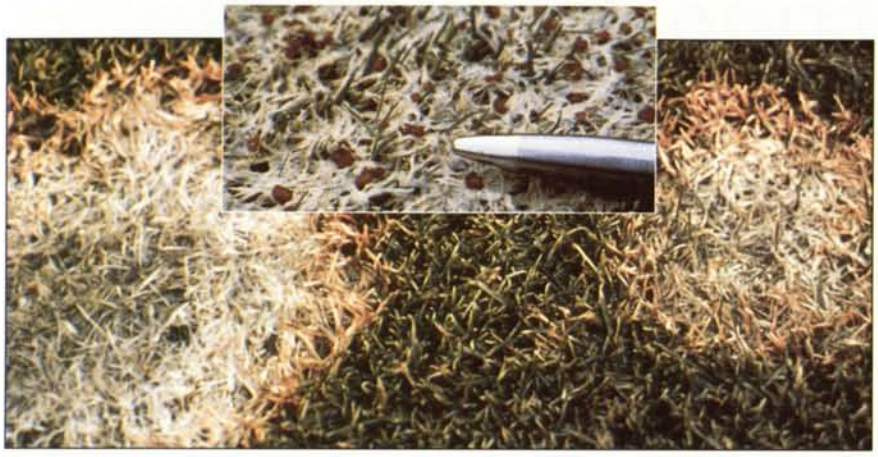
IPM:

Discouraging Diseases With Cultural Management



Nitrogen application is a key element in the management of turfgrass diseases. For example, both *Microdochium* patch (pink snow mold) and *Typhula* blight (gray snow mold) can be exacerbated by nitrogen application. Apply nitrogen cautiously if these diseases are a problem on your turf.

By Dr. J.M. Vargas Jr.

Cultural management is, of course, only one aspect of a comprehensive program for managing turfgrass disease. The other major components of a disease-management program are resistant cultivars and chemical management. This article deals with the effects of soil fertility, soil pH, watering and mowing on turfgrass disease.

Soil Fertility

Adding nitrogen to soil makes some turfgrass diseases worse but reduces the severity of others. Some diseases in each category are listed in Table A.

Once you know the effect of nitrogen on disease development, timing the nitrogen applications becomes the next important consideration. Nitrogen applied in the spring is not going to solve a stem-rust problem in the fall. Timing nitrogen applications to make a particular disease less severe is not as simple as it may seem. In the course of one growing season, a single turfgrass species may be subject to a variety of diseases, all of which must be taken into account. It would be ideal if each turfgrass species were susceptible to only one disease, for then it would be easy to plan nitrogen applications. Unfortunately, as things are, a program of nitrogen fertilization that alleviates one disease may worsen another.

You must balance disease management with the nutrient needs of the turfgrass plant. Grass plants need nitrogen, so you cannot simply eliminate all nitrogen applications in the interests of disease management. You should apply nitrogen at the time of year when it will assist disease management the most.

After nitrogen, the two most important elements for growing plants are phosphorus and potassium. The role of these elements in controlling diseases has not been determined. If most turfgrasses were subject to only one serious disease, it might be worthwhile to maintain relative concentrations of nitrogen, phosphorus and potassium designed to mitigate that disease. But, unfortunately, most turfgrass species have many diseases during a single growing season, and while it is fairly easy to regulate the nitrogen level, it is difficult to alter the amounts of phosphorus and potassium available to the plant. Phosphorus and potassium tend to be insoluble and thus are not readily leached. It is easy to raise the level of these nutrients in the soil but hard to bring it back down quickly. It would be very difficult to implement any program that required raising and lowering the levels of phosphorus and potassium throughout the season. The simplest solution is to maintain adequate levels of phosphorus and potassium and vary the amount of nitrogen.

Sulfur is known to be a fungicide. It may act to reduce disease directly as a fungicide or indirectly as a plant nutrient. R.L. Goss and C.J. Gould demonstrated control of *Microdochium* patch with sulfur, and P.H. Dernoeden showed take-all patch was reduced by sulfur. While all this may be well and good, other fungicides and cultural practices can be used to manage these diseases without the potential problems that sulfur poses. Sulfur has been shown to be the primary cause of the black layer. Managing *Microdochium* patch and take-all patch with sulfur is a little like curing the common cold with chemotherapy: It might do the job, but God help the patient. These two diseases can be managed using less drastic means, but it is very difficult to manage a black layer once it occurs.

Iron is a minor element that is applied when turf becomes chlorotic because of an iron deficiency. This deficiency may occur when low levels of iron are present in the soil or when adequate levels of iron are present in the soil but unavailable due to the high soil pH. When soluble iron

Table A: Effects of Nitrogen on Selected Turfgrass Diseases

Severity increased by nitrogen	Severity decreased by nitrogen
Pythium blight	Dollar spot
Brown patch	Rust
Gray leaf spot	Red thread
Stripe smut	Pink patch
Microdochium patch	Anthracnose
Typhula blight	Necrotic ring spot
	Summer patch
	Melting-out
	Leaf spot

is applied to foliage, it is a matter of only half an hour or so before the turf looks darker and greener. Iron sulfate is generally used, although other forms of soluble iron are available. If you desire a darker green turf, adding iron is a much safer way to get it than applying nitrogen. Adding excessive amounts of nitrogen will only encourage development of certain diseases, and you may be left with brown turf or bare ground instead of the lovely dark-green grass you envisioned.

Iron sulfate may be used to mask the symptoms of yellow tuft disease. While this won't control the problem, it will make turf infected with yellow tuft look better.

Soil pH

Most of the literature tells you that the soil pH should be maintained at the optimum level for turfgrass growth (between 6 and 7). This is really part of folklore and is based on research done on wheat and corn. Having a pH between 6 and 7 is important so the wheat and corn plants can have the phosphorus in the soil available at heading time because it is difficult to run a fertilizer down the field when the corn is 6 feet high. On the other hand, you can run a fertilizer spreader over your turf every day if need be. It is much safer to add the fertilizer as needed than to try to lower the pH with sulfur and wind up with a black layer. In most instances it is also impossible to lower the pH of soils above 7.5 with sulfur because of the high buffering capacity of the soil.

Although some diseases do respond to changes in soil pH, it is not practical to combat turfgrass diseases by adjusting pH. For example, it is impossible to change the soil pH from 5 to 7 to fight one disease and then change it back again when a different disease comes along. Since the effect of pH on turfgrass diseases is usually related to the levels of nitrogen, phosphorus and potassium, it is much simpler to live with the pH you have, adjust the levels of phosphorus and potassium in the soil, and add nitrogen as needed.

Irrigation

Proper irrigation can help minimize turfgrass diseases. The best time to irrigate is in the afternoon, lightly and daily. It not only supplies the plant with water but helps cool it off, so it can better make it through the stress of midday. The worst time to irrigate turf is early to late evening. This wets the turfgrass plant and debris (mat and thatch) and allows foliar pathogens to germinate, grow and infect all night, since normally very little drying takes place before sunrise. Watering early in the evening also cools off the plants and promotes the formation of guttation water, which is rich in nutrients and encourages even more disease development.

If irrigating during the day is impractical, the second-best time to irrigate is just before sunrise. The water dilutes the nutrient-rich guttation water and, by breaking up the droplets, allows quicker drying after the sun rises.

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Drainage

Good drainage is just as important as proper irrigation. In the transition zone and the warm-season grass areas, *Pythium* blight requires chemical management, but in the northern region of the cool-season grass belt, *Pythium* blight indicates a drainage problem. If you correct the drainage problem, you will also clear up most of the *Pythium* blight. Other diseases that are made worse by poor drainage are brown patch and *Typhula* blight.

Air drainage is important, too. Diseases like *Microdochium* patch, *Pythium* blight, brown patch, powdery mildew and gray leaf spot are more severe where air drainage is poor. Removing or pruning some trees, especially the lower limbs, will increase the air circulation and make these diseases less severe.

Mowing

Grass should not be mowed shorter than its minimum competitive mowing height. (See Table B for mowing heights of some turfgrass species.) For some species, like creeping bentgrass, this can be as short as 1/8 inch, although 3/16 inch is more practical, especially if you want to prevent the creeping bentgrass from becoming annual bluegrass, and 1/2 inch would be preferable (but is not possible on greens). Other species — Kentucky bluegrass, for example — have a minimum competitive height of 1 inch, and certain cultivars must be cut even higher. It has been suggested that the "new" Kentucky bluegrasses could be cut shorter and still compete with other grasses such as annual bluegrass. Maybe they could if they didn't have to sustain traffic, but traffic can't be eliminated from a golf course fairway. There is no reason to mow home lawns so short. Turfgrass plants mowed shorter than their optimal height of cut are, in general, more susceptible to diseases.

Seasonal variation in mowing heights can be beneficial. A lower cutting height during cool weather retards thatch development, whereas higher mowing heights during warm weather may lower the temperature around crowns and help the grass survive the stress period.

How often you mow depends on how much the turf is used. In any case, you must make sure that no more than one-third of the shoot growth is removed during a single mowing. A golf green needs daily mowing (at least six days a week), and fairways and tees require mowing daily to once a week (three times a week is common). For areas of general use such as parks, home lawns and athletic fields, mowing once a week is usually sufficient.

Mowing makes wounds through which pathogenic fungi can enter the plant and infect it. The more you mow, the more fresh wounds the grass will have. A dull mower inflicts more and bigger wounds than a sharp mower. Wounds made by a sharp mower are cleaner and heal faster than the tearing and shredding caused by a dull mower.

Clippings and Thatch

It is not clear what effect clippings have on disease development. There is little evidence to support the theory that clippings left on the ground increase inoculum levels and thereby encourage disease. In fact, clippings seem to have little direct effect on disease development, and they do not contribute to thatch. With some diseases, like melting-out, large amounts of inoculum may be present in the crown area and rootzone; however, there is little evidence that the disease is worse where clippings are left than where they are removed. Even when clippings are removed, there appears to be plenty of inoculum for an epidemic. If you want to prevent a melting-out problem, plant a resistant grass variety and leave the clippings debate to the plant pathologists.

Golf course greens have more diseases than other turfs although the clippings are removed. For diseases with airborne inoculum, like the rusts, smuts, powdery mildews and leaf spots in general, removing the clippings won't affect the inoculum level.

Leaving the clippings does, however, affect the total nitrogen and potassium available to the plant. Turfs from which the clippings are removed require more added fertilizer than turfs on which clippings are left.

Leaving the clippings on a higher-cut home lawn does not appear to cause any detrimental effects to the turf, assuming the turf is mowed frequently enough so that no more than one-third of the plant is removed at any one time. In fact, with the looming crisis of running out of landfill space, homeowners may find it impossible to dispose of their clippings and may have to resort to mulching mowers.

It is a different story on golf courses, where removing clippings definitely improves the quality of creeping bentgrass-annual bluegrass greens and fairways. On fairways, removing the clippings during the warm weather of summer has definitely improved the quality of the fairways. They remain much denser than fairways where clippings are not removed. No one seems to know exactly why, but it appears to be related to the rapid breakdown of the clippings in the warm weather, releasing toxic substances that thin the turf.

There has also been a noticeable increase in the creeping bentgrass content on fairways where clippings are removed. It appears that where the creeping bentgrass is not thinned by the toxins in the clippings, it gains a competitive advantage over the annual bluegrass during the warm weather.

The theory that collecting grass clippings can prevent thatch should rank with such fairy tales as Peter Pan, Goldilocks and the Three Bears, and Cinderella. God alone probably knows who started the tale, but few have spread as fast and as widely. Good experimental data have disproven the theory that grass clippings are a contributor to thatch development, but common sense should have disproven the theory long ago. Few areas have the thatch problems that a golf course green has, and yet clippings are removed there all the time! Collecting the clippings just removes valuable nitrogen and potassium. An additional one to two pounds of nitrogen per 1,000 square feet, as well as supplemental potassium, will have to be added each season where clippings are removed. Thatch is composed primarily of rhizomes, stolons and roots, which you don't mow. What you do mow is the leaf blades, which are composed of materials, cellulose and hemi-cellulose that are broken down readily by microorganisms. The other plant parts have a high lignin content, are therefore not readily broken down by microorganisms and

Table B: Mowing Heights of Some Turfgrass Species

Species	Minimum Height (in.)	Preferred Height (in.)
Creeping bentgrass	1/8	1/4-1
Kentucky bluegrass	1	2-3
Fine-leaf fescue	1/2	2-3
Bermudagrass	1/8	1/2-3
St. Augustinegrass	3/4	2-3
Zoysiagrass	3/4	2-3
Annual bluegrass	1/8	1/4-1

consequently contribute to the development of thatch.

Many people say that thatch causes disease, but there is little evidence that it actually does so. It is suggested that thatch harbors the pathogens that cause turf diseases. However, many diseases are airborne, like the rusts and powdery mildew, and the rest do just as well in a soil environment as in a thatch environment. The one problem with turfs that are maintained in thatch is that they are more susceptible to drought than turfs that are maintained in soils. Consequently, diseases like necrotic ring spot, summer patch and stripe smut, which develop symptoms under conditions of drought stress, will be more severe. However, this is quite different from the theory that thatch is the place that harbors all these nasty pathogens, as proposed by many turfgrass experts. The suggestion that if we somehow eliminate the thatch all our disease problems would go away just isn't true. Believe me, that's not going to happen.

Removal of the clippings for a crown or root-rot disease, like necrotic ring spot and summer patch, has little effect on inoculum levels. There are enough airborne spores of the fungi that cause melting-out, rusts, powdery mildew and smuts to negate what little could be done by removing clippings. The perfect example again is golf course greens, where clippings are always removed, yet there are as many disease problems on golf course greens as there are anywhere else.

Should you dethatch your lawn? The answer to that question depends on how much weight you have gained during the winter. If you gained a lot of weight, the exercise of running the power rake might be good for you. On the other hand, if you are too far out of shape, it might kill you! But it will do nothing for your thatch problem. You will remove the winter-killed grass, which would break down anyway, but you will not remove that thatch or correct a thatch problem. Where severe thatch exists, the lawn should be cored (aerated) and the soil in the cores returned to help facilitate thatch breakdown. It may be necessary to repeat this operation several times where severe thatch problems exist.

Rust, red thread, melting-out and leaf spot can be managed by mowing. Recommendations for managing these diseases call for increasing the nitrogen level. However, if you add nitrogen and do not mow, you will actually make the disease worse, not better. This has been demonstrated many times in the laboratory. In the field, where mowing occurs at least once a week, infected foliage is mowed off before the above-mentioned fungus has a chance to complete the disease cycle. Since these pathogens have a 10- to 14-day cycle from infection to sporulation, mowing once a week keeps it from becoming a serious problem. ❑

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