Defining the Nature of Creeping Bentgrass Root Diseases

Research directed toward accurate diagnosis and management of putting green diseases.

BY LANE P. TREDWAY AND JAMES P. KERNS

Many golf course superintendents in the southeastern United States have recently experienced unusual disease problems in creeping bentgrass putting greens. The problems have been mainly limited to newly constructed greens, built within the past six years. Disease symptoms typically appear during the late spring and summer in circular patches ranging from three inches to several feet in diameter. In these patches, the turf initially exhibits signs of wilt or nutrient deficiency, but the foliage continues to decline and turns yellow to orange in color. Examination of affected plants during the summer reveals a tan, brown, or black rotting of the crown and roots. These characteristics, combined with the young age of affected greens, were consistent with take-all patch, which was the diagnosis provided by several pathologists across the country.

Take-all patch has historically been limited to the northern United States, but it also occurs in mountainous areas of the western Carolinas and north Georgia. Take-all patch is not known to occur at lower elevations in the Southeast. We examined the problem more closely and found that the take-all patch pathogen, *Gauemannomyces graminis* var. *avenae*, was not present in these regions. This led to the conclusion that an undescribed disease was responsible. In fact, we now know that there are at least two previously unknown diseases occurring on creeping bentgrass in the southeastern United States.

Summer patch, caused by *Magnaporthe poae*, is one of the new creeping bentgrass diseases discovered in North Carolina.[4] This disease is a well-known problem in bluegrass species across the United States. In 1993, M. L. Elliott identified *M. poae* as a pathogen of creeping bentgrass in Orlando and Palm Beach, Fla.[1] However, summer patch was not known to be a problem on creeping bentgrass within its normal growing regions. Thus far, summer patch appears to be very isolated in North Carolina and has only been observed in areas with high soil pH (≥7.0). Based on our observations, reduction of soil pH to 6.5 or less is a very effective means for management of summer patch in creeping bentgrass.

Typical disease symptoms observed during the summer in newly constructed creeping bentgrass putting greens in the southeastern United States.

Another undescribed disease has been more widely distributed in the southeastern United States. This disease has been observed as early as four months after seeding of newly constructed greens and has been observed on most of the new-generation creeping bentgrass varieties. In contrast to summer patch, soil pH does not appear to influence this disease, as it has been observed in soils with pH ranging from 4 to more than 7.

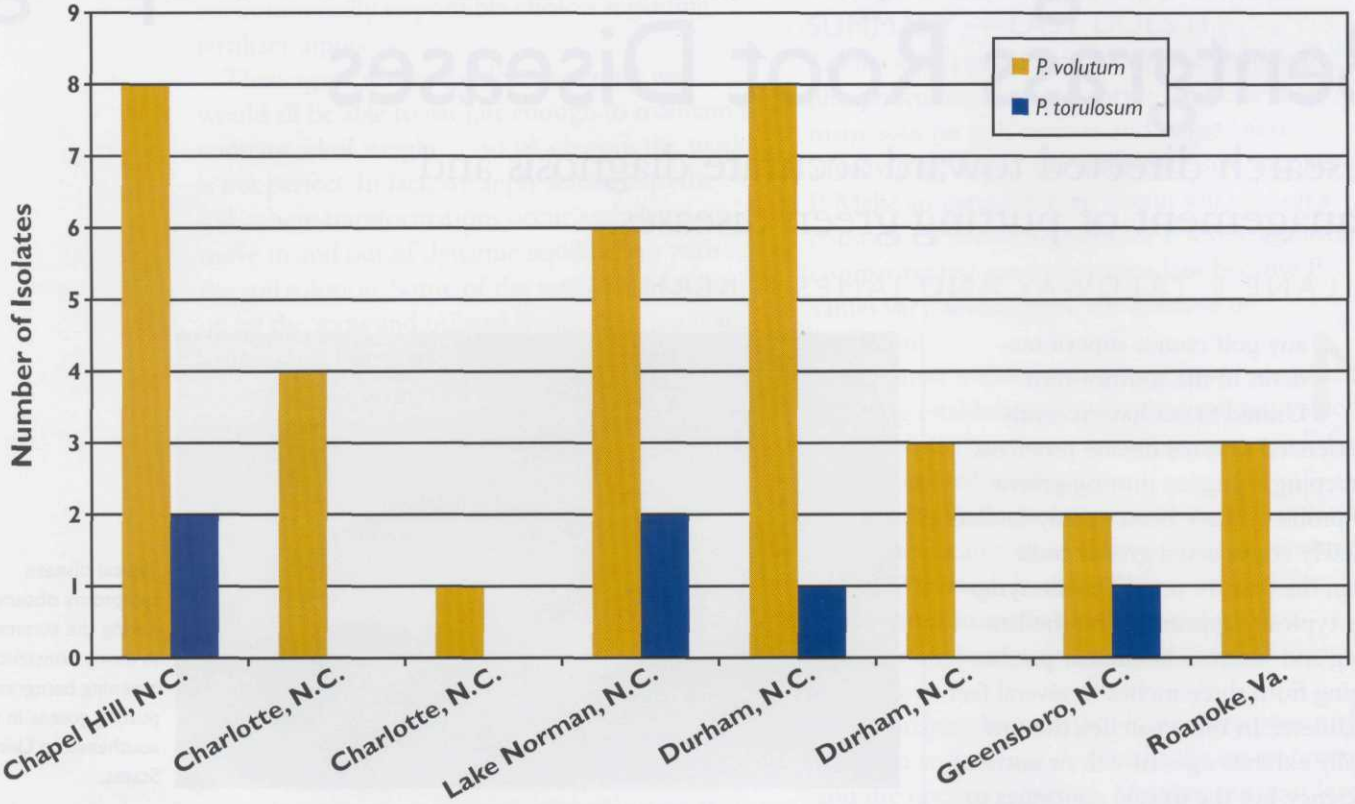
Unfortunately, this particular disease has been very difficult to characterize. In fact, we have been unable to consistently isolate any pathogens from the affected turf during the summer months, when the symptoms are most common. The tan to light brown rotting of crown and root tissues appears to be caused by secondary pathogens, such as *Curvularia spp.*, that are attacking the already weakened plants.

A major breakthrough occurred in November 2003 and March 2004 when mild symptoms of this unknown disease reoccurred in several locations, induced by unusually warm and dry weather. At that time, several unusual symptoms were observed in the actively growing bentgrass roots: dead root tips, lack of root hairs, and loose organization of cortical tissues. A significant amount of *Pythium* hyphae was also observed in the affected roots.

These symptoms are consistent with a disease called *Pythium* root dysfunc-

Figure 1

Distribution of *Pythium* species isolated from roots exhibiting dysfunction symptoms in North Carolina and Virginia.



tion, which was described in 1985 as a disease of newly constructed bentgrass putting greens in Iowa.[3] C. F. Hodges consistently isolated *P. arrhenomenes* and *P. aristosporum* from the roots of affected bentgrass plants and demonstrated the pathogenicity of these species in growth-chamber experiments. However, the disease was not reproduced in the field through inoculations, and control practices were not investigated.

In North Carolina and Virginia, *P. volutum* and *P. torulosum* were consistently isolated from roots exhibiting symptoms of *Pythium* root dysfunction in fall 2003 and spring 2004. *Pythium volutum* was dominant in every location, and *P. torulosum* was present in only half of the locations. Previous research conducted by Feng and Dernoeden in Maryland demonstrated that *P. volutum* is very aggressive toward creeping bentgrass seedlings at cool temperatures (64°F), whereas *P. torulosum* is only weakly pathogenic.[2]

Based on these results, we suspect that this more widely distributed disease is *Pythium* root dysfunction caused by *P. volutum*. The majority of pathogen growth and root damage appears to occur during the fall and spring when creeping bentgrass roots are actively growing. This activity may reduce the roots' ability to absorb water and nutrients. As a result, the bentgrass plants are more susceptible to heat and drought stress during the summer. The effect of *P. volutum* on creeping bentgrass root function is currently being studied in field and growth-chamber experiments. Additional isolates from other southeastern states reporting similar disease problems also are being obtained for comparison.

Based on our observations, cultural management practices have a major impact on the development and severity of this disease. Any source of stress, including nitrogen and other nutrient deficiencies, drought stress, and close mowing, appear to encourage the disease. Regular hollow-tine aerification and topdressing also appear to be important tools for managing this disease. In fact, when symptoms of the disease appear, the most recent aerification holes often remain completely healthy. Golf course superintendents who experience problems with this disease should conduct a comprehensive analysis of their management program to identify potential sources of stress. Regular tissue testing for nutrient content can be particularly helpful, and nematode populations also should be quantified in regions where these parasites are common.

Considerable progress has been made in the development of effective fungicide programs for control of this suspected *Pythium* disease. Surprisingly, the standard *Pythium* fungicides, such as mefanoxam (Subdue Maxx), propamocarb (Banol), and fosetyl-A1 (Signature), have provided poor to moderate control of the disease in our research trials. In 2003, we developed a curative

program that involved applications of Heritage + 3336, Terrazole, and Subdue Maxx within the course of a week. This intensive program provided up to three weeks of disease suppression in our trials.

In 2004, we applied the new QoI fungicide pyraclostrobin (Insignia 20WG) for the first time and found it to be more effective than individual fungicides or the 2003 curative program. Insignia has provided up to 28 days of curative control when applied at 0.9 oz. per 1,000 sq. ft. and watered in with ⅛ in. of water immediately after application. The vast majority of golf course superintendents who have applied Insignia for control of this disease have reported similar results. Golf course superintendents are strongly encouraged to submit samples to a diagnostic lab before initiating this type of control program so as to avoid unnecessary fungicide applications.

At this point, we still have far more questions than answers related to this suspected *Pythium* root disease. What is the effect of rootzone infiltration rate and other construction practices? What is the source of pathogen inoculum in newly constructed greens? Why are the standard *Pythium* fungicides not providing adequate control? Why is pyraclostrobin more effective than the other QoI fungicides? What is the appropriate timing for preventative fungicide applications? Research is continuing at North Carolina State University to answer these important questions and provide golf course superintendents with accurate methods for diagnosing and managing root diseases in creeping bentgrass.

LITERATURE CITED

1. Elliott, M. L. 1993. Association of *Magnaporthe poae* with a patch disease of creeping bentgrass in Florida. Plant Disease 77:429.

2. Feng, Y., and P. H. Dernoeden. 1999. *Pythium* species associated with root dysfunction of creeping bentgrass in Maryland. Plant Disease 83:516-520.

3. Hodges, C. F. 1985. *Pythium*-induced root dysfunction of secondary roots of *Agrostis palustris*. Plant Disease 69:336-340.

4. Tredway, L. P. 2005. First report of summer patch of creeping bentgrass caused by *Magnaporthe poae* in North Carolina. Plant Disease 89:204.

DR. LANE TREDWAY *is an assistant professor and extension specialist in the Department of Plant Pathology at North Carolina State University;* JAMES KERNS *is a graduate research assistant and Ph.D. student in plant pathology at North Carolina State University.*

Figure 2

Curative control of suspected *Pythium* root dysfunction in A-1 creeping bentgrass at Myers Park Country Club in Charlotte, N.C. Treatments were applied on July 20, 2004, in 2 gal. H_2O per 1,000 sq. ft., then watered in immediately with ⅛ in. of irrigation. Values represent average of four replications. Insignia provided significantly better curative control using the Waller-Duncan K-ratio t-test (k=100).