A3958

Organic and reduced-risk lawn care

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People who wish to move in the direction of creating an organic lawn, or what some people call a natural lawn, have two options: organic lawn care or reduced-risk lawn care.

An **organic lawn care** program uses only natural products and no synthetic chemicals. A **reduced-risk lawn** care program is not quite so strict in its adherence to purely natural products, for it relies also on pesticides when necessary, though only on pesticides that meet the criteria of the Environmental Protection Agency's (EPA's) reduced risk or minimum risk programs. These reduced-risk pesticides are often derived from natural organisms such as plants, bacteria, and fungi. According to the EPA, products classified as reduced-risk are typically used at lower rates than other pesticides, are less toxic to nontarget organisms like birds and fish, less likely to cause groundwater contamination, and less likely to endanger human health.

Techniques for growing an organic lawn are quite different from those used to grow a conventional lawn, and somewhat more complicated and expensive. This is because conventional lawn care relies on a full range of chemicals unavailable to the organic grower, including synthetic pesticides certified by the Environmental Protection Agency as safe because they pose only a low-level risk to humans and the environment.

But safety and risk are relative, and many people feel that conventional pesticide use on lawns is unacceptable no matter how low the risk to human or environmental health. As a result, interest in growing organic lawns—despite the scarcity of scientific information on how to do it—is increasing.

In making suggestions for growing an organic lawn we have adhered to the U.S. Department of Agriculture's standards for production of organic food, for there are no generally accepted standards for production of organic nonfood crops such as turfgrass. We have recommended only compounds listed in The Organic Foods Production Act (www.ams.usda.gov/AMSv1.0/nop). Unfortunately, most products listed there are of little or no use for turf management.

Organic lawn care

Navigating the sea of possible organic lawn care plans and coming up with a workable one is made difficult by a number of obstacles, including the lack of any single set of comprehensive standards for organic production of lawns, the relative scarcity of organic products tested for production of nonfood crops, the vast array of products claimed to be useful in organic production, the conflicting evidence as to their efficacy, and the numerous agencies regulating or authenticating them.

The United States Department of Agriculture (USDA) has established a set of guidelines for organic food production, but no guidelines for nonfood commodities like turf and ornamentals. The Organic Materials Review Institute (OMRI), a nonprofit entity that reviews products for possible use in organic food production, lists more than 2,100 fertilizers, pesticides, and other products, but few of these are appropriate for lawn use.

The EPA exempts from its registration requirements certain minimum risk products derived from natural substances, but even these do not always meet the organic standard. For instance, one such product is corn gluten meal, often recommended as both a fertilizer and as a pre-emergent herbicide for organic turf production. But most brands of corn gluten meal are produced from genetically modified corn, and under USDA guidelines these

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are not allowed for use in organic food production.

Another obstacle is that in Wisconsin all pesticides must be proven to meet the claims of the vendor in order to be legally sold. The result is that many products listed as derived from natural products by the EPA, or certified as organic products by the OMRI, cannot be sold in Wisconsin because they have not been shown scientifically to meet the seller's claims.

The complications that can be encountered are epitomized by a product called Bio Herb. It is listed by OMRI as an organic herbicide and fertilizer, but it is not approved for sale in Wisconsin as an herbicide. It can, however, be used as a fertilizer in Wisconsin—but the application rate recommended by the manufacturer exceeds the nitrogen level deemed safe for protection of water by the Wisconsin Department of Natural Resources. An application of Bio Herb intended as a fertilizer would be legal for a homeowner to use on less than five acres, but illegal to use on an area over five acres in size.

Organic lawn soil preparation

Healthy soil is the foundation of a healthy lawn. Ensuring that soil is healthy is the most important component of any turf management program—and is especially important for organic lawns. Without a deep, loose, rich soil containing plenty of organic matter, turf roots will not thrive. Poor soil will lead to chronically unhealthy turf and will give weeds a competitive advantage, for many weeds are successful precisely because they are able to thrive in poor soil. In addition, turf weakened by poor soil will be susceptible to damage by diseases, insects, drought, heat, cold, and traffic.

When preparing a new site for an organic lawn, use large quantities of high quality topsoil containing lots of silt (more than 50 percent) and not much clay (less than 10 percent). The Plant and Soil Analysis Laboratory at the University of Wisconsin-Madison can determine the sand, silt, and clay content of your soil for a small fee. Loosen the subsoil mechanically to alleviate compaction caused by construction or other activities. If the site is poorly drained, install drain tile in the subsoil to keep the water table well below the surface. Put at least six inches of topsoil over the subsoil and take care not to compact it. Natural settling of the soil surface will occur and should be planned for.

Soils of already-existing organic lawns should be core-cultivated at least twice per year, and cultivated even more often if traffic is heavy and if turf growth is poor due to compaction. The deeper the cores, the better. Many commercial core cultivation units penetrate only a few inches, but deep tine cultivation units are available which can penetrate up to eight inches. The cores can be left on the soil surface to decompose. More information is available in *Lawn Aeration and Topdressing*, University of Wisconsin Extension bulletin A3710.

Applying compost once in the spring and again in the fall each year will improve the soil's physical and chemical properties over time. As much as one inch of compost can be applied on top of the grass at a time. Choosing high quality compost is important (see table 1 for a list of the most important properties and optimum levels of compost). Some composts contain undesirable levels of salts, metals, or mineral matter that can actually harm the soil. If applying compost derived from manure, supplemental fertilization will not be required, while composts derived from yard waste tend to be nutrient poor, and supplemental fertilization would be beneficial to maintain turf density. For more information, see *The Art and Science of Composting* (www.cias.wisc.edu/wp-content/uploads/2008/07/artofcompost.pdf).

Table 1. Ideal compost properties and how to test for them.

Compost property	Optimum	How to test
Organic matter content	More than 45%	Have organic matter content tested by a soil lab.
C:N ratio	10–25:1	Have C:N ratio tested by a soil lab.
pH	6.0–8.0	Have pH tested by a soil lab.
Soluble salts	Less than 1.0 dS/m	Have soluble salts tested by a soil lab.
Phytotoxic compounds	So few as to allow greater than 50% germination	Plant ten seeds in a small pot and observe germination.
Weed seed content	No or few weed seeds	Keep compost moist and observe any weed growth.

Organic lawn establishment

Lawns that fail often do so because the environment is poorly suited to the grass being grown. Grasses require full sun for optimum growth, although some grasses do better in shade than others. For example, fine fescue is preferred over Kentucky bluegrass for shady areas. However, fine fescue may still weaken or be overtaken by weeds because of too much shade, or because tree and shrub roots are competing with the grass for water and nutrients. In Wisconsin, Kentucky bluegrass or fine fescue are usually the best lawn choices for full sun. For help choosing the right species or cultivar for shaded areas, see University of Wisconsin Extension bulletin A3700, *Growing Grass in Shade*, or visit your county extension office. Keep in mind that the best choice might be a non-grass ground cover.

Organic lawns established from seed are at risk of being overrun by weeds, for there are no effective pre- or post-emergent natural or organic herbicides that will selectively prevent or remove weeds in turfgrass stands.

To ensure the least possible amount of weed infestation, seed a lawn in August or early September, when weed seed is least likely to germinate. Fast-germinating species such as perennial ryegrass or tall fescue will reduce the possibility of weeds taking over the site, but both of these species are likely to die out over time and will need to be reseeded. Alternatively, they may be mixed at time of seeding with Kentucky bluegrass and fine fescues. Follow all steps for establishing turfgrass as described in University of Wisconsin Extension bulletin A3434, *Lawn Establishment and Renovation*.

Organic fertilizers derived from poultry manure are useful starter fertilizers to apply at the time of seeding. Once the grasses begin to germinate, begin mowing at a height of two inches. As the grasses start to fill in over the next several weeks, raise the mowing height to three inches. Mowing will eliminate many weed species and can stimulate grass growth.

Should the establishment fail, two nonorganic options may be considered—but if they are used, the lawn won't be truly organic. If broadleaf weeds have taken over the area, consider making a one-time application of a conventional or reduced-risk herbicide with selectivity for broadleaf weeds. Once the lawn is well established and weeds have been controlled, you may begin the organic program. A second option is to sod the area. It is unlikely you will be able to find organically-grown or reduced-risk sod, but starting a lawn with weed-free sod will minimize weed invasion for a longer time than if the lawn were seeded.

The best way to implement a successful organic turf care program is to begin with a healthy, dense, weed-free stand of turf. Organic practices preclude the use of chemical pest control, so eliminating weeds will rely heavily on pulling them by hand or on renovating weed-infested areas. One helpful weed control tactic is to keep the turf canopy dense by properly using organic fertilizers. The OMRI list contains some fertilizers appropriate for turf (though many on the list are unsuitable). The OMRI list of fertilizers can be found at www.omri.org/sites/default/files/opl_pdf/crops_category.pdf.

Organic lawn mowing and watering

The set of practices most important for success in organic or natural turf care starts with the lawn mower.

Mow grass as high as possible, usually three to four inches, and allow the clippings to fall back into the lawn in order to recycle nutrients and reduce the need for fertilizer. Follow the one-third rule: do not remove more than one-third of every grass blade at one time. Removing more will cause substantial stress to the stand and create an opportunity for pest encroachment. Make sure the mower blade is very sharp. Mowing creates a wound on every blade of grass, but a sharp blade creates a faster-healing wound. Most mower blades can be replaced or sharpened for less than the cost of a single bag of fertilizer.

Irrigate to prevent dormancy. When turfgrass experiences a severe water shortage, the plants enter a dormant state. Leaves stop growing, often die, and weeds are likely to grow. When footprints persist for several minutes after walking on the lawn, apply about one inch of water to the lawn and repeat this process weekly until rains return. For more information on proper watering practices, see University of Wisconsin publication A3950, *Watering Your Lawn*.

Organic lawn fertilization

Proper fertilization is critically important to a successful organic turf management program. Keep the turfgrass dense by fertilizing properly with organic fertilizers. A variety of organic fertilizers and compost are widely available from small local producers. Several national fertilizer companies offer organic fertilizer. Nitrogen (N) is usually the nutrient most needed for turf growth. The percentage of N in the fertilizer is indicated by the first number on the container; the other numbers represent the amounts of phosphorus and potassium (N-P-K). For most applications, choose a product with a large amount of N and with as little P as possible.

Avoid fertilizers made of biosolids or derived from sewage sludge, for they do not meet USDA organic standards.

Only 25 to 50 percent of nitrogen in organic fertilizers will become available to plants in a two-year period. For conventional fertilizers the proportion is usually 80 to100 percent. This means that in order to equal the effect of one pound of nitrogen applied through a conventional fertilizer, roughly two pounds of nitrogen must be applied through an organic fertilizer. After several years of organic applications—usually three to five years—organic matter levels will have built up in the soil and will serve as a nitrogen reservoir for the turf. At that point organic nitrogen application rates can be reduced by 50 percent.

A major difficulty in large-scale organic fertilization is storing and handling the large quantity of fertilizer required for success. Organic fertilizers usually contain five times less total nitrogen than inorganic fertilizers, and up to twenty times less *available* nitrogen, which means that applications requiring 50 pounds of inorganic fertilizer may require 1,000 pounds of organic fertilizer.

Another problem: most organic fertilizers cost significantly more than their inorganic counterparts, although rising production costs for inorganic fertilizers are likely to reduce this difference in years to come.

Organic weed control

There are very few weed control pesticides that comply with USDA organic standards. All USDA-approved organic weed control products are nonselective, meaning they will kill turfgrass as well as weeds. The same is true of all weed control products listed by OMRI.

Common organic weed killers include products containing seven percent or less of acetic acid (vinegar). When acetic acid comes in contact with plant tissue, it causes the leaves to die. Most of the time, the plant recovers and new leaves grow back after a few weeks. Higher concentrations of acetic acid are more effective but are not allowed for organic production (but they are allowed for reduced-risk programs). Other organic weed killers may contain soaps or plant oils which cause plant leaves (including grass leaves) to die back, leaving a dead spot in the lawn where the product was applied.

Corn gluten meal has been shown to be somewhat effective as a pre-emergent herbicide, but it only controls germinating weed seeds and will not harm existing plants—making it most useful as a crabgrass preventer. Also, although sources of organic corn gluten meal can be found, most sources supply corn gluten meal made from genetically modified corn, and this is disqualified for use in growing organic crops. If an organic source of corn gluten meal is found, and if it is registered as an herbicide in Wisconsin, it should be applied according to label directions (usually 10 to 20 pounds per 1,000 square feet). Little other information exists on the effectiveness of organic weed control products for use on turf. Products approved for use in Wisconsin may be checked at www.kellysolutions.com/wi/pesticideindex.asp.

Organic insect control

Few options exist for controlling insects organically in a lawn. These few include naturally derived products, synthetically produced products that mimic natural products, and living organisms. Available products include azadirachtin (derived from neem tree seeds), pyrethrum (derived from the chrysanthemum plant), spinosad (derived from a soil-dwelling bacterium called *Saccharoplyspora spinosa*), *Bacillus popillia* (derived from bacteria), and entomopathogenic nematodes, which are living organisms (worm-like creatures) that enter into insect pests, reproduce, produce destructive bacteria, and ultimately kill their host. The effectiveness of these products varies and the cost can be shocking. It is important to accurately identify the pest before implementing a control strategy. If you believe you have an insect problem, have the insect identified by the Insect Diagnostic Lab at the University of Wisconsin-Madison, and ask about organic control options.

Endophytes are nonpathogenic fungi that live inside some cultivars of tall and fine fescues and perennial ryegrass. Endophytes are known to suppress surface feeding insects like billbugs, chinch bugs, and sod webworms. For lawns that are damaged year after year by surface feeders, selecting an endophyte-infected grass might be the best strategy. However, endophyte-infected grass will not protect against root feeding insects, like white grubs, which are the primary insect pest of lawns in Wisconsin. Contact one of the authors for further assistance if you think endophyte-infected grass might be right for you.

Organic disease control

Occasionally turf is damaged by disease. A susceptible host, the presence of a virulent pathogen and a conducive environment are needed for disease to develop. Since substantial damage from diseases is infrequent, control practices above and beyond normal turf care are seldom required. One of the most common causes of disease is inadequate fertilization that leads to malnourished turf. Turfgrass diseases can also become a problem when turf is improperly irrigated, or when turf is stressed by soil problems, by extreme temperatures, or by improper timing of cultural practices. If a disease does become a problem, products are available that offer moderate levels of effectiveness while still meeting USDA organic production guidelines (see table 2).

Reasonable expectations

When using purely organic products to maintain a lawn, it is difficult, if not impossible—even with considerable time and money—to get results comparable to what can be attained using conventional lawn care products. A great start can be made by ensuring that you plant in good soil, choosing the best grass, and fertilizing properly. But it must be admitted that organic practices for controlling pest and disease outbreaks are costly and of limited effectiveness.

People interested in the principles of organic turf care, but wishing better results, have another option. They may consider *reduced-risk* lawn care, an organic-based system that follows many organic practices yet allows occasional use of low-risk synthetic products.

Table 2. Organic disease control products and turf diseases they may be used to treat. (Please note that these products have not been widely tested for efficacy against these diseases.)

Product	Target diseases
Sulfur	Powdery mildew, rusts
Bordeaux mixture[a]	Powdery mildew, rusts, brown patch, dollar spot
Rhapsody® (*Bacillus subtilis*)[b]	Brown patch, dollar spot, powdery mildew, rusts

[a] Mixture of copper sulfate and lime
[b] Microbial pesticide

Reduced-risk lawn care

A reduced-risk lawn care program makes use of the same mowing, irrigating, and soil management practices as an organic program, but additional fertilizers and pesticides may be used, including synthetic fertilizers and those derived from biosolids (like Milorganite®).

Reduced-risk lawn care makes use of conventional pesticides, but only those that meet the criteria of the EPA's reduced-risk or minimum-risk programs, which register "commercially viable alternatives to riskier conventional pesticides."

EPA reduced-risk products

EPA reduced-risk products labeled for residential lawns in Wisconsin include one insecticide (chlorantraniliprole) and three herbicides (carfentrazone-ethyl, mesotrione, and penoxsulam).

Chlorantraniliprole (Acelepryn ®) is effective in controlling white grub species as well as billbugs and leaf-feeding turf caterpillars such as sod webworm.

Carfentrazone-ethyl (Quicksilver ®), mesotrione (Tenacity™), and penoxsulam (Lockup ®) will control many types of broadleaf weeds in lawns. Mesotrione will injure some fine fescue cultivars and penoxsulam can cause injury to perennial ryegrass and tall fescue. Both are safe on Kentucky bluegrass. Mesotrione will also kill creeping bentgrass, yellow nutsedge, and crabgrass, which are weeds commonly found in Wisconsin lawns.

Mesotrione is one of the few herbicides that can be applied at the time of seeding, offering an efficient way to control weeds when establishing a new turf from seed. Carfentrazone can be applied without injuring turf shortly after turf emergence. Penoxsulam can be used only on established lawns.

Lawns in Wisconsin rarely, if ever, require fungicides. However, three reduced-risk fungicides are available: azoxystrobin (Heritage ®), fludioxonil (Medallion ®), and trifloxystrobin (Compass ®). These products have been shown to be highly effective on golf courses and home lawns for the control of brown patch, rusts, and fairy ring.

EPA minimum-risk products

Table 3 shows EPA minimum-risk products that are exempt from federal registration and are not tested for human or environmental toxicity under section 25(b) of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Minimum-risk products tend to be derived from natural sources which have undergone little processing and in which no changes have been made to the natural state of the compound. While EPA does not review or register these pesticides, registration is required by the state of Wisconsin and by many other states. Some of the products containing these pesticides may be classified as "USDA Organic," but many others do not meet the organic criteria. Aside from corn gluten meal, none of the minimum risk products have been verified to be beneficial for turf management in Wisconsin, although this is not to say none are beneficial. Consequently, many may not be legal for lawn applications in Wisconsin, for state law requires such products to have proven effectiveness before they can be sold, or before they can be used by professional applicators.

Table 3. List of EPA minimum-risk pesticides as defined by section 25(b) of the Federal Insecticide, Fungicide, and Rodenticide Act.

Castor oil	Linseed oil
Cedar oil	Malic acid
Cinnamon and cinnamon oil	Mint and mint oil
Citric acid	Peppermint and peppermint oil
Citronella and citronella oil	2-Phenethyl propionate (2-phenylethyl propionate)
Cloves and clove oil	Potassium sorbate
Corn gluten meal	Putrescent whole egg solids
Corn oil	Rosemary and rosemary oil
Cottonseed oil	Sesame (includes ground sesame plant) and sesame oil
Dried blood	Sodium chloride (common salt)
Eugenol	Sodium lauryl sulfate
Garlic and garlic oil	Soybean oil
Geraniol	Thyme and thyme oil
Geranium oil	White pepper
Lauryl sulfate	Zinc metal strips (consisting solely of zinc metal and impurities)
Lemongrass oil	

Other low-risk pesticides for organic lawn care

New weed control products are available which contain chelated iron (the abbreviated scientific name is Fe HEDTA). These products kill weeds by causing toxic or oxidative damage to the plant. Because the products are new, little university research has been done to test their effectiveness. However, preliminary research suggests the iron-containing herbicides are fairly effective at killing the leaves of dandelions in particular. The iron will not kill the grass surrounding the weeds when used properly and the dandelions may grow new leaves after several weeks. While not listed as a reduced or minimum risk pesticide, Fe HEDTA is classified by the EPA as a biopesticide because it is derived from a naturally occurring product (a mineral).

Conclusion

If you chose to live your life without taking any synthetic medicine, you would want to practice disease prevention in order to live long and happily: you'd eat healthy foods, exercise regularly, wash your hands, and try to avoid unhealthy lifestyles or situations.

Choosing to have a lawn that does not depend on synthetic chemicals is analogous. Start by choosing the proper grass, plant it on a healthy soil, maintain its health by fertilizing, mowing, and irrigating properly. These preventive steps are the key to success in a program without chemicals, yet sometimes they may not be enough to meet your goals—just as practicing disease prevention may not be enough to keep you from becoming sick.

Many health-enhancing practices—both for animals and plants—were discovered long before the scientific method put its imprimatur on them. Hundreds of years ago, for instance, people found that extracts from *Cinchona* plant species were effective in curing the fever associated with malaria. Later, scientists identified the extract responsible and synthesized it for wider distribution, with better dose and quality control. Similarly, a reduced-risk lawn care program relies on highly effective pesticides that are derived from or based on natural compounds that have been discovered, by trial and error, to work. However, the use of these pesticides should not overshadow the importance of proper soil preparation, grass selection, mowing, fertilization, and irrigation. If those fundamentals are ignored, pests will eventually dominate the lawn.

Incorporating reduced- and minimum-risk pesticides (see table 4) into an organic lawn care program will allow a very high quality lawn to be maintained with very low risk, though at higher cost. Knowledge of organic and reduced-risk production is continually evolving—and new discoveries are likely to increase the range of products that can be used for such lawns, and to increase their safety while reducing their cost.

Table 4. A selection of available pest control options for organic and reduced risk lawn care.

Weed control options	Program	Target	Cost*	Efficacy (relative to conventional)
5-7% acetic acid	organic	all plants	$	poor
hand pulling	organic	all plants	$$$	variable
Corn gluten meal	organic if non-GM	pre-emergent for grassy and broadleaf weeds	$$	moderate
20% acetic acid	reduced risk	all plants	$	moderate
carfentrazone-ethyl	reduced risk	selective post emergent for broadleaf weeds	$$	similar
FeHEDTA	reduced risk	broadleaf weeds, especially dandelions	$$	moderate
mesotrione	reduced risk	selective pre and post emergent for grassy and broadleaf weeds	$$	similar
penoxsulam	reduced risk	broadleaf weeds	$$	similar
Insect control options				
azadirachtin	organic	surface feeding insects	$	similar
pyrethrum	organic	surface feeding insects	$	variable
spinosad	organic	surface feeding insects	$	similar
Bacillus popillia	organic	white grubs	$	variable
entomopathogenic nematodes	organic	white grubs	$$	variable
chlorantraniliprole	reduced risk	white grubs	$$	similar
Disease control options				
sulfur	organic	powdery mildew, rusts	$	variable
Bordeaux mixture (copper sulfate + lime)	organic	powdery mildew, rusts, brown patch, dollar spot	$	variable (potential to burn)
Bacillus subtilis (Rhapsody ®)	organic	powdery mildew, rusts, brown patch, dollar spot	$$	variable
azoxystrobin (Heritage®)	reduced risk	many	$$	similar
fludioxonil (Medallion®)	reduced risk	many	$$	similar
trifloxystrobin (Compass®)	reduced risk	many	$$	similar

*Cost: $ is same or cheaper than conventional options, $$ more expensive, $$$ much more expensive

Table 5. Calendar of organic and reduced-risk lawn care tasks.

Time of year	Organic lawn care	Reduced-risk lawn care
Spring	Fertilize, apply compost, apply organic corn gluten meal (if available) when soil temperatures reach 50-55ºF, pull weeds by hand or spot-treat with nonselective herbicide.	Same as organic. Can use mesiotrione for pre- and post-emergent herbicide application.
Summer	Irrigate when necessary, control insects using organic methods, pull weeds by hand or spot-treat with nonselective herbicide.	Same as organic. If insects are a problem, control with chlorantraniliprole.
Fall	Fertilize, apply compost, pull weeds by hand or spot-treat with nonselective herbicide.	Same as organic, plus use reduced or minimum-risk chemicals to control weeds.

The information in this publication is for educational purposes only. Mention of a specific product should not be interpreted as an endorsement, nor failure to mention a product as a criticism. Information about products is consistent with label instructions at the time of this writing, but it is the responsibility of the reader to use these products in accordance with current directions of the manufacturer.

Some information presented in this guide, especially pesticide recommendations, may be specific to Wisconsin. Readers outside Wisconsin should check with a local cooperative extension service for state-specific information.

Additional resources

Organic Materials Review Institute list of products for possible use in organic food production: www.omri.org/sites/default/files/opl_pdf/crops_category.pdf.

University of Wisconsin-Madison Center for Integrated Agricultural Systems publication: *Art and Science of Composting*

University of Wisconsin Cooperative Extension Publications: *Lawn Establishment and Renovation* (A3434)

Lawn Aeration and Topdressing (A3710)

Watering Your Lawn (A3950)

Growing Grass in Shade (A3700)

Sampling Garden Soil and Turf Areas for Testing (A2166)

Lawn Maintenance (A3435)

Lawn Weed Prevention and Control (A1990)

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