

## EXECUTIVE SUMMARY

**Title: Development of Multiple Stress Tolerant Seashore Paspalums for Golf Course Usage**

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Eight paspalums out of 300 types in the collection, 5000+ tissue culture regenerants, and 100+ hybrids have been identified for additional evaluation. Three ecotypes (Fwy-1, AP-10 and AP-14) are currently being evaluated on golf courses. Eighteen golf courses are assessing the performance of one or more of these types on fairways, tees, or greens. Four sod companies (two in Georgia and two in Texas) are attempting to develop best management practices for long-term sod and stolon production. A seed company in Arizona is collaborating on assessment of viable seed production potential and seed dormancy problems.

Six paspalums (two from Guam, four from Australia) were entered into quarantine grow-out after collection during the summer 1997. Fwy-1, AP-10, and AP-14 were sent to quarantine in Hawaii and will be available for evaluation in the islands beginning in July 1998.

Herbicide studies involving paspalum encroachment into bermuda revealed Trimec Plus, Trimec Classic, Daconate 6, and Asulox would suppress paspalum growth, but more than one type of herbicide and multiple applications may be necessary to eliminate the paspalum. With bermudagrass encroachment into paspalum, preliminary research has revealed that Prograss (1.50 lb ai/A) + Cutlass (0.75 lb ai/A) may suppress the bermuda when temperatures are  $>70^{\circ}$  F and with multiple applications. Herbicides non-injurious to paspalum turf include: Betasan, Kerb, Balan, Dacthal, Ronstar G, Pre-M (preemergence) and Prograss, Drive, Trimec Southern, Dimension, Super Trimec, Vanquish, Manage, and Mecomec (postemergence).

Table 1. Herbicides non-injurious to paspalum turf.

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**PREEMERGENCE APPLICATIONS**

\*Betasan EC  
Kerb WP  
Balan G  
Dacthal WP  
Ronstar G  
Pre-M WDG

(Marginal: Goal EC and XL 2G)

**POSTEMERGENCE APPLICATIONS**

Prograss EC  
Drive DF/WD  
\*Trimec Southern SL  
Dimension EC  
\*Super Trimec SL  
\*Vanquish SL  
Manage WG  
\*Mecomec 4SL

(Marginal: Amine 4SL)

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\* These herbicides have more than one trade name or similar/slightly different chemical formulations.

## 1997 Annual Progress Report

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Title: DEVELOPMENT OF MULTIPLE STRESS TOLERANT SEASHORE PASPALUMS FOR GOLF COURSE USAGE

### Overview

The 5-year old comprehensive breeding/evaluation program continues to grow in terms of 1) efficiency in identifying new promising ecotypes for increase and subsequent larger scale evaluation, 2) increasing the volume of vegetative material for the most promising ecotypes so that they can be evaluated on larger sites or on more environmentally-challenging sites, and 3) increased collaboration, both public and private.

### Best Potential Ecotypes

Three ecotypes are currently being evaluated on several golf courses:

1. Fwy-1 (Argentina selection).  
For tees and fairways. Aggressive. Very good recoverability. Seed head production (scale: 1 = none, 9 = 100%) = 5.0. Dollar spot (1 = best; 9 = worst) = 2.0 @ Griffin and 1.7 @ Tifton. Best winter-hardiness found so far among ecotypes.
2. AP-10.  
Greens type. Seed head production = 1.5. Appears to be the best greens type so far. Dollar spot = 4.0 @ Griffin; 2.3 @ Tifton.
3. AP-14.  
Greens type. Seed head production = 5.0. Dollar spot = 4.5 @ Griffin; 1.6 @ Tifton. More cold temperature responsive than AP-10. Slightly better winterhardiness than AP-10.

Promising types being increased for evaluation:

4. †TCR1 (somaclonal variant out of tissue culture).  
Fairway type. Aggressive. Seed head production = 4.0. Dollar spot = 1.5.  
Winterhardiness = unknown.
5. †Hyb 5.  
Greens type from crossing program. Seed head production = 1.9. Dollar spot = 1.5.  
Winterhardiness = unknown.
6. †TCR 6 (somaclonal variant out of tissue culture).  
Unknown whether greens or fairway type. Will be planted on paddock green in 1998.  
Seed head production = 1.0. Darkest green color found among all paspalums. Last paspalum to go off color this fall. Winterhardiness = unknown. Dollar spot (small plot) = 1.0.
7. †Hyb 7.  
Suspected fairway/tee type. Will be planted on paddock green in 1998. Seed head production = 2.0. Dollar spot (small plot) = 1.0. Winterhardiness = unknown.

† Evaluated on 10x10' paddock green in 1997.

‡ Selected from modified fairway in 1997.

## 8. HI-14.

Hawaii selection. Fairway/tee type. Seed head production = 6.0. Retains better color in fall with decreasing air temperatures than other ecotypes (except for TCR 6).

These ecotypes have emerged as the top group for continued or additional evaluation, among the 300 ecotypes in the collection and among the 5000+ tissue culture regenerants or 100+ hybrids.

Current Evaluations/Collaboration.

UNIVERSITIES

Florida (Pensacola area) — J. Bryan Unruh  
 Auburn — Jeff Higgins, Harold Walker  
 North Carolina (NCSU) — Fred Yelverton, Art Bruneau  
 Clemson — Vance Baird  
 Arkansas — John Boyd  
 California — Ali Harivandi  
 Arizona — Dave Kopec  
 Texas (Dallas) — James Read  
 West Virginia (Beckley) — Ralph Clark  
 Oklahoma — Charles Taliaferro  
 Kansas — Jack Fry  
 Nebraska — Terry Riordan  
 Guam — Greg Wiecko

GOLF COURSES

Georgia (Atlanta area)  
 The Standard Club (Duluth) — Mark Hoban  
 Berkeley Hills Country Club (Duluth) — Lewis Lawrence  
 Atlanta National Golf Club (Alpharetta) — Jim Dusch  
 Florida  
 Sailfish Point Golf Club (Stuart) — Craig Baker  
 Hawks Nest Golf Club (Vero Beach) — George Mackanos  
 Bay Beach Club (Ft. Myers Beach) — Tom Davis  
 South Carolina  
 Moss Creek Country Club (Hilton Head Island) — Bob Volpe  
 North Carolina  
 The Landfall Club (Wilmington) — Gary Smither  
 Carolina National Golf Club — Terry Vassey  
 California  
 Tony Lema Golf Club (San Leandro) — Ken Schwark  
 Fairbanks Ranch Country Club (Rancho Santa Fe) — Brian Darrock  
 Old Ranch Country Club (Seal Beach) — Don Parsons  
 Pala Mesa Resort (Fallbrook) — Kevin Kienast

## Texas

The Cliffs (Graford) — Steve Minor  
 Kings Crossing Country Club (Corpus Christi) — Sam Orozco

## Arkansas

Longhills Golf Club (Benton) — Bud Busken

## Cayman Islands (Grand Cayman)

Safe Haven — Jerry Hardy

## Portugal

Vale do Lobo — Dean Watkins

## SOD COMPANIES

## Georgia

Sod Atlanta (Cartersville) — Ken Morrow  
 Rapid Turf (Rincon — near Savannah) — Mark/Jimmy Egan

## Texas

Thomas Bros. (Granbury) — Kevin Kenworthy  
 Bladerunner Farms (San Antonio) — David Douget

## SEED COMPANY

Seeds West Inc. (Las Cruces, NM) — Arden Baltensperger

## MISCELLANEOUS

Georgia Seed Development Commission (Athens) — Earl Elsner  
 California (Van Nuys) — Recreation and Parks Dept. — Ron Strong  
 Florida (Estero) — The Scotts Company — Frank Reed  
 California (San Diego) — Pace Consulting — Larry Stowell  
 Hawaii (Oahu/Waimanalo) — Quality Turf — Tom Staton

Comments on Evaluations/Collaboration

Introduction of a new cultivar of a species (i.e., Tifdwarf vs. Tifeagle bermuda or A2 vs. Crenshaw creeping bentgrass) already on a golf course takes some adjustment on the part of the superintendent. When a totally different species with a management protocol that is radically different than the existing turfgrass on the course is introduced, additional adjustments are warranted. I have tried to be as flexible as possible in working with the superintendents. In some cases, separate test sites adjacent to playing areas were established and the superintendent was encouraged, where appropriate and reasonable, to implement management protocols that would favor the paspalums. This requires some effort over and beyond his normal management strategy to effectively evaluate a turf with which he/she might not be familiar.

Other test sites were established with paspalum integrated into a tee, fairway, or green with existing turf, usually bermuda. Management strategies favored the existing turf and

realistically the evaluation was one of assessing the competitiveness of the paspalum. Some paspalum failures have occurred and some of those areas were reestablished when it was feasible and mutually beneficial. Some of the reestablishment was directed to existing problem areas on the course—wet, boggy areas; transition zones moving into wetlands or other ecologically sensitive areas; or severely stressed areas where the grass canopy was not acceptable. Again, management strategies were not altered significantly and generally favored the existing turfgrass.

In a few cases, I was able to supply enough vegetative material to establish an entire practice tee (Hawks Nest) or practice green (Fairbanks Ranch). My goal in 1998 is to reach a point at which I will be able to supply sufficient vegetative material to establish whole tees or greens or a large portion of a fairway at selected sites. Collaboration with the four sod companies should help in this endeavor. I will also be concentrating on establishment on courses having problems with salt/saline conditions, salt water intrusion, poor water quality (gray/recycled/reclaimed/brackish), and wet, boggy areas. Use of coarse or intermediate textured types for transitioning into wetlands or other environmentally sensitive areas will be implemented.

#### Collection Activities

Five paspalums from Israel should clear quarantine grow-out sometime during 1998. Paspalum seed collected by Engelke on his China bermudagrass collection trip were not viable. The collection trip to Perth, Adelaide, and Brisbane following the ITS meeting during July 1997 in Sydney, Australia, provided only four accessions—all of which are intermediate texture and similar to Adalayd. I was able to visit the Western Australia Herbarium in Perth where they had about 20 paspalum accessions “on the books,” but only 12 specimens could be viewed. All were either coarse or intermediate texture types and none were superior to the ecotypes currently in the UGA collection. Travel to roadside and coastal parks/pastures revealed the same trend of minimum diversity. The ecotype on the Adelaide Bowl was an intermediate texture type. Four accessions (one from Perth area, two from Adelaide, one from Brisbane) were carried back and submitted to quarantine for grow-out.

Two accessions were returned from Guam (one from the Mangilao Golf Club and one from the Leo Palace Resort).

I have contacted individuals in Argentina and South Africa about assembling representative ecotypes in each country. Both countries would be “hot spots” for the best potential new, fine-textured accessions and if I cannot manage to put together a collection trip over the next year or two, I may try to get some accessions sent directly to quarantine (which takes 18-24 months to ‘clear’ an accession).

Fwy-1, AP-10 and AP-14 are currently in quarantine in Hawaii. They should clear quarantine during July 1998 and will be evaluated on selected courses.

### Genetic Analysis

After a long search, I have hired Wayne Hanna's former M.S. student (who worked on AFLPs in bermudagrass for his master's thesis) Linhai Zhang to work in Steve Kresovich's genetic analysis laboratory. He will concentrate on DNA library assembly, microsatellite-primer development, construction of phylogenetic trees, and typing (profiling or fingerprinting) of specific paspalum ecotypes. A representative cross-section of 160 ecotypes has been selected from the 300 accessions in the paspalum collection for initial comprehensive studies. The goal is to generate enough genetic information to understand how and where paspalum has moved worldwide and to develop definitive fingerprints on promising ecotypes by the time they are released. This profiling information should prove valuable in developing quality control and handling standards as well as monitoring possible mutation/contamination issues.

### Graduate Students

Laurie Trenholm, Ph.D. student co-advised with Bob Carrow, is working on paspalum traffic X fertility interactions on a USGA-specification green (AP10 and AP14 ecotypes) and on a natural clay fairway with 8 paspalums and 2 bermudas. First year data will be analyzed this winter. Funds from the Potash & Phosphate Institute is partially supporting her research.

Geungjoo (Joo) Lee from South Korea is also a Ph.D. student co-advised with Bob Carrow. His dissertation research is assessing salt tolerance diversity among paspalum ecotypes. The initial greenhouse/solution culture study involved 94 paspalums and 4 bermudas and salinity stress ranging from 0 to 40 d Sm<sup>-1</sup>. Visual estimation (leaf firing) of salinity tolerance at 40 d Sm<sup>-1</sup> revealed diversity in the collection:

very tolerant—AP14, PI28960, Taliaferro, FSP-1, K1, HI-107, HI 33, HI 32, SIPV 35-2  
 tolerant—AP10  
 moderately tolerant—Adalayd, FSP-2  
 low tolerance—Tropic Shore, Tifway bermuda

With adequate funding, Bob Carrow and I will be recruiting a post-doc or possibly two Ph.D. students to conduct additional paspalum research during 1998, primarily to address various management aspects. I have also submitted a grant calling for a post-doc to initiate research into improving winterhardiness/seed production capability via biotechnology in paspalum.

### Insect Resistance

A molecricket field evaluation study at Tifton involves 35 paspalums and 7 bermudas. Data are preliminary and another year of insect data accumulation will be needed before these data can be regressed on turf quality and density traits. Results so far have indicated a range in diversity among paspalum ecotypes for cricket tunneling. Collaborators are Kris Braman and Wayne Hanna.

Susan Shortman, a Ph.D. student advised by Kris Braman, collected first-year spittlebug damaged data in a field study at Griffin that involved 9 paspalums, 1 centipede, 4 bermudas, and 4 zoysias. Even though data are preliminary, paspalum apparently exhibits a wide response range to spittlebug feeding. Greenhouse, laboratory, and field data will be eventually combined to provide a comprehensive assessment of potential spittlebug damage on paspalum.

Additional insect evaluation studies are planned on paspalum in 1998, including white grubs (Kris Braman), and fall armyworm – black cutworm – sod webworm (Jim Reinart) provided that grant proposals are funded.

### Herbicide Studies

Weed control studies involving paspalum encroachment and suppression in bermuda, tolerance to preemergence herbicides during establishment, and tolerance to postemergence herbicides were completed in 1997. In general, Surflan, Asulox, Aatrex, Sencor, and Princep are phytotoxic to paspalum. Crabgrass, goosegrass, and annual bluegrass (Poa) in paspalum can be controlled with preemergence applications of granular Ronstar, Kerb, Balan, Pre M, Barricade, Team, Dimension, and Prograss or postemergent applications of Drive, Kerb, or Dimension. Winter broadleaf weeds can be controlled with granular Ronstar, Balan, and Gallery (preemergence) or Vanquish (postemergence) in paspalum turf. Nutsedge species can be controlled with postemergence applications of Manage or Basagran.

When bermudagrass encroaches into paspalum, preliminary research has indicated several postemergence applications of Prograss + Cutlass (1.50 + 0.75 lb ai/A respectively) may suppress the bermudagrass, except when temperatures are <70°F. When paspalum encroaches into bermuda, initial research results have shown that Trimec Plus, Trimec Classic, Daconate 6, and Asulox will suppress paspalum growth. Multiple applications and more than one type of herbicide may be needed to effectively eliminate the paspalum. Additional definitive encroachment studies involving rates and timing will be initiated during 1998. Collaboration with North Carolina State University (Fred Yelverton) will address plant growth regulator effects on paspalum during 1998. Four cultivars (Fwy-1, AP-10, Adalayd, and SIPV-1) were planted during August at the Sandhills station.

### Sod Company Collaboration

Paspalum ecotypes were shipped to four sod companies during 1997 for establishment and grow-in. The objective of the collaboration is to develop best management practices for sod/stolon maintenance and reestablishment/grow-in.

#### Georgia

Sod Atlanta (Cartersville): Fwy-1, AP-10 greens type

Rapid Turf (Rincon near Savannah): Fwy-1, AP-10, AP-14



## Texas

Thomas Bros. (Granbury): Fwy-1

Bladerunner Farms (San Antonio): Fwy-1, AP-14 greens type

During 1998, sod and stolons will be harvested and either reestablished on the sod farms or planted on other recreational turf evaluation sites. Variable treatments involving cutting and mowing height, verticutting or slicing, fertility and irrigation scheduling will be implemented to find the best management practices for regrowth and long-term sod and stolon maintenance.

### Seed Production Collaboration

In conjunction with Seeds West (Arden Baltensperger), 8 paspalums (Fwy-1, AP-10, AP-14, Adalayd, Temple 2, PI 299042, TCR-1, TCR-2) were planted all together in two separate crossing blocks at Las Cruces, NM, during April 1997 on the Leyendecker Plant Science Research Center. Good seed head production was initiated in September; however, a technician inadvertently mowed the plots before seed could be harvested. Seed production will potentially peak during spring and fall when nighttime temperatures are between 55-60°F. Nicking occurs during early morning just prior to sunrise. Preliminary results in Georgia have revealed the highest viable seed counts have come from Blairsville (1530' elevation); thus the 3000'+ elevation of Las Cruces is a logical starting point to assess seed production potential.

Additional preliminary results have indicated a seed dormancy problem in paspalum. One month storage of harvested seed at 40°F and at 0°F did not affect dormancy-viability. Seed treatment with weak acids or KNO<sub>3</sub> did not enhance viability. However, storage of harvested seed for 3 months at 0°F in plastic bags significantly enhanced seed germination. Additional studies to overcome the dormancy problem will be implemented when consistent seed production is achieved.

Plans for 1998 include 1) collaboration with a private seed company in Oregon to assess whether that environment might be conducive to adequate seed production, and 2) planting of dual and 3-way differential pedigrees to ascertain the best combination(s) for maximum seed production. Initial plantings will be in Blairsville.

### GCSAA Chapter Collaboration Program

With split funding from GCSAA and the Georgia GCSA, paspalums were established on three Atlanta-area golf courses during 1996:

Berkeley Hills Country Club (Duluth) — Fwy-1 established on the rear portion of a tee and on a high traffic area beside a tee.

The Standard Club (Duluth) — Fwy-1 established on a practice tee and overseeded with perennial ryegrass and AP-10 established on a practice green and overseeded with creeping bentgrass.

Atlanta National Country Club (Alpharetta) — Fwy-1 established on an exceptionally high traffic tee overseeded with ryegrass.

During 1997, additional Fwy-1 was planted on a low, boggy drainage zone on a fairway at Berkeley; on one-half of a practice tee at the Standard Club; and on an in-play tee at Atlanta National. Plans for 1998 will include continued monitoring of the paspalum on the Atlanta-area courses and hopefully expansion of the paspalum evaluations to 1-2 coastal courses in Georgia.

#### Conference Presentations on Paspalum

USGA Green Section, Florida Regional Conferences  
Orlando Airport Marriott, April 14, 1997  
Palm Beach Gardens Marriott, April 17, 1997

#### 1997 Paspalum Research Support

USGA — \$40,000  
Georgia Turf Foundation Trust — \$4,000  
GCSAA — \$4,000  
PPI — \$4,000  
Lesco Inc. — fertilizer, 'Cutlass' donations  
Rhone-Poulenc Inc. — 'Ronstar' donation  
Ag Evo — 'Prograss' donation

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