Chemical and Cultural Control of Turfgrass Diseases

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The fungi which are presently recognized as parasites on turfgrasses have been widely discussed. We are primarily concerned here with diseases in the Midwest, but these considerations will generally apply throughout any temperate zone of the world.

The plant pathologist is involved in the recognition of disease-causing fungi, their epidemiology and control, primarily by chemical means. The agronomist is interested in general recognition and control, primarily through cultural means. Through the years turf growers have come to realize that chemical disease control and disease control through cultural manipulation are about equal in importance. It is intimated here that turf managers can be called neither pathologists nor agronomists. When dealing with turf, consider all facets of a problem and then pursue a course which promises the greatest results.

Results when dealing with disease control of turf are consistent, inconsistent, ambiguous, complete, incomplete, enlightening and frequently quite maddening. This, of course, points out the incompleteness of our knowledge and understanding in this field.

Listed below are diseases in a possible order of importance in the Midwestern area and suggested methods for chemical control. More specific chemical control information is available in numerous publications from turf fungicide manufacturers.

COOL SEASON GRASSES

Fusarium sp. (Fusarium patch; pink snow mold)

Visible symptoms of attacks by this fungus are most readily detected either under melting snow or in areas of free moisture resulting from melting snow. Dead areas usually from ¼ to 3 inches in diameter have a characteristic pinkish or reddish periphery.

One of the reasons for the seriousness of this fungus is that it frequently is not "most readily detected." The author has found microscopic evidence of this fungus and apparent damage to turf, primarily bents and **Poa annua,** during all 12 months of the year. Small spots the size of a paper match head develop on diseased turf especially when the environment is cool and damp and shade and tree root competition a factor. The best way to define this symptom is a "salt and pepper effect." More often than not these symptoms go unnoticed until the mower man or the golf course superintendent begins to notice that "something is wrong." By this time consider-

able leaf surface (also perhaps crown and root) has been lost and severe damage may have occurred.

Obviously, spring and fall are the seasons when **Fusarium** sp. will be the most damaging. Fungicide applications should be regularly made in early spring as a guard against this serious pathogen. Conceivably **Fusarium** sp. could be indirectly associated with the severity of parasites which follow later in the season by initially reducing the natural vigor and resistence of turf.

During the warmer and even drier months Fusarium sp. can be microscopically detected in diseased and/or dead turf areas along with other fungus organisms. The extent of damage is not definitely understood, but surely this fungus is intimately associated in a complex with other leaf disease-causing organisms, and involved in the unexplored area of root maladies. Mercurials, both organic and inorganic, and mixtures of these and broad spectrum turf fungicides seem to give the most positive and long lasting control.

Helminthosporium sp. (Leaf spot, melting out)

Visible symptoms of attack by this fungus are characteristic dead spots on individual leaf blades and/or dead areas varying in size from ¼" to indefinite. Individual dead spots on leaves usually have tan colored centers surrounded by blackened borders. **Helminthosporium** sp. is known to be parasitic on all the grasses with which we deal.

Here again, one of the dangers of this fungus is its subtlety. It often goes undetected for a period of time and faulty diagnosis is common. One of the reasons it is listed among the most important or severe pathogens is its tendency to kill stems and crowns. No doubt it plays a starring role in the previously mentioned, little explored area of root maladies.

Damage from **Helminthosporium** sp. has been detected year around but tends to be most pronounced during cool, humid weather. However, attacks have been severe during hot, dry periods on high, well-drained areas. Apparently species differentiation is a factor here. The author believes **Helminthosporium** sp. is the most omnipresent and omnivorous genus of fungi with which we deal. The fact that hundreds of species of this genus of fungus are recognized tends to verify this.

Chemical controls for this malady are not consistent. Here again, this no doubt is dependent upon the particular species in question. At times a mixture of zinc ethylene bisdithiocarbamate (Zineb) and iron sulfate offers the most positive control. At other times mecurials and mixtures of them and broad spectrum turf fungicides are the most effective. Antibiotic fungicides also offer positive control either alone or in combination.

Pythium sp. (Cottony blight, grease spot)

Visible symptoms of attack by this fungus characteristically follow presence of free moisture and usually higher temperature. Diseased spots which vary in size from ½" to include an entire green (or larger) have a black-greasy appearance which later turns straw (dead grass) color.

Perhaps many will question the consideration of this fungus in importance before various other disease causing organisms. Its importance is not because it appears so regularly in the Midwest, but because when it does appear there seems to be only limited chemical control available. Reports of partial to complete control are frequent but no regular or constant control has yet been developed. Daily applications of broad spectrum turf fungicides or a mixture of Captan and antibiotics are the most frequently used chemicals. Concerted efforts must be made to dry the diseased area in any way possible such as through the use of sand or lime and temporarily improving surface drainage with hollow-tined forks, etc.

Rhizoctonia solani (Brown patch); **Sclerotinia homoeocarpa** (Dollar spot); **Typhula** sp. (Snow mold)

In many respects these pathogens are quite similar and they react similarly to chemical control treatments. Visible symptoms of attacks by these fungi are quite similar. The characteristic variation is in temperature requirements: snow mold—cold; dollar spot—temperate; brown patch—hot. (Physiologic races of Rhizoctonia have been found which will thrive under moderate temperatures.) The fungi which causes these

diseases all require free moisture and in general wet, humid conditions in order to attack and be damaging. They are all easily controlled by chemical means, which reduced them from the most damaging turf disease causer to a secondary role.

A mixture of inorganic mercuries continues to give the most positive and long lasting control. About the only time this chemical mixture fails to give satisfactory control is when excess moisture is present for an extended period of time. Thiram, phenyl mercuric acetate and other chemicals also offer control.

Gloeocercospora sorghi (Copper spot); **Corticium fuciforme** (Red thread)

Visible symptoms of attacks by these fungi are quite similar. Copper spot is just that, copperish colored spots 2" or 3" in diameter appear speckled over the affected area. Red thread does not appear as regular spots but rather irregular and reddish strands of fungus are visible. Environmental conditions are similar; humid and cool to mild.

These diseases rarely appear in the Midwestern area. Occasionally they are present in the Detroit area and rarely in the Chicago area. Perhaps this is true because exact environmental conditions are lacking. Also, these organisms would attack in spring or fall; Cadmium compounds are effective long lasting controls for these maladies and are generally used at this time of year in these areas.

WARM SEASON GRASSES

Considerably less has been determined and thus written about fungus diseases of the warm season grasses. Zoysia and bermudagrass are the species involved as far as golf turf in the Midwest is concerned.

Some years ago Dr. Frank Howard, Pathologist at the University of Rhode Island, commented that "the reason little is said about diseases of warm season grasses is that they are relatively newly introduced into this country, thus the diseases have not caught up with them yet." To a considerable extent this is still true. However, it is beginning to appear that a number of fungi are becoming increasingly more damaging to bermudagrass or are beginning to "catch-up" with it. It is believed that "winter kill" of bermudagrass (primarily U-3) is largely the result of attacks by parasitic fungi when bermudagrass is in its dormant stage. Under microscopic examination **Helminthosporium** sp. and **Fusarium** sp. have been found repeatedly on dormant stems, leaves, roots and rhizomes of U-3.

As far as summer diseases of these grasses are concerned, they still seem to be relatively minor. **Helminthosporium** sp. appears to be increasing in incidence and severity on U-3 bermudagrass. Possibly U-3 grows so rapidly during hot weather that it simply out-produces the disease.

Control measures for disease of these grasses are the same for corresponding diseases on cool season grasses at this time. Perhaps other controls will be developed in the future.

Cultural Control

The turf specialist will note that the leaf spot type of diseases such as **Curvularia** sp., **Colletotrichum** sp., **Septoria** sp., **Phyllosticta** sp. and others have been omitted. It is believed that by and large these are not primary turf pathogens but are secondary or damaging only when the grass has been weakened through some other influence. These influences can be anything which weakens turf: attacks by other fungi, traffic, shade, tree root competition, excess of mat and thatch or organic matter, lack of air circulation, mechanical damage, damage from excesses or fertilizers-herbicides-fungicides, presence of insects and shortage of plant nutrients. Therefore, even though most of these secondary organisms can be checked or controlled by the use of chemicals, they will rarely be troublesome if primary parasites are controlled and the various cultural controls are practiced.

The practice of cultural control also affects the incidence and severity of the primary pathogens but cannot stop them completely. One item is consistent in the epidemiology of the primary parasitic fungi (likewise the secondary). This is the presence of free moisture. It has been determined that proper drainage is an excellent fungicide. The most important concept of effective cultural disease control, and one which is regularly ignored, is the assurance of ade-

quate surface and sub-surface drainage. Of the fungi known to attack grass, apparently all require free moisture in order to penetrate the above ground plant parts. Few of these fungi will develop to damaging proportions if surface and soil water is not in excess. Under waterlogged conditions all of the known parasitic fungi can and do develop into serious problems with which it is difficult to cope. Therefore if water drainage is assured, our primary cultural disease control concept is a guarantee. A considerable amount has been done in this regard; greens and other areas now can be constructed so that adequate and permanent drainage is assured.

The next most important cultural control concept is considered to be traffic, primarily cart and foot. Without the golfer it would be relatively easy to maintain golf courses and control the diseases thereon. However, we must face the fact that golf courses are present for the enjoyment and abuse of the golfer and plan accordingly. Turf, damaged as a result of excessive traffic, is susceptible to severe attacks from both primary and secondary organisms. Not only must proper and adequate fungicides be applied but the golf course superintendent must make all efforts to direct traffic over as much of the course as possible thus dispersing it away from localized heavy traffic areas. This is only partially possible and consequently we resort to such things as installation of asphalt cart paths, the building of larger greens and tees (and courses for this matter), the placing of traps closer to greens thus discouraging traffic (foot and cart) and heavy equipment from abusing such restricted areas and the placing of signs and ingenious traffic directing devices in susceptible heavy traffic areas. It is becoming increasingly more apparent that the club must allow its superintendent more uninterrupted time in order to complete his work if they expect him to give them a presentable course. This increase in traffic is reaching alarming proportions. Many clubs are now closing the course to all play on Mondays, as an example.

Other important cultural considerations are dependent upon common sense.

1. Apply proper amounts of plant nutrients. Fungi vary in their pathogenic severity according to availability of nutrients to the grass. Brown patch and pythium diseases are more troublesome when nutrient levels are high. Therefore, the practice of reducing fertilizer rates during hot weather is generally and properly practiced.

Dollar spot is less of a problem when nutrient levels are high. However, Fusarium patch can be more of a problem when nutrients are in excess. As previously stated, possibly Fusarium patch is one of the most damaging diseases in the Midwestern area. Careful use of nitrogen in cooler months, regardless of the dollar spot picture, is a safeguard.

There is so little proven through scientific endeavor along this line that the assumptions and practices followed have been determined through observation by golf course superintendents. This is a subject about which more information is needed.

2. Remove trees in order to decrease shade and tree root competition. If entire trees are not removed, prune tree roots and limbs as necessary. Not only are fungi more damaging to tender shaded grass but evaporation of surface moisture is reduced in shaded areas which increases activity of fungi.

3. All of the fungi discussed are known to be facultative organisms. That is, they can subsist on both living and dead material. If a thick layer of mat and thatch or organic matter is present disease-causing organisms are also present—either in a growing or dormant stage in this layer of organic matter. When turf loses its resistance to these omnipresent disease-causing organisms because environmental conditions favor the fungi or when turf is weakened through some cultural aspect such as excessive traffic, trees, etc., the fungi are then capable of attacking and causing disease.

A thick layer of organic matter also interferes with water movement down to and through the soil. This layer will sometimes absorb and hold free moisture while under other conditions it will shed applied water and become dry.

Thus the entire irrigation or water relationship is confounded. However, our interest here rests in the accumulation and presence of surface moisture. As we

previously discussed, fungi benefit greatly as a result of this moisture.

Spiking, aeration, aerothatching, and rebuilding greens are often done in an effort to reduce this organic layer and thus effect cultural disease control. Basic soil consistency is a consideration here and was discussed under moisture.

CONCLUSION

All turf management practices are either directly or indirectly associated with incidence of disease. As can be seen, chemical control and cultural control of disease-causing fungi are intrinsically interwoven. Cultural control goes a long way in keeping turfgrass disease free (or disease reduced) and unless proper management practices are pursued, even the best chemical controls often fail to stop disease spread. On the other hand, chemical control measures are frequently and regularly necessary especially during periods when adverse environmental conditions prevail, even though the best known cultural practices are followed.

The frustrating aspects of disease control mentioned earlier arise primarily as a result of the lack of basic knowledge. As examples, why will a green, even though located in a similar area or adjacent to other greens, be constantly susceptible to disease while its neighbors remain relatively disease free. The author has seen examples of courses located in the same general area; one course receives the best possible management known, yet disease is a problem even though fungicides are regularly and frequently used. The other course receives far inferior management and less frequent and regular fungicide applications, yet diseases are much less of a problem and in general, turf is healthier. Of course, these are exceptions. Nonetheless, they exist.

COMING EVENTS

February 26-March 1
Cornell Turfgrass Conference
Cornell University
Ithaca, N. Y.

March 5-6-7
Midwest Regional Turfgrass Conference
Memorial Center, Purdue University
Lafayette, Indiana

March 8-9
Massachusetts Turfgrass Conference
University of Massachusetts
Amherst, Mass.

March 13-14-15
Iowa Turfgrass Conference
Memorial Union Building
Iowa State University
Ames, Iowa

March 22-23
Michigan Turfgrass Conference
Michigan State University
East Lansing, Mich.

Potassium — That Mysterious Macronutrient

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Of the various soil minerals known to be essential to plant growth, potassium was among the first to be recognized. One of the first observations of potassium-plant relationships was that potassium is required in relatively large quantities by plants. Yet, since those early observations, progress has been slow in understanding the specific part potassium plays in plant growth and development. Through scientific investigations and practical observations we have learned that plant uptake of potassium is often higher than any other mineral and that a deficiency of potassium will give a very marked decrease in growth and, if the potassium level is low enough, even death of the plant. Since the beginning of the 20th century, emphasis on quality of crop production, especially in turf management, has increased to a prime factor. Here, too, potassium and plant quality are very closely related. It seems only profitable, then, to survey briefly what is known of the potassium-plant relationships.

Function of Potassium in Plants

Voluminous amounts of investigations on potassium-plant relationships have clearly indicated that unlike nitrogen, phosphorus, calcium, and magnesium,