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Integrated Pest Management Strategies[1]

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One of the most appealing aspects of a landscape is the beauty of the lawn. The responsibility for maintaining this beauty and acceptable conditions usually falls on the homeowner and/or contracted lawn maintenance firm. One method for meeting these objectives is the incorporation of a common sense approach to protecting the turf by information gathering, analysis, and knowledgeable decision making. Integrated Pest Management (IPM) utilizes the most appropriate cultural, biological and chemical strategies for managing plant pests.

Unfortunately, the pressures to maintain perfect conditions throughout the year have often forced lawn care managers to abandon sound agronomic practices for quick-fixes to get them through any current crisis. For example, too-close mowing heights, requests for perfect lawns with no scars or disruptions in consistency and growing grasses outside their natural range of adaptability have required increased use of fertilizer, water and pesticides. At the same time, public concerns over these inputs and restrictions on the availability of traditionally used resources, such as water, will require that many homeowners consider incorporating IPM programs into their total management scheme.

IPM BEGINNINGS

Modern IPM concepts and practices began to evolve in the late 1950s with apple production and was vastly expanded with cotton production in the 1960s. This evolved from the mid-1940s when the modern use of pesticides began to explode. Many felt at that time that pesticides were the "silver bullet" or ultimate specific weapon needed to control all pest problems. Many traditonal pest and plant ecological studies were abandoned, as were non-chemical control alternatives. This led to a new generation of producers and scientists who had little experience with non-chemical approaches to pest or plant management. However, resistance to pesticides, especially insecticides, forced researchers and growers to seek alternative methods of pest control, thus, the birth of IPM.

In recent years, turf managers have begun to realize that their escalating dependence on pesticides and the lack of research and training in the pest management arena are now affecting their industry. For example, in the early 1980s, several very effective and relatively cheap pesticides were banned from the turf market. Two such pesticides were EDB (ethylene dibromide), a soil-injected nematicide, and chlordane, an insecticide. Managing the turf to withstand higher populations of nematodes or insects, particularly mole crickets and grubs, was not followed as long as EDB and chlordane were available. However, since the loss of these materials, nematodes, grubs and mole

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crickets have become the most serious turf pest problems in many areas. Researchers are currently trying to find alternative methods of management and control for these pests based on pest life cycle and the use of biological control agents. Obviously, additional time and research will be necessary to solve the problems that were basically ignored for more than 40 years.

STRATEGIES OF INTEGRATED PEST MANAGEMENT (IPM)

Strategy Development

Developing IPM strategies requires reliable information. Three main areas are:

- Knowledge concerning all normal inputs required for growing the turf--not only what they are but also why they are required. This is supplemented by knowing pest life cycles and which management practices disrupt or influence them to reduce pest numbers. Understanding the logic behind a management practice, rather than just doing it "because that is the way we have always done it," allows the homeowner to make decisions to alter these practices to reduce pest problems or encourage turf growth to overcome or tolerate the pest.

- Use of a monitoring system to carefully follow pest trends to determine if a pesticide will be necessary and, if so, when it would be most effectively applied. Ideally, monitoring systems are based on known economical or aesthetic threshold levels. Unfortunately, in many cases, these thresholds are not specifically known, thus are determined to reflect local conditions and threshold levels tolerated by clientele.

  A professional scout, who may be employed by one or several lawn maintenance firms, is often used. Since these scouts visit several areas, pest trends are more easily recognized and information useful from one area can more easily be used to assist others.

  Tools required for scouting vary with pest problems, scout training and clientele budget. A good set of eyes and an inquisitive mind are essential. These are supported by a standard 10X hand or pocket lens, soil profile probe, spade, cup cutter, pocket knife, tweezers, scalpel, collection vials and paper bags, and field identification guides. Soap and water also are necessary for insect monitoring.

  Monitoring intensively maintained lawns includes scouting turf areas, adjacent ornamental plantings, flower beds and trees. Frequency of scouting reflects pest trends, desired level of aesthetics and, of course, economics. During periods of active turf growth or suspected pest activity, weekly scouting may be justified. During periods of inactive growth, scouting frequency can be extended.

  Scouting begins by simply walking around the area to observe insect and disease activity as well as other pest and non-infectious symptoms. Specific techniques to detect or ascertain pest populations are described in detail elsewhere in the *Florida Lawn Handbook*. In order to better recognize specific pest damage such as disease symptoms and nocturnal insect feeding, early morning scouting is suggested.

- Maintenance of careful records to measure the effectiveness of the IPM strategies. Generally, it is important to stress to homeowners that elimination of pests is not ecologically or economically desirable. However, if necessary, the decision to apply a pesticide will be supported by maintaining careful records should it be questioned by regulatory officials or the public. In addition, an IPM program will constantly evolve as new control strategies, monitoring techniques and threshold information become available.

IPM Control Tactics

Tactics involved with these IPM control strategies can be divided into cultural controls, biological control and chemical control strategies. All are equally important in implementing a successful IPM program.

Cultural Controls

The following tactics are integral features of a good cultural control strategy for pest management:

- ***Host-plant resistance.*** Until recently, turfgrass breeders have been concerned primarily with improving the appearance and playability characteristics of grasses, including texture, density and growth habit. Breeding for pest

resistance has been a secondary concern. However, one of the oldest means of pest control has been through careful breeding and selection of resistant or tolerant plants. For example, Floratam and FX-10 St. Augustinegrasses are noted for their resistance to chinch bugs.

- ***Pest-free propagating material.*** Another easy but often overlooked means of preventing pest establishment in turf is the use of planting materials (seed or vegetative sprigs/sod) that are pest free. Each state has a certification program to provide pest free propagation material. Each bag of certified seed must provide information on purity and germination percentages. In addition, a weed seed listing must be provided, and no noxious weed seeds are allowed. If vegetative material such as sprigs or sod is being planted, inspect the turf for weeds, fire ants and other pests. If applicable, ask to see results from a nematode assay of the planting material before purchasing. Remember, these steps will help to prevent or reduce pest problems during and after establishment.

- ***Site preparation.*** Proper preparation of a planting site is an important step in pest management, primarily due to its effects on the health and viability of the turf. For turf managers, this includes planning and constructing highly utilized areas with irrigation and drainage systems capable of providing precise water management. If the soil remains saturated for too long, diseases and soil compaction eventually occur.

- ***Basic agronomic practices.*** Probably the best defense against pest invasion is providing a dense, healthy, competitive turf. This is achieved after establishment by providing cultural practices which favor turf growth over pest occurrence. Important cultural practices in IPM programs include proper irrigation, fertilization, mowing, aerification, verticutting and topdressing. Prolonged use of incorrect cultural practices and lack of understanding concerning interrelationships of these practices weaken the turf, encourage pest activity or invasion and, quite often, excessive thatch development. Thatch harbors many insects and disease pathogens. It also binds pesticides and reduces the efficiency of an irrigation program.

Biological Controls

Pests in their native areas are usually regulated by predators and parasites that help keep populations at a constant level. Problems occur when pests, but not their natural enemies, are introduced into new areas and the pest populations increase unchecked. Biological pest control involves use of natural enemies to reduce pest populations, indigenous and introduced, to aesthetically acceptable levels.

One inherent principle concerning classic biological pest control, where the agent is introduced only once or on a limited basis for permanent establishment, is accepting that a minimum level of the target pest will always be present. This low pest population is necessary for the biological control agent to have a continual food source after the target pest has been reduced to an acceptable level. Thus, complete elimination of the pest is not feasible when integrating biological control measures into the overall pest management scheme. Homeowners must be educated to this fact and be willing to accept minor levels of pest pressure.

Various success stories have occurred using biological control agents involving parasites, predators or diseases to control another organism. However, only a few examples of biological control measures are currently being used in commercial turf production. *Bacillus popilliae*, a bacterium that causes the milky spore disease, has been used with variable success in the control of Japanese beetle grubs. Other potential agents for biological control of turf pests include endophytic fungi for insect control, various rust fungi (*Puccinia* spp.) for nutsedge control, several predacious nematodes for mole crickets and possible parasitic fungi and bacteria for turf nematode control. Research on antagonistic fungi and bacteria for biocontrol of diseases and fire ants also show promise. Other examples of non-synthetic pesticides include using soap flush for mole cricket control; the use of natural pyrethroid derived from chrysanthemums for foliage feeding insects; and the use of a mixture of copper and sulfur in the form of the Bordeaux Mixture for foliar diseases.

Biological control agents are complex, not totally effective and not always predictable. The concept of biological control has been so widely publicized that the general public views it as a viable and readily available alternative to all pesticides. Unfortunately, this is not the case, but this area currently is receiving much needed attention and hopefully will provide

additional control agents in the future. The public must be informed that biological controls are not the answer to all pest problems, but may be a useful component of a good IPM program.

Chemical Controls

Not all pest problems can be solved by manipulating cultural practices in the plant environment or by the use of biological control agents. In these cases, pesticides become the second or third line of defense. In the IPM scheme, indiscriminate spraying is eliminated and only judicious use of pesticides is employed, minimizing damage to biological control agents and the environment. This requires knowledge of the ecological interrelationships between the pest, the host plant and the biological control agent. Judicious pesticide use involves making management decisions.

- The pest must be properly identified and monitored with reliable techniques to establish aesthetic thresholds. A determination then must be made on when or whether further action is necessary. These threshold levels have been referred to in other IPM programs as economic, damage or action thresholds. However, in turf management, economic and related threshold level terms mean little since an acceptable aesthetic level, not crop yield, is the ultimate goal. An aesthetic threshold level deals with the amount of visual damage a particular turf area can withstand before action is required. Obviously, highly maintained lawns have a lower aesthetic threshold level before action is warranted than turf areas maintained at much lower levels.

- Best control of many insects and weeds occurs at a particular stage in its life-cycle, which is usually during the early stages of development. For example, mole crickets are most susceptible to chemical control when they are small, usually during the months of May or June. Chemical applications at other times are less effective.

- If use of a pesticide is necessary, select the one that is most effective but least toxic to non-target organisms or least persistent in the environment, whichever is more important in that location. Read the label completely and thoroughly. Spot treat, if possible, instead of applying blanket or wall-to-wall treatments. This requires effective scouting techniques and proper recording or mapping of pest outbreaks.

STARTING AN IPM PROGRAM

Pest problems are going to occur in turf and even the best management program cannot guarantee that pest damage will not occur. The following steps have proven successful in developing IPM programs and should provide a good starting point for those who are innovative enough to try such an approach.

- Define the role and responsibility of all people who will be involved in the IPM program. This includes establishing good communication between homeowners and maintenance staff. Emphasize and explain to these individuals exactly what will be involved and why. Do not lead anyone to expect perfection—either on the lawn, or in the IPM program—as there will probably be as many problems as successes, especially during the development stages of the program.

  Scouts who are conscientious and trained to recognize turf pest problems provide the base of a successful monitoring program. The field technician will probably want to begin as the primary scout until a feel for IPM strategies is attained. Once this occurs, the responsibility might be delegated to an assistant. However, it should be emphasized that **all** employees, especially those who regularly mow the lawn, should play an important role in recognizing pests and/or damage symptoms.

- Determine management objectives for specific areas of the client and correct all practices which favor pest development or place undue stress on the turf. Before implementing the IPM program, inspect and map each site. This will provide the foundation on which all management decisions can be based. For each lawn, information that should be obtained includes:

  - turf species,
  - mowing height and schedule,
  - irrigation amount and frequency,
  - soil drainage,
  - complete soil analysis,
  - fertilizer program,
  - traffic patterns, and
  - shade and air circulation concerns.

A field history form similar to the one shown in Table 2 can be used to record such foundation data.

Be prepared to improve the existing problems which weaken the turf, such as a poor irrigation or drainage system or severe tree effects. Improve these conditions before the IPM program is implemented. Otherwise, the potential success of the IPM program will be greatly reduced. Again, communicate openly with the homeowner.

Table 1. Common turf insects, their aesthetic thresholds, and inspection/detection methods.

Insect	Aesthetic Threshold for Lawns	Inspection/ Detection Method
Armyworms	3 to 4 per sq ft	Visual + soap flush
Billbugs	6 per sq ft	Visual
Chinch bugs	20 per sq ft	Water float
Cutworms	1 per sq ft	Visual + soap flush
June beetle grubs	3 to 4 per sq ft	Visual + soil inspection
Masked chafer beetle grubs	4 per sq ft	Visual
Mole crickets	2 to 4 per sq ft	Visual + soap flush
Sod webworms	10 to 12 per sq ft	Visual + soap flush

- Monitor local weather patterns closely. This will provide detailed, localized data on rainfall, soil temperatures, humidity and sunlight indexes and evapotranspiration rates. Climatic conditions usually play the most important role in specific turf growth patterns and pest problems.

- Establish aesthetic or action threshold levels and begin monitoring and recording pest levels. A field infestation form similar to the one shown in Table 3 may be used to record such levels. Threshold levels will vary according to location of the course, the specific pest being scouted, use of the turf area, expectations of the owners and budget constraints. Table 1 list suggested aesthetic or action thresholds for several common turf insects. In addition to recording pest levels on forms, pinpoint pest problem areas on a map for each hole of the course or lawn. For example, mole crickets usually lay eggs in the same location each year. This may allow for spot treatment rather than a blanket pesticide application. Over time, these maps can indicate where pest problems annually occur and possibly allow management or environmental variables influencing this occurrence to be corrected. These maps also allow new crew members a visual aid in examining and treating problem areas. Computer programs are available that allow one to draw or paint such maps.

- Use pesticides correctly and only when threshold limits are reached. One of the goals of IPM is intelligent and prudent pesticide use. Pesticide use may not necessarily be reduced by an IPM program, although it often is, but it will allow for more efficient and effective use of pesticides. For example, by monitoring pest development, the pesticide can be used during the most susceptible stage of its life cycle. Utilize the safest, most effective pesticide available for the particular pest. Spot treat whenever possible.

- Evaluate the results of the cultural modifications and pesticide treatments by periodically monitoring the site environment and pest populations. Keep written records of site pest management objectives, monitoring methods, data collected, actions taken and the results obtained. This will provide additional information for owners who do not necessarily understand the IPM program but do understand desirable results. It will also aid in demonstrating that lawn maintenance firms are striving to reduce the inputs in maintaining the turf and to obtain an ecological balance between man and nature.

Table 2. Field history report form used for lawn IPM programs.

TURF IPM FIELD HISTORY REPORT FORM

Location Owner Phone Number

Scout Phone Number Date

Site	Plant Species	Area	Mowing Height/ Schedule	Soil Analysis			Soil Drainage	Fertilization					Irrigation Scheduling
								Amount (N/1000 sq ft)				Frequency	
				pH	P	K		Spring	Summer	Fall	Winter		
Lawn													
Trees													
Ornamentals													
Flower Beds													
Other													

Comments on specific topics such as shade, overseeding, nitrogen carrier, weather, irrigation salinity levels, etc.:

Table 3. Field infestation report form used for lawn IPM programs.

TURF IPM FIELD INFESTATION REPORT FORM

Location Owner Phone Number

Scout Phone Number Date

Site	Mowing Height	Soil Moisture	Weeds		Diseases		Insects		Nematodes	
			Species	No. or %	Species	No. or %	Species	No.	Species	No.
Lawn										
Trees										
Ornamentals										
Flower Beds										
Notes:			1. Goosegrass 2. Crabgrass 3. Thin Paspalum 4. Dollarweed 5. Florida Betony 6. Matchweed 7. Doveweed/dayflower 8. Beggartick 9. Pusley 10. Nutsedge (Yellow, Globe, Purple, Annual, Kyllinga) 11. Other		1. Dollar Spot 2. Leaf Spot 3. *Pythium* Blight 4. *Pythium* Root Rot 5. Fairy Ring 6. Brown Patch (*R. solani*) 7. Algae/Moss 8. Centipedegrass Decline 9. St. Aug. Take-all Root Rot 10. Rhizoctonia Leaf and Sheath Blight (*R. zeae*) 11. Other		1. Mole Crickets 2. Sod Webworms 3. Armyworms 4. Cutworms 5. White Grubs 6. Fire Ants 7. Mites 8. Grass Scales 9. Billbugs 10. Spittlebugs 11. Other		1. Sting 2. Lance 3. Stubby-Root 4. Root-Knot 5. Cyst 6. Ring 7. Spiral 8. Sheath 9. Other	