

EFFECTS OF ELEVATED CO₂ ON CREEPING BENTGRASS (*Agrostis stolonifera* L.) DURING THE ANTE MERIDIEM PHOTOPERIOD FOR SUMMER HEAT STRESS TOLERANCE

A Thesis
Presented for the
Master of Science Degree
The University of Tennessee, Knoxville

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May 2008

ABSTRACT

The demand for optimum putting conditions requires golf course superintendents to manage cool season creeping bentgrass (*Agrostis stolonifera* L.) in the transition zone and upper south. Summer heat stress combined with low mowing heights and constant traffic are challenges that superintendents must face in order to successfully manage creeping bentgrass from early May to late September. A field experiment was conducted on a Crenshaw putting green under golf course conditions during the 2006 summer and twice during the 2007 summer in Knoxville, TN. 2006 enriched air treatments of ~692 ppm CO₂ and ~891 ppm CO₂ were compared to a control of ambient air (~363 ppm CO₂). 2007 enriched air treatments of ~716 ppm CO₂ and ~1076 ppm CO₂ were compared to a control of ambient air (~451 ppm CO₂). Indirect heat stress was characterized by measuring the accumulation of total nonstructural carbohydrates (TNC) which is the sum of soluble carbohydrates and insoluble starch. The effects of CO₂ enriched air on TNC during the ante meridiem (between 12 midnight and 12 noon) photoperiod were determined using near infrared reflectance spectroscopy (NIRS). The effects of CO₂ enriched air on turfgrass quality during the ante meridiem photoperiod were determined using normalized difference vegetative index (NDVI) chlorophyll measurements. Disease and visual quality differences amongst treatments or locations were measured on an incidental basis.

No significance occurred within the 2006 and 2007 TNC or NDVI analysis for differences amongst treatments. 2006 average TNC for shoots were 24.8, 20.1, and 28.5 mg g⁻¹ of tissue for the 363, 692, and 891 ppm CO₂ levels, respectively. 2006 average

NDVI for shoots were 7.2, 7.3, and 7.3 for the 363, 692, and 891 ppm CO₂ levels, respectively. 2007 average TNC for shoots were 25.6, 18.9, and 23.1 mg g⁻¹ of tissue for the 451, 716, and 1076 ppm CO₂ levels, respectively. 2007 average NDVI for shoots were 7.9, 8.0, and 8.0 for the 451, 716, and 1076 ppm CO₂ levels, respectively. All results were analyzed at 0.05 probability level within SAS 9.1. No incidence of disease or visual quality differences among treatments or locations occurred.

To the Graduate Council:

I am submitting herewith a thesis written by Rodney Vincent Tocco Jr. entitled "Effects of Elevated CO₂ on Creeping Bentgrass (*Agrostis stolonifera* L.) during the Ante Meridiem Photoperiod for Summer Heat Stress Tolerance" I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Plant Sciences.

John C. Sorochan

Major Professor

We have read this thesis
and recommend its acceptance:

Robert Auge

Carl Sams

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of Graduate School

(Original signatures are on file with the official student records.)