DISEASE MANAGEMENT IS BASED ON FIVE GENERAL AREAS OF EFFORT

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In plant pathology disease control, I prefer the term Disease Management. Disease management is based on five general methods or traditional areas of effort.

First, resistant lines: this is and has been a major form of plant disease control or management with all plants. It is depended upon for disease control or management in crops such as cereals, corn, beans, hay and many others. In many of the more intensive crops, disease resistance is necessary to manage and produce even with the use of fungicides. The introduction of leaf spot resistance (i.e. Merion Kentucky bluegrass) changed the turf world. Today's term is "a revolution occurred." Resistant plants are, I believe, the "natural state" and we should (1) do all we can to utilize genetic material and (2) provide favorable environments for plant growth to express genetic potential.

Pathologists in general and myself specifically have not involved themselves to the extent they should in defining optimum conditions for turf growth.

The second general method of disease management is exclusion (i.e. quarantine). The best known quarantine for plant disease is at international ports of entry where ships, planes, cars, trucks and people are crossing from one country into another. Quarantine is also accomplished on a smaller scale as in foundation seed, commercial greenhouses, and many other cases where valuable stocks and certain crops are grown in confined areas with good sanitation procedures.

In turf leaf spot management, exclusion or quarantine has limited value.

The third general method is eradication (i.e. the attempt to remove the disease organism after it has entered an area). This is very difficult on a field scale once the organism has become established. However, in some confined areas this can be accomplished. The profits obtained from such a program often are quite high. This technique again has limited use in turf leaf spot management.

The fourth general method is sanitation, a term meaning clean up of an area to reduce chances of infection. Persistence of the individual plant manager in watching and using all procedures makes the difference between success and failure. This is important in turf leaf spot management.

The fifth general method is protection, the use of chemicals (i.e. fungicides). There may be too great a reliance on chemical protectants since they are easily used, readily available and response is expected where disease threatens. Fungicides are needed in disease management and are very useful in turf leaf spot control.

The five general methods of disease management are resistance, exclusion, eradication, sanitation, and protection. What management factors should the turf managers use when developing practical methods of leaf spot management in turf? *Helminthosporium* Leaf spot is one of the most common and serious disease complexes attacking cool season turfgrasses in the U.S. Leaf spot can be very destructive during wet humid weather or in areas where the turf is sprinkled frequently especially in early evening. The more often grass is wet and the longer it remains wet, the greater are the chance of disease. *Helminthosporium* fungi are responsible for the gradual browning, thinning and melting out of Kentucky bluegrass cultivars and other susceptible grasses. As the disease progresses, large irregular turfgrass areas are yellowed, browned and finally killed. Once *Helminthosporium* fungi become established in a turfgrass stand, they remain an ever present problem.

The disease cycle of all species of *Helminthosporium* fungi is essentially the same. They survive from year to year as mycelium in dead grass tissues or in infected leaves, crowns, roots and rhizomes. Under moist conditions, tremendous numbers of spores are produced on this debris and carried to new leaf growth by air currents, mowers and foot and vehicular traffic. The spores germinate in a film of moisture and infect the leaves. Spore germination and infection of leaves can take place within a matter of hours when conditions are favorable. New spores are produced on these infected leaves within a few days which in turn spread to new leaf parts and neighboring plants. Thus the cycle is repeated. New leaf infections may occur as long as conditions remain moist and the temperatures are favorable for germination and growth.

Best management of leaf spot begins by providing an adequate soil zone for turfgrass root growth.

Best management of *Helminthosporium* leaf spot begins by providing an adequate soil zone for turfgrass root growth. Turf areas developed with planned surface drainage and adequate internal drainage will produce a vigorous network of plants (leaves, roots and rhizomes). Plants growing under these conditions will respond best to adverse environmental stresses.

When managing to prevent disease problems, it is important to remember the disease formula (i.e. you must have the host, the causal agent and a favorable environment for disease to develop). A vigorously growing plant is best suited to express its genetic resistance and to survive the period of disease stress and to recover faster.

Best management of *Helminthosporium* leaf spot continues with the selection and use of resistant

varieties. Leaf spot resistance in the form of Merion Kentucky bluegrass so changed the turf industry that now we recognize other summer diseases of turf. Before Merion, summer disease problems were always caused by *Helminthosporium*. *Helminthosporium*-incited diseases rank among the most important fungus disorders of turfgrasses. Characterized by leaf blighting, leaf abscissium, root, rhizome, stolon and crown rots, it is not uncommon in certain seasons for this group of diseases to become the limiting factor in turfgrass production.

The best control of *Helminthosporium* leaf spot is obtained through the use of resistant varieties. Many lines exhibit nearly complete resistance to *Helminthosporium* under field conditions. Select high quality, disease resistant seed or sod that is locally adapted or a mix of locally tested grass varieties resistant to one or more *Helminthosporium* diseases.

But what if you already have a turf area, and do not want to begin a major rebuilding program? What should you consider in a *Helminthosporium* leaf spot sanitation program?

First - mow the bluegrass or for that matter, rye and fescue at the recommended height. *Helminthosporium* leaf spot is most damaging when close mowing occurs, so avoid close clipping at all times and especially when the leaf spot stage is a serious threat and when conditions are favorable for disease development. Mow the grass frequently, removing no more than one third of the leaf surface with a single mowing. Removal of clippings may further reduce the available food base for *Helminthosporium* leaf spot development.

Second - water turf areas as needed, wetting the soil to a depth of 4-6 inches. Repeat every week if nature does not supply adequate amounts. Apply supplemental water during or immediately after light showers during any dry periods. The value and importance of the soil can and should be noted here. Soil that is slow to wet and soil that has an inadequate water holding capacity forces you into frequent light sprinklings, and water-logging the soil surface, which promotes disease development.

Third - fertilize based on soil tests and nutritional needs of the plant. Avoid heavy applications of water soluble fertilizers, when *Helminthosporium* leaf spot disease is expected. Fertilize to maintain a uniform level of soil nutrients in the root zone, following the local recommendations for the grasses being grown. Consider fertilizer needs beyond having the greenest turf in the area.

Fourth - reduce thatch accumulation or mat to less than one centimeter by using a power rake or an aerifier. These operations are usually accomplished in the spring, fall or both when turf growth and recovery are rapid for cool season species. Thatch reduction is a process not completed in one treatment, just as thatch accumulation occurs over the entire growing season. Management of thatch accumulation and its removal is needed in most turf areas.

Development of resistant lines
is a major form of plant disease control and utilizes known resistant material

Fifth - consider modifying the local environment. Is the turf growing under dense shade, in areas with restricted air movement? Could trees or shrubs be removed or pruned? If so, will more light penetrate to the turf and will greater air movement over the turf speed the drying process thus reducing disease conditions?

Sixth - If *Helminthosporium* diseases are not adequately managed by cultural treatments, fungicide sprays may be needed on a responsive-preventative schedule. A responsive - preventative schedule means fungicide applications begin with the development of the disease and continues every seven to fourteen days during the period when conditions permit disease development. This spray program requires disease awareness, disease diagnosis, time, money, and for the average individual may not be practical. If only a few sprays will be applied, to be most effective, most of the time, the applications should occur in the spring, fall or both when cool wet growing conditions are common. If spraying is delayed until leaf blighting is severe, or thinning is obvious, the results will be poor.

Spraying fungicides or "all the world loves a universal green paint" is the "take two aspirins and call me in the morning" philosophy. Spraying, the easy, accepted, and indeed expected disease response, often may not be well understood. We can cite chapter and verse on preventative schedules, curative schedules, manufacturer directions, package label rates, application intervals, compatibility, safe use, pressure, volume, time of day, uniformity, nozzles, nozzle spacing, temperature, moisture, grass condition, grass potential, chemical persistence, spreaders, stickers, rainfall, past fungicide use and resistant isolates.

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Fungicide disease control basically involves products that are (1) lethal to the fungus, or (2) inhibit fungal germination, growth or multiplication. Some fungicides are "broad spectrum", inhibiting a wide range of pathogens and other are "narrow spectrum", having a specific activity for only a few fungi.

Helminthosporium leaf spot fungicides prevent infection by the fungus rather than cure the disease. Thus effective fungicide control occurs only on plant parts to which fungicides are applied and only for the period fungicides remain on the plant. Contact fungicides must be applied at regular intervals to maintain protection on turfgrass leaf surface. Since control is achieved by a protective coat of fungitoxic chemical on the plant surface the fungicide must be applied uniformly. New, unprotected shoot growth is constantly being formed within the turf stand. These limitations must be recognized whenever you use fungicides to manage plant diseases. Certainly fungicides do help in a turf leaf spot management program but they will not replace a poor leaf spot management program or substitute for no leaf spot program at all.

In summary, of the general disease management methods, three are suitable for *Helminthosporium* leaf spot management consideration. These are resistant lines, sanitation and protection, while exclusion and eradication have limited value. The guts of a leaf spot management program is proper cultural management. Turf managers where *Helminthosporium* leaf spot is a threat should consider the effects of modified mowing, watering, and fertilizing practices. Further, they should consider de-thatching and if needed, modifying the turf environment. Lastly, apply fungicides as needed. If the results of these efforts are unsatisfactory, renovate by over seeding with resistant cultivars or reestablish completely including necessary soil and site preparations. **WTT**

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early spring application nitrogen and auxin-like herbicides might temporarily retard leaf spot symptoms by promoting youthfulness in rapidly growing leaves.

Summer

A. Appearance of Symptoms.

1. Minimal appearance of small leaf spots under a normal, relatively dry summer environment.
2. Moderate to heavy leaf spot symptoms during wet summers or with irrigation.

B. Factors Involved.

1. Increasing day length and temperature, and reduced levels of moisture would normally reduce invections and decrease disease development on individual leaves. These factors would keep leaf spots relatively small.
2. Excessive rainfall or irrigation during summer will compensate for higher temperatures and increase infections. Applications of nitrogen and herbicides under these circumstances would further enhance disease severity. Some preliminary evidence suggests that high temperature stress combined with nitrogen and (or) herbicides may greatly enhance leaf spot symptoms on irrigated turf during the summer months.

Fall

A. Appearance of Symptoms.

1. Early fall number and size of leaf spots increases.
2. Late fall to early winter leaf spot symptoms become severe, including yellowing and blighting of entire leaves. Turf may appear to have a yellow undercover.

B. Factors involved.

1. Increasing moisture, shorter day lengths, and lower temperatures increase number of infections and enhance senescence of leaves. Enhanced senescence predisposes leaves to more severe disease development.
2. By late fall and early winter decreasing day length becomes a primary factor in enhancing leaf aging, and older infected leaves respond by blighting.
3. Nitrogen applied in late summer or early fall may have some delaying effect on senescence and for a period slow yellowing of older infected leaves.
4. Late summer to early fall applications of herbicides may enhance yellowing of older infected leaves by increasing the rate at which the leaf reaches senescence.

Winter

A. Appearance of Symptoms.

1. No leaf spot symptoms on dormant grasses. Winter may be the most important season for fungal colonization of dead tissues.
2. Grasses remaining green under snow cover and especially unfrozen soil will continue to show leaf spotting, yellowing, and blighting typical of late fall.

B. Factors Involved.

1. Provided adequate moisture is available, mycelium will grow slowly down to 36 degree F. Such growth could be important to colonization of dead tissue and an increase in spore production the following spring.
2. The potential availability of nitrogen, especially slow release forms, during winter months could provide an important nutrient source for pathogens and aid colonization of dead tissue.
3. Kentucky bluegrass will often remain green under snow cover, especially if the ground is unfrozen, and if nitrogen fertilizer is applied in the late fall. Under such circumstance leaf spotting and yellowing will persist as long as temperatures are 36 degrees F. or above.