

Group 10: Alternative Lawns

Using Clover as a More Eco-Sustainable Alternative

Tag Words: grass, lawn, alternative, clover, sustainability, ecology, bees, apiculture

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Summary

Traditional grass lawns are costly, time-consuming, and not a sustainable, environmentally friendly option. Planting a White Dutch Clover (*Trifolium repens*) lawn as opposed to a traditional Kentucky Bluegrass (*Poa pratensis*) lawn reduces the fiscal and physical investment of lawn maintenance and promotes more sustainable practices, all while maintaining the green lawn appeal. This project investigates this lawn alternative, among others, and considers the advantages and disadvantages when compared to a traditional grass lawn. We have compiled our findings as a proposal to benefit Rutgers University and homeowners alike. We have created plans to implement clover lawns on both the engineering quad on Busch Campus and at Rutgers Gardens, which will make on-campus lawn maintenance more efficient while also educating the public about this alternative. Additionally, the project includes a start-up guide to planting a clover lawn to educate any interested individual who would like to grow such a lawn.

Video Link

<http://youtu.be/vD7Z0n-LNKI>

Section 1: The Traditional Grass Lawn

Grass lawns are a ubiquitous component of suburban society, often considered the “connective tissue” of neighborhoods. A well-maintained lawn acts as a symbol of status, with good lawns associated with good citizenship. Lawns also provide an open, natural space for children to play, dogs to run, and frisbees to be thrown. As one of the more “out there” ideas, it has been theorized that as a species, humans developed a penchant for open grassy landscapes that resemble the short-grass African savanna that were the setting of our early evolutionary history.

In most areas, it’s completely unnatural for a grass to stay green year-round. The maintenance of such a lawn is a constant struggle with the environment. To survive, grass lawns require a significant investment of time, effort, and money. They must be watered and mowed regularly and require potentially harmful pesticides, herbicides, and fertilizers. In the United States, there are about 50,000 square miles of grass lawns - about three times as much as there are of corn - making grass the largest nationally irrigated crop per surface area (Lindsey 2005).

Water Needs

Water is perhaps the most important natural resource on Earth. Considering that less than 1% of the water that covers the Earth’s surface is available for human use, it is extremely important that this resource be efficiently managed and not wasted. Water scarcity is a significant problem facing the world today, with decreasing freshwater supplies and consumption rates that are

increasing at twice the rate of the global population (“Water Scarcity”). Even in the United States, rivers and streams go dry as water is removed for irrigation, and the water table has dropped by hundreds of feet in many areas along the West Coast and The Great Plains (Lindsey 2005). It is superfluous to use copious amounts of such a precious resource on something as superficial as a lawn. According to the U.S. Geological survey, 7.8 billion gallons of U.S. water goes towards outdoor use, with the majority of it used in landscaping. This amounts to 30% of all water consumed in this country. In western states, where water is even scarcer, up to 70% of water use is estimated to be devoted towards landscaping. In a year, a single typical suburban lawn will consume 10,000 gallons of supplemental feed from a hose (Vickers 2001). To make matters worse, most homeowners tend to water in excess, exacerbating the already high water demands of the lawn. Installation of efficient irrigation and watering systems could mitigate this problem, but at a substantial monetary cost. The traditional home grass lawn is an obvious glutton in terms of water consumption.

Fertilizers

The application of pesticides and fertilizers, required by traditional lawn care techniques, is also an issue. Citizens of the United States apply almost eighty million pounds of pesticides and ninety million pounds of fertilizer to lawns and gardens annually. Suburban lawns and gardens receive 3.2-9.8 pounds of pesticide per acre, which is significantly greater than the agricultural average of 2.7 pounds of pesticide per acre (Pimental et. al 1991). These pesticides and fertilizers contaminate the soil and air while causing runoff that can leach into bodies of water and contaminate the drinking water supply. Nitrogen and phosphorus contained in these chemicals can also lead to eutrophication events, such as algae blooms, that have the potential to destroy entire ecosystems. The Gulf of Mexico experiences a yearly dying event where countless aquatic organisms die due to a flux of nitrogen that travels down the Mississippi and into the gulf. The use of these supplemental chemicals influences our larger ecosystems in a pronounced way.

Maintenance

Mowing the lawn isn’t just a chore; it’s a serious risk to the environment. The motorized equipment used for lawn care exudes emission of toxic exhaust and greenhouse gases and often relies on fossil fuels for energy. In a single hour, a gasoline-powered lawn mower emits as much pollutants as eleven new cars would in the same time frame. These emissions include volatile organic compounds and nitrogen oxides, both of which are serious threats to the natural environment (“Green Landscaping”). With a U.S. estimated 3 billion hours a year use of gasoline-powered lawn and garden equipment, there is a significant amount of toxic pollutants produced. Lawn mowing produces solid wastes as well. Grass clippings that are not composted end up in landfills and composted grass clippings that are contaminated with pesticides can be even more harmful to the environment (Lerner 2002). Mowing can eliminate plant habitat diversity and limit floral resources, both of which are important for insect populations.

Additionally, lawn mowers have a direct effect on insect mortality as slow moving adults and juveniles may not be able to escape the rotating blades (Black et al. 2011).

The maintenance of traditional lawns requires a significant investment of personal time, money, and effort. The average lawn owner in the United States spends between \$400 and \$700 a year on maintenance alone. As a whole, citizens spend around \$30 billion annually on lawn care, with the average individual spending forty hours a year maintaining their lawn.

Conclusion

The idealized image of a perfectly manicured lawn becomes tainted when the determinants involved in its care and maintenance are considered. The superfluous use of water, heavy application of toxic chemicals, emission of pollutants, destruction of habitat, and investment of personal time and effort are a high price to pay for a patch of grass. There are more sustainable lawn alternatives available, ranging from groundcover and ornamental plants to inorganic and synthetic options. Each lawn type, whether grass or an alternative, has their own advantages and drawbacks. Despite their differences, some may offer a preferred lawn experience that a property owner may not have previously considered.

Section 2: Clover as an Alternative

Low growing clover provides a similar lawn aesthetic, yet offers unique advantages over traditional grasses. Clover does not require herbicides to kill weeds because it outcompetes typical lawn weeds. Clover is nitrogen fixing; meaning it creates its own fertilizer which not only benefits itself but surrounding plants as well. Additionally, soil compaction, which leads to excess run-off and erosion, especially in the clay soils common to New Jersey, is reduced by the deep root system of clover. Compaction is a natural process in which drought and animal feet can compress layers of soil. Unlike most other soils, clay doesn't bounce back after it's compacted, making it more dense and difficult for plants and animals to penetrate. Clover also attracts bees, which is especially important when considering the recent decline in bee populations. Bees are reportedly responsible for pollinating 30% of the world's crops; the support of this species and rebuilding of bee populations is critical. Overall, clover lawns are an easy and effective way to promote agricultural sustainability.

Clover is often treated as weed, but it's a practical choice for lawns. Clover's surface is soft and comfortable to walk on and is recommended for low-to-mid traffic areas. On paper, it provides the same traffic rating as the common Kentucky Bluegrass (*Poa pratensis*), however clovers tend to be slightly more delicate than grass. Depending on the area, clover may also need to be reseeded every two to three years in order to maintain uniformity. Both of these issues can be resolved by mixing different species of clover together or mixing clover with traditional grasses. That being said, a variety of species is key to increasing the resilience of any plant, not just

clover. Clover is best seeded in the early spring with sawdust or dirt added to the seed for a more even seeding.

Other Alternatives

Other lawn alternatives are also available. Inorganic cover, such as pebbles and stones, offer a clean and uniform look, but requires frequent herbicide use to keep out weeds. It can also be expensive to lay out and equally expensive to pick up if renovations need to be made. Synthetic grass offers a mock lawn experience, but is expensive to maintain and, as with inorganic cover, is expensive to lay down and rip up. Moss has the lowest maintenance of the options stated thus far, but it tends to burn in direct sunlight and its shallow root system can cause it to shift if walked on during wet weather. Despite their flaws, these options might be more suited for certain environments and specific needs.

Alsike Clover

Alsike Clover (*Trifolium hybridum*) is a more durable hybrid of the common red and white species of clover (Figure 1, p.6). It can grow up to two feet high and its flowers range from red to white, but are generally pink. Although it is technically a perennial plant, its short life span often causes it to be treated like a biennial (Veterinary Medicine Library 2013). This particular species is more suited for wet, poorly drained areas (St. John 2008). Though considered a minor pollen species, Alsike clover is considered to be one of America's best honey plants, allowing bees to produce up to 500 pounds of honey from one acre. Alsike produces similar yields and quality of honey as White Dutch, but it is less far reaching nationally (Pellett 1920). This clover grows quite tall and when blended with other clovers, lawns can be more resilient against pedestrian or animal traffic.



Figure 1: Images of White Dutch Clover (Left) and Alsike Clover (Right)

White Dutch Clover

White Dutch Clover (*Trifolium repens*) is a perennial white clover that matures at about four to eight inches in height (Figure 1, p.6). It is the most popular species of clover for alternative lawns and mixed lawns alike. This clover tolerates shade and its root system is longer than most grasses, growing best in moist, fertile soils. One pound of seed will cover a 1000 square foot lawn, while four pounds per acre is recommended for beekeeping. It has a potential nitrogen production of 60 pounds per acre per year. This clover is best seeded in early spring or late summer and no soil tilling is required. White dutch typically blooms mid-March and tends to grow slower during the summer months. Bee colonies love white dutch and rarely produce less than 200 pounds of honey per colony (Pellett 1920). White Dutch Clover is widely available, requires low maintenance, looks great, and is a great lawn alternative.

White clover is often found in stores labeled as goose feed and deer attractant. White dutch is a type of white clover, but the clover used to attract animals is traditionally ladino clover. Ladino clover is a larger variety of white clover, and has been contested to be a completely different species from white dutch. The relative animal attractiveness of white dutch compared to ladino is still unclear, however, white dutch is expected to be as attractive to wildlife as traditional grasses.

Conclusion

There are currently 245 recognized species of clover, members of the genus *Trifolium*. Out of these varieties, alsike and white dutch are two of the most popular clovers when seeding alternative lawns and are often mixed together. For our purposes however, White Dutch Clover (*Trifolium repens*) presents the best option for an alternative lawn. Alsike is a great option that can be used to sustain honey production, but it's too tall and its lifespan is too short for our needs. Its short stature and resilience makes white dutch the most practical clover for the traversable, open space areas that our service projects require.

Section 3: Clover on Busch Campus, Rutgers University

As previously mentioned, traditional grass lawns are a critical element of the traditional vision of a friendly, suburban home. Often, individuals do not even consider the irrationality of the grass lawn - they continue to fertilize, spray pesticides, mow, water, and labor over their lawns. These practices are highly unsustainable while being unfriendly to both the environment and the budget. We plan to serve the community by providing a positive example to spread awareness and tools to help individuals follow this example. The implementation of a clover lawn on the campus of Rutgers University will not only be more sustainable for the university but also expose students to the idea of an alternative lawn. Similarly, a clover lawn at Rutgers Gardens will provide exposure to the public while also being useful to the gardens for pollination purposes. Finally, the project will include a start-up guide to planting a clover lawn to educate any interested individual who would like to grow such a lawn for their own home or elsewhere.

Current Lawn

The lawns at Rutgers University currently use a grass blend made up of primarily Kentucky Bluegrass (*Poa pratensis*). This is one of the most common grasses in the world and for good reason. It is highly resistant to heat, cold, drought, pests, disease, and is moderately priced at \$23 per pound, with one to two pounds needed to overseed 1000 sq. ft. of turf. Bluegrass requires more water and fertilizer than other cool grasses and is best planted in low-to-mid traffic areas. Seeded in spring, bluegrass is one of the longest living perennial grasses, but it can become thin and be outcompeted by weeds if not manicured (Wennerber 2004). Kentucky Bluegrass is a great choice as far as grasses go, but clover offers more benefits for the university.

Location

The Engineering Quad is the best place on campus to seed White Dutch Clover. The location, identified as red in Figure 2, receives a lot of traffic, but the traffic is largely confined to the sidewalks. Due to the numerous concrete paths and cut-throughs, there is no need to seed around student-made paths, like those often found on Cook Campus. The plot currently has no construction in progress and is approximately 1000 feet in width and 500 feet in length, when measured by its corners. Based on calculations by Google Earth, the marked area is 327,937.75

sq. ft., or 7.53 acres (Figure 2: p.8). The area's limited disturbance and high traffic makes the Engineering Quad an optimal place to plant White Dutch Clover, while also exposing passersby to its aesthetics.

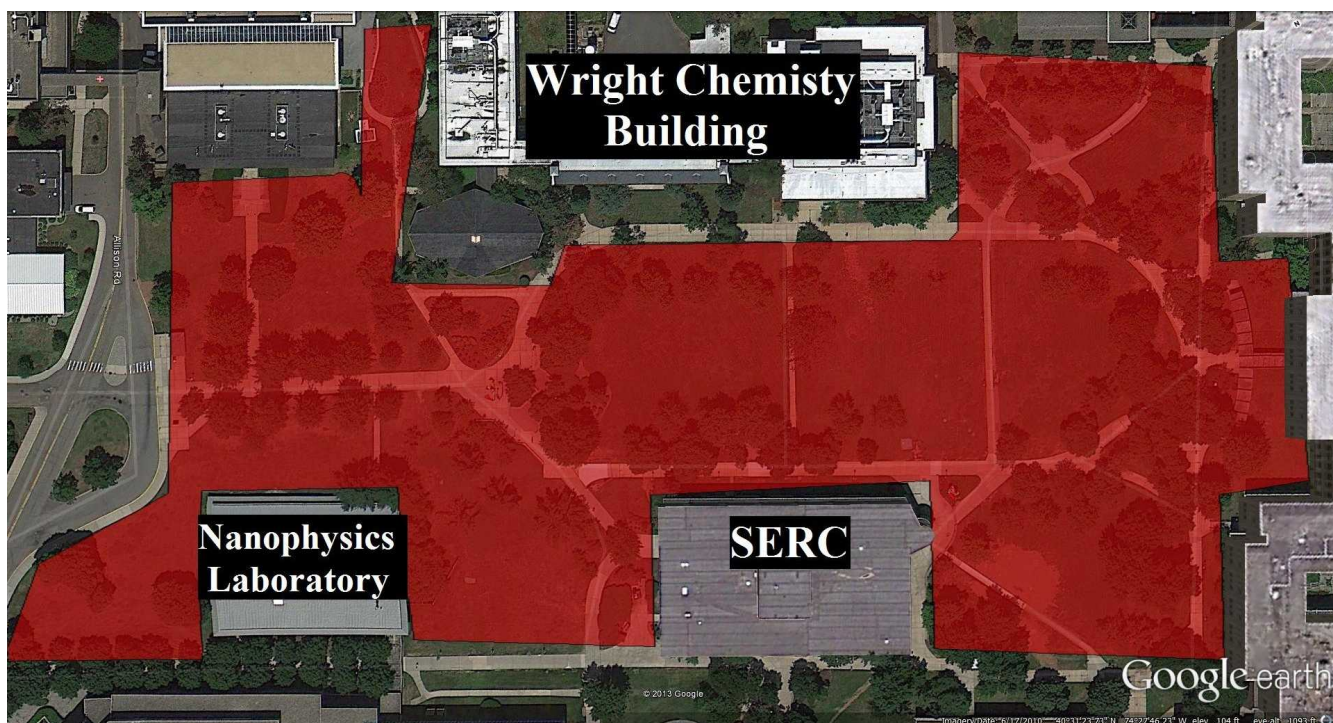


Figure 2: Top down view of the Engineering Quad area. Red represents the proposed area to overseed with clover.

Timeline of Implementation

Clover is best seeded in the early spring when temperature lows are at 40 degrees. Before seeding can take place however, the grass lawn must first be cut at the shortest possible mower setting. This step reduces competition, allowing the seedlings to thrive. The mow should be followed by a dethatcher to reduce the thatch and allow more opportunities for the seed to reach the soil. Only now is the White Dutch Clover seed ready to be spread. Clover seeds are smaller than grass seeds, so a little goes a long way. To reduce waste and provide a more even coating, mix 1 part seed with 10 parts soil when using a broadcast spreader. The spreader will bury the seed in the necessary $\frac{1}{4}$ in of soil, so no additional topsoil is necessary. After seeding, the soil needs to be watered regularly for 7 to 10 days to maximize seed production. Once germination is complete, watering can cease. The lawn should not be cut until the initial sprouts reach a minimum height of 4 inches.

As far as maintenance goes, there are some important points worth noting. Over time, clover will outcompete grass. This is completely normal as germination of Kentucky Bluegrass occurs 3 times slower than White Dutch Clover. When combined with clover's horizontal growth, it will

eventually push out grass as the dominant lawn cover. As the density of clover increases, mows should become less frequent. Assuming the grass lawn is mowed once a week, mows can be reduced to every other week due to the reduced grass population. If weeds become an issue, most broadleaf herbicides will kill clover in addition to the weed, so herbicides should be avoided. Clover can be cut shorter than grass, but, as with grass, shorter cuts will reduce its natural reseeding process. If buds are cut before they bloom, yearly over-seeding may be necessary. 4 inches is the recommended lawn height and clippings should not be bagged.

By simply seeding a clover lawn, Rutgers can expect to save \$146,250 for the seeding year. A comprehensive list of resource comparisons between grass and clover at the quad is shown in Table 1 (Appendix). An in depth cost comparison between grass and clover in the Engineering Quad is shown in Table 2 (Appendix).

Reducing bee attraction

Clover's tendency to attract bees has clear agricultural and ecological advantages, but it may not be desirable for a major campus. The health and safety of people with allergies and younger children is the primary concern, but bees can also be viewed as pests. Regardless of the reasoning, regular summer mows at 1.5 to 2 inches prevents clover buds from flowering and reduces bee density. It is highly recommended that flower buds be left to bloom in more isolated areas where the presence of bees are not be an issue. Bee populations desperately need the nectar that clover patches can provide.

Section 4: Clover at Rutgers Gardens

Rutgers Gardens would benefit from a clover field because clover is one of the preferred flowers of honey bees. During the warmer months, their flowers produce significant amounts of nectar that attract these bees. Bees attracted to clover gardens also benefit nearby plants that rely on animal driven pollination. According to Goulson et al. (2010), plants within 1 km of clover gardens are significantly more likely to be visited by bees than those without.

The natural surroundings of Rutgers Gardens provide an optimal habitat for bees. Windbreaks, caused by dense tree cover, provide less turbulent wind, allowing bees to fly and traverse more efficiently. The gardens also provide the variety of flower shapes and sizes and overlapping bloom times needed to maintain bee populations (Vaughan and Black 2006). The variety of flowering plants and the density of trees and shrubs at Rutgers Gardens would provide bees with a comfortable habitat to survive year round.

Decline of Bee Populations

It is still unclear as to the exact cause of the recent decline in bee populations. Colony Collapse Disorder (CCD) is a mysterious condition in which worker bees abandon the hive, leaving their queen, and those remaining in the hive, to perish. This condition was first noted in Europe, with current research suggesting that it was introduced to the North American species as a result of globalization. CCD, compounded alongside other factors such as habitat loss, parasites, and pesticide use, has led to serious economic and ecological consequences (Sperling 2009). The primary bees affected are honeybees, which are important for pollination in natural systems as well as of agricultural crops. One third of all human crops rely on honeybees for agriculture, with some crops relying entirely on these bees for reproduction (“Pollinator”). The fostering of bee-friendly habitats is critical to better support this precarious, pollinating population.

Timeline of Implementation

Currently we are working together with Rutgers Gardens to create a clover plan. Until the final location is realized, we’ve constructed a per acre resource and cost calculator to quickly generate an estimate as to the predicted gains by seeding White Dutch Clover. From those calculations, assuming honey yields are harvested from the local bees, an acre of White Dutch Clover can save Rutgers Gardens a total of \$6766 a year. A comprehensive list of per acre resource comparisons between grass and clover is shown in Table 3 (Appendix). An in depth cost comparison between grass and clover per acre is shown in Table 4 (Appendix). These per acreage tables can prove incredibly beneficial when applying clover to new locations as well.

Section 5: Clover at Home

For the home, we recommend over-seeding clover onto an existing lawn. This will result in a lawn that is a hearty mixture of clover and grass. To have a pure clover lawn, all of the existing grass would need to be torn up and this is outside the scope of most homeowners. The addition of the short growing, self-fertilizing, low maintenance, long living white dutch species will provide many of benefits of a pure clover lawn, with the durability of a grass lawn. This clover is best seeded from early spring to late summer, when the ground is thawed, and no soil tilling is required. White dutch typically blooms mid-March and tends to grow slower during the summer months.

See page 12, under Supplemental Materials, for an informative brochure designed with homeowners in mind.

Current Implementation of a Clover Lawn

At the moment, we are working with Professor Fagan to plant clover on her personal lawn in Bucks County, Pennsylvania. We intend to plant clover on a grassy plot during the spring months to document and publicize how it grows. We also intend to compare the cost of

maintenance between grass and clover to demonstrate how they compare. Having a genuine clover lawn testimonial, backed up by cost, resource, and personal experience comparisons, is just another effort to raise public awareness of alternative lawns.

Conclusion

When compared to grass, clover is an easy, cost reducing way to enjoy your lawn. It leaves more money in your pocket, is less of a hassle to maintain, and as a nice side benefit, is a more sustainable, resource prioritizing practice. When we think of sustainability, we tend to think in terms of large complex objects and technology. Businesses and homeowners are offered incentives to install expensive solar panels on their property and automobile manufacturers offer more hybrid and electric alternatives, for a price. These are steps in the right direction, but truly effective environment changers are going to occur when applied to deceptively smaller issues. Much like re-engineered water bottles and cloth grocery bags, alternative lawns represent a small change that can provide substantial gains. By providing an effective strategy for homeowners, nature lovers, and businesses, we intend to show that clover lawns are a smarter alternative than grass.

Supplemental Material: Introductory brochure for homeowners

Growing a Clover Lawn

LAWN PREPARATION & PLANTING

- 3. Plant between early spring and late summer.**
As long as the soil has thawed, you're ready to get started.

- 4. Cut grass to shortest mower setting.**
Less grass affords a greater opportunity for seeds to germinate after being planted.

- 5. Rake the grass to thin it.**
For this, we recommend you use a thatch rake, but a regular old leaf rake will work as well. For larger areas, power dethatchers are also available. Raking also helps reduce the thatch.

Thatch: a thick layer of living and dead material made of primarily the roots and stems of grass that impedes growth of new seeds.

- 1. Spread the seed.**

For small areas, it can be spread by hand, but larger areas should be seeded using a broadcast spreader, which allows for a more even distribution of seed.

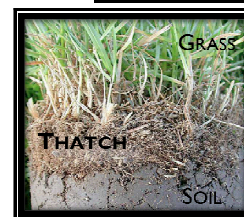
Tip for using a broadcast spreader:

1 part seed should be mixed with 10 parts sand, sawdust or compost. Clover seeds are smaller than grass seeds, so the filler ensures that the seed is spread out evenly across the lawn.

- 2. Water daily for 7-10 days.**
After the seeds are spread, the soil needs to stay moist for optimal germination. To maximize seed production, make sure the seeds are watered daily until the clover has sprouted.



Over-seeding cover onto an existing lawn will result in a lawn that is a hearty mixture of clover and grass.



Estimated Time Required

Mowing	1 hour/acre
Raking	2.5 hours/acre
Seeding	1 hour/acre

Other Materials

Lawn Mower
Dutch white clover seed
Hose or sprinkler



White Dutch Clover

YOUR GUIDE TO A NATURAL & LOW-MAINTENANCE LAWN



FOR ADDITIONAL INFORMATION

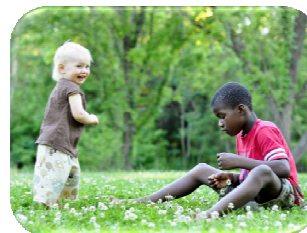
A **paper** covering this brochure can be found in:

Daniels, S. et al (2013)
Alternative Lawns: Using Clover as a More Eco-Sustainable Alternative.
<http://rucore.libraries.rutgers.edu/search:ggreat>

A **video** comparing clover and grass can be found at:
<https://vimeo.com/64557113>

An **editorial** expressing the benefits of clover lawns can be found at:
<http://haycockwildlifehabitat.wordpress.com>
search: white dutch

Benefits OF A CLOVER LAWN



- **Outcompetes weeds:** no pesticides required
- **Nitrogen-fixing:** naturally self-fertilizes and can grow in poor soil
- **Drought tolerant:** requires less water than grass to stay green
- **Resists pet urine**
- **Reduces soil compaction:** prevents run-off and erosion
- **Attracts bees*:** important for pollination of many native species

***NOTE:** regular summer mows at 1.5 to 2 inches prevents clover buds from flowering and reduces bee density

Appendix

Table 1: Estimated Yearlong Resources to Plant Kentucky Bluegrass and White Dutch Clover at the Engineering Quad

	Kentucky Bluegrass	White Dutch Clover
Seed	377 lbs. ¹	68 lbs. ²
Topsoil	0 cubic ft.	8 cubic ft.
Water	12,460,051 cubic ft. ³	6,820,017 cubic ft. ⁴
Fertilizer	1314 lbs. ⁵	0 lbs.
Pesticide	20 lbs. ⁶	0 lbs.
Overseeding Frequency	1	2
Mower Hours	66 hrs. ⁷	36 hrs. ⁸
Mower Fuel Consumption ⁹	66 gallons	36 gallons

Table 2: Estimated Cost for Kentucky Bluegrass and White Dutch Clover at the Engineering Quad

	Kentucky Bluegrass	White Dutch Clover
Seed	\$1520 ¹	\$300 ²
Topsoil ¹⁰	0	21
Water ¹¹	313,193	171,427
Fertilizer ¹²	1305	0
Pesticide ¹³	70	0
Labor ¹⁴	2583	1409
Total Variable Cost	\$318,671	\$172,421

Table 3: Estimated Yearlong Resources to Plant Kentucky Bluegrass and White Dutch Clover per Acre

	Kentucky Bluegrass	White Dutch Clover
Seed	50 lbs ¹	9 lbs ²
Topsoil	0 cubic ft.	1 cubic ft.
Water	326,700 cubic ft. ³	108,900 cubic ft. ⁴
Nitrogen Production	0 lbs.	60 lbs.
Total Fertilizer	175 lbs. ⁵	0 lbs.
Pesticide	2.7 lbs. ⁶	0 lbs.
Seed Depth	½ in	¼ in
Overseeding Frequency	1 year	2 years
Honey Production per Colony¹⁵	0 lbs.	16.7 gallons
Mower Hours	14 ⁷	10 ⁸
Mower Fuel Consumption⁹	14 gallons	10 gallons

Table 4: Estimated Cost for Kentucky Bluegrass and White Dutch Clover per Acre

	Kentucky Bluegrass	White Dutch Clover
Seed	\$190 ¹	\$35 ²
Topsoil¹⁰	0	4
Water¹¹	8212	2737
Fertilizer¹²	180	0
Pesticide¹³	35	0
Labor¹⁴	548	391
Potential Honey Yield¹⁶	0	-768
Total Cost (3/29 6:32)	\$9165	\$2399

¹ Amount and cost values are based on Kentucky Bluegrass - Midnight, sold at \$190 for a 50lb bag of seed, supplied by OutsidePride.com, Inc. <http://www.outsidepride.com/seed/grass-seed/bluegrass-seed/midnight-kentucky-bluegrass-seed.htm>

² Amount and cost values for White Dutch Clover seed, sold at \$150 for a 50lb bag and \$35 for 10lbs, were calculated based on values supplied by OutsidePride.com, Inc. <http://www.outsidepride.com/seed/clover-seed/white-dutch-clover-seed.html>

³ Kentucky Bluegrass yearly water intake calculated based on findings by Texas AgriLife Extension Service, Texas A&M. [System.http://aggie-horticulture.tamu.edu/archives/parsons/turf/publications/bluegrass.html](http://aggie-horticulture.tamu.edu/archives/parsons/turf/publications/bluegrass.html)

⁴ White Dutch Clover yearly water intake calculated based on information provided by Outsidepride.com, Inc. http://www.outsidepride.com/resources/planting/clover_instructions.html

⁵ Kentucky Bluegrass fertilizer requirement provided by Seedland, Inc. <http://www.bluegrasses.com/maintenance/>

⁶ Kentucky Bluegrass pesticide value based on Pimentel et al. 1991.

⁷ Kentucky Bluegrass mowing hours are based on calculations by Landscape Calculator. The assumptions are that the mower is 5 feet in width, is moving at a speed of 7 mph, and the lawn is mowed every week for a total 30 weeks. Also included as constants are the short cut preparation period, power thatching period, and over seeding period, totaling out to be 6 hours. The estimated rate is 3.82 acres mowed per hour.

<http://www.landscapecalculator.com/calculators/mow>

⁸ White Dutch Clover mowing hours are based on calculations by Landscape Calculator. The assumptions are that the mower is 5 feet in width, is moving at a speed of 7 mph, and the lawn is mowed for a total of 15 weeks. Also included as constants are the short cut preparation period, power thatching period, and over seeding period, totaling out to be 6 hours. The estimated rate is 3.82 acres mowed per hour. <http://www.landscapecalculator.com/calculators/mow>

⁹ Fuel consumption rates are based on the assumption that a commercial lawn mower consumes fuel at a rate of 1 gallon per hour. This value was the average of several testimonials. <http://www.lawnsite.com/showthread.php?t=103815>

¹⁰ Soil price was calculated using Scotts 0.75 cu. ft. Premium Topsoil, provided by The Home Depot U.S.A. Inc. Pounds were converted into cubic feet under the assumption that 1 cubic foot of topsoil is 85 pounds, an averaged value based on professional experience.

<http://www.homedepot.com/p/t/100619053?catalogId=10053&langId=-1&storeId=10051&N=5yc1vZbx76Z1z0w0fi&R=100619053#.UVX5Mhzvv-w>

¹¹ Water prices are based on non-exempt industrial rates provided by New Jersey-American Water Company, Inc. Base charges are not included in their rate of \$2.51358 per 100 cu ft. Cost values assume that there is no rain over the course of the year.

http://www.amwater.com/files/2012%20PWAC%20PSTAC%20Tariff_Final%20Stipulated%20Rates.pdf

¹² Fertilizer cost was calculated based on Pennington Lawn Food Fertilizer, sold at \$45 for 46 lbs., provided by Seedland, Inc.

http://www.seedland.com/mm5/merchant.mvc?Screen=CTGY&Store_Code=Seedland&Category_Code=FERT-453284#.UVShrRzvv-w

¹³ Pesticide expense is based on Monterey Once-a-Year Insect Control, available by The Home Depot U.S.A. Inc. for \$35 per 128 oz. bottle. We assume that 1 oz. of fluid is equal to 1 oz. of weight and ignore the cost of pump canisters.

<http://www.homedepot.com/p/t/202043625?catalogId=10053&langId=-1&storeId=10051&N=5yc1vZc5uqZ1z0w0lj&R=202043625#.UVYIcBzvv-w>

¹⁴ There is a contractor rate, based on Homewyse's Job Cost Calculator, that is assumed to be \$39.13 for every hour. We've taken this to assume it includes fuel, labor, and repair costs. The 16.7 values are multiplied by the total number of mowing hours.

http://www.homewyse.com/services/cost_to_mow_lawn.html

¹⁵ Honey production values are based on White Dutch Clover (Pellett 1920). Pounds were converted into cups assuming 1.33 cups are present in one pound. Cups were then converted to gallons.

¹⁶ Honey yield is based on the assumed value of \$46 per gallon for raw, unprocessed clover honey. The price has been set by the family run New Bee'n Farm. Ignored are maintenance fees.

<http://mysite.verizon.net/vzeyevlm/theschwandtfamily/id17.html>

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Additional Material

- An article by the EPA discussing water-efficient landscaping.
http://www.epa.gov/WaterSense/docs/water-efficient_landscaping_508.pdf
- A Beyond Pesticides article examines health risks associated with pesticides.
<http://www.beyondpesticides.org/lawn/factsheets/facts&figures.php>
- University of Minnesota article examing ways to grow a bee lawn.
<http://blog.lib.umn.edu/efans/ygnews/2012/03/a-bee-lawn-how-to-have-an-inse-1.html>
- University of Michigan article explaining how to plant alternative lawns.
http://www.lsa.umich.edu/mbg/files/DIY_Alternative_Lawns.pdf
- Washington State University on Lawn Alternatives.
http://clark.wsu.edu/volunteer/mg/gm_tips/Lawnalt.html
- An article by The Week discussing grass lawns.
<http://theweek.com/article/index/216592/blades-of-glory-americas-love-affair-with-lawns>

Letters to the Editor

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Clover lawns beneficial

Column

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Posted: Tuesday, March 26, 2013 12:00 am

By Steven Daniels | 0 comments

A well-maintained lawn is part of the American dream. It's a symbol of the suburban lifestyle, and it shows off the property owner's control over nature. A green lawn is a constant battle with the environment, but it doesn't have to be. Clover is a low-maintenance alternative lawn that retains the green lawn aesthetic, without infringing on your wallet or your weekend while benefitting the environment.

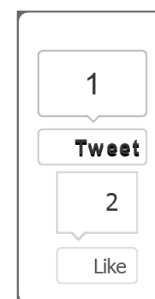
Unlike commercial grasses, clover doesn't require excessive resources. It produces its own fertilizer. Normal grass fertilizers wash away during the first rain shower. Materials purchased for that lawn are essentially being flushed down the drain. Much of that sewer water then ends up in the local water supply, encouraging bacteria to grow and suffocate fish populations. By using clover, you can save money on your lawn while also befriending the local wildlife.

Clover needs very little water to survive. Often referred to as a weed, clover is extremely resilient to seasonal changes. It can survive both flood and drought and stays green while doing it. Clover is like the camel of lawns — effectively holding moisture, but without the whole spitting-on-tourists thing. The plant's toughness means that it doesn't have to be watered by property owners to look great. Without a sprinkler, you can save money on water and save our most essential natural resource.

Clover lawns require less frequent mowing than a traditional grass lawn. While grass grows vertically, clover grows laterally. This means you can expect fewer cuts per year and less spotty coverage with clover. Fewer cuts not only reduce budgets spent on gas, bags and repairs, but something even more valuable: time. With that extra time, a homeowner might actually be able to appreciate the lawn they've sculpted by playing catch or relaxing in the shade.

Compared to grass, clover is an easy, cost-reducing way to enjoy your lawn. It leaves more money in your pocket, is less of a hassle to maintain, and as a nice side benefit, is a more sustainable practice. When we think of sustainability, we tend to think in terms of large complex objects and technology. Businesses and homeowners are offered incentives to install expensive solar panels on their properties, and automobile manufacturers offer more hybrid and electric alternatives, for a price. These are steps in the right direction, but truly effective environmental changes will occur more subtly. Much like re-engineered water bottles and cloth grocery bags, alternative lawns represent a small change that can provide substantial gains.

Steven Daniels is a School of Environmental and Biological Sciences senior majoring in marine sciences.



Considering Clover

Sent to EnviroPolitics on April 9, 2013, Asbury Park Press via yourviews@app.com, and published by Haycock Community Wildlife Habitat on April 19th, 2013 at <http://haycockwildlifehabitat.wordpress.com/2013/04/19/using-clover-as-an-eco-sustainable-alternative-lawn-by-kelsey-noll/>

By Kelsey Noll

A picturesque green grass lawn is associated with the suburban dream; it is a symbol of status and good citizenship. However, the maintenance of such a lawn is incredibly timely and costly, not to mention completely unnatural and harmful to the environment. The required input of resources to maintain a green lawn, especially throughout the entire year, is quite large. Watering, pesticide and fertilizer application, and mowing all place a significant time and financial burden on the homeowner while polluting the environment through run-off and toxic emissions.

Foregoing the traditional grass lawn in favor of a more sustainable alternative can alleviate these burdens. Clover is an excellent alternative choice for a lawn; though traditionally considered a weed, clover has many properties that make it ideal for lawn coverage. Its ability to outcompete other species means that herbicides need not be applied. It is also nitrogen-fixing, and therefore does not require additional fertilizer application. Clover is drought resistant, meaning it requires minimal watering to stay green. The deep root system of clover helps alleviate soil compaction, a problem that causes run-off and erosion.

The species recommended for a homeowner looking to grow his or her own clover lawn is white Dutch clover. This species is a perennial plant that grows to four to eight inches in height, with long roots that grow in moist, fertile soil. One of the interesting benefits of growing this breed of clover is that its pollen attracts honey-producing bees. While bees may be considered a nuisance to some, they are an incredibly important species that is currently in danger due to colony collapse disorder. One can support this at-risk species by maintaining a clover lawn. However, for the homeowner that would prefer to not attract bees, more regular summer mowing will keep them at bay.

Any homeowner should consider planting a clover lawn over their traditional grass lawn. The planting process is easy, as clover can be seeded over an existing lawn to create a durable grass-clover blend that has many advantages over a traditional lawn. The new clover lawn will require significantly less input of time and resources, making life easier for one's schedule and budget while also serving the environment.

2013 Rutgers Energy Innovation Contest Cover Page: Submitted on April 1st 2013 via email to bea@marine.rutgers.edu

Alternative Lawns:
Using clover as an eco-sustainable alternative to grass



Total Number of Pages: 9 (15 including supplemental materials, an Appendix, and references)

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Summary:

Traditional grass lawns are costly, time-consuming, and not a sustainable, environmentally friendly option. Planting a White Dutch Clover (*Trifolium repens*) lawn as opposed to a traditional Kentucky Bluegrass (*Poa pratensis*) lawn reduces the fiscal and physical investment of lawn maintenance and promotes more sustainable practices, all while maintaining the green lawn appeal. This project investigates this lawn alternative, among others, and considers the advantages and disadvantages when compared to a traditional grass lawn. We have compiled our findings as a proposal to benefit Rutgers University and homeowners alike. We have created plans to implement clover lawns on both the engineering quad on Busch Campus and at Rutgers Gardens, which will make on-campus lawn maintenance more efficient while also educating the public about this alternative. Additionally, the project includes a start-up guide to planting a clover lawn to educate any interested individual who would like to grow such a lawn.

2013 Rutgers Energy Innovation Contest Poster

Steven Daniels and Kelsey Noll
Julie M. Fagan, Ph.D.

CLOVER LAWNS

A sustainable alternative to traditional grass



RESOURCE CONSUMPTION AND COST COMPARISON: CLOVER VS. KENTUCKY BLUEGRASS

	Kentucky Bluegrass		White Dutch Clover	
	Resource Use	Cost	Resource Use	Cost
Seed	50 lbs	190	9 lbs	35
Topsoil	0 cubic ft	0	1 cubic ft	4
Water	326,700 cubic ft	8,212	108,900 cubic ft	2,737
Nitrogen Production	0 lbs		60 lbs	
Total Fertilizer	175 lbs	180	0 lbs	0
Pesticide	2.7 lbs	35	0 lbs	0
Seed Depth	1/2 in		1/4 in	
Overseeding Frequency	1 year		2 years	
Honey Production per Colony	0 lbs		16.7 gallons	
Mower Hours	14		10 ⁵	
Mower Fuel Consumption	14 gallons		10 gallons	
Labor		548		391
Honey Yield		0		-768
Total Cost		9,165		2,399

Table 2: Estimated Yearlong Resources to Plant and Cost to Maintain Kentucky Bluegrass and White Dutch Clover per acre

BENEFITS FOR AND OF BEES

- Bee populations have declined due to the mysterious Colony Collapse Disorder
- Honeybees are ecologically important as pollinators and are attracted to clover
- Plants near clover are significantly more likely to be visited and pollinated by bees

CLOVER ON BUSCH

PROPOSED LOCATION: ENGINEERING QUAD

- Approximately 330,000 ft²
- Traffic confined to footpaths
- High visibility for public awareness

REDUCING BEE ATTRACTION

- Bees may not be desirable on campus
- Regular summer mows at 1.5-2" prevent buds from flowering, lowering the attraction of bees

SUMMARY

Traditional grass lawns are costly, time-consuming, and non-sustainable. White Dutch Clover lawns are an environmentally-friendly alternative that require less input of both time and resources. We propose to implement clover lawns on Busch campus at Rutgers University and at Rutgers Gardens to make on-campus lawn maintenance more efficient while educating the public.

BACKGROUND

GRASS LAWNS

- Require significant input of resources as well as time.
- Suburban lawns consume 10,000 gallons of supplemental water feed annually.
- Every year, 80 million pounds of pesticides and 90 million pounds of fertilizer are applied to lawns in the US.
- Motorized mowing equipment produces 11x the amount of emissions as driving a car per hour.
- Grass clippings that are not composted end up in landfills, and pesticide-contaminated clippings can be more harmful if composted.
- The average US homeowner will spend 40 hours and \$400-700 annually on lawn maintenance.

CLOVER LAWNS

- Less time and resource consuming.
- Outcompetes weeds: no pesticides required
- Fixes nitrogen: no fertilizer required
- Drought tolerant: requires less water than grass
- Reduces soil compaction: prevents run-off and erosion
- Resists pet urine
- Attracts and supports bees



CLOVER AT RUTGERS GARDENS

BEE HABITAT: Rutgers Gardens provides an optimal bee habitat. Tree cover provides windbreaks and the variety of flowers, with overlapping bloom times, helps maintain the bees.

COMMUNITY AWARENESS: The proposal includes the planting of a clover lawn at the gardens along with an informative bulletin to educate the public about clover.



ACKNOWLEDGEMENTS

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