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*)

Kevin Laskowski, Dr. Emily Merewitz, and Dr. Kevin W. Frank

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. From research using the perspective that *P. annua* is a weed, it has been determined that the weaknesses of *P. annua* include being sensitive to numerous abiotic, biotic, and management stresses. *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.

Material and Methods

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 by recording soil moisture levels every 20 minutes and adjusting irrigation rates for nightly irrigation cycles to maintain the soil moisture targets.

Individual plots are set up as a total area of about 191 ft. There are 3 of these plots per irrigation block with buffer alley ways 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.

Physiological evaluation

Visual turf quality ratings, canopy reflectance, electrolyte leakage, chlorophyll content and photochemical efficiency will be determined to evaluate turf responses to the watering treatments.

Water use measurements

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. Leachate will be collected from the lysimeters on a weekly basis, or more frequently if necessary. Irrigation amounts will be recorded by the central control system daily.

Ethylene measurement

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.
Evaluation of rooting parameters

A rhizotron system will be utilized to measure root quantity and quality in situ under all watering and traffic stress treatments. Soil cores will also be taken to evaluate total biomass and root length.

Results

2012 proved to be a tough year on turf stands mainly from heat and drought stresses. In a golf setting, trafficking also increased the amount of stress placed on the turf. In 2013 research being conducted at the Hancock Turfgrass Research Center is looking at physiological aspects of drought and traffic stresses on *Poa annua* and creeping bentgrass. A few of the main aspects that are being monitored are water usage, rooting habits, and ethylene gas production.

It was seen in 2012 that both creeping bentgrass and *Poa annua* use much different amounts of water. Rainbird technology is being used to monitor moisture levels at a 3.0 inch depth. Target moisture settings were set at 8%, 12%, and 16% volumetric water content. Currently it is seen that 16% target moisture content leaches a much greater amount of water than either 8% or 12%.

Rooting habits are drastically different between *P. annua* and creeping bentgrass. Since 2013 has been a much different year than 2012 drought stresses on rooting habits are much more difficult to determine. Rooting habits caused by traffic stress are much more observable through the use of a rhizotron system. It has been seen that a low traffic rate increases rooting depth and density of roots as compared to a control. A moderate traffic rate begins to decrease rooting length and density compared to a control.

Ethylene gas production has long been known to be a plant hormone mainly for the ripening of fruits. In turfgrass it can be correlated to rooting habits and senescing organic matter in a turf stand. With new technology we are now able to measure amounts of ethylene gas that both creeping bentgrass and *P. annua* are producing. It has been seen so far that turf under higher traffic stress produces more ethylene gas as compared to a control.