WSU Puyallup
**Turfgrass Science**

# Effects of Nitrogen Fertility and Mowing Heights on AnthracnoseBasal Rot Severity in Annual Bluegrass

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## Introduction

Incidence and the severity of anthracnose basal rot (ABR) outbreaks have greatly increased throughout the Midwest, Northeast, and the Pacific Northwest in the last 5-10 years. This highly destructive disease has rapidly become one of the most difficult and challenging management issues for a large number of golf course superintendents. It is now considered a very serious and common disease of annual bluegrass and creeping bentgrass putting greens. In Washington and Oregon, ABR had typically been considered a cool season disease occurring in the fall, often with symptoms appearing shortly after aerification. However, similar to the Northeast, symptoms are now observed on annual bluegrass in the Pacific Northwest throughout the growing season, appearing in spring, summer, and fall.

On turfgrasses, there are two distinct types of anthracnose symptoms caused by the pathogen *Colletotrichum graminicola*. The diseases appear as either a foliar blight or a rot of the shoots, crowns, and roots (Smith, 1954; Vargas, 1994). The latter, called anthracnose basal rot (Jackson and Herting, 1985), is much more destructive and more difficult to manage than anthracnose foliar blight (AFB). Once established, ABR quickly destroys the stems, crowns and roots of susceptible turf, thus compromising the overall playability and appearance of the putting surface.

Anthracnose basal rot is a highly variable disease that is often frustrating for superintendents to manage. Little is known about the factors that predispose turfgrasses to ABR infection. It is difficult to predict when and where disease symptoms will occur, and fungicides are often ineffective in controlling the pathogen. Our current knowledge of this disease is based on limited research with most information obtained primarily through field observations. From these observations, ABR development has been associated with nutrient deficiencies, low mowing heights, compaction, poor drainage, and wounding caused by aerification and topdressing (Smith et al., 1989; Vargas, 1994; Landschoot and Hoyland, 1995). Most of these associations have not been confirmed as predisposing factors through controlled experiments.

## Problem

Typical of most diseases attacking annual bluegrass, ABR is more severe on stressed plants. One probable explanation for the recent increase in ABR is the golfer's demand for faster putting surfaces. These expectations have forced superintendents to lower their mowing heights, with many courses mowing greens as low as 3/32 of an inch. Lower nitrogen levels are also used to increase speed. The result is usually a weaker plant with reduced stress tolerance. Research at Michigan State University (MSU) (Vargas, 1994) has shown that nitrogen fertility is an important factor in managing AFB. Increasing the rates of N-fertilizer increases resistance to the disease and also aids in recovery from anthracnose. The GCSAA has recently funded work at MSU (Horvath and Vargas) to evaluate the effects of nitrogen on ABR symptom development on annual bluegrass in controlled environments.

## Purpose

The purpose of this project is to develop an effective ABR management strategy for golf course superintendents. We must evaluate the cultural and environmental factors that predispose annual bluegrass to ABR before this can be achieved. This study will determine the effects of three nitrogen rates and three mowing heights on ABR severity. Soil temperature, air temperature, and surface moisture (rainfall and irrigation) will be monitored in an attempt to correlate these conditions with ABR outbreaks. In addition, basal rot symptoms occurring at surrounding golf courses will be recorded and compared to disease symptoms found on the research green.

A 5,000 square foot annual bluegrass green will be constructed at the Washington State University (WSU) Farm 5 Research Facility in Puyallup, Washington. The research team will consist of five investigators. Paul Backman, Research Associate in Turfgrass Management, gained valuable experience on ABR research with the completion of his masters thesis at Pennsylvania State University (PSU). The title of the project was "Variation in Pathogenicity, Cultural Characteristics, and RAPD Markers among *C. graminicola* from Turfgrass Hosts" (Backman, 1997). Dr. Gwen Stahnke, Associate Professor in Turfgrass Management, has been actively involved in research and extension programs with the northwest turfgrass industry for eight years. Dr. Eric Miltner, Assistant Agronomist in Turfgrass Research, recently joined the WSU team from Utah State University, providing years of experience in applied and basic research techniques. Thomas Cook, Associate Professor in Turfgrass, has been involved in teaching, research, and extension in the Northwest for over 20 years; and Dr. Peter J. Landschoot, Associate Professor of Turfgrass Science, provides an extensive background in turfgrass pathology and disease research. In addition, technical support is available from staff at the WSU Farm 5 research facility.

## Methods

**Construction** - Construction of the annual bluegrass green will begin in March of 1998 and will coincide with the reconstruction of the present research green at the WSU Farm 5 facility. Initial site preparation includes sod removal, excavation of 14 inches of the existing soil, and installation of the irrigation and drainage systems. The rootzone material will consist of an 80-20 sand/organic matter mix, which will be spread over a four-inch layer of gravel. Particle size analysis of the sand and gravel will be tested in order to meet the USGA specifications for elimination of a choker layer.

**Establishment** - Annual bluegrass will be established using aerification cores acquired from putting greens in the Northwest which have previously experienced severe ABR outbreaks. The aerification cores from all the greens will be thoroughly mixed together before distribution. Using these cores guarantees that the green will be composed of selections of annual bluegrass susceptible to ABR. It is known that host resistance to *C. graminicola* does exist within annual bluegrass selections (Landschoot and Backman, unpublished; Bolton and Cordukes, 1981). In addition, these cores should contain fruiting structures or quiescent mycelium, providing natural inoculation sources of *C. graminicola* that will becomeactive when environmental conditions are conducive to pathogen development. Aerification plugs will be collected in late April and early May after spring aerification from three golf courses: Everett Golf and Country Club and Oakbrook Country Club.

**Inoculation** - To guarantee ABR disease symptoms, an artificial inoculum source will be produced. Turf samples of annual bluegrass exhibiting symptoms of ABR will be collected from Washington and Oregon. From the infected root, crown, and/or shoot tissue, isolates of *C. graminicola* will be extracted and cultured on half-strength Potato Dextrose Agar (PDA). The inoculum will be prepared by transferring colonized half-strength PDA plugs on to a sterilized 2% (v/v) cornmeal/sand inoculum mixture (Backman, 1997). Once colonized, the mixture can be dried, spread evenly over the turfgrass surface, and worked into the crown region.

**Experimental Design** - The experiment will be arranged as a split-plot randomized complete block design, with six replications. Whole plots will be nitrogen rates of 3, 5, and 7 lbs. N/1000/year, with plots measuring six feet wide by thirty feet in length. Subplots will be ten feet wide by six feet long and consist of three mowing heights (1/8, 3/16, and 1/4 of an inch). Plots will be assessed visually for disease severity on a percentage basis, and disease ratings will be taken at two-week intervals throughout the growing seasons in 1999 and 2000. In order to track nitrogen availability, overall turf quality ratings will be taken looking at color, density, and growth rate.

**Maintenance** - Throughout the duration of the study, the plots will be irrigated as needed to prevent drought stress. Aerification and topdressing will be performed in the spring and fall, with light frequent topdressing during the growing season. Fertilizer applications will be made in 0.25 lb. N/1000 square feet increments with urea as the nitrogen source, using a combination of soluble (spray) and granular products. Supplemental applications of phosphorous, potassium, and minor nutrients will be made equally to each plot. Once the green is established, mowing will be scheduled five to six times per week during the growing season.

The establishment of the annual bluegrass research green will provide continuous long-term controlled experiments of ABR management. After evaluating the effects of nitrogen levels and mowing heights on ABR for two growing seasons, the green can be used for evaluation of preventative and curative fungicide applications, water volumes, and application timings. Other cultural factors such as drainage, irrigation, and timing of aerification and topdressing could be tested if found to be a major impact on disease development in previous research.

## Conclusion

Anthracnose basal rot outbreaks have become so severe that entire greens have been destroyed by the pathogen. With incidence of ABR on the rise, attempted control of this disease has had a major economic impact on the budgets of an increasing number of golf course operations. It is imperative that a successful integrated management strategy with a foundation based on cultural practices and environmental conditions be developed to prevent anthracnose basal rot outbreaks. The effects of nitrogen and mowing heights must be understood for their antagonistic properties to the pathogen *C. graminicola* in the attempt to reduce infection. The results of this project will benefit golf course superintendents across the country who are challenged daily to increase putting green speeds, thus compromising the health/stress tolerance of their putting green turf.

## BIBLIOGRAPHY


Backman, P.A. 1997. Variation in Pathogenicity, Morphology, and RAPD Markers of *Colletotrichum graminicola* from Turfgrass Hosts. MS Dissertation, The Pennsylvania State University, State College, PA. 74

Bolton, A.T. and Cordukes, W.E. 1981. Resistance to *Colletotrichum graminicola* in strains of *Poa annua* and reaction of other turfgrasses. Canadian Journal of Plant Pathology 3:94-96.

Jackson, N., and Herting, V.J. 1985. *Colletotrichum graminicola* as an incitant of anthracnose/basal stem rotting of cool season turfgrass. In Proc. 5th Int. Turfgrass Res. Conf. August 1985, Avigon, France pp.647-655.

Landschoot, P.J. and Hoyland, B.F. 1995. Shedding some light on anthracnose basal rot. Golf Course Management. Nov 52-55.

Smith, J.D. 1954. A disease of *Poa annua.* Journal Sports Turf Research Institute 8:344-353.

Smith, J.D., Jackson, N., and Woolhouse, A.R. 1989. Fungal Diseases of Amenity Turf Grasses. E. & F.N. Spon, London.

Vargas, J.M., Jr. 1994. Management of Turfgrass Diseases, 2nd ed. Lewis Publishers, Ann Arbor, MI.


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