Some Causes for Yellow or Chlorotic Putting Greens

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Throughout the year pathologists receive numerous samples of yellow bentgrass (*Agrostis* spp.) or annual bluegrass (*Poa annua*) from putting greens. In autumn or spring, superintendents sometimes suspect yellow tuft (*Sclerophthora macrospora*) or yellow patch (*Rhizoctonia cerealis*) diseases are the problem. These diseases, however, generally do not cause a uniform chlorosis throughout large portions of greens.

Yellow tufted infected plants are distinctively tufted and are most conspicuous during cool, wet periods. The yellow tuft fungus produces large numbers of tillers. Healthy plants have 4 to 8 tillers, whereas yellow tuft plants from putting greens typically have 15 or more tillers. Furthermore, yellow tuft plants are easily detached from the putting surface, because the roots of infected plants are short and bunchy. Yellow tuft is most commonly observed from late winter to early summer following an autumn seeding or heavy interseeding.

Yellow patch appears in distinctive circular patches or rings that may be yellow or reddish-brown in color. Yellow patch can develop from autumn to spring, but is most common during excessively wet, overcast periods in the spring.

When turf on putting greens develops a chlorosis in the summer, many believe they have a root pathogen such as parasitic nematodes or a *Pythium* disease. The latter can elicit a chlorosis, but the disease symptoms caused by these pathogens are nonspecific, and only a lab analysis can confirm their presence. **Many samples of chlorotic turf sent to our lab turn out to be negative for disease.** A negative disease diagnosis frustrates most superintendents, and other causes for the yellowing must be sought.

Chlorosis or yellowing can be caused by a lack of chlorophyll production or abnormal breakdown of chlorophyll levels. **Chlorosis may be induced by nutrient-related deficiencies, senescence, environmental stress, or genetic factors.** The most common nutritional problems would include low nitrogen (N) fertility; high nitrogen use in combination with low potassium-levels in some soils; and iron (Fe) or magnesium (Mg) deficiencies. While growth limiting FE and Mg deficiencies are relatively uncommon in most soils, even in high-sand USGA method root zone mixes, creeping bentgrass (*A. stolonifera*) often exhibits a "green-up" response following an application of Fe and Mg. Other factors, however, can limit Fe or Mg uptake, such as extremes in soil pH, and possibly cold or wet weather. Because problems with nonuniform chlorosis often appear during spring and autumn, it seems probable that environmental conditions may be interfering with root uptake of Fe, Mg, or other micronutrients. It is also likely that these weather conditions inhibit chlorophyll production and/or retention levels in plants. Both spring and autumn are characterized by generally warm days and cool nights. These conditions are ideal for growth of cool-season grasses. It is therefore probable that cool to cold nights impair the ability of plants to produce sufficient chlorophyll levels in rapidly growing leaf and sheath tissues, and as a result the turf develops a yellow appearance. **Some biotypes of annual bluegrass and creeping bentgrass are naturally yellow-green in color and their color cannot be darkened significantly by applying nutrients.** Annual bluegrass plants often turn yellow in the spring and early summer when producing seedheads. Furthermore, prolonged periods of overcast and rainy weather from spring to early winter induce chlorosis, particularly in low-lying or poorly drained sites. This yellowing is partially attributed to oxygen deprivation in excessively wet soils.

Autumn chlorosis is also very common on creeping bentgrass and other cool-season grass fairways, intermediate roughs, and green surrounds. The chlorosis in these areas often develops in pockets. Normally, there is no apparent relationship between the appearance of chlorosis and soil condition, i.e., well drained vs. wet. Chlorosis, however, is more common in shaded or wet sites, but these factors are not associated with all warm-day/cool-night related chlorosis problems.

Creeping bentgrass, annual bluegrass, and other cool-season grasses may also develop a chlorosis with the advent of hot and humid conditions in summer. This is particularly true when soils are extremely wet as a result of extended rainy weather or excessive irrigation. Annual biotypes of bluegrass typically turn yellow in response to high temperature stress. Many annual bluegrass biotypes are simply yellow-green in color.

In creeping bentgrass, distinct yellow and circular spots or patches 2 to 3 inches (25 to 75 mm) in diameter may appear in the summer. This often is a clonal or biotype

Continued on page 6

...Chlorotic Putting Greens

Continued from page 4

response to heat stress and high humidity, but usually there is no turf thinning. Thinning and turf loss, however, may be the result of a pathogen. When in doubt, samples should be sent to a diagnostic lab. Excessive irrigation, soil compaction, poor internal drainage, supraoptimal temperature stress, and shade also cause yellowing during the summer. The yellowing is due to altered physiological processes—such as lowered photosynthesis and increased respiration—leading to senescence, low soil oxygen levels, impaired transpiration, or possibly an inability of roots to effectively take up nutrients. In the aforementioned situations, it is important to promote soil drying and cooling by restricting irrigation and syringing judiciously, avoiding mechanical injury, and improving air circulation with fans or by selective tree and bush removal.

In most situations, the chlorosis that develops in response to abrupt temperature or relative humidity changes or extremes dissipates within a few weeks or months. Nutritionally related chlorosis can debilitate plants, especially annual bluegrass and creeping bentgrass on greens. **Should thinning of the turf become evident, an application of 0.1 to 0.2 lb N per 1,000 ft^2 (0.5 to 1.0 kg N per ha) from a quick-release nitrogen source or a micronutrient product may alleviate the condition.** Because Fe and Mg are involved in chlorophyll production and elicit a shoot green up response, they are frequently recommended. **Iron sulfate (1 to 2 oz per 1,000 ft^2, 30 to 60 g per 93 m^2) or chelated Fe materials are suggested. Epsom salts or $MgSO_4$ (2.0 oz per 1,000 ft^2; 60 g per 93 m^2) are good sources of Mg.** Also, the next time large increments of nitrogen (i.e., >0.5 lb N per 1,000 ft^2; 25 kg N per ha) are to be applied use a complete fertilizer, i.e., N + P + K. The application of other micronutrients and biostimulants may also be beneficial. If the yellowing is clonal, i.e., genetic, a significant greenup in response to N, Fe, Mg, or other micronutrient applications is unlikely. Covering chlorotic greens during unusually cold spring or autumn nights may be somewhat beneficial. Promoting soil drying and evaporation, as previously noted, is recommended in the summer.

There are other causes of a generalized chlorosis, including the following: (a) integrating applications of plant growth regulators and biostimulants containing gibberellic acid; (b) certain pesticides applied during warm to hot weather can scorch on yellow turf; (c) use of extremely high seeding rates, which result in huge numbers of plants occupying a small space; (d) excessively wet or poorly drained soils that become temporarily anaerobic; (e) prolonged periods of overcast or rainy weather; (f) iron chlorosis due to alkaline soils; (g) plant parasitic nematodes; (h) *Pythium*-induced root dysfunction; and perhaps (i) viruses and other diseases. In the case of these latter situations, the chlorosis could develop at almost any time of the year.

...New Turf Insecticides

Continued from page 5

residues are leached down to the root zone. That's why they should be watered-in soon after application.

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Naturalis-T® is a new product containing the insect-specific fungus *Beauveria bassiana.* When the fungus comes into contact with the target pest, ostensibly it sticks to its outer surface, penetrates the body wall of the insect, and causes death by rapid loss of water and nutrients. Natural epidemics of *Beauveria bassiana* sometimes suppress populations of chinch bugs and certain other insects under moist conditions. The commercial product has performed poorly in my cutworm and grub trials. So far, I've not seen convincing evidence that Naturalis-T® provides reliable, consistent control of turfgrass pests.

Note: Additional information on insecticides is included in the author's new book *Destructive Turfgrass Insects: Biology, Diagnosis, and Control,* which is available from Ann Arbor Press (121 South Main Street, P.O. Box 310, Chelsea, MI 48118; tel 1-800-858-5299; fax 734-475-5299).