

122 and 244 kg N ha⁻¹ yr⁻¹, and no N (control). The SMS-based irrigation applied 32 to 70% less water than frequency-based irrigation. No differences in nitrate leaching occurred between irrigation treatments or among N sources and leaching levels did not exceed 0.6 mg L⁻¹, which is well below EPA thresholds. All fertilized turf had acceptable quality throughout the study. Results indicate that on silt loam soils, SMS-based irrigation saves water compared to standard frequency-based irrigation while providing acceptable quality, and nitrate leaching is negligible. (Josh Chabon, M.S. and Drs. Dale Bremer and Jack Fry).



▲ Late-season bermudagrass control with glyphosate, fluazifop and mesotrione combinations for spring renovations

Irrigation Management, Cutting Height, and Primo Effects on Mowing Requirements of Tall Fescue. In-ground irrigation systems are often mismanaged, resulting in excessive application of water. In this 2-year study, we evaluated mowing requirements of tall fescue irrigated using frequency-based irrigation and irrigation controlled by soil moisture sensors (SMS). Frequency-based irrigation cycles ran three times weekly regardless of precipitation amounts, and SMS applied water only when soils dried to a predetermined threshold. Within each irrigation treatment, we evaluated mowing at 5.1 cm or 8.9 cm, based upon the 1/3 rule, with or without monthly applications of Primo. In 2012, tall fescue mowed at 5.1 cm and treated with Primo required three fewer mowings than untreated turf mowed at 5.1 cm; at an 8.9 cm cutting height, only one fewer mowing resulted after Primo application. Mowing at 8.9 vs. 5.1 cm, or using Primo vs. not resulted in a 9% reduction in total mowings required in 2013. (Josh Chabon, M.S. and Drs. Dale Bremer and Jack Fry).

Nitrous Oxide Emissions and Carbon Sequestration in Turfgrass: Effects of Irrigation and N Fertilization. Nitrous oxide (N₂O) and carbon dioxide (CO₂) are important greenhouse gases that have been implicated in global climate change, and N₂O is the most important ozone-depleting substance in the atmosphere. Turfgrass

covers ~50 million acres in the USA and is typically fertilized with nitrogen and irrigated, which may result in significant N₂O emissions. Turfgrass also has the capacity to sequester or emit CO₂ from/into the atmosphere. We are beginning a 3-year study to measure N₂O emissions and carbon sequestration from turfgrass when fertilized with different nitrogen (N) fertilizer types (urea and poly-coated N) and different irrigation regimes. The use of slow-release N fertilizer and deficit irrigation may mitigate N₂O emissions from turf, although deficit irrigation may also reduce carbon sequestration. Therefore, it is important to measure N₂O fluxes and carbon sequestration in turfgrass managed under various combinations of deficit irrigation and fertilized with urea or slow-release N. Our goal is to develop smarter management practices that may reduce N₂O emissions from turfgrass and enhance carbon sequestration in turf soils, which could help mitigate climate change and atmospheric ozone destruction. (Ross Braun, M.S. student, and Drs. Dale Bremer and Jack Fry).

Rough Bluegrass Physiology and Control. Rough bluegrass (RBG, *Poa trivialis* L.) is a difficult-to-control weed that commonly develops in cool-season turfgrasses due to vegetative propagation of stolons and contamination from seed lots. Rough bluegrass is less tolerant of heat stress than desirable cool-season species such as tall fescue (TF), and often declines during mid-summer due to biotic or abiotic stresses. The objectives of these 2011-2013 controlled environment and field studies were to 1) observe growth and physiological differences between 'Laser' and 'Pulsar' RBG and TF; 2) differentiate between physiological and pathological contributors to RBG decline; 3) determine the effects of TF seeding rate and mowing height on TF/RBG establishment when RBG is a seed contaminant; 4) evaluate herbicide combinations for selective RBG control; and 5) evaluate seasonal timing of glyphosate for nonselective RBG control. Tall fescue was less affected by elevated temperature than RBG. When subjected to 35°C, Laser and Pulsar experienced similar reductions in quality, gross photosynthesis, shoot and root biomass, and root length density compared to when grown at 23°C. Evaluation of RBG foliage and roots did not reveal a fungal pathogen associated with RBG decline. Still, repeated applications of strobilurin fungicides increased RBG quality and cover during summer compared to untreated RBG, possibly due to poorly understood non-target physiological effects of the fungicides. Mowing TF at 7.6 or 11.4 cm reduced RBG incidence up to 57% compared to mowing at 3.8 cm. Tall fescue seeding rate had no effect on RBG incidence. Several herbicides and herbicide combinations provided transient RBG control in the field, but Velocity was the only treatment that provided RBG control (16 to 92%) in Manhattan, KS; Hutchinson, KS; and Mead, NE. Spring-applied glyphosate resulted in the lowest RBG coverage (1 to 31%) among field studies in Manhattan and Mead, followed by late-summer applications (6 to 58%), and mid-summer applications (9 to 86%). (Drs. Cole Thompson, Jack Fry, and Megan Kennelly; Univ. of Nebraska Cooperators: Dr. Zac Reicher, Mr. Matt Sousek).

Using Colorants to Improve Color of Dormant Warm-Season Turfgrasses in the Transition Zone 'Chisholm' zoysiagrass (*Zoysia japonica*) is a new cultivar that is well adapted to the transition zone, with low maintenance requirements, and good quality and drought