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Integrated Pest Management for Lawns

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Many home owners are frustrated in their attempt to produce the "perfect" lawn. Little do they realize that cultivating and maintaining the "perfect" home lawn is an unrealistic goal. The average lawn of 5,000 square feet contains approximately four million turfgrass plants, and individual plants change morphologically and physiologically during a season as they progress through the normal growth cycle. There is also constant and ongoing change in the growth environment, including changes in soils, temperature, moisture availability, light, and pest populations. The interactions of a large number of individual grass plants with the total environment result in constantly changing lawn conditions. Some interactions favor healthy grass plants and a quality lawn appearance, while others result in stressed turfgrasses and a less attractive appearance. Under the best conditions, a quality lawn is difficult to sustain for long periods.

Poor lawn care can create additional problems. Often, typical home lawn care begins with inappropriate establishment techniques and is followed by cultural activities that result in turfgrass stress. Lawn mismanagement, when combined with the changes in turfgrasses and growth environments, creates a situation in which quality turf is almost impossible to maintain. Frequently, pesticides are used as "Band-Aids" to solve problems created by mismanagement and environmental and growth changes.

Pesticide use on home lawns is widespread. The U. S. Environmental Protection Agency recently reported that almost four million pounds of 2,4-D, a herbicide, and approximately six million pounds of the insecticide diazinon are applied annually to residential lawns. In many cases, these and other pesticides are broadcast over entire home lawns, even though weed or insect populations are small or localized. Misuse of pesticides is obviously undesirable and can result in unnecessary health risks for living organisms in the treatment area. Misuse can allow pest organisms to develop resistance to a pesticide, rendering it useless when it really may be needed.

What Is Integrated Pest Management?

The overall goal of home lawn care should be to produce a healthy lawn. A healthy lawn will produce the best possible appearance under a given set of growing conditions. In addition, a healthy lawn is usually less reliant on pesticides to achieve a desired quality. One method of producing the healthiest lawn possible is to practice **Integrated Pest Management (IPM)**.

IPM combines all available pest management methods to produce the healthiest lawn possible. It does not aim to totally eliminate pests but to maintain pest populations at tolerable levels. Pesticides are often part of an **IPM** program but are selected and applied responsibly to avoid health risks to other living organisms than those targeted.

Pest management control practices in an **Integrated Pest Management** program include:

- soil management
- turfgrass selection
- appropriate cultural practices
- biological and genetic controls
- physical or mechanical removal
- exclusion through prevention and sanitation
- pesticides.

In **IPM**, a lawn manager selects or combines appropriate methods to maintain lawn health as environmental conditions allow.

A major emphasis in a turfgrass **IPM** program is determining the point at which action to reduce pest problems is taken. Perceived lawn quality is subjective and personal; different home owners will tolerate different levels of lawn quality. Each home owner decides when a lawn's appearance has declined and when actions should be taken to restore the desired lawn appearance. The lawn's health needs to be monitored regularly for the presence of problems. As problems develop, their causes must be determined and corrective measures evaluated. When problem solving in **IPM**, all management practices are considered along with the effects that each will have on the pests and other organisms in the area.

There are several benefits of using **IPM** on home lawns. First, more accurate pest control is achieved. Since a problem is properly identified prior to activating a control, shotgun controls are avoided. Pesticide misuse can be minimized in this type of program. A second benefit of **IPM** is the potential for reduction of total pesticide usage. Pesticides are used only when absolutely necessary to maintain a desired turf quality. A final benefit is that **IPM** produces the healthiest turfgrass possible for a given set of growing conditions, and a healthy lawn always has a better appearance than a stressed lawn.

Pest Management Methods

Integrated Pest Management programs combine various methods to produce the healthiest, most trouble-free lawns possible, as well as lawns of high visual quality. Indvidual pest control methods are presented in the following discussion.

Soil Management

Proper soil management is important; healthy lawns have healthy root systems. Many turf problems can be traced to soils that are excessively wet, dry, acidic, or alkaline, and to soils that are infertile, prone to compaction, impenetrable, or full of debris. Fertile soils with a pH of between 6 and 7 are desirable. Many home lawns suffer because grasses are grown on soils that are poorly drained. Healthy lawns usually grow on soils that have adequate water and oxygen.

The best time to make major soil modifications is at establishment. Begin by taking soil samples for a soil test. A properly prepared planting bed meets the growth demands of a turf. Incorporate amendments based on soil test recommendations to provide the best possible turfgrass growing conditions.

Even established home lawns will benefit from a soil test. Major changes, however, are not often possible because of potential turfgrass damage. Modifications to soils in which established turf is growing can be accomplished by supplying amendments in small increments.

Turfgrass Selection

When establishing or renovating a lawn, carefully select turfgrasses based on use, growth environment (e.g., soil type, light availability, moisture availability), the desired appearance, the management level it will receive, and its pest resistance. Turfgrass cultivars (also referred to as varieties) are types of a grass species selected for specific characteristics such as disease resistance, tolerance of unusual environments, or appearance, and should be used whenever quality turf is desired. To reduce overall turfgrass disease potential and provide tolerance to varied sites, plant mixes (combinations of two or more species of turfgrass) and/or blends (combinations of two or more cultivars of the same species).

The five grasses that are commonly used for Illinois lawns are Kentucky bluegrass, perennial ryegrass, tall fescue, fine-leaf fescues, and zoysiagrass.

Kentucky bluegrass is the most commonly used grass in Illinois. It is planted both by seed and sod.
Uses: In home lawns it has medium wear tolerance but readily recovers from damage.
Growing Environment: Well-drained, moist, neutral to slightly acid, fertile soils. Full sun to light shade.
Appearance: Fine to medium leaf width, green to dark green with good density.
Management Requirements: Low to high. Match cultivars with appropriate environment and management level.

Perennial ryegrass is commonly combined with Kentucky bluegrass. It is particularly useful for overseeding and renovation work because it germinates vigorously and strongly. It is only planted by seed.
Uses: In home lawns it has good wear tolerance but recovers poorly from damage.
Growing Environment: Well-drained, moist, neutral to slightly acid, fertile soils. Full sun. Avoid temperature extremes.
Appearance: Medium leaf width, green to dark green with good density and uniformity.

Management Requirements: Moderate to high.

Tall fescue should be used in blends in Illinois lawns. It is especially drought and heat tolerant and is planted only by seed.
Uses: In home lawns it has good wear tolerance but recovers poorly when damaged.
Growing Environment: Adapts to wide range of soils. Full sun to light shade. Does well in heat and drought.
Appearance: Medium-wide to wide leaf with low shoot density.
Management Requirements: Low to moderate.

Fine-leaf fescues (including creeping red fescue, hard fescue, chewings fescue, and sheep fescue) are narrow-bladed grasses useful for dry, shaded environments and are often combined with Kentucky bluegrasses in shade lawn mixes. They are planted only by seed.
Uses: In home lawns these grasses have poor to moderate wear tolerance and poor to moderate recovery following damage.
Growing Environment: Well-drained, droughty. infertile, acid soil. Light to moderate shade.
Appearance: Very narrow to narrow leaf width with good density and uniformity.
Management Requirements: Low to moderate.

Zoysiagrass produces a rugged lawn that turns brown during cool and cold weather in Illinois. It is expensive and slow to establish, normally by sod or plugs.
Use: In home lawns it has good wear tolerance and a moderate to good recovery rate following damage.
Growing Environment: Well-drained, moist, slightly acid, fertile soils. Full sun to light shade. Tolerates heat and drought well.
Appearance: Low growing and medium leaf width with high density, quality, and uniformity.
Management Requirements: Moderate to high.

Cultural Practices

Proper lawn care is probably the most useful **IPM** method for managing pests and controlling appearance. Mowing, watering, fertilizing, and cultivating can be combined to reduce weed, insect, and disease problems and to produce turf of high quality.

Mowing. Proper mowing is crucial to turfgrass health and appearance. Turfgrasses cut too short become sparse, inviting weed invasion, and increased in susceptibility to several turf diseases. Lawns allowed to grow too tall between mowings may become weedy and generally will have a poor appearance.

Never remove more than one-third of the grass blade at any one mowing, and mow frequently at the heights recommended in Table 1. Mowing heights may be reduced within the desired range during spring and fall when grass is growing rapidly. Raise mowing heights within the desired range during warm to hot periods or when turf is stressed due to drought, disease, shade, insects, or traffic. Mow when grass is dry; wet turf may clog the mower or form clumpy masses on the turf's surface.

Be sure mower blades are sharp. Dull blades tear turf, leaving a ragged appearance. Ragged leaf edges can also cause excessive water loss from lawns and increase susceptibility to disease invasions. Clippings contribute little to thatch buildup and can be returned to turf when mowing at proper intervals.

Table 1. Mowing heights for selected turfgrasses

	Desired Height (inches)	Mow At (inches)
fine-leaf fescues	2–2.5	3–3.75
tall fescue	2–3	3–4.5
perennial ryegrass	2–2.5	3–3.75
Kentucky bluegrass	2–2.5	3–3.75
zoysiagrass	1–1.5	1.5–2.25

Watering. Watering turfgrasses is important. Excessive watering, however, can cause rapid turf growth, resulting in more mowing and clippings. It can also lead to a shallow turf root system and weed and pest invasions. Underwatered turf becomes open and sparse, develops a poor appearance, and allows weed invasion.

Water lawns deeply and infrequently at a rate no faster than the soil can absorb. To maintain green, actively growing turfgrass throughout the entire season, 1 to 1-1/2 inches of water per week is required for most soils, whether coming from natural or artificial sources. Water turf on an "as needed" basis, wetting the soil to the root system's depth. Watering early in the day can reduce turf disease problems and excessive water loss due to evaporation.

Develop a consistent lawn-watering regime; it is important that lawns not go into and out of dormancy due to inconsistent moisture levels. Delay watering as long as possible in the early growing season. Once started, continue watering as needed to maintain green growth during summer. If water availability is restricted, however, most Illinois lawns can go into summer dormancy and recover as environmental conditions improve in late summer or fall.

Fertilizing. A properly fertilized lawn will maintain good color and density and will grow rapidly enough to discourage weeds and other turf pests. Overfertilization, especially with water soluble forms of nitrogen, can burn turf, cause inadequately developed root systems, and

increase turf susceptibility to many diseases. Using slow-release forms of nitrogen often produces more uniform growth over a longer period of time.

Inadequate nitrogen fertilization leads to open turf that is readily invaded by weeds and diseases. Inadequate amounts of other mineral nutrients, especially potassium, phosphorus, iron, and sulfur, can also reduce turf color, disease resistance, and stress tolerance.

Fertilizer needs of turf will vary (Table 2). For healthy turf, provide the appropriate annual quantity of fertilizer. Mineral nutrients should be available when the turfgrasses are actively growing. Phosphorus, potassium, and iron should be applied based on soil-test recommendations. Lacking a soil test, use fertilizers with analysis ratios of 3-1-2 (this means 3 parts N to 1 part P to 2 parts K).

Table 2. Pounds of actual nitrogen per 1,000 sq ft per year required by selected turf species

fine-leaf fescues	1–3
tall fescue	2–4
perennial ryegrass	2–4
Kentucky bluegrass	1–4
zoysiagrass	2–4

Supply low to medium quality lawns with mineral nutrients in two applications per year, and higher quality lawns in three or four applications per year (Table 3). Never apply more than one pound of soluble nitrogen per 1,000 square feet at any one application. Supply phosphorus, potassium, sulfur, and iron as indicated by soil test results. Adjust soil pH to between 6 and 7 using lime or sulfur as also indicated by soil test results.

Cultivating. Cultivation activities include core aerification, slicing, and vertical mowing. These activities can reduce thatch and prepare turf for overseeding. Core aerification is also useful for relieving soil compaction. Conduct cultivation activities during periods of active growth when turfgrasses are best able to recover from these practices. Avoid cultivating during periods of turf stress or weed seed germination.

Try to keep the thatch layer less than one-half inch by core aerifying, power raking, or vertical mowing. Avoid excessive watering, nitrogen fertilization, and fungicide use to slow thatch development, and adjust soil drainage and pH (optimum range is 6 to 7) to benefit soil organisms responsible for thatch breakdown.

Table 3. Cool-season turfgrass fertilization schedule*

Nitrogen Applications per year		Time
1		Early Sept.
2		Early May + Early Sept.
3		Early May + Early Sept. + Late Fall
4	(only with summer irrigation)	Early May + Mid June + Early Sept. + Late Fall

*Make late fall application approximately one week following the final mowing of the season. Fertilize warm-season turfgrasses at the initiation of growth in spring. If desired, make additional applications monthly during the growing season.

Biological and Genetic Controls

Advances in turfgrass breeding and pest control research present some exciting and potentially useful methods of pest control. Presently, however, disease-resistant turfgrass cultivars present the most useful application of this technology.

Biological Control. Biological control includes the use of bacteria, fungi, nematodes, and parasitic or predaceous insects to control pest organisms. An example of this type of control is the use of milky spore (a bacteria) to control Japanese beetle grubs. Milky spore, unfortunately, is not effective against the common grubs that invade Illinois turf.

Currently, researchers are evaluating many biological controls. Nematodes used for grub control, diseases and insects for weed control, and bacteria and fungi for lawn-disease control are receiving attention and may be available for general lawn use in the future. These products cannot be endorsed until university research conclusively proves their worth.

Some cultivars of perennial ryegrass and tall fescue have been found to be associated with fungi (endophytes) that sod webworms, chinch bugs, and billbugs find an undesirable food source. Endophytes are present in turf seed of certain cultivars and are passed along from generation to generation. Several endophyte-containing perennial ryegrasses and tall fescue are presented in Table 4. Use fresh seed that has been properly stored; survival of the endophyte fungi is dependent on proper seed storage conditions.

Table 4. Endophyte-containing perennial ryegrass and tall fescue cultivars

Perennial Ryegrasses	Tall Fescues
All Star	Arid
Citation II	Mesa
Dasher II	
Pennant	
Regal	
Repell	

Genetic Control. Disease-resistant turfgrass cultivars currently provide an important avenue for reducing disease problems in home lawns. Presented in Table 5 is a list of common turfgrass cultivars exhibiting resistance. This list is current, but other cultivars presently available may also offer some resistance. Consult a current list of recommended turfgrasses before selecting a turfgrass cultivar in the future.

Table 5. Common lawn diseases and resistant turfgrass cultivars

Disease-Resistant Kentucky Bluegrass Cultivars:

Red thread: Adelphi, Admiral, Aspen, Banff, Barblue, Baron, Bono, Bristol, Dormie, Eclipse, Enmundi, Holiday, Majestic, Merit, Midnight, Mona, Monopoly, Nassau, Nugget, Plush, Ram I, Touchdown, Trenton, Victa, Welcome

Dollar spot: Adelphi, America, Banff, Bensun, Bristol, Brunswick, Challenger, Columbia, Eclipse. Majestic, Merit, Midnight, Nassau, Parade, Park, Plush, Rugby, Trenton

Leaf spot/melting out: A-34 (Bensun), Adelphi, Admiral, America, Aspen, Banff, Barblue, Bono, Bristol, Brunswick, Challenger, Cheri, Columbia, Eclipse, Enmundi, Fylking, Holiday, Majestic, Merit, Midnight, Mona, Monopoly, Nassau, Nugget, Parade, Plush, Rugby, Sydsport, Touchdown, Trenton

Summer patch/necrotic ringspot: Adelphi, Admiral, America, Banff, Baron, Bristol, Brunswick, Challenger, Cheri, Columbia, Eclipse, Enmundi, Glade, Majestic, Midnight, Monopoly, Mystic, Nassau, Parade, Rugby, Sydsport, Trenton, Victa

Disease-Resistant Perennial Ryegrass Cultivars:

Red thread: Citation II, Delray, Prelude, Premier, Ranger, Regal, Tara

Brown patch: All Star, Barry, Birdie II, Blazer II, Citation II, Derby, Diplomat, Gator, Manhattan II, Omega II, Palmer, Pennant, Pennfine, Prelude, Premier, Regal, Repell, Tara, Yorktown II

Dollar spot: All Star, Birdie II, Blazer, Delray, Elka, Fiesta, Gator, Omega, Palmer, Pennant, Prelude, Premier, Regal, Yorktown II

Leaf spot/melting out.: Birdie II, Blazer II, Brenda, Citation II, Dasher, Delray, Derby, Diplomat, Gator, Manhattan II, Omega II, Palmer, Prelude, Premier, Ranger, Repell, Rival, Tara, Yorktown II

Disease-Resistant Tall Fescue Cultivars:

Brown patch: Apache, Arid, Finelawn, Galway, Houndog, Jaguar, Olympic, Pacer

Leaf spot/melting out: Adventure, Apache, Bonanza, Galway, Houndog, Jaguar, Olympic

Disease-Resistant Fine-leaf Fescue Cultivars:

Red thread: Aurora, Banner, Biljart (C-26), Dawson, Highlight, Jamestown, Koket, Pennlawn, Reliant, Scaldis, Shadow, Waldina

Brown patch: Scaldis

Dollar spot: Aurora, Banner, Biljart (C-26), Checker, Fortress, Highlight, Jamestown, Pennlawn, Reliant, Scaldis. Shadow, Waldina

Leaf spot/melting out: Aurora, Biljart (C-26), Reliant, Scaldis, Waldina

Physical or Mechanical Removal

In turf, mechanical removal of pests entails removal by hand. Small populations of weeds can be controlled by pulling, digging, or hoeing. For large weed populations, physical removal is laborious, time consuming, and often impractical.

Physical removal of insect or disease pests is generally not practiced.

Prevention and Sanitation

When planting a lawn, it is important to use seed or vegetative propagules (sod, plugs, or sprigs) that are as pest free as possible. Inspect seed labels or vegetative propagules to determine if weeds or pests are present. Select and plant pest-free turfgrasses. Obviously, planting a pest-free lawn will minimize future problems.

Collect clippings in established turf when weeds are in flower to reduce seed spread. Collecting clippings will also reduce the spread of diseases during periods of infection.

Reducing pest spread from areas adjacent to established turf can also help prevent pest infestations. Mowing weeds in those areas prior to flowering can reduce seed movement into turf areas.

Pesticides

Pesticides are an available pest control method in **IPM** programs but are applied only when other corrective methods are unable to achieve the desired turf quality. The use of preventive pesticides on a home lawn is limited to situations where regular pest invasions are guaranteed. In **IPM**, select pesticides that are not only an effective pest control but also pest specific, of limited persistence, and of low toxicity. To reduce the amount of pesticides applied, make spot applications only to areas where pests are a problem rather than broadcast applications to an entire lawn. *If pesticides are used, be sure to read, understand, and follow the label directions for the safest and most effective use.*

Weeds. Herbicides are pesticides that control weeds and are applied either before weeds germinate (preemergence) or after weeds are up and growing (postemergence). A dense, healthy stand of turf is the best defense against weed invasions, but occasionally even well-managed lawns suffer from weed invasions. If it becomes necessary to control turf weeds chemically, spot treat using postemergence herbicides in limited amounts. For best success, apply herbicides when weeds are most vulnerable to control as directed on the herbicide label.

Insects. Monitor lawns for insect invasions to avoid unnecessary preventive applications. The two most common insects in Illinois turf are the annual white grub and the sod webworm. A well-managed lawn can withstand a number of feeding grubs without suffering great damage. Begin monitoring for grubs just below the soil level in early August, and apply an insecticide if populations are above 8 to 12 grubs per square foot. Be sure to supply adequate water and fertilizer after grubs have begun feeding so that turf is better able to survive the damage to its root system. *If an insecticide is applied, be sure to follow label directions for most effective and safest use.*

Sod webworms are common in Illinois during July and August, eating grass blades just above the soil. Two or more worms per square foot warrant control. An indication of sod webworm activity is the presence of large numbers of birds feeding in lawn areas. To monitor for sod webworms, dissolve 3 tablespoons of dishwashing liquid in one gallon water and pour over one square yard of turf. Irritated webworms will emerge if present.

Diseases. Turf fungicides are expensive and require considerable experience to use properly. The use of fungicides on home lawns is not recommended. Control diseases with proper management and replant with resistant cultivars if diseases persist.

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