UNIVERSITY OF ILLINOIS

A Realistic Whole Plant Microculture Selection System For Turfgrasses

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Superior salt and drought-tolerant turfgrass lines are needed for marginal planting sites, or irrigated sites where salt build-up is likely to occur. Effective selection of stress tolerant genotypes is extremely complicated in the field due to environmental interactions that sometimes mask stress tolerance traits. Controlled environments can provide a more uniform test environment to permit efficient germplasm pre-screening and selection prior to scale-up for field evaluations.

As part of this turfgrass program, comparative, parallel studies to elucidate the symptoms of salt tolerance in warm and cool season turfgrasses have been completed in both solution culture (plant cells grown in solution) and whole plant microculture. Plants are monitored from the small plug or seedling stage through an extended test period to define adaptations in both the root and shoot zone to increasing salt levels over time. Video image analysis uses a video camera and microcomputer to capture quantitative (plant height, shoot area, root length and area) and spectral (visual density, color index) data on grass performance. Since the technique is completely non-destructive, plants can be effectively monitored as they adapt over time.

The turfgrass responses to salt stress in both the solution culture and microculture systems have shown excellent correlation, and have identified key growth responses to stress, levels of salt that induce growth reductions, and the amount of time required before stress symptoms are evident. The visual data collected rapidly through image analysis agrees with conventional growth analysis of the treatments (the latter requires destructive sampling and dry weight measurement of plants). The experiments initiated in 1988 and 1989 were repeated in late 1989 and 1990 to provide additional replication of the experimental system data.

In whole plant microculture, additional tests have separated the response characteristics of grasses similar to the "shock" they experience when transplanted into saline soils or when allowed to gradually adapt to those same salt concentrations. The recovery from salt stress is evaluated after grass samples are transplanted back to non-saline control media. The microculture salt stress screens, however, can be conducted on a smaller scale than field or greenhouse tests, do not require the high maintenance of growth chambers, and can be rapidly accomplished on a year-round basis. The tests will be extended to novel selections which have been first screened for salt tolerance at the cell level (solution culture), then regenerated into whole plants. This intermediate whole plant microculture step is an effective laboratory pre-screen to determine whether cell-level traits are actually expressed in whole turfgrass plants before the time and expense of field trials are conducted.