OSMOTIC ADJUSTMENT IN KENTUCKY BLUEGRASS

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The research grant from the United States Golf Association Green Section for the amount of $1,248.00 for the first of two years became effective on June 1, 1984. This grant is funding the project Osmotic adjustment in Kentucky bluegrass which has two objectives:

1. To test whether enough variability exists between Poa pratensis cultivars to allow osmotic adjustment to be used as a selection criterion for drought tolerance.
2. To establish a relationship between water use requirements and ability to osmotically adjust to water stress in Poa pratensis.

The following is a description of the progress to date.

Temperature-Controlled Nutrient Culture System

In order for osmotic adjustment in response to water stress to be evaluated with some degree of accuracy, induction of water stress treatments need to be carefully controlled. Many researchers have adopted the use of osmotica in nutrient solution for this reason. Polyethylene glycol is the osmoticum of choice because higher grades are non-penetrating. However, the level of water stress of solutions containing polyethylene glycol depend upon temperature. In order to accurately induce water stress, nutrient solutions containing polyethylene glycol must have their temperatures controlled. A temperature-controlled nutrient culture system,

therefore, has been constructed for the Osmotic Adjustment in Kentucky Bluegrass project.

The temperature-controlled nutrient culture system consists of four 76 X 63 X 19 cm stainless steel pans filled with approximately 70 liters of water and insulated on all sides with 1-inch thick styrofoam. A constant 23 C is maintained in each pan by opposing a thermostatically-controlled heating element against chilled ethylene glycol (50% V/V) being circulated through each pan in approximately 50 foot of copper tubing. A circulating pump (Little Giant Model 2E-38N) moves the chilled ethylene glycol through the copper coils in the pans and returns it to a reservoir in a refrigerator (closed system). Water in the pans is constantly circulated within each pan by non-submersible pumps (Little Giant Model CP-6500). Water temperature is maintained to within ± 0.5 degrees. Plants are grown in silver-painted nutrient culture jars (100 mls volume) that are positioned in a 1-inch layer of styrofoam floating on the surface of the water. Constant aeration of the nutrient solution is provided by pressure-regulated PVC manifold connected to a compressed air line. Light is provided by two 400-watt metal halide lamps (Halophane Company, Inc., New York) over each pan. Approximately 450 ± 50 micromoles $sec^{-1}m^{-2}$ PAR light intensity can be achieved in this fashion. Each of 4 pans can support 30 individual nutrient culture jars.

Genetic Diversity

In an effort to establish a relationship between osmotic adjustment and water use requirement in Poa pratensis, it is essential that genotypes be utilized that exhibit a broad range of water use requirements. Dr. Bob Shearman and his colleagues at the University of Nebraska have established water use data over several Kentucky bluegrass cultivars (1978 NCR-10

Turfgrass Research Report; unpublished data). These cultivars have been established in pot culture and are being maintained under greenhouse conditions. They are being used as stock plants for subsequent experiments in polyethylene glycol-amended nutrient solution. The following cultivars are being used: Victa, Fylking, Baron, Adelphi, Bristol, Enoble, Nugget, Aquila, Park, Cheri, Bensun, Newport, Sydsport, Glade, Merion, Majestic, Delta, and Touchdown.

Equipment

A PMS Model 1000 pressure bomb (for leaf water potential determination) has been purchased with monies from another research grant. This pressure bomb and associated pressurized nitrogen tank have been set up in laboratory space. In addition, use of a sensitive analytical balance (Sartorius Model 1602MP8) has been granted. Preliminary experiments have been completed utilizing this equipment to establish moisture release curves of single Poa pratensis leaves as plants are grown in nutrient culture. Preliminary results indicate the system and methods are sound. Water stress treatments have been recently initiated using progressively more concentrated polyethylene glycol nutrient solutions.

EXECUTIVE SUMMARY

A temperature-controlled nutrient culture system has been constructed. This system enables water stress treatments to be accurately induced using polyethylene glycol in nutrient solution. Eighteen Kentucky bluegrass cultivars that exhibit a broad range of water use requirements have been established in the greenhouse. Laboratory equipment needed to establish moisture release curves has been acquired and results from preliminary experiments indicate the system and methods are sound. Water stress treatments have been recently initiated to single Poa pratensis shoots grown in polyethylene glycol-amended nutrient solution.