

**Semi-Annual Progress Report**

**Concerning**

**BREEDING AND EVALUATION OF COLD-TOLERANT BERMUDAGRASS VARIETIES**

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**INTERIM REPORT  
BREEDING AND EVALUATION OF COLD-TOLERANT BERMUDAGRASS VARIETIES  
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**OBJECTIVE:** To develop seed-propagated, cold-tolerant, fine-textured bermudagrass varieties for the northern half of the U.S. bermudagrass belt.

**METHODS:** Phenotypic recurrent selection is being used to effect improvement in seed yield potential, or plant morphology (texture), or cold-tolerance, or combinations of these traits in bermudagrass breeding populations. This includes: 1) selection for increased basic fertility (seed-set) and fine-texture in cold-tolerant germplasm, 2) selection for increased cold-tolerance and finer-texture in common bermudagrass germplasm of Arizona/California origin, and 3) selection for seed production and cold tolerance within the very fine-textured C. transvaalensis taxon. The recurrent selection breeding procedure is designed for ongoing population improvement via increase in frequency of quantitative genes controlling the desired characters. Desirable plants can be extracted from the populations at any point in time and used as parents in the synthesis of a variety, or propagated vegetatively as a variety if desired.

Acquisition, evaluation, and breeding use of new Cynodon germplasm accessions is standard and ongoing. New germplasm has recently been acquired from the Southern Regional Plant Introduction Station, Griffin, GA, and from Australia (now in quarantine).

Laboratory and/or field measurements of important traits, e.g., cold- and drought-tolerance and water-use efficiency are obtained on advanced breeding lines. Cold-tolerance characterization is accomplished by the freeze-regrowth, or electrolyte leakage tests. Water use rate has been measured using mini-lysimetry and time domain reflectometry. Mass screening of large bermudagrass populations in greenhouse/growth chamber/laboratory facilities for cold- and drought-tolerance will be conducted in the coming months.

Tissue culture is being investigated as a potential aid in the genetic improvement of bermudagrass. We are particularly interested in perfecting techniques permitting its use for screening at the cellular level (e.g., for increased herbicide tolerance) and for obtaining haploid plants (anther culture).

**PROGRESS AND PLANS:** Three cycles of recurrent selection in a cold-tolerant, broad gene-base, bermudagrass population has increased basic fertility more than three-fold. Truncated selection (fertility first, fine-texture second) has also modified texture in the population, but to

a lesser extent. In the coming months this population will be subjected to intense selection for finer texture in the greenhouse. From 1500 to 2000 plants at a time will be grown in 3-inch pots with selection of the best 1 to 3%.

In 1988, selected plants from the cold-tolerant population were planted in isolated polycross blocks for production of Syn-1 seed. These Syn-1 strains will be planted in an evaluation trial on the Turf Research Center at Stillwater this spring.

Highly fertile, relatively fine-textured, but moderately winter hardy common bermudagrass germplasm of Arizona/California origin has been field evaluated for winterhardiness. Differences were found among space planted plants in survival and spring greenup. The best of these plants were selected and intercrossed to provide seed for further cold tolerance screening. Some 2200 plants of this population are now growing in the greenhouse in "Conetainers" for cold tolerance screening. The screening will be done by taking the plants from the greenhouse directly to a controlled environment chamber for a 4-week acclimation period (13/6°C) followed by exposure to freezing temperatures using the same equipment and methods as used in the freeze/regrowth test. The best of the surviving plants will be intercrossed to produce a new generation for further screening and evaluation.

Last year some of the Cynodon transvaalensis accessions in our breeding nurseries had good seed head production and good seed set. Four of the best had respective seed set percentages of 83, 77, 73, and 72. Those four plants were vegetatively propagated in a larger isolated plot area on the SW Forage and Livestock Research Station for seed production studies to begin this year. Eight hundred and sixteen seedlings resulting from open-pollinated seed harvested from the four accessions were transplanted from the greenhouse to the field August 1, 1988. By the end of the growing season differences among plants in spread, growth habit and other traits were evident. Laboratory/greenhouse cold tolerance evaluation of 25 of these plants using the freeze-regrowth procedure indicated substantial differences. These differences were confirmed this spring by observation of regrowth, or lack thereof, of the individual plants. Spring regrowth ranged from none (complete winterkill) to excellent. Those with good winter survival will be evaluated and used in further breeding. The four above mentioned accessions were also intercrossed and used as parents in crosses with selected C. dactylon plants in spring 1988. Over 1500 hybrid plants from these crosses are to be transplanted to the field this spring (1989). Twenty-two hundred plants from open-pollinated (OP) seed of the four C. transvaalensis accessions will be space planted this spring for evaluation. These populations will provide materials for selection and will be used to evaluate genetic variation and breeding potential in C. transvaalensis. An additional 500 OP plants will be established this spring for evaluation under golf course tee management conditions.

In bermudagrass tissue culture work, techniques have been successfully developed to regenerate plants from meristematic somatic (2n) tissue explants. Extensive efforts in 1988 to regenerate plants from gametophytic tissue explants (anthers) were not successful. Planned

experiments in 1989 include development of cell screening techniques using somatic callus tissue and further efforts to regenerate plants from anthers.

In 1988, Dr. Joel Barber and graduate student Kevin Hays completed two experiments relating to water relations of selected bermudagrass genotypes from the breeding program. In the first, they compared the Mini-Lysimetry and Time Domain Reflectometry methods of measuring water use using 12 genotypes. A second experiment was conducted to study drought avoidance mechanisms of ten genotypes. Characteristics studied in the second experiment were root and carbohydrate redistribution throughout the soil profile in response to simulated drought stress. In the first experiment the Mini-Lysimetry method indicated significant differences in water use rate among the genotypes. The Time Domain Reflectometry method did not detect any differences. Water use rate, averaged over the genotypes, estimated by the Mini-Lysimetry method was significantly greater than the rate estimated by Time Domain Reflectometry. In the second experiment, superior genotypes for drought avoidance were identified. The results suggested root redistribution between 30 and 150 cm to be partially responsible for differences. Carbohydrate redistribution was not significantly correlated with drought avoidance.

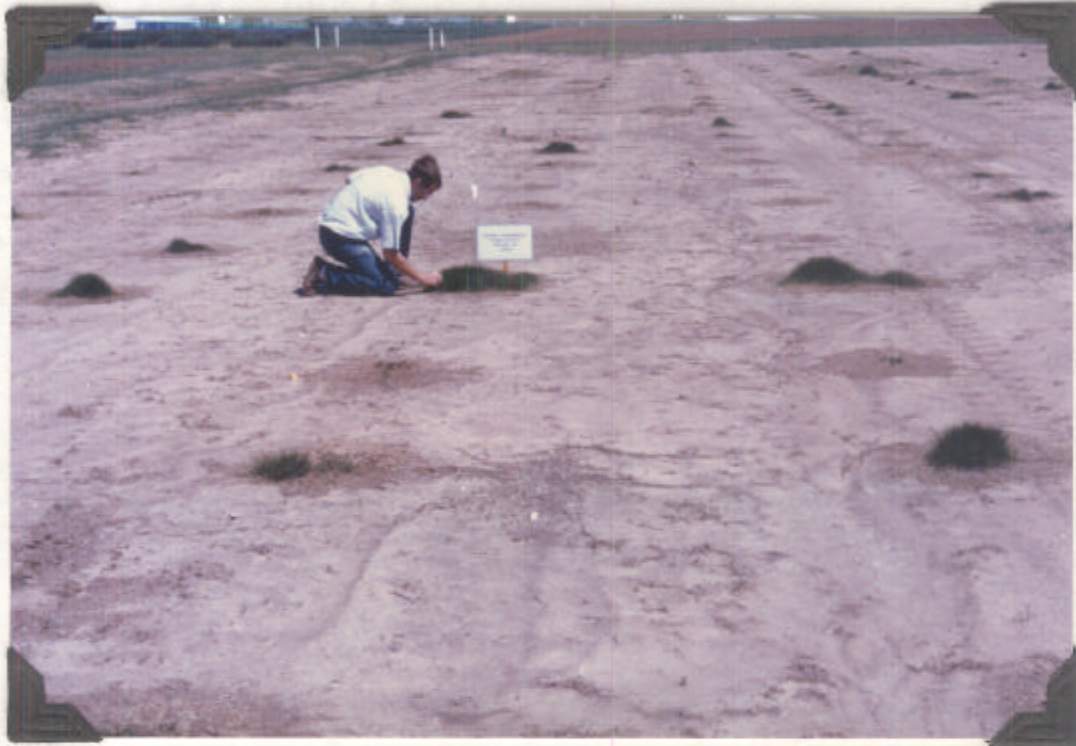


Bermudagrass plants being grown for cold-tolerance screening. Each "conetainer" contains a plant grown from a seedling. These plants will be acclimated in a growth chamber for one month (12 hr photoperiod, 13/6 °C day-night temp.), then screened for cold tolerance using the freeze/regrowth procedure.



Flats of progeny plants of *Cynodon transvaalensis* and *C. transvaalensis* X *C. dactylon* hybrids. Over 4000 of these plants are being readied for transplanting to the field.





An April 1989 photograph showing differential survival of fine-textured *C. transvaalensis* progeny established on the Agronomy Research Station, Stillwater, OK August 1, 1988.