Relationship of Environment, Management, and Physiology to Bermudagrass Decline

Richard H. White
Texas A & M University

Objectives:

1. To determine the relationship between several environmental, cultural, and physiological factors and the development of bermudagrass decline.

Start Date: 2000
Project Duration: 3 years
Total Funding: $74,984

Bermudagrass decline (BD) is caused by an interaction of host-predisposing abiotic stresses and the fungus *Gaeumannomyces graminis* var. *gramini*. Our research focuses on cultural and environmental factors that promote escape and recovery from this disease. During 2002, disease severity was less for ammonium sulfate (AS) than for urea formaldehyde (UF) in field studies. Leaf and axillary bud appearance required fewer growing degree days for UF than for AS. But shoot density and growing degree days required for leaf and axillary bud appearance and plant growth decreased as annual N increased. Thus, increasing N contributes to disease escape due to more efficient generation of plant tissues and organs, whereas N sources may affect the suitability of the soil pH for pathogen development.

Recovery of Tifeagle from BD was enhanced by aerification with either solid or hollow tines, heavy topdressing, and aggressive fertilization with AS. While the amounts of N and topdressing used may be excessive for routine culture of Tifeagle golf greens, these aggressive treatments provided more effective recovery from BD than less aggressive treatments.

Growth chambers were used to further explore the importance of disease escape in the management of BD. Tifdwarf bermudagrass was used in these studies. Artificial lighting provided about one-third of full sunlight. Although ectotrophic runner hyphae, some root necrosis, and lobed hyphopodia were observed in inoculated treatments, above ground disease symptoms were not evident. Nitrogen nutrition influenced growth, but was not as influential as temperature regime. The effects of temperature were significant. Internode and leaf length increased with decreases in temperature regime from 95/80, 80/66, and 66/51ºF (day/night). Additional studies were conducted with light levels of about 10, 25, and 50% of full sun within temperature regimes. Decreasing light caused increases in leaf and internode length, but the degree of increase was regulated by temperature.

The effect of temperature regime (90/80°F day/night top and 80/66°F day/night bottom) on Tifdwarf bermudagrass growth. Plants were grown in growth chambers with 14 hours artificial light at about one-third the intensity of full sunlight.

While increased leaf and internode length are responses common to bermudagrass grown under low light (shade), temperature regulated the degree of response in these studies. Our results explain why raising the mowing height is often recommended as a cultural practice to reduce BD symptoms. During periods of overcast, rainy weather, conditions favorable for BD, growth habit of dwarf bermudagrasses may change dramatically in response to low light and lower temperatures. The altered growth form of Tifdwarf would not likely tolerate close mowing heights. Thus, mowing stress would result in increased sensitivity to pathogenic organisms such as *G. graminis* var. *gramini*. Evidence of the altered growth form was observed within three to four days of exposure to the moderate temperature regime and light levels used in this study. In addition to the implications that this altered growth habit may have for disease escape in dwarf bermudagrasses, the dramatic changes in growth habit observed have tremendous implications for dwarf bermudagrass golf green management. This notable discovery about environmental impacts of temperature on dwarf bermudagrass growth and development provides strong rational for additional research on numerous aspects of bermudagrass culture, establishment, and pest and abiotic stress tolerance.

Summary Points

- Increasing N apparently contributes to disease escape due to more efficient generation of plant tissues and organs.
- N sources most likely affect soil pH and the suitability of the soil environment for pathogen development.
- Ammonium sulfate may reduce bermudagrass decline symptom development.
- Tifeagle bermudagrass recovery from bermudagrass decline symptoms was enhanced by aerification, heavy topdressing and aggressive fertilization with ammonium sulfate.
- Low light causes increased leaf and internode length in dwarf bermudagrasses, but temperature regulates expression of the dwarf growth habit.
- The alterations in growth form in Tifdwarf bermudagrass caused by low light and cooler temperatures justifies raising the mowing height to reduce mowing stress that contributes to bermudagrass decline severity.