UNIVERSITY OF ILLINOIS

A Realistic Whole Plant Microculture Selection System For Turfgrasses

1991 Research Grant: $ 9,000
(Third year of support)

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New methods for assessing the responses of turfgrass to salinity in the root zone are required to help identify selections with potential for use on marginal sites. The response of a turfgrass cultivar to salt stress is an important evaluation criterion, because the demand for new selections that will tolerate saline conditions is escalating. Due to the experimental complexity involved, few screens have attempted to gauge comprehensive salt stress reactions of entire grass plants over time. Some plant adaptations, notably those in the root zone, are particularly difficult to observe or quantify.

Solution culture and whole plant microculture techniques were compared for paired cultivars from three turfgrass species (bermudagrass, creeping bentgrass and St. Augustinegrass). Shoot and root growth (using machine vision), and osmotic adjustment responses within the test environments were evaluated. While all of the turfgrass cultivars exhibited growth reductions under conditions of elevated salinity stress, the degree of response was more dramatic for cultivars of bermudagrass and St. Augustinegrass which had previously been rated as salt-sensitive in field evaluations. Morphological shoot growth evaluations between solution culture and whole plant microculture tests exhibited similar trends, while root responses were more variable in microculture. Osmotic adaptation responses were highly correlated between solution culture and whole plant microculture. In general, the whole plant microculture system provided a simpler, smaller scale test environment which allowed non-intrusive evaluation of salt stress adaptation over the course of the screening test.

Now that we have validated the system using turfgrass lines with established salt tolerance [ST] or salt susceptible characteristics (as identified by breeders in extensive field tests), we see the project extending in two important ways. First, the whole plant microculture (WPMC) system can be used to test the ST of unique germplasm developed using the tools of biotechnology. *In vitro* methods for manipulating turfgrass lines have very recently been worked out for many important species. Cell level screening for ST (with callus cells growing on high salt media) can be an effective way to rapidly isolate unique lines with cell level tolerance to salt. The WPMC system can provide an excellent vehicle to facilitate a intermediate testing stage; to quickly and efficiently identify and isolate cell lines selected through biotechnology. Towards this objective, I currently have a student working with callus generation/regeneration of turfgrass callus on high salt media, and testing these new regenerated lines using the WPMC system.

Second, the WPMC system we have developed can be an effective tool to test turfgrasses for other stresses (heat, drought tolerance, etc.). We can establish an effective link with traditional turfgrass breeders at this point for pretesting new lines they have developed, prior to scaling up for full field testing of the turf.