Rooting and Carbohydrate Metabolism in Creeping Bentgrass Putting Greens in Response to Summer Irrigation and Aerification

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Objectives:

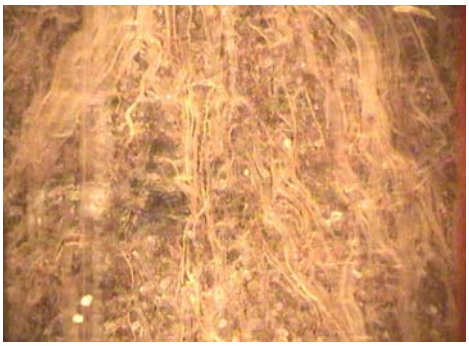
1. Evaluate physiological processes and rooting of putting green height creeping bentgrass in response to two irrigation management and three aerification regimes.
2. Determine the influence of aerification and irrigation frequency on creeping bentgrass summer performance and root longevity during periods of supraoptimal temperature stress.
3. Provide information on the effects of soil temperature and soil water content on carbohydrate metabolism and its relationship to summer bentgrass decline.

Start Date: 2006
Project Duration: three years
Total Funding: $90,000

'Providence' creeping bentgrass was established in September 2005 at the University of Maryland Turfgrass Research Facility in College Park. One study assessed three aerification regimes (no aerification, spring only, and spring and summer combined) and the other study assessed two irrigation regimes (frequent and infrequent). A spring aerification program included core aerification using hollow tines (0.5-inch diam.) on April 27, 2006. A spring (April 27) plus summer aerification regime was imposed using narrow diameter tines (0.25-inch diam.) on June 6, 27, July 18, and August 8, 2006.

In the irrigation study, plots were irrigated lightly and frequently on nearly a daily basis (LF) or were irrigated deeply and infrequently (DI) about once weekly to saturate to rootzone depth at the first sign of wilt. Root growth and production were monitored biweekly in both studies by using the minirhizotron imaging technique. A total of 11,200 video images of roots visible against the surface of the tubes were recorded in 2006.

Soil moisture in the 0 to 5.9-inch zone was determined using time domain reflectometry. The device, however, does not measure soil moisture in the 0 to 2.6-inch zone, where most roots generally are located in a creeping bentgrass green during summer. Therefore, soil moisture at the 0 to 2.6 in. depth was measured using an HH2 moisture meter. Soil temperature was measured just below stem bases.



A total of 11,200 video images of roots visible against the surface of the tubes were recorded in 2006 using a high-magnification minirhizotron camera and camcorder.

Thatch/mat depth was measured by taking several 1.0-inch diam. and 3.2-inch deep soil cores in each plot when the study began in June, mid-summer, and when the treatments ceased in autumn. The uncompressed thatch depth of each core was measured with a ruler. Organic matter mass in the thatch/mat layer was determined by combustion in September 2006. Canopy net photosynthesis and whole plant respiration were measured every two weeks. Leaf and root tissues were collected biweekly and will be analyzed for carbohydrate content. Canopy temperature usually was measured a day or two before the first signs of wilt using a hand-held infrared thermometer.

Both spring and summer aerifications caused a transient reduction in overall turf quality and full turf recovery took approximately two to three weeks. Spring alone and spring and summer combined aerified plots produced a deeper thatch/mat layer, when compared to non-aerified plots in 2006. An equal depth of organic matter was found among all treatments. As a percent by volume, however, more organic matter was found in non-aerified versus aerified plots. Summer and spring aerification had no effect on photosynthesis or respiration during most of the 2006 experimental period. The 6,720 root images will be analyzed over winter using an image analysis program.

Creeping bentgrass grown under DI irrigation generally exhibited reduced quality and color, when compared to bentgrass maintained in LF irrigation regime. Deep and infrequent irrigation reduced photosynthesis, but had no effect on respiration during most of the 2006 experimental period. Creeping bentgrass subjected to DI irrigation developed less thatch/mat (0.12 inch), compared to turf subjected to LF irrigation (0.17 in.). Less organic matter also was found in the thatch/mat from DI irrigated plots. Plots subjected to DI irrigation had a higher canopy temperature compared to turf subjected to LF irrigation during the summer.

Root growth was monitored biweekly in both studies by using the minirhizotron imaging technique

Summary Points

- Both spring and summer aerification caused a transient reduction in turf quality and full turf recovery took approximately two to three weeks.
- Spring and spring plus summer aerification generally had no effect on photosynthesis, respiration, or total mass of organic matter in the thatch/mat layer.
- Deep and infrequent irrigation reduced creeping bentgrass quality, photosynthesis, and thatch/mat depth, but had no effect on respiration during most of the experimental period.
- Deeply and infrequently irrigated creeping bentgrass experienced an increase in canopy temperature and a decrease in organic matter in the thatch/mat layer during the summer.