Introduction

One of the most appealing aspects of golf is the beauty of the course. It is the superintendent's responsibility to minimize weeds, insects, nematodes, and diseases and to maintain an "acceptable" playing condition. One method to aid in meeting these objectives is the incorporation of a common-sense approach of protecting the turf. This is accomplished by gathering information, analyzing the information, and knowledgeable decision-making. Integrated Pest Management (IPM) is a term encompassing a management method combining proper plant selection, correct cultural practices, monitoring of pests and environmental conditions, use of biological control, and the judicial use of pesticides. The principles and practices of IPM also are referred to as Best Management Practices (BMP) and recently, Low Input Sustainable Agriculture (LISA). **Integrated Plant Management**, which covers all of these methods, is a better term for turf managers.

IPM is not a new concept. IPM practices have been in use since the birth of agriculture. Humanity has naturally strived to use the best management practices which encouraged plant health and produced maximum yield. The desire is to accomplish this with minimum fertilizer, and water use along with mechanical pest control. However, more susceptible plants and new pests have recently been introduced. In addition, there has been an increase in customer standards, resulting in agriculture becoming dependent on pesticides, a relatively new weapon, to try and meet these goals.

Golf course superintendents experience pressure from customers to provide "tournament" conditions on a year-round basis, regardless of the agronomic conditions necessary to grow grass. Players commonly request one-eighth inch mowing heights along with "soft" greens with no scars or disruptions in consistency. Many times, this demands that grasses be grown outside their natural range of adaptability. This, plus many other factors, has forced superintendents to increase fertilizer, water, and pesticides to maintain the grass to the player's satisfaction. Public concerns about chemical use has been increasing while restrictions on the availability of traditionally used resources is also an issue. Superintendents now need to consider incorporating and informing the public about programs such as IPM that are being used to reduce these inputs for maintaining golf courses. However, until golfers themselves lower their expectations for playing conditions, superintendents will continue to be pressured to accommodate the player which is not necessarily best for the grass or the environment.

Background information

Modern IPM concepts and practices began to develop in the late 1950's with apple production and was vastly expanded with cotton production in the 1960's. This evolved in the mid-1940's when the modern use of pesticides began to expand. Many felt at the time that pesticides were the "silver-bullet" or ultimate specific weapon needed to control all pest problems. Most traditional pest and plant ecological studies were then abandoned along with non-chemical control alternative research efforts. This led to a new generation of producers and scientists who had little experience with non-chemical approaches to pest or plant management.

This was evident when cultural practices were altered because it was believed all pest problems were now solvable with the new line of pesticides. Practices of planting susceptible crop varieties, extensive monoculturing, increased use of fertilizers, improper (lack of) crop rotation, improper field sanitation practices, and the introduction of plants into new regions, all led to a sharp increase in pesticide use.

Problems from improper cultural practices and increases in pesticide use soon began to unfold. Pesticides began to reduce the number of natural enemies (predators and parasites) of pests, resulting in the need for new, more potent chemicals. Farming costs also began to rise as pesticide use increased. Petroleum prices, a major energy component needed to synthesize and transport most pesticides, as well as pesticide development and registration costs, sharply rose while food prices did not. In addition, the development of pest resistance to certain chemicals left many voids in the pest control programs. This, coupled with increased concerns of pesticide effects on the environment, has raised the principles behind an IPM approach.

In recent years, turf managers have felt dependant on pesticides and suffered from the lack of research and training in the pest management area. For example, in the early 1980's, two very effective and relatively inexpensive pesticides, EDB (ethylene dibromide) and chlordane, were banned from the turf market. EDB was a highly effective soil-injected nematicide. Since EDB was so effective and inexpensive, turf management research for tolerance to higher populations of nematodes was essentially abandoned. Chlordane, an insecticide, was especially