

# Maintaining Sustainable Lawns and Landscapes

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## I. Sustainable Lawn and Landscape Management

The model implementation plan encourages homeowners, renters, and lawn care professionals to protect the health of people and the environment in the community. The model creates a strong incentive to transition to land management practices that protect the health of the community and the local ecosystems. The good news is that these practices are easy to adopt!

This publication provides tips for those managing an existing lawn without the use of toxic materials restricted by the model ordinance. A separate guide, Establishing New Lawns and Landscapes, identifies the steps to take in installing a new lawn.

High quality lawns and landscapes can be achieved with practices that build soil health through natural fertilization and cultural practices, such as soil aeration, mowing height, and timing and volume of water. This approach, which eliminates synthetic fertilizers and nurtures soil microorganisms, is a “feed-the-soil” approach. It centers on the utilization of compost, and microbial food sources. Experience demonstrates that this approach helps to prevent problems that typically arise from chemical-intensive practices by building a soil environment rich in microbial life that, in turn, produces a strong, healthy lawn able to withstand pressures from heavy usage, insects, weeds, and disease, as well as drought and heat stress.

Pursuant to the model ordinance, which prohibits the use of certain cosmetic pesticides, this guide provides the tools and tactics that will promote effective and safe lawn landscape management.

## II. Transitioning to Sustainable Lawn Care Practices

Proper cultural practices are key to a healthy lawn. This includes careful mowing, aeration, watering, fertilization, and overseeding, as well as setting tolerance levels for weeds. These practices build the backbone of a healthy organic lawn –healthy soil high in organic matter (or biomass) and teeming with microbial life. In a healthy, fertile, and well-maintained lawn, diseases and pest problems can most often be preventable. This guide describes a systems approach that is designed to put a series of steps in place to prevent and solve problems. The systems approach is based on three concepts, including (i) natural, organic product where use is governed by soil testing, (ii) the acknowledgement that the soil biomass plays a critical role in fertility, and (iii) specific and sound cultural practices.

Once established, an organic lawn may use fewer resources, such as water and fertilizers, and may require less maintenance. More importantly, your lawn will be safe for children, pets, the environment, and your local drinking water supply. Follow these steps to start working on your organic lawn.

1. **Soil Testing** – Knowing the condition of your soil will determine some of the practices that are needed to develop healthy soil and a healthy lawn. The baseline soil analysis will evaluate soil chemistry, texture, and nutrient availability. Among other issues, soil testing will identify the pH,

or relative acidity (or alkalinity) of the soil, which must be maintained in the neutral range to ensure that the nutrients in the soil are most readily available to the grass plant. In addition, the soil analysis will give you other important information about your soil chemistry, including readings for phosphate, potassium, calcium, and magnesium –all important to the health of the grass plant. Soil samples should be collected and sent to a laboratory for an analysis that will guide future decisions on proper practices and inputs. (For more information on how to take a soil sample and where to get it tested, see the [Soil Testing Factsheet](#).) With this information, you will be able to embark on a program that ensures the transition to and maintenance of a healthy well-balanced soil in which to grow healthy grass.

2. **Mow High until the Season Ends** – Poor mowing practices cause more problems than any other cultural practice. Mowing with a dull blade makes lawns susceptible to disease and mowing too closely invites sunlight to germinate weed seeds. Keep your mower blades sharp.

Allow grasses to grow, mow high, and never remove more than one third the height of the grass. Use a mulching mower to return organic matter and nutrients to the soil. These practices will help shade out weeds and foster deep, drought-resistant roots. Longer roots allow grasses to readily utilize nutrients and water, developing greater strength to counter pests and lawn diseases. Use the Table 1 for grass-specific recommendations for mowing heights.

**Table 1. Mowing Height Guide<sup>1</sup>**

	Mow to this Height
<b>Kentucky Bluegrass</b>	3 inches
<b>Tall Fescue</b>	3½ inches
<b>Perennial Rye</b>	3 inches
<b>Fine Fescue</b>	3½ inches
<b>Bermuda Grass</b>	1 inch
<b>Zoysia Grass</b>	1 inch

3. **Aerate**– Compacted soil encourages weeds. If your lawn is hard, compacted, and full of weeds or bare spots, aeration will help air, water, and fertilizer to enter. If you can't stick a screwdriver easily into your soil, it is too compacted. Determining when to aerate depends on the type of grasses: Warm-season turf, such as Bermuda and Zoysia grass, begin active growth during the summer, so they should be aerated in the late spring and early summer. Cool-season turf, such as tall fescue, Kentucky bluegrass, and ryegrass, should be aerated in the fall when the grass emerges from summer dormancy. Aerate your lawn with a core aerator just prior to reseeding and addressing issues related to fertility and organic matter in your soil (see below). Aeration creates openings for nutrients and seeds to access the soils.

<sup>1</sup> Source: [Maryland Department of Agriculture](#)

A core aerator, which can be rented from a local hardware or garden store (see [The Well Stocked Tool Shed Factsheet](#)), is preferable to spiked aerators which simply punch holes in the soil and compact the surrounding soil. To use a core aerator, remove soil cores that are approximately ¾ inch in diameter and 3 inches long. For best results, aerate lawns when the soil is moist, neither wet nor dry. Lawns that are properly aerated should have 20 to 40 holes per square foot. Since most core aerators won't remove the proper number of holes with a single pass, you may need to take several passes.

4. **Watering**– Well-established organic lawns are drought-tolerant and may need to be watered less frequently. If watering (irrigation) is needed during the summer months, be sure to water deeply only in the morning. Frequent shallow watering results in shallow root growth, which allows for weeds to colonize. It also creates a humid environment, which encourages harmful soil fungi and pathogens. (See [Watering Techniques Factsheet](#).)

5. **Use Compost or Natural Organic Fertilizer**– Compost is the product of an aerobic process, whereby microorganisms break down and decompose various forms of organic matter. It is the humus in the compost that provides for organic matter rich in nutrients and microbial life. As the organic material in the soil increases through organic management, less additional natural fertilizer becomes necessary. While nitrogen is important to plant health, too much of a good thing will actually weaken grass and promote fungal disease. If applied too late in the fall, nutrients can leach directly into nearby surface waters.

The state of Maryland's fertilizer laws is an example of the type that is being adopted in many states. As of October 1, 2013, Maryland State will restrict the use of fertilizers to protect the Chesapeake Bay from runoff nutrients. Specifically, the law prohibits the fertilizing of lawns in the winter months, limits the amount of nitrogen that can be applied, requires "no fertilizers zones" of 10 to 15 ft. next to waterways, and prohibits the products containing phosphorous, with certain exceptions. For more information go to [Maryland](#)

Your grass clippings are rich in nitrogen, phosphorous, and potassium, and can build organic matter in the soil. So, **leave the clippings on your lawn**. You can also use a mulching mower and leave the leaves on the lawn too –a great alternative to raking. In the fall, preferably after aerating, spread ¼ inch layer compost over your lawn. Compost tea and worm castings are also great additions. (See below for more on composting and compost tea.)

Chemical fertilizers can compromise some portion of soil organisms. The application of natural organic products, which feeds the soils, builds organic matter, and encourages microbial diversity. Use only the amount indicated as necessary by soil testing. (See the [Soil Testing Factsheet](#).)

Strictly speaking, compost is not a fertilizer, although it is central to soil fertility. Compost is an inoculant, or starter culture, of the organisms that build soil fertility. The organisms that make up the soil food web are diverse, including bacteria, fungi, protozoa, nematodes, earthworms, insects, and other arthropods. The byproduct of all these organisms consuming one another is the excretions of “wastes,” which are plant nutrients. When you add compost to the soil, you add the organisms of the food web. When we feed them with more organic matter –in the form of lawn clippings, for example– they produce more nutrients, which produce more grass. This is why additions of fertilizer are rarely needed in a lawn with healthy organic soil that is maintained without chemicals and mowed with a mulching mower.

6. **Overseed with the Correct Grass Seed** – Adding grass seed to turf, known as overseeding, is actually a more effective way to manage weeds than using herbicides. Seeding should be done in late summer and early fall –following aeration when necessary– with a top dressing of 1/4 inch of compost. If you have bare spots or areas where the grass is sparse, they should be reseeded or overseeded with a mixture of grass cultivars, such as tall fescue. Grass varieties differ enormously in their resistance to certain pests, tolerance to climatic conditions, growth habit and appearance. Endophytic grass seed (e.g. tall fescue) provides natural protection against some surface insects and fungal diseases. Check with your state’s extension service to determine which grass is recommended for your region. Avoid seed coated with pesticides and inexpensive grass seeds that contain weed seeds. [Note: Avoid genetically engineered varieties in the future. Scott’s has developed a genetically engineered grass, which may be on the market soon, that is resistant to the herbicide glyphosate (Roundup). Genetic resistance to herbicides is unnecessary in a healthy lawn –and it may be counterproductive because it may take away from other advantageous traits of the grass plant.]
  
7. **Develop Your Tolerance** – Many plants that are considered weeds in a lawn have beneficial qualities. For instance, clover, considered a weed, is found in soil with low nitrogen levels, compaction issues, and drought stress, conditions that can be alleviated with the above recommendations. However, clover is a beneficial plant that takes free nitrogen from the atmosphere and distributes it to the grass. Clover roots are extensive and extremely drought resistant, providing significant resources to soil organisms, and staying green long after a lawn goes naturally dormant. Learn to read your “weeds” for what they indicate about your soil conditions.

The lawn care calendar (see Table 2 below) is an example for cool-season grasses, typically consisting of tall fescues, perennial ryegrasses, and Kentucky bluegrass. Just remember, lawns just coming off of chemical dependency may take a little longer for the improvements to start showing. Also, amendments to your soils will need to be based off of soil tests, this is just a general guide to get started.

See the [Further Resources Factsheet](#) for organic landscape and lawn care providers, plant nurseries and landscaping resources, as well more information on lawn care and watering.

**Table 2. Lawn Care Calendar<sup>2</sup>**

<b>Mar</b>	Remove winter debris, test soils, dethatch if thatch is greater than ½", overseed thin areas, apply corn gluten after snow melt for germinating weeds.
<b>Apr</b>	If you haven't already, dethatch and overseed, aerate lawns coming off chemicals, lime soils if needed for pH adjustment.
<b>May</b>	First mowing (high). Only if soils has less than 5% organic matter, top dress with ¼" compost.
<b>June</b>	Remove weeds by hand, mow high.
<b>July</b>	Mow high, sharpen mower, apply compost tea every two weeks to unlock nutrients in organic matter in soil, apply beneficial nematodes for grubs if needed, water deeply if grass begins to wilt.
<b>Aug</b>	Mow high, water deeply, test soil.
<b>Sept</b>	Dethatch if necessary, add lime, if necessary, and/or natural fertilizer if recommended by soil tests, aerate, or top dress with compost, reseed thin spots, continue mowing high.
<b>Oct</b>	Leaf shredding and mulching, mow ½ to 1 inch shorter than usual.
<b>Nov- Feb</b>	Winter dormancy, do not apply nutrients or organic matter during this time.

### **III. Solving Turf Problems**

#### **A. Read Your Weeds**




Since the growing conditions that are ideal for weeds are not the same as those that promote healthy grass, the presence of certain weeds can help to identify soil imbalances and deficiencies. Weeds may demonstrate compaction, poor mowing practices, pH imbalance, poor site conditions, and improper fertilization and watering practices and soil health. Use the following chart to identify the weeds in your lawn and correct the conditions that are promoting them with the information below. For example, wild violets often indicate compaction and excessive watering, while aeration and proper watering may alleviate the conditions that promote wild violet growth.

Many plants considered weeds have beneficial qualities. For instance, clover takes free nitrogen from the atmosphere and distributes it to the grass, which helps it grow. Crabgrass provides erosion control, dandelions' deep roots return nutrients to the surface, and chickweed is a tasty addition to a salad! Table 3 provides some examples of common lawn weeds and conditions within the Mid-Atlantic region.






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<sup>2</sup>Taken in part from: [Connecticut State](#)

Table 3. Common Lawn Weeds and Conditions Contributing To Them<sup>3</sup>

Table Key: X- Condition associated with the weed, D- Drought, E- Excessive, H- High, L- Low, K- Potassium, Mg- Magnesium, N- Nitrogen								
Weed	Common Name	Soil Compaction	Mowing Height	pH	Fertility	Watering	Poor Drainage	Light
Broadleaf winter annual weeds								
	Chickweed		L			X (Shallow watering)	X	L
	Dead nettle		L					
	Hairy bittercress		L					L






<sup>3</sup> Photo Sources: [University of Maryland Cooperative Extension](#)






	Henbit		L		L			
	Shepherd's purse		L		X			
	Speedwell (Veronica)	X	L		L	D		
Broadleaf summer annual weeds								
	Black medic				L (N)	D	L	
	Carpetweed		L			D		






	Knotweed	X		L	L( Ca) E (K, Mg)		X	
	Mallow		L		L (N)			
	Oxalis		L			D		X
	Prostrate spurge	X	L			D		H
	Purslane	X			L	D		H
Broadleaf Perennial Weeds								


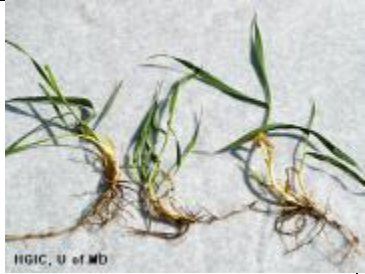



	Broadleaf and Curly Dock				E	E	X	
	Clover	X		L	L (N)	D/E		
	Common Cinquefoil		L					H
	Creeping Oxalis		L					
	Dandelion	X	L	L	L (Ca) E (K)			

	Ground Ivy					E	X	L
	Indian Mock Strawberry		L					L
	Mouse-ear Chickweed		L				X	
	Plantains	X	L	H	L	L	X	
	Sheep Sorrel			L	L			

	Wild Garlic and Wild Onion		L		L			
	Wild Violet	X	L	L		E		L
	Yarrow				L	D		
Grassy winter annual weeds								
	Annual Bluegrass	X	L		E (N)	E		
Grassy summer annual weeds								
	Crabgrass	X	L		L	D		

	Goosegrass	X	L			D		
	Japanese Stiltgrass				E (N)	E		L
Grassy perennial weeds/Sedges								
	Bermudagrass		L			E		H
	Dallisgrass	X				E	X	
	Nimblewill		L		L			H

	Orchardgrass				E (N)			
	Quackgrass	X				D		
	Yellow Nutsedge					E	X	H







## B. Other Symptoms of an Unhealthy Lawn

Imbalances such as soil compaction, thatch, mow height, fertility, watering practices, and poor drainage can result in turf problems including fungal diseases and insect infestations. The following tables can help you diagnose and solve your lawn problems. Table 4 provides some examples of common lawn diseases within the Mid-Atlantic region.

Table 4. Damage Caused by Disease<sup>4</sup>

Table Key: X- Condition associated with the weed, D- Drought, E- Excessive, H- High, L- Low, K- Potassium, Mg- Magnesium, N- Nitrogen

<sup>4</sup> Photo Source (top to bottom) PennState "Leaf Spot and Melting Out", NC State University "Melting Out", University of Maryland Extension Service "Red Thread in Tall Fescue", Wikipedia "Dollar Spot", University of Maryland Extension Service "Brown Patch", Texas A&M Agrilife Extension "Grubs", University of Maryland Extension Service "Rust", University of Maryland Extension Service "Fairy Ring"

Symptoms	Common Name Description	Soil Compaction	Mowing Height	Fertility	Watering	Drainage	Organic Controls
	Leaf Spot Brown/black spots on leaves		L	E (N)			Overseed with resistant species. Correct mowing, fertility.
	Melting Out Reddish brown rotting, wilting, yellow leaves		L	E (N)			Overseed with resistant species. Correct mowing, fertility.
	Red Thread Circular patches of red or pink patches 4"-2' diameter			L (N)	E Too late in day		Overseed with resistant varieties. Maintain fertility.
	Dollar Spot Small round, tan spots in lawn	X	L	L (N), E(N)	D		Compost, overseed with tall fescue or perennial ryegrass, <i>Pseudomonas aureofaciens</i> and <i>Bacillus licheniformis</i> SB3086
	Brown Patch Patches of brown, lesions on grass bordered above and below by tan, brown bands	X	L	E (N)	E	X	Overseed with resistant varieties. Correct management practices.
	Rust Yellow spots on leaves that produce powdery orange spores	X		L (N)	E, D		Maintain fertility. Reseed with resistant varieties.














	<p>Fairy Ring</p> <p>Zone of dead grass inside a ring of green grass. Ring of mushrooms.</p>	X		L	D		<p>Aerate, maintain N fertility, irrigate during dry spells.</p>
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Table 5. Damage Caused by Insects<sup>5</sup>

<p>Table Key: X- Condition associated with the weed, D- Drought, E- Excessive, H- High, L- Low, K- Potassium, Mg- Magnesium, N- Nitrogen</p>								
Symptoms	Insect	Common Name Description	Compactio n	trowing Height	Fertility	Watering	Poor Drainage	Organic Controls
		<p>Armyworm</p> <p>Defoliation and thinning of the turfgrass.</p>			E			<p>Plant turfgrass varieties with high levels of endophytes</p> <p>B.t. (<i>Bacillus thuringiensis</i>) can be used to control young larvae.</p> <p>Beneficial nematodes.</p>

<sup>5</sup> Photo Sources (top to bottom): [University of Maryland Extension Service "Grub Damage to Lawns"](#), [University of Maryland Extension Service "Grubs"](#), [University of Maryland Extension Service "Chinch Bug Damage to Lawns"](#), [Kansas State University "Chinch Bugs"](#), [University of Maryland Extension Service "Billbug Damage to Lawns"](#), [Colorado State University Extension "Billbugs"](#), [University of Maryland Extension Service "Sod Webworm Damage to Lawns"](#), [University of Maryland Extension Service "Sod Webworm"](#), [University of Minnesota Extension "Cicada Killer Wasp Lawn Damage"](#), [Missouri Botanical Gardens "Cicada Killer Wasp"](#), [Encyclopedia.com, "Miner Bee Holes"](#), [University of Maryland Extension Service "Miner Bee"](#), [University of Maryland Extension Service "Armyworm Damage to Lawns"](#), [University of Maryland Extension Service "Armyworm"](#), [University of Maryland Extension Service "Cutworm Damage to Lawns"](#), [University of Maryland Extension Service "Cutworm"](#), [Mid Southern Entomologist "Mole Cricket Hole"](#), [Wikipedia "Mole Cricket"](#)

		<p>Billbugs</p> <p>Turf blades can be pulled easily from sod.</p>			E		<p>Water and fertilize grass to stimulate regrowth. Reseed with tall fescue containing endophytes.</p>
		<p>Chinch bug</p> <p>Localized yellow or brown areas.</p>			E		<p>Reseed with grasses with high levels of endophyte such as tall fescue. Often controlled by natural predators such as big-eyed bugs.</p>
		<p>Cicada killer</p> <p>Burrowing/ mounds of soil.</p>		L			<p>Beneficial insect</p>
		<p>Cutworm</p> <p>1-2 inch dead spots with a pencil-sized hole in the center.</p>		L			<p>May increase as a result of toxic pesticide use. Endophytes do not protect against black cutworm. Use Bt, beneficial nematodes.</p>
		<p>Grubs of several beetle: Japanese beetle, May/June beetles, chafers, etc.</p> <p>Destroy roots</p>	X				<p>Reseed with resistant variety, nematodes, Bt (<i>Bacillus thuringiensis japonensis</i>), or pheromone</p>










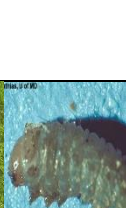









		<p>Mining bee</p> <p>Burrowing/ mounds of soil.</p>		L				Beneficial insect
		<p>Mole Cricket</p> <p>The mole cricket found in MD is the native northern mole cricket, which is not considered a pest.<sup>6</sup></p>						Plant resistant cool season grass.
		<p>Sod webworm</p> <p>Off-white moths flying over turf are noticeable.</p> <p>Irregular patches of yellow-brown grass.</p>			E			Reseed with grasses with high levels of endophyte such as tall fescue.Bt.

Table 6. Other Damage<sup>7</sup>

<sup>6</sup> Names, Origins, and Distributions of Mole Crickets, <http://entomology.ifas.ufl.edu/fasulo/molecrickets/MCRI0200.HTM>

<sup>7</sup> Photo Sources (top to bottom): [Iowa State Extension "Slime Mold"](#), [University of Maryland Extension Service "Drought"](#), [University of Maryland Extension Service "Dog Urine"](#), [University of Maryland Extension Service "Fertilizer Injury"](#), [University of Maryland Extension Service "Oil or Gasoline Damage"](#), [Ohio State University "Dealing with Chlorine Damage"](#), [University of Maryland Extension Service "Mower Injury"](#), [University of Maryland Extension Service "Dull Mower Injury"](#), [University of Maryland Extension Service "Nutrient Deficiency"](#)

Symptoms	Common Name Description	Soil Compaction	Thinning Height	Fertility	Watering	Poor Drainage	Organic Controls
	Slime Mold Blades covered with black sooty-like material				E		Wash off with hose, not harmful
	Drought General straw colored, browning of cool-season turf				D		Build organic matter. Irrigate. Drought-resistant varieties.
	Dog Urine Straw colored patches surrounded by ring of green turf			E			Irrigation and spot reseeding improves area
	Fertilizer or chemical injury Banded streaks or irregular patterns			E			Moderate the application of fertilizers
	Oil or Gasoline Damage Black or dark spots or patches on the lawn						Remove affected soils, replant
	Chlorine Damage Large yellow area near pool						Replant
	Mower Injury Grass over high spots looks scalped		L				Adjust mow height and direction
	Dull Mower Blade Injury Shredded grass blade tips						Sharpen mower blades

	<p>Nutrient Deficient</p> <p>All-over or mottled pale green to golden yellow color.</p>			L		Fertilize according to soil test results
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See the lawn care section of the [Further Resources Factsheet](#) for more information.

## IV. Recommended Materials for Healthy Soils and Lawns

Correcting the imbalances indicated in the tables above can often solve the problem. A sustainable management system ensures that preventive practices are in place to support healthy soils and turf. The best weed management is proper soil management practices, cultural practices, and overseeding with an appropriate variety of grass.

### A. Fertility and Soil Building

As mentioned above, compost and other natural organic soil amendments are recommended because chemical fertilizers may be harmful to soil organisms that build fertility, as well as causing problems when they run off into waterways.

#### 1. Compost

The process of composting breaks down organic matter, while growing the organisms necessary for a healthy soil food web. Composts dominated by wood chips, sawdust, straw, or dry leaves (“browns”) promote beneficial fungi, while composts dominated by kitchen scraps, grass cuttings, green plant residues, and/or manures (“greens”) promote bacteria. The food webs of forest soils are predominately fungi-based, while grassland, lawn, and garden soils have bacteria-based foodwebs.

As a soil amendment, compost improves soil texture and microbial life (unlocking nutrients in the soil), moderates temperatures, and increases the ability of the soil to absorb air and water. It can decrease erosion, and reduce or eliminate the need to apply fertilizer. To start your own backyard compost system, follow these simple steps:

- a. **Make a compost pile:** You can build wooden or concrete block bins or buy a commercially made plastic bin to hold your pile in place. Montgomery County offers large capacity compost bins to residents and businesses at no charge. They are available for pick up at a [range of locations](#). Otherwise, residents can just layer the materials in a heap. An easy way to keep a compost pile contained is to set up a heavy chicken wire frame.
- b. **Location:** Select a shady, well-drained spot for your pile. It’s best to compost when temperatures are above 50 degrees F. At lower temperatures your pile will not be active or may freeze.
- c. **Preparation:** Clear away sod or other surface cover at the site, loosen the soil with a spading fork, and put down a base layer of brush or woodchips.

- d. **Materials:** There are a wide range of materials you can use, including garden wastes, grass clippings, kitchen scraps, manure, newspaper, and sawdust. Never include meat scraps or fats, which attract dogs and rodents. It's also best not to add kitchen scraps that are heavy with oil, as oils take longer to break down and slow the composting process.
- e. **Layering:** Alternate layers of dried plant materials such as chopped leaves or straw with nitrogen rich layers of kitchen scraps mixed with manure or blood meal. If you don't have nitrogen rich materials it will just take longer to fully decompose.
- f. **Shredding:** Shredding materials will make the compost decompose more quickly.
- g. **Moisture:** Be sure to keep the compost moist but not wet; it should feel as damp as a wrung-out sponge. Cover loose piles or open bins with plastic or heavy canvas so they won't become waterlogged.
- h. **Aerating:** The microorganisms that drive the composting process need air. Fluff or turn the pile regularly to keep microorganisms active, and to prevent the pile from overheating.

If you're not interested in making your own compost, check with your state's extension program to see if there are any local or regional compost companies that will take your waste and convert it into compost.

For those who are interested in buying compost from stores –look for the Organic Materials Review Institute ([OMRI Listed](#)) label to ensure that a product contains natural materials and/or synthetically derived micronutrients reviewed and allowed by the National Organic Standards Board. OMRI-listed compost products have standards for allowable limits on pathogens and heavy metals, which are not required for other composts. See the compost section of the [Further Resources Factsheet](#).

## 2. Compost Teas

Compost tea, like compost, can be applied to soils to provide beneficial organisms and unlock nutrients essential for plant and soil health. Compost tea is literally the liquid extraction of beneficial microorganisms and soluble nutrients from the compost that is reproduced during the brewing process. Aeration is used during the extraction to ensure that the aerobic organisms that are beneficial to soil survive. Because of its higher microbial activity, it can improve soils in less time than compost. Both are important tools to use to improve soil and plant health. (For detailed information on making your own compost tea and brewer, see [Brewing Compost Tea](#) by Elaine Ingram.)

## 3. Natural Organic Fertilizer

Lawns need essential nutrients to be healthy. Nutrients such as nitrogen (N), phosphorus (P), potassium (K), and a variety of micronutrients provide that sustenance and are already available within the soils. However, additional fertilizer may be required until soil organic matter accumulates. Providing the right amount of natural organic fertilizer will allow plants to develop strong and healthy roots, but applying too much fertilizer, such as manure, can pollute waterways, trigger excessive aquatic plant growth, and deplete oxygen in the water that fish need to survive. Chemical fertilizers may discourage some microbial life in the soil that supports healthy plants. In addition, chemical fertilizers and weed-and-feed products are water-soluble, may leach out of the soil and into waterways before plants can access them. For that reason, it is suggested that application of natural organic products, which will feed the soils,

build organic matter, and encourage microbial diversity be used. Use only the amount indicated as necessary by soil testing.

#### 4. *Biological Pest Controls*

The majority of the tactics used above are common sense and well understood cultural practices. However, two tactics require some background before use: biological and least-toxic chemical control, discussed below. The goal of using biological controls is to suppress population levels below damaging levels through the use of beneficial predators, parasites, pathogens, and competitors. There are three primary ways of using biological control: classical biological control entails introducing imported natural predators, parasites, or pathogens into an area to combat pests; conservation biological control entails manipulating the local environment to favor local enemies of pests; and augmentation biological control entails buying commercially available biocontrol plants or animals that supplement already occurring populations. Below are a few biological controls that can be introduced into your lawn or landscape to control for pests.

- **Turf grasses containing endophytes.** Endophytes are beneficial fungi or bacteria that live within plant tissue. Perennial ryegrass and fescue turf with high endophyte levels are more drought resistant and less prone to damage from insect pests than grass that does not contain endophytes.
- **Milky spore**, *Bacillus popilliae*, is just one effective biological control of lawn Japanese beetle grubs. Commercial milky spore dust is made by inoculating beetle grubs with the product and then extracting the spores, which resemble dust or powder when dry. The spores can be applied any time except when the ground is frozen or a strong wind is blowing. Grubs become infected when they feed on the thatch or roots of grass where the spores have been applied. As the infected grubs move about in the soil, then die and disintegrate, they release one or two billion spores back into the soil. This spreads the disease to succeeding generations of grubs. If the conditions are right, with the grub population high and feeding vigorously, and soil temperature at least 70 degrees F and very moist, milky spore can spread through the grub population in a week or two. In general, however, milky spore should not be thought of as a quick knockdown insecticide. It may take a season or two before it has a substantial impact.
- ***Bacillus licheniformis* and *Pseudomonas aureofaciens***, registered as the products BioJect Spot-Less and EcoGuard, respectively, are naturally occurring soil bacteria used to control dollar spot and other fungal diseases of turf and ornamentals.
- **Beneficial nematodes** are microscopic soil-dwelling worms that actively search for insects like pre-adult fleas, fire ants, or termites in the yard and serve as an important biological control. After invading the larvae or pupae, they release a bacterium that kills the host within 48 hours. The nematodes then feed on the pest's body, reproduce and seek out more pests. When all larvae and pupae are killed, the nematodes die off and biodegrade.
- **Live biological controls**, such as beneficial insects, can effectively control pests. These include spiders, ladybugs, lacewings, praying mantises, predatory mites, many parasitic flies and wasps, and more. Most of these species are probably already present, unless pesticides are used, and they should be protected and encouraged to visit your lawn and garden. For example, ladybugs

are known for their voracious appetite for aphids and thrips. Each ladybug can take care of a piece of land measuring about 19-by-19 inches, eating up to 50 pests a day, plus insect eggs. Similarly, the praying mantis offers natural control of moths, flies and mosquitos. Terrific hunters, the praying mantis naturally controls many pest insects that affect lawns. A searchable database of biocontrols available in North America is available [here](#).

- ***Bacillus thuringiensis (Bt/Bti)***, a naturally-occurring soil bacterium, is a biologically based control for insects. B.t. kills insects through a toxin produced by the bacteria. Since the commercialization of B.t. around 1970, nearly 400 registered products have been marketed in this country by 94 different firms, providing effective control of such major insect pests as gypsy moths, mosquitoes and blackflies, and many others.

*5. Chemical Controls Allowed for Lawn and Landscape Management*

When mechanical pulling of weeds, proper cultural lawn care management practices, and biological controls have failed, then, and only then, should you consider least-toxic chemical products. The model ordinance allows materials designated by the U.S. Environmental Protection Agency as minimum risk pesticides under section 25 (b) of the *Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)*, which are not subject to federal registration requirements, because their ingredients are viewed as safe for the intended use. Below are some examples of effective products for cosmetic management of lawns.

**Table 7. Minimum Risk Pesticides Exempt Under Section 25(b)<sup>8</sup>**

Castor oil (USP or equivalent)	Cottonseed oil	Linseed oil	Sesame (includes ground sesame plant) and sesame oil
Cedar oil	Dried blood	Malic acid	Sodium chloride (common salt)
Cinnamon and cinnamon oil	Eugenol	Mint and mint oil	Sodium lauryl sulfate
Citric acid	Garlic and garlic oil	Peppermint and peppermint oil	Soybean oil
Citronella and citronella oil	Geraniol	2-Phenethyl propionate	Thyme and thyme oil
Cloves and clove oil	Geranium oil	Potassium sorbate	White pepper

<sup>8</sup> Source: U.S. EPA Minimum Risk Pesticides Federal Insecticide, Fungicide, and Rodenticide Act Section 25(b), 40 CFR 125.25

Corn gluten meal	Lauryl sulfate	Putrescent whole egg solids	Zinc metal strips
<b>Corn oil</b>	Lemongrass oil	Rosemary & rosemary oil	

Others products not listed in Table 7 that are effective for least-toxic pest management include:

- **Corn gluten meal**, the protein fraction in corn, is a nontoxic herbicide that inhibits root formation in a wide variety of grasses and broadleaf weeds during germination. It is a waste product from corn milling, but because of its high nitrogen content can be applied to lawns as a fertilizer and top dressing. Although large application rates are needed, it is an effective preemergent herbicide that suppresses growth of annual weeds such as crabgrass.
- **White vinegar** or **acetic acid** is effective for eliminating unwanted vegetation. Horticultural vinegars are much stronger than household vinegar and are more effective at weed management. Household vinegar has 5% acetic acid while horticultural vinegars range from 15 to 30% acetic acid. Take care when applying horticultural vinegars as it is non-selective, so it will kill or harm any treated plant.
- **Fatty acid soaps** or **insecticidal soaps** contain potassium and coconut oil, which are effective in controlling many soft-bodied insects such as aphids, caterpillars, crickets, fleas, flies, and mites. Because fatty-acid soaps can kill a variety of arthropods, including those that are beneficials, outdoor use should be limited to spot treatments. Some plants may be injured or killed by insecticidal soaps, so test them on a small area before spraying a large area.
- **Horticultural oils** are also effective in controlling aphids, adelgids, spider mites, mealy bugs, sawfly larvae, whiteflies, plant bugs, caterpillars, scales, and some plant diseases like rusts and mildews. They flood insects breathing pores which lead to prompt asphyxiation and suffocation. Oils also kill an insect when it touches the outer body, or cuticle, of an insect leading to dehydration and death of the pest. They will kill beneficial insects as well as pests, so they should be used carefully.

(See the section on Least-Toxic Control of Pests in the [Further Resources Factsheet](#), for more pest-specific information.)

## V. Products to Avoid

The model ordinance explicitly restricts use of pesticides for use on lawns that are classified as “Carcinogenic to Humans” or “Likely to be Carcinogenic to Humans” by EPA; Classified by EPA as a “Restricted Use Product”; Classified as a “Class 9” pesticide by the Ontario, Canada, Ministry of the Environment; and any pesticide classified as a “Category 1 Endocrine Disruptor” by the European Commission.

## **Glossary**

**Biological Pest Control:** Technique to suppress pest populations below damaging levels through the use of beneficial predators, parasites, pathogens, and competitors.

**Compost:** Decayed organic material which may include food wastes, yard wastes, or grass clippings used to promote plant growth.

**Fertilizer:** Refers to turf fertilizer registered by the Maryland Department of Agriculture to promote plant growth.

**Lawn:** Grass or other vegetation of at least 25 square feet that is kept mowed, as defined by the *Safe Grow Act*.

**Minimum Risk Pesticides:** Materials designated by the EPA as exempt from federal pesticide registration requirements because their ingredients are demonstrably safe for the intended use.

**Pest:** Any undesirable insect, animal, plant, fungi, bacteria, virus, or microorganisms, as defined by the *Safe Grow Act*.

**Pesticide:** Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest, including insecticides, herbicides, and fungicides, as defined by the *Safe Grow Act*.

**Restricted pesticides:** A pesticide identified in the register of restricted pesticides developed under Section 14.28.040, as defined by the *Safe Grow Act*.

**Turf:** See "Lawn"