GROWTH AND PHYSIOLOGICAL RESPONSES OF TURFGRASSES TO DEFICIT IRRIGATION

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ABSTRACT

Drought stress reduces the aesthetic and functional value of turfgrass. I conducted several studies to determine the effects of water deficits on turfgrass growth and physiological processes.

Surface soil (0-20 cm) drying in the greenhouse did not influence turf quality, leaf relative water content, leaf water potential, canopy photosynthesis, or the activity of catalase and peroxidase in Kentucky bluegrass or tall fescue. Leaf growth rate and canopy and root respiration were reduced for both species during surface drying. Surface-dried plants had higher root: shoot ratios, total nonstructural carbohydrate levels in shoots and surface roots, and superoxide dismutase activity. However, full soil drying (40 cm deep) had greater detrimental effects on the above parameters compared to surface drying.

Irrigation levels required to maintain season-long acceptable turf quality in the field were 60% ET for tall fescue and bermuda, 80% ET for zoysia, and 100% ET for Kentucky bluegrass. Irrigation at 20 and 40% ET resulted in a significant reduction in leaf relative water content and increase in leaf electrolyte leakage in Kentucky bluegrass, tall fescue, bermuda and zoysiagrass. Tall fescue and zoysia irrigated at 20% and 40% ET had significantly lower canopy net photosynthesis, whole-plant respiration, canopy vertical growth rate, tiller density, and underlying soil water content than turf receiving 100% ET.

Field-grown tall fescue irrigated at 20% ET had more roots at a 13 to 18 cm depth than turf irrigated at 60% or 100% ET. Irrigation at 60% ET increased root surface area at 22 to 32 cm in 2002.

Zoysiagrass and tall fescue receiving 60% and 20% ET in a growth chamber exhibited increased sucrose content and activity of sucrose phosphate synthase and sucrose synthase, and decreased acid invertase activity. The root: shoot ratio of total nonstructural carbohydrates was higher at 60% than 100% ET for tall fescue and zoysia.

In summary, I determined the minimum water requirements for four turfgrasses, and quantified some of the growth and physiological processes that occur in turfgrasses subjected to irrigation deficits. This information should be useful to turf managers and researchers interested in reducing water inputs in turf systems.

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