Seashore Paspalum Ecotype Tolerance to Root Limiting Soil Stresses and Traffic Stresses

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Start Date: 1998
Number of Years: 3
Total Funding: $75,000

Objectives:

1. *Develop and implement a salinity tolerance screening procedure that a) provides salinity tolerance of seashore paspalum ecotypes under well-watered and drought stress, b) allows 3 salinity tolerance screening protocols to be assessed for efficiency in separating seashore paspalum ecotypes and for establishing a "standard" protocol, and c) provides detailed data on seashore paspalum ecotype root tolerance data on the edaphic (soil) stresses of salinity, drought, and drought+salinty.*
2. *Determine seashore paspalum ecotype tolerance to the multiple root stresses in the acid soil complex (soil strength, drought, nutrient deficiencies, element toxicities, high soil/air temperatures) that strongly influence drought resistance via drought avoidance from deep rooting.*
3. *For nine seashore paspalum ecotypes with the greatest potential for release, to determine relative to TIFWAY bermudagrass overall drought resistance, rooting, shoot performance, and water use (ET)/soil extraction patterns under close-cut fairway conditions.*

The breeding/genetics paradigm of Dr. R.R. Duncan's program for seashore paspalum (SP) (*Paspalum vaginaturn*) is to determine ecotype tolerance to important stresses. Of particular interest is genetic-based resistance to soil chemical and physical factors that limit root development/longevity . In this project, SP ecotypes are screened for root responses to 4 of the 6 edaphic factors that limit rooting. This multiple stress approach provides important information for SP resistance to individual and multiple soil stresses and is highly effective in identifying SP ecotypes with high nutrient uptake efficiency and drought resistance via possessing a deep, extensive, viable root system. Root tolerance assessment to the major edaphic stresses has been a "missing ingredient" in almost all breeding programs targeted to improve drought resistance, water-use efficiency, or nutrient-use efficiency. The four studies included in this project are:

Study 1. Evaluation of Seashore Paspalum Ecotypes and Selected Grasses To The Acid Soil Complex. Eighty-four seashore paspalum ecotypes and three control grasses (common bermudagrass, Tifway bermudagrass, and Meyer zoysiagrass) were plugged (3.5 in. dia. x 3 in. deep; A = 0.07 $ft.^2$) on 30 June 1998 into two adjacent sites at 4.5 feet centers. Both sites were a Cecil kaolinitic clay soil with 23 percent clay (A horizon) and 45 percent (B horizon). Site A was at pH 4.2 to create the acid soil complex stress which consists of Al/Mn toxicities and potential deficiencies of Mg, K, Ca, and P. Site B was at

pH 6.5. Both sites imposed the root stresses of high soil strength in a non-cracking soil, drought stress, and high soil temperatures. Study completed 26 July 1999.

For maximum multiple root stress tolerance and potential for good performance under adverse soil/drought conditions a turfgrass should: (a) have an acceptable, inherent growth rate under the low pH conditions (where all soil stresses are present and severe), and (b) exhibit a low pH/high pH growth ratio that is near 1.0. A grass could possess good tolerance to the multiple root stresses (i.e., high low pH/high pH ratio) but have slow inherent growth rate (Example: Temple 2, Fidalayel, PI 509022). Conversely, other grasses may have a higher inherent growth rate but somewhat lower low pH/high pH ratio (i.e., common bermuda, Tifway bermuda, K7). The seashore paspalum HI 101 has both characteristics.

Seashore paspalums with a low pH/high pH ratio of $\geq$ 1.0 are particularly strong in tolerance to the "acid soil complex" stress. These were able to grow as good or better at pH 4.2 than at the higher pH conditions. The SP ecotypes exhibiting this trait were: PI 509022, Temple 2, HI 101, PI 509021, and Fidalayel. For developing SP's that could be grown with limited inputs (water, lime, fertilizers) and under severe soil stress conditions, these ecotypes demonstrate considerable potential in the SP germplasm base.

Study 2. Fairway Type Seashore Paspalums: Rooting, Water Use, Drought Resistance. Nine seashore paspalum ecotypes and Tifway bermudagrass were established 16 July 1998 using a limited quantity of stolons due to availability. Turf coverage, quality, color and density ratings were taken in 1999. Rooting and water use (ET) data were also obtained and are under analyses.

Study 3. Traffic Tolerance of Seashore Paspalum Ecotypes. Twenty nine seashore paspalums, three bermudagrasses (TifSport, TifEagle, Tifway), and Meyer Zoysiagrass were stolonized on 12 August 1999. In 2000, these will be assessed for tolerance to: (a) wear, and (b) traffic-wear plus soil compaction.

Study 4. Salinity and Salinity + Drought Tolerances of Seashore Paspalum Ecotypes. This study will involve 34 seashore paspalums to be screened for salinity tolerance + drought stress with salinity up to seawater (EC_w = 54 dS m^{-1}) and applied by overhead irrigation. The greenhouse facility is 80 percent completed and the study will be conducted this winter.