Stop 7. Effects of Drought and Traffic Stresses on Physiological Responses and Water Use Characteristics of Creeping bentgrass (*Agrostis stolonifera*) and Annual bluegrass (*Poa annua*)

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A significant amount of research has been devoted to understanding the interaction of the two predominant turfgrass species on golf course greens, creeping bentgrass and Poa annua. Much research has been tailored to identifying the faults of P. annua in order to kill the species by targeting its physiological weaknesses. P. annua relies on aggressive growth and frequent seedhead production and highly viable, quick germinating seed for survival under both optimal conditions and during times of stress. Under stressed conditions, golf course superintendents do not desire the characteristics inherent to P. annua stress escape strategies such as prolific seed heads.

A putting green approximately 24,000 ft.2 in area was constructed at the Hancock Turfgrass Research Center in 2008 according to the United States Golf Association recommendations for putting green construction. Within the entire putting green there are eighteen, 36 ft. by 36 ft., blocks with independent irrigation control. Nine of the irrigation blocks are Poa annua and nine are A4 creeping bentgrass. During construction seventy-gallon plastic cattle watering tanks were buried in the putting greens to function as lysimeters that can be used to measure water quantity and quality. Before burying the tanks in the putting green, cement was poured in the bottom of the tanks on an angle to ensure water movement out of the tank to the collection vessel on the north side of the greens. Within each 36 ft. by 36 ft. putting green three lysimeters were buried.

Rain Bird TSM-1 soil sensors were installed at a 3 inch depth within each irrigation block in the summer of 2012. Using the Rain Bird Integrated Sensor System (ISS), three different volumetric soil moisture targets will be set (8, 12, and 16%). The irrigation system will automatically schedule irrigation to maintain these soil moisture levels.

Individual plots are set up as a total area of about 191 ft^2. There are 3 of these plots per irrigation block with buffer alleyways between each. Traffic treatments are applied at a low and moderate rate through the use of a traffic simulator. One plot in each irrigation block will receive the low rate while one plot will receive the moderate traffic rate. The last plot is left as an untreated control. Visual turf quality ratings, canopy reflectance, electrolyte leakage, chlorophyll content and photochemical efficiency will be determined to evaluate turf responses to the watering treatments. Determination of root moisture content and leaf relative water content will also be performed. The TSM-1 soil sensors will measure volumetric soil moisture every twenty minutes, as well as the use of TDR technologies.

New equipment that to our knowledge is not commonly utilized in turfgrass systems will be used to directly measure ethylene concentration in the field (CID Bio-sciences; CID-900). This equipment will be tested for effectiveness of determining ethylene production from both roots and shoots of the plants sampled from the turfgrass plots both by destructive and non-destructive sampling. Evaluating efficacy of this equipment could pose extremely valuable to the turf industry and research community.

Results

In 2013 research commenced at the Hancock Turfgrass Research Center is looking at physiological aspects of drought and traffic stresses on Poa annua and creeping bentgrass. This research has been carried through to 2014 observing the same characteristics.
Regarding water use characteristics, overall P. annua requires more water to maintain the target soil moisture content. For example, at 8% and 12% soil moisture target, P. annua used about 0.5 in. more water than creeping bentgrass per month in 2013. In 2014, the same trend is being seen, where P. annua uses more water to maintain soil moistures levels to the specified targets. 2014 also is offering greater amount of drought stress than 2013 and increased localized dry spots can be observed on low target moisture plots.

Physiological responses such as electrolyte leakage, relative leaf water content, photochemical efficiency, chlorophyll content and chlorophyll reflectance were affected by different levels of traffic. After two weeks of traffic treatments, traffic started to cause a decline in the quality of turf. The moderate trafficked plots had a lower quality, low trafficked plots had better quality than moderate, and non-trafficked plots had the highest quality within both species. Across traffic treatments, creeping bentgrass consistently maintained higher turf quality compared to P. annua. A yellowing of turfgrass color was also observed showing that there is decreased chlorophyll content.

Regarding ethylene production, on some dates P. annua tended to have higher ethylene production than creeping bentgrass in 2013. This result is also being seen in the 2014 season. Data from 2013 field research shows that rooting is very different between P. annua and creeping bentgrass with creeping bentgrass having longer and more abundant roots. Traffic and irrigation treatments did not significantly affect rooting habits of either species. As cooler weather sets in (Fall), P. annua rooting habit exhibits that of creeping bentgrass in length but not quantity.