***Figure 1**. As the disease progresses, the roots become short and completely rotted and may appear totally black in color. Entire plants may die resulting in an irregular thinning of the grass and eventually bare patches may develop.*

Bermudagrass decline

Chemicals alone won't control this root-rotting fungus

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Bermudagrass decline is a destructive root rot disease caused by the fungus *Gaeumannomyces graminis* var. graminis. This fungus grows on the root system, invades the root vascular system (xylem and phloem) and thus debilitates the plant due to lack of water and carbohydrate movement between roots and leaves.

In combination with other stresses (for example, low mowing height, nutritional deficiencies or imbalances), aboveground symptoms will develop during the late summer and fall months if environmental conditions are conducive for disease development.

Initial symptoms of this disease may include the appearance of irregular yellow (chlorotic) patches ranging in diameter from a few inches to a few feet. A general chlorosis and necrosis (dead tissue) are first observed on the lower leaves.

Foliar lesions, such as leaf spots, are absent.

The root systems of these plants are

discolored with dark-colored lesions present on the roots. Associated rhizomes and stolons may have lesions also.

As the disease progresses, the roots become short and completely rotted and may appear totally black in color. Entire plants may die resulting in an irregular thinning of the grass (Figure 1) and eventually bare patches may develop.

As a general rule, the outer margins (clean-up pass) of a putting green exhibit the disease symptoms first (Figure 2). Correct diagnosis of the problem will require having a sample analyzed by a plant diagnostic clinic such as the Florida Extension Plant Disease Clinic in Gainesville (904-392-1994) since severe nematodes or Pythium species may cause similar damage.

I have been examining cultural and chemical methods for controlling this disease using the portion of the FCGSA Otto Schmeisser Research Green that is planted with Tifgreen 328. This area is maintained as a "normal" putting green mowed at 3/16 inch six times each week during the summer.

Fertility during the summer months (May through October) is 6 pounds each of nitrogen and potash per 1000 square feet with 1/2 pound of each applied every two weeks. Phosphorus is applied twice each year in May and October. Micronutrients are applied with each nitrogen application as they are a component of the fertilizer blend currently used (Harrell's 12-0-12 with Polyon TM polymer coated urea). The area is verticut and topdressed with an 80/20 mix approximateley once each month.

Experiments conducted in 1991 were initiated after moderate to severe above-ground disease sysmptoms were apparent (Figure 1). These experiments indicated that fungicides alone had no curative effect on this disease and that the best cultural treatment was simply to raise the height of cut.

In other words, once the above-ground symptoms are observed, it is too late to apply fungicides to control *G. q.* graminis, as the fungus has been attacking the root system for weeks or even months.

Contact fungicides may be useful to prevent secondary leaf diseases and to control the algae that usually develops in the areas where the grass thins and/or dies.

Experiments conducted in 1992 and 1993 were designed to examine preventive controls of this disease.

In one experiment, I evaluated all currently registered systemic fungicides and fungicides expected to be registered shortly for bermudagrass. Three preventive rate applications were made at 28-30 day intervals beginning the end of April.

In another experiment, fertility (N, P, K and Mn — individually and combined) was increased.

In addition, a 6-foot wide strip of the area was cut at 1/4 inch rather than 3/16 inch for the entire summer. The primary discernable difference among all treatments (fertilizers and fungicides) throughout the duration of the experiment was the better quality associated with the grass strip cut at 1/4 inch rather than 3/16 inch (Figure 3). No symptoms were ever observed on this higher cut of grass. Thus, as was observed in 1991, the higher height of cut is extremely important in preventing and eliminating the disease.

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If you have Tifdwarf putting greens, the same priciples apply in terms of raising the height at least 1/32 inch greater than your normal mowing height.

Cultural practices must be used in addition to any preventive fungicides. As soon as you observe any stress or initial symptoms, raise the height for a few days. There are ways to maintain speed — double cut, topdress, roll.

Explain to the members and players why you feel it is important to increase mowing height. Stress the need to raise the height off and on throughout the summer so the grass will not decline.

Bermudagrass Decline is a root rot disease and not a leaf disease. Grass can easily recover from a leaf disease. However, once the crown and root system of the plant dies, the plant will not recover, resulting in the bare patches of soil often

If you feel you must use a systemic fungicide, follow the directions completely and do not overuse these products.

observed. Emphasize that a little inconvenience during the summer means there will be grass to play on this fall and winter.

Superintendents and golfers must realize that both Tifgreen and Tifdwarf are over 20 years old. The grasses have not changed, but the maintenance practices and amount of play have changed dramatically. The primary maintenance change, due to the demand of the golfer, has been the decrease in the mowing height. Without leaf tissue, the plant cannot produce carbohydrates to sustain itself. Without a viable root system, there will be no leaf tissue. A simple but important lesson to remember and to emphasize to the golfer.

If you feel you must use a systemic fungicide, follow the directions completely and do not overuse these products. During the 1991 curative experiment, when the fungicides were used after severe symptoms had developed, the curative rates of the registered triazole fungicides actually slowed recovery of the grass. Again, the emphasis should be placed on cultural practices for disease prevention and control rather than chemical practices.

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Figure 2. *As a general rule, the outer margins (clean-up pass) of a putting green exhibit the disease symptoms first. Correct diagnosis of the problem will require having a sample analyzed by a plant diagnostic clinic.*

Figure 3. *The primary discernable difference among all treatments (fertilizers and fungicides) throughout the duration of the experiment was the better quality associated with the grass strip cut at 1/4 inch rather than 3/16 inch.*