COLLEGE OF AGRICULTURE AND HOME ECONOMICS

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ANNUAL REPORT
to
USGA Green Section

Project Title: Breeding Improved Seeded Bermudagrass for Turf

Submitted By: Arden A. Baltensperger, Professor of Agronomy, NMSU
October 1985

As indicated in a Status Report submitted to Dr. James Watson and Mr. Bill Bengefield in early 1985, (see attached), the objectives of this USGA Grant Project are closely tied to our ongoing Bermudagrass Breeding Project at NMSU.

Results:

Objective 1) of our cooperative agreement is - The evaluation of single cross (2 clone synthetics) vs polycross combinations of elite clones.

Six polycross progeny and three single cross progeny were evaluated this growing season in comparison with Common, Guymon and 13 vegetatively propagated strains and cultivars. This experiment was established in 1984 and this was the first year data was taken on the plots as solid turf. Data were collected at 2 clipping heights for quality factors such as color, density, regrowth and bermudagrass mite damage. Although this data collection is not complete for 1985 there are indications that 2 of the polycross combinations are superior to Common for color, density, and bermudagrass mite resistance.

As a part of the existing NMSU bermudagrass breeding program a heritability study was completed and published in 1985 as a source of methodology information for breeding bermudagrass for turfgrass quality characteristics. (See attached copy of Crop Science article.)

Objective 2) As part of our overall NMSU project we have initiated a graduate student study on parent-progeny relationships for shade tolerance. However no progress was made on evaluating for N, Fe, moisture, cold and shade tolerance as a part of this grant project.

Objective 3) All polycrosses and single crosses at several generation levels were evaluated on a gross basis for seed productivity in western Arizona and at Las Cruces, NM. At this time, these evaluations will serve as a criteria for discarding only very low seed yielders. Also, as part of the overall NMSU Bermudagrass Breeding Project, a parent-progeny relationships study is near completion relative to seed yield and seed yield components.

Status Report

NMSU Bermudagrass Breeding Project
December 3, 1984

1. Six polycross progeny and three single cross progeny were established at Las Cruces, New Mexico, in a turf evaluation experiment in July 84. The first, second and third generation of some of the above are entries in the experiment along with several vegetative experimentals and check cultivars. The entries total 30.

   Seed of the exprimental entries was produced at Las Cruces and/or Yuma, Arizona, in small crossing and increase blocks. As would be expected, several of these experimentals do not appear to be satisfactory for seed production. Crosses planned for 1985 will continue to include material with seed as well as turf quality potential.

   Establishment year results from the above strain test indicate we have had some success in incorporating nitrogen efficiency (better color at modest N levels) and shorter intermode length in some of our seeded material.

2. Seed yield and seed quality data from increase blocks at Yuma, Arizona, is only non-replicated (yes or no) type information. Such information is probably satisfactory at this time, but more precise estimates will be necessary before variety release. Also seed increase of any expected release will need to be greatly increased in the next two years to provide seed for expanded testing for turf quality at other locations.

3. A genetic study to provide better breeding methodology for seeded bermudagrass is continuing (see attached 1984 Agronomy Abstracts).

Prepared by:

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they may be responsible for the sporadic occurrence of polyembryony and polyploids in the msl msl genotype.

Improvement in Evaluation of Grain Yield Among Breeding Lines with Lattice Design.
F. A. CHOLICK*, G. W. PARTELOW, and D. L. KIEM, South Dakota State Univ.
Though the concept of using a lattice design to evaluate breeding lines is not new, we believe it is a design that has been somewhat overlooked by breeders. The lattice design (partially balanced) with three replications has been utilized by SDSU's Spring Wheat Breeding program since 1979. Experimental precision was improved in 42 of 54 experiments when the lattice was compared to radomized complete block design. Lattice was defined as being more precise when it reduced error mean square (EMS) by more than 5%. In 30 of 54 experiments, EMS was reduced by more than 15%. We have not found the lattice design restrictive in evaluating breeding lines.

Divergent Selection for Ear Moisture in Early Maize. J. R. CHYLE, JR. and H. Z. CROSS*, North Dakota State Univ. Mass selection utilizing 2 selection criteria based on ear moisture characteristics was initiated in 5 early maize (Zea mays, L.) synthetics to evaluate their effectiveness in changing ear moisture at harvest. Subpopulations divergently selected for 2 or more cycles in each synthetic for fast (FD) and slow (SD) ear drying rates in a laboratory and high (HM) and low moisture (LM) percentage at the dent stage were field evaluated. The SD method reduced moisture by -0.673%/cycle and reduced ear length, kernels/ear, rows/ear, ear weight, and root lodging. The LM method reduced ear moisture by -0.715%/cycle, increased test weight, and decreased stalk lodging. Neither yield nor silking date were changed by any method. Lower moisture at the dent stage rather than differences in drying rates produced lower harvest moisture. The LM method should be easily adaptable to most maize breeding programs.

Reciprocal Crosses between Genotypes of Glycine max and G. soja. S. R. CIANZIO* and W. R. FEHR, Iowa State Univ. Interspecific crosses between Glycine max and Glycine soja may be useful for broadening the genetic base of the cultivated soybean. Our objective was to determine if cytoplasmic effects were present in crosses between 'Century' and PI 326581 and between 'Amsoy 71' and PI 424001. Parents and F1 plants were sown af three environments to evaluate seed weight, fatty acid, protein, and oil percentage of the seed, number of days to flowering (R1) and maturity (R8), lodging, defoliation, shattering, vining, agronomic type, plant height, and leaf length and width. No significant differences were detected between reciprocals, except for vining in the cross Amsoy 71 x PI 424001. Our results indicated that cytoplasmic effects were not important for interspecific crosses between cultivars of G. max and accessions of G. soja.

Excised-Leaf Water Retention and Yield in Durum Wheat Crosses. J.M. CLARKE* and T.F. TOWNLEY-SMITH, Agric. Canada, Swift Current, Saskatchewan, Canada.
Field research was undertaken to determine the inheritance and relationship to grain yield of excised-leaf water retention capability in durum wheat (Triticum turgidum var. durum L.). 'Pelissier', which shows high water retention capability, was crossed with eight adapted high-yielding cultivars and lines. Fifty random lines derived from single head selections in the F_2, F_4 and F_6 generations (F_3, F_5 and F_7 increased in California winter nursery) were evaluated for excised-leaf water retention capability in the F_4, F_6 and F_8 generations. Water retention capability was measured as leaf water content at sampling minus leaf water content after wilting for 6 h (F_4 and F_6) or 2 h (F_8). The water retention trait appears to be under relatively simple genetic control. Correlation coefficients between leaf water retention and grain yield ranged from low positive to low negative, varying among years. Leaf water contents at sampling showed a broader range in some crosses than in others.

Heritability Estimates for Components of Seed Yield in Bermudagrass (Cynodon dactylon (L.) Pers.).
G. J. CLUFF* and A. A. BALTENSPERGER, New Mexico State Univ.
The polycross progeny method was used to estimate broad-sense and narrow-sense heritabilities for components of seed yield of bermudagrass in a field experiment at Las Cruces, New Mexico. Measured traits included seed yield, percent seed-set, number of spikelets per branch, length of branches per panicle, panicle density, number of branches per panicle, and percent germination. Characters measured in the field were correlated with flowering characters measured in a growth chamber. Single-season, broad-sense heritabilities ranged from 0.22 to 0.97. Broad-sense heritability for seed yield was 0.77. Narrow-sense heritabilities were larger than 1.0 for seed yield, seed-set, and percent germination indicating non-additive gene action. Narrow-sense heritabilities ranged from 0.51 to 0.97 for the other traits. No simple, phenotypic correlations between growth chamber and field traits were significant. These preliminary results indicate that a selection scheme involving progeny testing and use of specific combining ability is necessary for breeding for seed yield in bermudagrass.

Effect of Three Fertility Treatments on Virginia-Type Cultivars. T. A. COFFELT* and D. L. HALLOCK, USDA-ARS and VPI & SU, Tidewater Research Center.
Nutrient uptake of large-seeded virginia-type peanut (Arachis hypogaea L.) cultivars Florigiant, Early Bunch, VA 81B, NC 7, and NC 6 was determined under three fertility levels. Fertility level 1 was 448 kg/ha^{-1} of 3-9-18 fertilizer applied to corn prior to peanuts. Fertility level 2 was 1344 kg/ha^{-1} of 3-9-18 fertilizer applied to corn prior to peanuts. In addition, peanuts received 34 kg/ha^{-1} Mn, 3.4 kg/ha^{-1} Zn and Cu, and 0.6 kg/ha^{-1} B prior to planting. Fertility level 3 was the same as level 2, except 1344 kg/ha^{-1} of landplaster was applied to the peanuts at early pegging. The experiment was conducted at Suffolk, VA, for 3 years (1980-1982) on a Wagram loamy fine sand. Petioles and leaflets were analyzed for Ca, P, K, Cu, Mg, Mn, Zn, and Fe at early pegging and harvest, and pod yield and market grade were determined all 3 years. Seed germination and nutrient content were determined in 1981 and 1982. Significant differences occurred among cultivars and among fertility levels for nutrient content of petioles, leaflets and seeds, yield, market grade, and germination. These results indicate that cultivars differ in nutrient requirement and/or nutrient uptake. The interrelationships of Ca and K were important in seed germinability and pod rot.

Heritable Somaclonal Variation in Wheat Gliadin Proteins.
D. B. COOPER*, R. G. SEARS, A. C. GUENZI, N. L. LAPITAN, B. L. JONES, and G. L. LOOKHART, Kansas State Univ. and USDA-ARS.
Fertile R_0-plants of the line ND-7532 were regenerated from callus tissue after 90 days in culture. Self-pollinated R_1 seed produced by these plants were space planted in the field in the fall of 1981. Of the 5586 R_1-plants, 33 were different from non-regenerated controls for one or more agronomic traits. Gliadin electrophoregrams were prepared from bulk samples of these 33 plants. Four of the 33 produced gliadin patterns different from controls, so 12 single seeds of each of these four lines were examined individually. All of the single seeds examined, from the four mutant lines, contained a 'new' protein band at 30 relative mobility units (RMU); this mutant protein was never seen in non-regenerated control plants. Three of the four mutant lines were also fixed for the presence of a second mutant protein of 50 RMU and the corresponding loss of a parental protein of 26 RMU. The remaining line was segregating 5:7 for the presence of band 50 and the loss of band 26. This indicates a close linkage between the gene(s) coding for proteins 50 and 26. Other minor variations in gliadin patterns were also noted in the four mutant lines.

A Comparison of Theoretical Models for Covariances of Relatives Under Selfing.
N.M. Cowen* and K.J. Frey, Iowa State Univ.
A comparison was made of 5 models dealing with covariances of relatives under selfing. In all models linkage equilibrium or no linkage is

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EXECUTIVE SUMMARY
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Research Project: Breeding Improved Seeded Bermudagrass for Turf

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Presently only three seeded, turftype bermudagrass varieties are available for turf use. "Common" bermudagrass seed is commercially available in quantity and used as a general purpose turfgrass in the southern half of the U.S. Improved seeded varieties are needed that are more attractive, especially in color, and density and that are less sensitive to stress conditions of low moisture, iron, nitrogen, and cold than "Common."

Plant breeding and genetic information now available indicates that improvement in the tetraploid or common type bermudagrass can be achieved by conventional selection and breeding.

This research project is designed to develop new seeded strains by polycrossing and single crossing desirable clones and evaluating progeny in several generations for turf quality and seed production. Several progeny from these crosses have been made and are currently being evaluated. Additional cycles of selection will be made if necessary, to develop suitable strains.