we prepare whenever we give one of our talks. This is a sour cream dip with garlic and dill. Here, you can try it on this celery ... or on these wheat crackers or these potato chips.
>
> MOTHER: Boy! That's *really* good. I want some more of that.
>
> Shurtleff: And you're the guy who just asked me about the taste of tofu.
>
> MOTHER: OK, OK. I get your point. This is delicious. . . . This stuff is *great*. I'm going to eat it all. And while I'm doing that, Bill, please tell me about the tour you're on.[107]

[107] "Plowboy Interview: Shurtleff and Aoyagi."

Shurtleff and Aoyagi interspersed these events with stops at zen centers, where they meditated, and visits with prominent figures in the natural foods and vegetarian movements, including Francis Moore Lappe in her home in Hastings-on-Hudson. Shurtleff also gathered information, displaying even then a wide-ranging interest in the soybean: he visited the headquarters of the American Soybean Association in Hudson, Iowa; took a side trip to ADM and Staley in Decatur, Illinois; and visited food science departments and agricultural experiment stations in Urbana and Geneva, New York. At The Farm in Summertown, where the couple stayed for two weeks and where a speaking event went rather badly – "heavy confrontation with Farm folks," he noted in his log, "about how they didn't like my way" – he was able to work with Cynthia Bates on a 4-page pamphlet entitled, "What Is Tempeh?" This was the seed the later *Book of Tempeh.* He also completed the final draft of *The Book of Kudzu*, in which he sought to reclaim the reputation of a plant that, as it happened, Charles Piper had made great efforts to spread to American farmers in the same decade that he and Morse promoted the soybean, but which now was considered a noxious weed. As Shurtleff explained to *Mother Earth News*, "the starch which comes from its roots is the highest quality cooking starch in the world [and] an extract from those roots is a super medicine."[108] Like Piper, he would have more success promoting the soybean.

If the backbone of the Tofu and Miso Tour was provided by the circuit of macrobiotic and natural-foods shops, bookstores and distributors – which had developed prior to the publication of *The Book of Tofu* – it was a goal of Shurtleff and Aoyagi to help establish a new network, specifically of soy food companies, especially tofu shops. Their book had

[108] Ibid.

already inspired the creation of new enterprises, but they hoped to further the cause with a sequel that offered a blueprint for opening up viable businesses. They had a rough draft of *Tofu and Soymilk Production* with them on the tour and shared it with Richard and Kathy Leviton, the owners of the Corncreek Bakery in South Deerfield, Massachusetts, when they visited in early November. The Levitons, responding to demand for tofu from the bread accounts, joined with two other partners, rented a 1,000-foot shop in nearby Millers Creek, and equipped it with a stainless-steel industrial mixer for grinding the beans, 15-gallon stainless steel pots to cook the go, as well as a solid-oak cider press to extract the soy milk, hand-made oak curding barrels and forming boxes, and cedar soaking barrels (from a Maine lobster supply house), all of which gave the factory a rustic New England feel. Originally named the Laughing Grasshopper Tofu Shop, it started producing 300-1,000 pounds of tofu a week beginning in January 1977. It experienced a number of growing pains: the wooden equipment tended to warp and absorbed some of the curd, which then rotted; the drains clogged, the floors warped, the forming boxes fell apart, it took superhuman effort to hoist the pressing sacks into the cider press, and the town library, located in the same building, complained of the smell. “Only willpower and dedication kept us going,” one of the managers later remarked.[109]

Nevertheless, with demand strong, the company was producing 7,000 pounds a tofu a week by the beginning of 1978. By this time, they had incorporated under a new name, the New England Soy Dairy, and had moved to a new location in a former spray-nozzle factory, where they installed a pressure cooker system purchased from Japan. They upgraded the equipment again in the early 1980s, having secured $350,000 in loans, and

[109] Shurtleff and Aoyagi, “History of Tofu,” 6 (www.soyinfocenter.com/HSS/tofu6.php).

by 1982 produced almost 40,000 pounds of tofu a week. If this expansion belied strict adherence to their originally stated goal – of producing "high-quality natural nigari tofu in the traditional Japanese way using small-is-beautiful technology"[110] – it was an evolution that Shurtleff and Aoyagi anticipated in *Tofu and Soymilk Production*, the first edition of which was published in 1979. Shurtleff still extolled the traditional Japanese cauldron shop – "it still produces the most delicious tofu and has the most beautiful feeling of craftsmanship in the work" – but cautioned that it was only viable when a large proportion of the nearby population ate tofu regularly, allowing the tofu to be retailed directly from the store.[111]

The book offered advice for all scales of production, including small-scale "community or village" shops appropriate mainly for communes, but concluded that the best type for "middle-level commercial operation in the West" was what Shurtleff called the "Pressure-Cooker Plant" (which now represented almost half of the tofu shops in Japan itself).[112] Designed to produce up to 3,700 pounds of tofu per day, pressure-cooker plants used stainless-steal equipment – "wood is not generally allowed by health inspectors" – that could either come from Japan or, more commonly, be creatively assembled ("improvised") from U.S. suppliers.[113] Good results had been found with machinery used in fruit processing: Brown No. 2203 extractors, for instance, that could separate soy milk from okara as easily as pulp from fruit juice; and the Rietz Stainless Disintegrator, typically used for pulping fruits and vegetables, for grinding the beans,

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[110] Ibid.

[111] William Shurtleff and Akiko Aoyagi, *Tofu and Soymilk Produciton: The Book of Tofu, Volume II, A Craft and Technical Manual*, 2nd ed. (Lafayette, CA: Soyfoods Center, 1984), 35-36.

[112] Ibid., 55.

[113] Ibid., 55.

although electrically-powered stone mills were also suited for this scale of production.[114] Larger machinery was used at the next two scales of operation, the “Soy Dairy” and “Modern Factory,” to which Shurtleff devoted less space. Aoyagi took as much care in the illustrations as she had in *The Book of Tofu*, rendering complicated arrays of modern equipment, such as “carousel curding machines,” in clean but detailed black-and-white line drawings.

The first chapter of *Tofu and Soymilk Production* was devoted to sound business practices: such things as how to choose “a good location and area and estimating the market potential,” how to deal with “health inspectors, sanitation, safety, and standards,” and advise for “choosing a business name or logo” (examples of good choices were The Cow of China, The Soy Plant, and The Joy of Soy). He also included a section entitled, “Starting a Business and Right Livelihood,” which cautioned that six out of ten new businesses fail within five years, which could result in the “loss of all one’s savings, home, and even personal possessions,” and that being a business owner required stamina, maturity, creativity, and the willingness to make sacrifices. Nevertheless, “managing one’s own business can be a personally and financially rewarding experience for an individual strong enough to meet the test.”

If in his most radical days, Shurtleff had diverged from the ideals of his father and grandfather, he now reconciled these with the ideals of craft work. “We view money as a form of energy which, like other forms of energy should be treated with due respect and used creatively to accomplish worthwhile objectives. Profits are often the most accurate measurement of a business' success in accomplishing its objectives. . . . Individuals with

[114] Ibid., 63, 68.

a negative or disrespectful attitude toward money and profits . . . may both have a difficult and unpleasant time running a sound business and practicing Right Livelihood." When Blyth & Co. celebrated its fortieth anniversary in 1954, it had published a booklet crediting an "unseen but ever present ideal" and a commitment to "strict rectitude and honor in every phase of its dealing" for its success: "Napoleon said: 'The spiritual is to the physical as two to one,' and no enduringly successful business institution lives or can live by bread alone." Lawton Shurtleff cited his father's example of honorable business as ultimately convincing him that "business, capital, and wealth are not the dirty words of the New Deal, but are at the heart of our country's potential." For William Shurtleff, Right Livelihood could be practiced by businesspeople running larger enterprises, as well as small-scale craftspeople; in either case, "when the master becomes selfless, the tofu makes itself."[115]

Shurtleff would later summarize the core principles of the growing movement that he and Aoyagi did much to spark. Sometimes called soycrafters, sometimes soy dairies – which encompassed the tofu made from soy milk, although Shurtleff would also use "soy dairy" in a more restricted sense – these new "Caucasian-run plants" in North America outnumbered Asian tofu manufacturers by the middle of 1978 (although the latter produced the lion's share of the volume), whereas in 1975 there had been only 55 tofu makers in the United States, all Asian.[116] By 1978, they were numerous enough that Shurtleff and Aoyagi, along with Richard Leviton and others, founded the Soycrafters

[115] Ibid., 13; Shurtleff and Shurtleff, 196.
[116] Soyinfo Center, "History of Tofu," 6; William Shurtleff and Akiko Aoyagi, *The Soyfoods Industry and Market: Directory and Databook*, 5th ed. (Lafayette, CA: The Soyfoods Center, 1985), 48. By 1981, according to Shurtleff's later accounting, there were 173 U.S. tofu makers, Asian and non-Asian. Ibid., 52.

Association of North America.[117] Their principles helped distinguish soycrafters from the streams of soybean culture that preceded them. In contrast to most Asian tofu makers, who had switched to calcium sulfate as a curding agent, soycrafters used the traditional nigari, which also retained more protein in the tofu.[118] In contrast to the Adventists, who had originated many fake meats and were eager adopters of textured and isolated soy proteins when they became available, many soycrafters were critical of modern, artificially-flavored and colored meat analogs. They wondered why "go to all the trouble and expense . . . just to pretend you are eating meat, poultry, or fish, when soyfoods taste so much better . . . and are better for you in their traditional, natural form," which could moreover just as easily be made into tofu burgers, sloppy joes, whipped dressings or tofu cheesecake?[119]

Above all, soycrafters objected to the practices of the modern soybean industry, even as it made foods directly from soybeans rather than by way of livestock. They opposed the use of hexane extraction, principally because they did not trust assurances that the toxic hexane solvents had been thoroughly removed, but also perhaps because it violated the wholeness of the soybean – as the first cut in its division into numerous specialized commodities – in a way that the extraction of soy milk, with its connection to the holistic aura long enjoyed by mother's and dairy milk, did not. Likewise, it was also important that "soyfoods [be] enjoyed for themselves," rather "than simply as functional ingredients or extenders to be used in other products, or in extenders." Soycrafters "made foods, not products." Soycrafters were also committed to "appropriate technology," a concept popularized by E.F. Schumacher and Ivan Illich in the midst of the energy crisis that

[117] Sass, "Couple."
[118] Lorna J. Sass, "Soy Foods: Versatile, Cheap and On the Rise," *New York Times,* 12 Aug. 1981, C1.
[119] Soyinfo Center, "Soyfoods Movement."

emphasized smaller-scale technology that was less energy-intensive and more people-centered, rather than machines that might "deprive them of their work and craft which they genuinely enjoyed." Small-scale technologies were also the key to improving conditions in the Third World, the final commitment outlined by Shurtleff; as with Plenty's work in Guatemala, soy dairies could represent a bottoms-up approach to development that contrasted with that of international aid agencies, as well as provide Third World people with a "tasty source of low-cost protein."[120]

Commitment to such principles set the stage for tensions within the movement as it sought to grow in the 1980s: between holism and commercialism, and between craft and industrial production. As indicated by *Tofu and Soymilk Production*, Shurtleff and Aoyagi were not inclined to be purists. They emphasized that "conscientiously run factories – whose basic methods are completely natural and essentially the same as the smaller traditional methods – can produce excellent tofu" at a low price.[121] And while Shurtleff had been saddened by the displacement of traditional tofu shops in Japan by large factories which mass-produced tofu with stainless-steel, automated machinery – it wasn't "as good as the tofu made fresh each morning in the little shops" – he didn't judge the Japanese for proudly embracing the new technology. In the 1977 *Mother Earth* interview, he asked, "How can I criticize the Japanese for using factories to produce so much of the tofu that they now consume? At least they're eating mostly tofu instead of meat ... which means they're getting almost all their protein eight or ten times more efficiently than we're getting ours. How can I criticize a people that still has so much to

[120] Ibid.
[121] Shufteff and Aoyagi, *Tofu and Soymilk Production,* 35.

teach us?"[122] As he and Aoyagi set up the Soyfoods Center in their home in Lafayette to be clearinghouse for those interested in any phase of the soybean business in America – they never opened a tofu shop themselves – they hoped that tofu might become the next decade's yogurt, a commercial crossover from the health-food world, despite all of the contradictions that such success might entail.[123]

The Picture Bride

In 1910, a young Tsuru Yamauchi arrived on the shores of Hawaii seasick and homesick, trembling at the prospect of meeting her husband for the first time and resolving, once she had seen the barren landscape of the canefields, to return to her native Okinawa within ten years. She sent many of her children to school in Okinawa, and lived there again herself for four years beginning in 1919 while her husband remained in Hawaii. Even then, she found that the heat and mosquitoes now seemed oppressive when compared to her new home, and many of the friends she had longed to see had married and moved away. She last visited Okinawa in 1952, when the impacts of war made conditions even more miserable than she had remembered. "Everything appeared dirty and broken down," she recounted in an oral history recorded in 1981. "Our house was so small. Even cleaned up, it was like a chicken coop." Returning to Hawaii, she helped her homeland by sending money through the Okinawa Prefecture Club. But though her relatives would urge her to through the years, she never went back: "They had nothing in Okinawa." Tofu had helped her get over her initial homesickness and, decades later, helped her to create a comfortable life for herself. She worked at the tofu shop, helping

[122] "Plowboy Interview: Shurtleff and Aoyagi."
[123] Sass, "Couple"; Sass, "Soy Foods."

one of her sons, until 1959 when, in her late sixties, she devoted herself to passing the naturalization test despite her illiteracy. As a citizen, she was able to bring to United States the one child who did not already live there, a daughter who had moved to Micronesia when she married. This daughter ultimately moved to California, but Yamauchi was satisfied staying where she was in a way she could not conceived in 1910. "After 70 years I feel there's no better place than Hawaii. When we first came, we didn't think we could stay very long. But after all, the place one stays is the best. Everyone who comes back from Okinawa finds it is still depressed compared to Hawaii. Life is good here."[124]

If Hawaii was good to Yamauchi, California is where her son Shoan – one of three sons that went into the tofu business – found even greater success. Having purchased the Hinode Tofu Co. in Los Angeles, he introduced products common in Hawaii but as yet unfamiliar on the mainland: Chinese-style tofu, silken tofu, and deep-fried tofu pouches.[125] In 1958, he innovated further by packaging tofu cakes individually in plastic bags filled with water and sealed with a heat sealer, then placed in the white cartons with wire handles that during World War II had become widely used for Chinese takeout.[126] This step was spurred by a new regulation in Los Angeles requiring tofu to be sold in individual containers, but also led to Hinode marketing tofu in Boy's Market, the first supermarket chain to sell tofu. Yamauchi approached the Sealright Company to devise a waterproof plastic tray for his tofu deep enough to hold 28 ounces and capable of being

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[124] Tsuru Yamauchi, interview by Michiko Kodama, ed. Marie Hara, trans. Sandra Iha and Robin Fukijawa, in *Uchinanchu: A History of Okinawans in Hawaii* (Honolulu: Ethnic Studies Oral History Project, Ethnic Studies Program, University of Hawaii, 1981), 507-09.

[125] Soyinfo Center, "History of Tofu," 4 (www.soyinfocenter.com/HSS/tofu4.php).

[126] Before that, they had been used variously for shucked oysters, ice cream, other deli goods, and goldfish sold at carnivals. Jennifer 8. Lee, *The Fortune Cookie Chronicles: Adventures in the World of Chinese Food* (New York: Twelve, 2008), 140.

made by high-speed machines that met the challenge of heat-sealing containers brimming with water. The result, debuted in 1966, proved enduring and eventually iconic, despite drawbacks – printing was possible only on the top flap of the packaging – and even as competing forms of packaging later tried to edge them out.[127] In 1963, Hinode had bought out a competitor to become Matsuda-Hinode, the largest tofu manufacturer on the mainland.

Partly as a result of Yamauchi's aggressive marketing and innovative packaging, tofu gained a following among non-Asians several years before *The Book of Tofu*. In a 1968 newspaper article which reported that "although tofu is far from becoming an American household word, the number of Americans eating the product appears to be increasing, at least in the Los Angeles area," Yamauchi testified that "about 10 years ago, 95 per cent of our users were Japanese, with all purchases made in neighborhood stores. Now only about 50 per cent of all tofu customers are Oriental, and most chain stores sell it in their delicatessen sections." This resulted in sales of more than one million packages of tofu, a fifteen percent increase over the previous year. Low cost was cited as one reason for its crossover appeal, its "high protein content and digestibility" another, leading to its use in two area hospitals as a meat substitute for heart patients.[128] Los Angeles was also a center of Adventist food production, including tofu-like offerings, which may have prepared the market. Despite his early advantage in the mainstream market, however, Yamauchi was keenly aware that the new wave of interest in tofu among whites in the mid-1970s would revolutionize his business. While most Japanese tofu makers were indifferent or hostile to the soycrafter movement, Yamauchi was grateful. In the last leg

[127] Soyinfo Center, "Chronology of Tofu Worldwide: 965 A.D. to 1929 by William Shurtleff and Akiko Aoyagi," last modified 2001, www.soyinfocenter.com/chronologies_of_soyfoods-tofu.php.
[128] "Tofu is Good, Good For You," *Ada [OK] Evening News* [AP], 25 June 1968, 3.

of his Tofu and Miso Tour, in early 1977, William Shurtleff had dinner with Yamauchi before one of his presentations on tofu. In the parking lot afterward, Yamauchi handed Shurtleff an envelope full of cash, containing perhaps several hundred dollars, "his way of saying thank you for the work we were doing on behalf of tofu."[129]

In the arena of tofu, Yamauchi, the son of a picture bride, was in the position to welcome the descendent of New England Puritans as a newcomer.

[129] Shurtleff and Aoyagi, *Erewhon*, 120.

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