ANNUAL PROGRESS REPORT

CONCERNING

BREEDING AND EVALUATION OF SEEDED COLD-TOLERANT BERMUDAGRASS VARIETIES

AND

BERMUDAGRASS VARIETIES FOR GOLF COURSE PUTTING GREENS

For the Period

1 November 1994 - 31 October 1995

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EXECUTIVE SUMMARY

The objectives of the Oklahoma State University bermudagrass breeding program are to develop improved seed-and vegetatively-propagated varieties for use in the transition zone and southern states. Two broad genetic-base *C. dactylon* populations, one derived from cold-tolerant relatively infertile germplasm, the other from cold-sensitive highly fertile germplasm have been developed using phenotypic recurrent selection. Selection within the cold-tolerant population, $C_{3fer4tex}$, has been for increased seed production potential and finer texture. Selection within the cold-sensitive population (C_{3ct}) has been for increased freeze tolerance. Cumulative performance data indicate synthetic varieties from the cold-hardy breeding population to be well-adapted to the U.S. transition zone with turf quality competitive with other seeded bermudagrasses. Commercial release of one or more synthetic varieties is planned. Field evaluations are underway to define optimum cultural management strategies for the varieties.

African bermudagrass, *C. transvaalensis*, has extensive phenotypic variation within the species for many traits influencing adaptation and turf quality. A genetic population is now being studied that will permit estimation of genetic parameters for traits of interest. Field evaluation of selected African genotypes indicate their major weaknesses to be instability of turf quality and light-green color. In tropical environments the African selections generally maintain good to excellent putting-green turf in winter, but dramatically decline in quality during summer. Variation in summer performance of genotypes has been documented indicating potential for improvement. As a result of its weaknesses, African bermudagrass is now being evaluated for potential use on tees and/or fairways. Furthermore, African genotypes having demonstrated the best overall performance are being used extensively as parents in crosses with *C. dactylon* to produce large F_1 progeny populations. Several selections from these populations are performing well in field tests. In 1995, African bermudagrass tolerance to herbicides and response to fertility were more clearly defined.

Alterations in protein synthesis associated with cold acclimation (CA) have been documented in Midiron and Tifgreen bermudagrasses. Acidic (pi's of ca. 5 to 6) proteins of ca. 34 kD were diminished in crowns of both varieties following CA. Both varieties synthesized cold-regulated (COR) proteins of several size ranges, including ca. 14 to 15 kD, 20 to 28 kD, 32 to 37 kD, and 45 to 55 kD, in association with CA. Midiron crowns synthesized low molecular weight (MW) (ca. 20-28 kD) basic (pi's of ca. 7 to 9) COR proteins in greater numbers and amounts, and intermediate MW (ca. 32 to 37 kD) acidic (pi's of ca. 4 to 6) COR proteins in greater amounts than Tifgreen crowns. Peptide sequence analysis of a prominent 27 kD protein from Midiron crowns indicates it to likely be a chitinase.

I. INTRODUCTION

The turf bermudagrass breeding program was initiated in 1986 under the joint sponsorship of the United States Golf Association and the Oklahoma Agricultural Experiment Station. The initial broad objective was to develop fine-textured, winter hardy, seed-propagated varieties for the U.S. transition zone. The program was expanded in 1990 to include the development of superior vegetatively-propagated varieties. Important ongoing activities supporting the breeding effort include the development/improvement/use of techniques to measure physiological and morphological parameters related to environmental stresses; the procurement, evaluation, and use of new turf bermudagrass germplasm in the breeding effort; use of tissue culture in generating genetic variation and screening for desirable traits at the cellular level; and evaluation of bermudagrass varieties and breeding lines for turf performance.

This report summarizes activities and progress for the period 1 November 1994 through 31 October 1995.

II. RESEARCH PROGRESS

Breeding Seed-Propagated Varieties.

Two broad-genetic base *Cynodon dactylon* populations have been developed using phenotypic recurrent selection (PRS) for seed yield, or turf quality indices, or both. One population was developed from cold-hardy germplasm subjected to PRS for increased fertility (% of florets setting seed) and finer texture. It was designated in recent reports as $C_{3fer\text{-}3tex.}$ The second population was developed from cold sensitive germplasm with high seed production potential and was designated in recent reports as C_{2ct}. This population was developed by initially selecting for seed yield and turf quality among spaced plants growing at Yuma, Arizona. Each of these populations has undergone an additional cycle of selection within the past year and are presently designated as $C_{3fer\text{-}4tex}$ and C_{3ct}. Experimental varieties have been synthesized from these populations at various stages of cyclic development and several are now being evaluated for adaptation and turf performance in tests at Stillwater and other locations. Results from these tests follow.

1992 NTEP Bermudagrass Test: Two experimental synthetic varieties OKS 91-1 and OKS 91-11, were entered in this test. OKS 91-1 was derived from the C_{1CT} (less cold-hardy) population, while OKS 91-11 was derived from the $C_{3fer2tex}$ (more cold hardy) population. Selected data tables from the 1993 and 1994 NTEP progress reports are presented (Tables 1-3) to facilitate discussion of the performance of these strains. The mean turf quality ratings of OKS 91-1 were in the middle of the ranges for seeded varieties in both 1993 and 1994. In both years, turfgrass quality of OKS 91-1 was significantly higher than that of Primavera and Arizona Common and equal to that of NuMex Sahara and related types. Ratings of percent living spring ground cover and percent winter kill indicate possible advance in cold tolerance from the one cycle of selection practiced for the trait. OKS 91-1 had more ground cover than Arizona Common in spring 1994 in the Kentucky and Missouri tests. In the Virginia test it had less injury during the 1992-93 winter than Cheyenne and differences between it and Arizona Common and NuMex Sahara are likely significant at the 90 % probability level. Two additional selection cycles for increased cold tolerance have been completed in the base population of this material. OKS 91-11 has consistently ranked high relative to other seeded varieties for turf quality and cold hardiness. The differences in spring growth of cold hardy and non-cold hardy bermudagrasses in the transition zone are exemplified by the differences between BERPC 89-3 and Arizona Common in Fig. 1.

Mowing Height x Fertility Trial: Research was continued in 1995 on the response of 18 seeded bermudagrasses to varying mowing heights and nitrogen fertility regimes. This study is being conducted by M.S. Candidate Richard Austin under the supervision of Dr. Dennis Martin. The bermudagrasses in this study were established by seed at the OSU Turfgrass Research Center at Stillwater on July 20 - 24 of 1992. All plots were seeded except for those containing DSM 250, which were established by plugging due to shortage of seed. The soil present was a silty clay loam. In spring of 1994 mowing height treatments as well as nitrogen fertilizer treatments were begun. The 8.5 x 17 ft (2.6 x 5.2 m) cultivar plots were split into three 4.25 x 5.75 ft (1.3 x 1.8 m) subplots, each mowed at 3/8, 1/2 or 1.5 inches (1.0, 1.3 and 3.8 cm) 2 - 3 times per week. These mowing heights represented commonly used tee, fairway and rough heights-of-cut on bermudagrass, respectively. Mowed subplots were split in half, applying either 3 or 5 lbs of N per 1000 ft^2 per year (146.5 or 244.1 kg N ha^{-1} yr^{-1}) to each subplot. Nitrogen was applied 4 times per year at 0.75 or 1.25 lbs N per 1000 ft^2 (36.6 or 61.0 kg N ha^{-1}) each time. The experimental design was a randomized complete block with split block application of mowing treatments and an additional split due to fertilizer application (Figs 2 and 3). There were three replications in the study. Soil available phosphorus and potassium were maintained at 65 and 250 lbs per acre or greater. A urea formaldehyde (Nutralene, 40-0-0) fertilizer was utilized for nitrogen treatments. Irrigation was performed to supplement natural rainfall and total water received through irrigation and rainfall was monitored and recorded. Visual color and visual quality as well as a visual estimate of seedheads on the plots were measured every 2 weeks. Additionally, visual density ratings and visual texture ratings were collected one time per month. A divot machine (Figs 4 and 5) was utilized one time per month in order to create a divot to monitor for recuperative capacity of the grasses (Fig 6). Finally, sample cores for measuring shoots per area and soil cores for measuring root mass distribution were collected two times per growing season. Because of the great amount of time involved in counting individual plants and in washing soil cores to retrieve roots, these samples were frozen to allow their analysis during the winter months following the conclusion of the bermudagrass growing season.

Shoot density, recovery from divoting, visual texture, visual color, and visual quality ratings taken in 1994 and 1994 have been analyzed to date and will be discussed at this time. Those parameters for which we have not yet analyzed both year's results, will be discussed in the May 1, 1996 report. The information covered here will be presented in poster form at the 1995 American Society of Agronomy meetings in St. Louis, MO.

Seasonal mean shoot density of the bermudagrasses as a function of mowing height and fertility regime are shown in Table 4. Shoot density in general was greater under the 5 than the 3 lbs N 1,000 sq. ft yr^{-1} treatment. A mowing height by fertilizer interaction was present in 1994 but not in 1995. Means were averaged over fertilizer treatments in 1995. The seeded African bermudagrass selection OKSCt-1 had statistically greater shoot density under all mowing heights and fertilizer regimes than any common bermudagrass in the test. Among seeded common bermudagrass selections, Jackpot usually ranked numerically highest in shoot density, although never statistically greater than OKS 89-3 and OKS 91-2 which usually had the greatest shoot density of any of the OSU selections. Guymon and Sundevil bermudagrasses had the consistently lowest shoot density under any management regime.

OKS 91-2 and Sundevil ranked consistently high in recovery from divoting during both years of this study (Table 5). OKS 89-3 and Guymon bermudagrasses ranked consistently low in terms of recovery from divoting. In general, the differences present in recovery from divoting were much smaller at 4 weeks after divoting (WAD) than at 2 WAD. It is important to note that a value of 100% recovery from divoting in this work indicates that 100% of the soil surface has been revegetated by the bermudagrass, but complete recovery of pre-divoting shoot density has not likely occurred. Shoot density recovery within divots was not a practical parameter for measurement in this study due to the large number of cultivar x mowing height x fertilizer treatments present in the study.

The African bermudagrass selection OKSCt-1 had statistically higher texture ratings in both years of the study, indicating the substantially finer texture of this grass (Table 6). Guymon and Sundevil were statistically more coarse than OKS111-1 which was statistically more coarse than any of the remaining 14 seeded common bermudagrasses. Among these 14 grasses, few textural differences were present.

Sundevil and OKS 111-1 had consistently high color ratings in both years of this study, with the African bermudagrass OKS Ct-1 always having statistically lower color ratings than all other grasses in the study (Table 7). Differences among the remaining grasses were not consistent.

In general, quality of all of the seeded grasses increased with increasing mowing height, with the exception of the African bermudagrass OKS Ct-1 (Table 8). This grass had poorer quality at 1.5 inches than at the 0.38 or 0.5 inch cut because it was extremely stemmy and graining at the 1.5 inch cut. At the 0.38 and 0.5 inch cuts, OKS Ct-1, OKS 111-1 and OKS 91-2 provided consistently high quality ratings. Guymon, Tropica, Poco Verde and Sonesta usually had the poorest quality ratings at the two lowest heights of cut. Fewer differences in quality were present among the cultivars at the 1.5 inch cut than at the lower heights of cut. This fact would suggest that there are true differences in tolerance among the cultivars to lower heights of cut. The encouraging results of quality ratings from the African bermudagrass OKS Ct-1 at the two lower heights of cut suggests that other African bermudagrasses from our program should be examined for their field performance at typical tee and fairway heights of cut. The results of this research are useful in documenting progress of the OSU Bermudagrass breeding effort as well as the effort of several companies and individuals in the turfgrass industry. This progress can be assessed by comparing performance of the new grasses to that of AZ Common. These results are also useful in selecting a seeded bermudagrass for placement on golf course fairways, tees, roughs and general grounds. Finally, the development and commercialization of seeded bermudagrasses is increasing rapidly. During the course of this work, C2 bermudagrass became commercially available, and by the end of the 1995 growing season it was no longer being produced for sale.

Spring Dead Spot Evaluation. Twenty-three seeded and three vegetatively-propagated bermudagrasses were planted in August 1993 to evaluate their turf quality characteristics and tolerance/resistance to Spring Dead Spot disease. The bermudagrasses were maintained at a 0.5-inch mowing height, 5 lb N/1000 ft^2/year, and irrigated to prevent wilting.

Fall color retention ratings from 1994 and spring green-up ratings in 1995 are shown in Table 9. BERPC 89-3, 91-3, 91-4, 91-12, and 91-13 were rated among the highest of bermudagrass varieties for fall color retention and spring green-up. Relative green-up among the bermudagrass varieties in March and April was consistent between 1994 and 1995.

Dr. Ned Tisserat, Plant Pathologist at Kansas State University, inoculated the bermudagrass varieties on September 24, 1994 with *Ophiosphaerella herpotricha* , a known causal agent of Spring Dead Spot disease in Oklahoma. Six plugs were removed from each plot using a cup cutter. Three of the six holes received the *Ophiosphaerella herpotricha* inoculum before being replaced with the plugs.

Although disease symptoms caused by the inoculated pathogen were expected to be minimal this spring, dead spots were observed in the areas of inoculation. The average area of dead tissue resulting from inoculation and the average number of live bermudagrass shoots growing in the dead areas are presented for the bermudagrass varieties in Table 10. A smaller area of dead tissue and a greater number of live shoots growing in the dead area may be an indication of greater varietal tolerance to the disease. Sundevil, Guymon, 91173, Midlawn, and Midfield, African, and several of the BERPC varieties exhibited the least severity of spring dead spot disease in terms of dead spot area. The highest number of live shoots per dead area were observed for African and Midlawn bermudagrasses, thus suggesting that these varieties have a greater ability to recover from the disease.

Visual color, density, and cover ratings taken in May, and quality ratings taken throughout 1995 are presented in Tables 11 and 12, respectively. Midlawn, Midfield, African bermudagrass, and Tifton 10 were rated among the highest bermudagrass varieties for density and cover in May. Visual quality ratings for most of the BERPC varieties were consistently higher than Arizona Common.

OKS 91-11 Evaluation. A field study was initiated in July 1995 to further evaluate OKS 91-11 in comparison with Jackpot and Mirage seeded bermudagrasses for potential use on tees, fairways, and/or rough. The bermudagrasses were seeded on July 5, 1995 at a rate of 2.0 lbs PLS/1000 ft^2 on clay loam. The experimental design was a randomized complete block with 3 replications and plot size measured 15 ft x 25 ft. Seedling count, percent cover, color ratings are presented in Table 13. Stand cover of OKS 91-11 was less than Jackpot and Mirage in September but equal by October. The experiment will begin in 1996 with the following treatments applied to the bermudagrasses: nitrogen at 3 and 6 lbs/1000 ft^2/yr and mowing height at 0.5 and 1.5 inches. All other essential plant nutrients will be supplied at levels for optimum plant growth. Data collection will include: color, winter hardiness, turf quality, pest severity, pesticide injury, root mass, shoot density, response to a simulated traffic machine, and recuperative capacity in response to divots made from a divot machine. An additional 45-ft x 75-ft monostand of OKS 91-11 was established on July 5, 1995 at a rate of 1.3 lb PLS/1000 ft^2 on clay loam. Experiments will begin in 1996 to evaluate tolerance of OKS 91-11 to new and commonly used pesticides.

New Germplasm. An average of 20 plants from each of 22 bermudagrass accessions collected as seed in the Peoples Republic of China in 1993 were field planted in nonreplicated plots in summer 1994 and observed during establishment and in 1995. There is substantial variation among and within accessions for morphological characteristics and seed yield potential. Seed-set and seed yield estimates from unreplicated individual plants range up to 93% and 1078 lbs/acre, respectively. Of particular interest are three accessions that exhibit good turf growth characteristics (texture, sod density and color) and seed yield potential. These three accessions come respectively from Guangdong, Nanjing, and Beijing, respectively in southeastern, east central, and northeastern China. Their common origin from eastern China should make them adapted to a humid environment, but they may differ in cold tolerance based on their latitude of origin. Seed set and seed yield estimates from nonreplicated individual plants in these accessions range up to 86% and 786 lbs/ac, respectively. Two select plants respectively from the Guangdong and Beijing accessions were placed in a replicated turf evaluation test planted August 18, 1994. These plants, identified as 3200E Beijing and 3200 PRC-7 in Tables 14-16 serve to demonstrate the turf quality potential of the two accessions. Selected plants from the three accessions were used in 1994 in intra- and interspecific crosses (*C. dactylon* x *C. transvaalensis*, *C. dactylon* x *C. dactylon*) and were also planted in field polycross nurseries in August 1994. Hybrid seedlings will be transplanted to the field next spring. Syn-1 seed from the polycross nurseries will be produced in June/July, 1996 and planted in evaluation tests immediately after harvest and processing.

Summary - Breeding Seed-Propagated Varieties. Cumulative data from the various field tests indicate synthetic varieties from the cold-hardy breeding population to be relatively well-adapted to the U.S. transition zone and to have turf quality competitive with presently available seeded bermudagrasses. Accordingly, we are scaling up production in anticipation of commercial release of one or more synthetic varieties. New germplasm from the Peoples Republic of China that has demonstrated good turf quality plus good seed production potential in initial evaluations will be advanced to intensive replicated testing for adaptation, turf quality, and seed production capability. This germplasm is being used to formulate new breeding populations, create narrow-base synthetic varieties, and may be incorporated into the two existing breeding populations.

Breeding Vegetatively-Propagated Varieties

African Bermudagrass. African bermudagrass selections from screening trials conducted during 1990-93 in Oklahoma and Florida are included in several tests and observation plantings in several states. Results have been inconsistent, but generally point to deficiencies in the African bermudas which must be overcome. The performance of the African selections in central and south Florida plantings fluctuates with season. During the winter they have turf quality equal or superior to Tifdwarf, but dramatically decline in turf quality during the summer months. The summer decline in turf quality of the African bermudagrasses appears to be less severe in transition zone climatic conditions.

Significant variation among African genotypes for turf quality and performance stability continue to exist in screening trials planted 2-3 years ago. At the Champions Course in Houston Texas one African genotype (Ctr 2567) has consistently stood out in terms of both turf quality and aggressiveness according to Superintendent Charles Joachim (Fig 7).

Our African bermudagrass research program has been expanded to examine the potential use of the species on tees and/or fairways. A field study was initiated in July 1995 to evaluate Ctr 2747 and Ctr 2567 African bermudagrasses for potential use on tees and/or fairways in comparison with Tifway bermudagrass. The bermudagrasses were plugged on 2-ft centers on 15-ft x 16-ft plots on these soil types, one a clay loam and the other a sand/peat moss (85:15 v/v). The experimental design for both locations was a completely randomized block with 3 replications. Percent cover ratings for both locations are presented in Table 17. Establishment was slower on sand/peat compared to the clay loam. Furthermore, African bermudagrass establishment was slower than that of Tifway bermudagrass on both soils. Once full cover is attained, the following treatments will be applied to the bermudagrasses at both locations: nitrogen at 4 and 8 lbs/1000 ft^2/year and mowing height at 0.1875 and 0.25 inches. All other essential plant nutrients will be supplied at levels for optimum plant growth. Data collection will include: color, turf quality, pest severity, pesticide injury, root mass, shoot density, response to a simulated traffic machine, recuperative capacity in response to divots made from a divot machine, and response to winter overseeding.

A field study was initiated in April 1995 to evaluate African bermudagrass response to fertility. The study was conducted on a 7500-ft^2 clay loam green that was established with African bermudagrass in 1990. The green was mowed 3 times a week at 0.188 inches. An N-P-K-micronutrient interaction study was initiated using the following sources and rates: N at 3, 6, and 12 lbs/1000 ft^2/year (0.5, 1, 2 lbs/1000 ft^2/months of April-September) from urea formaldehyde (38N-0P_2O_5-0K_2O), P_2O_5 at 0 and 3 lbs/1000 ft^2/year (1 lb/1000 ft^2/months of April, June, and September) from triple superphosphate (0N-46P_2O_5-0K_2O), K_2O at 0 and 3 lbs/1000 ft^2/year (1 lb/1000 ft^2/months of April, June, and September) from K_2SO_4 (0N-0P_2O_5-45K_2O), and micronutrients at 0 and 180 lbs/A/year (60 lbs/A/months of April, June, and September) including: sulfur (10.97%) from ferrous sulfate and calcium ammonium sulfate; iron (9%) from ferrous sulfate and ferric oxide; calcium(6.08%) from calcium ammonium sulfate and dolomite; manganese (2.6%) from manganese oxide; magnesium (2.23%) from dolomite; zinc (1.3%) from zinc oxide; copper (0.5%) from copper oxide; and molybdenum (0.026%) from sodium molybdate. No additional fertilizer was applied during the test period. Fertilizers and rate treatments were arranged in a factorial combination. Plots measured 6 ft x 15 ft, and the experimental design was completely randomized with three replications. Visual quality, density, and color ratings are presented in Table 18. Fresh and dry clipping yield data are presented in Table 19. These data indicate that African bermudagrass growth response was affected most by nitrogen. Increased turf quality and clipping yield resulted from nitrogen application rates of 6 and 12 lbs/1000 ft^2/year. The fertility study will continue in 1996.

A field study was initiated in May 1995 to evaluate African bermudagrass response to herbicides. The study was conducted on a 7500-ft^2 clay loam green that was established with African bermudagrass in 1990. The green was mowed three times a week at 0.188 inches. Herbicides were applied at the recommended rate for bermudagrass turf and two times the recommended rate (Table 20). Plots measured 8 ft x 12 ft, and the experimental design was completely randomized with three replications. The experiment was repeated in August, 1995 at a nearby location with identical growing conditions. African bermudagrass injury and root mass ratings for the May experiment are presented in Tables 20 and 21, respectively. Injury ratings for the August experiment are shown in Table 22. Samples were taken for root mass in the August experiment but were not processed in time for this report. 2,4-D, MCPP, and dicamba formulated as Triplet® herbicide and triclopyr were most injurious to African bermudagrass at both application rates and dates. Although injury caused by these herbicides and rates would be considered unacceptable, African bermudagrass recovered by 42 DAT and turf in plots treated with Triplet® and triclopyr was darker green in color compared to other treatments. None of the herbicide treatments in the May study significantly reduced root dry mass at six weeks after application. In the August study, both rates of dithiopyr caused injury to African bermudagrass; however, the injury was less severe than Triplet® or triclopyr.

A field study was initiated at the Turfgrass Research Center in June 1994 to screen recent African bermudagrass selections under putting green conditions. Forty-five *C. transvaalensis* selections, some of which were made from hybrid *C. transvaalensis x C. transvaalensis* populations in 1993, in addition to Uganda, Tifdwarf, Tifgreen, and TifTW72 (Georgia) bermudagrasses were plugged into a sand/peat moss (85:15 v/v) research green. The experimental design was a randomized complete block with two replications. Establishment rate and spring green-up ratings are presented in Table 23. Winter injury occurred to both Tifdwarf and TiftW72 hybrid bermudagrasses. Inflorescence formation and visual quality ratings are presented in Table 24. Extensive variation was observed among the African bermudagrasses with respect to inflorescence formation. Evaluation of the genotypes will continue in 1996.

In July 1995, Ctr 2747 was sprigged onto a practice green at the Karsten Creek Golf Club in Stillwater, OK. The green was overseeded with perennial ryegrass in September 1995. In 1996, the African bermudagrass green will be evaluated for overseeding transition and putting green quality characteristics.

No experiments have been conducted to assess the magnitudes of genetic variation in *C. transvaalensis*. We have observed substantial phenotypic variation for many traits that affect adaptation and turf quality performance. Included among these traits are cold hardiness, growth rate, plant texture, sod density, and color. Significant variation likely exists for many other traits of importance. We completed the development of a genetic population in 1994 which can be used to assess genetic variation in the species and estimate heritabilities of important traits. In 1992, 32 *C. transvaalensis* plants were randomly chosen from our germplasm pool to include in the mating design. Eight plants were randomly assigned to each of four groups, and within each group four plants were randomly chosen to serve as males and the remaining four to serve as females. Within each group, each male was crossed with each female to provide half- and full-sib progeny. Testing of these progeny is now underway to provide data for assessing genetic variation within the species and to estimate heritabilities for selected characters of interest.

Interspecific Crosses. A major benefit of the work with African bermudagrasses is the development of new genotypes for use as parents in crosses with *Cynodon dactylon*. Over the past 3 years we have made numerous such crosses and presently have growing in preliminary screening nurseries several hundred putative F_1 hybrid plants from *C. transvaalensis x C. dactylon* crosses. Crosses made in spring and summer 1995 are expected to provide hundreds of additional F_1 progeny plants for preliminary evaluation in 1996.

Twenty-two F_1 hybrids selected from the preliminary nurseries were planted in a replicated test in August 1994 and evaluated for turf performance in 1995 (Tables 14-16). The performance of several of the 22 selections equalled or exceeded that of varietal standards during this first evaluation year. Continuation of this test will provide more data on their cold hardiness and stability of performance.

F_1 Hybrid Evaluation. A field study was initiated in July 1995 to evaluate vegetatively-propagated bermudagrasses for use on fairways. Eight experimental F_1 hybrid bermudagrasses from OSU together with Tifway and Midlawn were plugged on 2-ft centers in 10-ft x 25-ft plots on July 21, 1995. The soil was clay loam and the experimental design was a completely randomized block with 3 replications. Percent cover ratings are presented in Table 25. Many of the experimental genotypes exhibited rapid establishment compared to Tifway. Once full cover is attained, the following treatments will be applied to the bermudagrasses: nitrogen at 4 and 8 lbs/1000 ft^2/year and mowing height at 0.5 inches. All other essential plant nutrients will be supplied at levels for optimum plant growth. Data collection will include: color, turf quality, pest severity, pesticide injury, root mass, shoot density, response to a simulated traffic machine, recuperative capacity in response to divots made from a divot machine, and response to winter overseeding.

Tifdwarf Bermudagrass. Several tissue culture regenerated somaclonal variant Tifdwarf bermudagrass plants, along with six field collected Tifdwarf mutants, and Foundation Tifdwarf were planted on a sand green in a nonreplicated test. Green-up ratings are presented in Table 26. Many of the genotypes did not survive the winter. The Tifdwarf evaluation was terminated in June to provide additional space for evaluation of African bermudagrasses. The data from this test will be used in association with other cytological and morphological data from greenhouse plantings to verify the mutant phenotypes of these plants.

Freeze Tolerance Research.

Significant strides have been made in cold hardiness research in bermudagrass over the past 5 years beginning with the development of a laboratory procedure to assess relative or absolute freeze tolerance of individual plants. This technique has been used to quantify freeze tolerance differences among turf bermudagrass varieties. A preliminary study was conducted in 1995 to evaluate the cold hardiness of three experimental genotypes [C_{tr} 2747, 3200W 47-3, and 3200E PRC-7] in comparison to Tifgreen and Uganda. C_{tr} 2747 and Uganda belong to the taxon *C. transvaalensis*; 3200W 47-3 and Tifgreen are *C. transvaalensis* x *C. dactylon* hybrids; 3200E PRC-7 belongs to the taxon *C. dactylon*. Plants were established in conetainers for approximately 6 weeks, then subjected to acclimating conditions (8/2C day/night) for 4 weeks. Acclimated plants were induced to freeze at -3C and held overnight at this temperature. Four subsamples of each genotype were removed at each target temperature as the chamber temperature was lowered at approximately 1C per hour. Plants were slowly thawed, then evaluated for regrowth in a greenhouse. The experiment was one time. Tifgreen was the least cold hardy under these conditions, with 50% survival at about -6.5C (Fig 8). Selections 3200EPRC-7, CTR2747, 3200W473, and Uganda were about 1C hardier than Tifgreen. Although these results suggest that several Cynodon transvaalensis selections are more tolerant than Tifgreen, additional studies are necessary to fully characterize cold acclimation in African bermudagrasses.

Research led by Dr. Mark Gatschet, Research Associate, has provided exciting new information on cold-regulated (COR) proteins of bermudagrass crowns. This research has demonstrated that protein synthesis in crown tissues of Midiron and Tifgreen is altered in association with cold acclimation. Synthesis of COR proteins 14 to 15, 20 to 26, and 32 to 37 kilodaltons (kD) in size was demonstrated in both Midiron and Tifgreen crowns. Synthesis of basic COR proteins of 20 to 26 kD was significantly greater in Midiron than in Tifgreen crowns. The increased synthesis of these proteins in Midiron crowns correlates with it's greater freeze tolerance compared to Tifgreen. One of the most prominent of these COR proteins was recently determined to be a chitinase. Chitinase proteins frequently function in defense against biotic or abiotic stresses and some have been shown to have anti-freeze activity. The identification of cold-regulated chitinases and other defense-related proteins as having antifreeze activity suggests that some defense-related proteins may have dual roles, i.e., in defense against pathogens and in modulating freezing in plant cells. It is possible that these proteins in bermudagrass may function to enhance freeze tolerance and retard diseases such as spring dead spot. The characterization of the many protein alterations in bermudagrass crowns in response to cold acclimation and the identification of one prominent up-regulated protein as a chitinase provides a solid basis for continued research into the fundamental physiological/genetic mechanisms of stress tolerance in bermudagrass. The manuscript "A cold-regulated protein from bermudagrass crowns is a chitinase" was recently accepted for publication in CROP SCIENCE and is appended to this report.

Dr. Gatschet resigned his position in summer 1995 to enter law school. The bermudagrass cold tolerance research will be continued in collaboration with Dr. Mike Anderson, Associate Professor, Agronomy Department. Dr. Anderson is a plant biochemist. He has been added as a co-investigator on the project. A new graduate student, Benildo Delos Reyes, will work with the team in the cold tolerance research. The emphasis of the work has shifted to the identification of genes associated with freeze tolerance. This research will employ a relatively new technique known as "Differential Display." This procedure uses reverse transcription and polymerase chain reaction to identify differentially expressed genes. Our initial objectives are 1) to first perfect the mRNA Differential Display procedures for bermudagrass, and 2) then to test differential gene expression between cold-acclimated and non-acclimated bermudagrasses and identify, clone, and characterize genes which are upregulated or downregulated in respone to cold acclimation.

III. RESEARCH PLANNED

Seed-Propagated Bermudagrasses.

Experimental synthetic varieties are being scaled-up in production for commercialization. OKS91-11 will be further evaluated in field experiments to determine optimum cultural management regimes and tolerance to pesticides. Additional synthetic varieties are in various stages of development and/or evaluation. The two broad genetic-base populations will undergo additional cyclic selection and new narrow base synthetic varieties will be developed from them. Recently acquired bermudagrass germplasm from the Peoples Republic of China which has demonstrated good turf quality and good seed production potential in initial evaluations will be intensively evaluated and incorporated into the breeding effort. The Chinese germplasm will be used to formulate new breeding populations for recurrent selection, and further used to develop narrow base synthetic varieties for direct testing as potential new varieties.

Bermudagrass Mowing Height x Fertility Trial. The remaining results of Mr. Austin's field trial on seeded bermudagrasses that were not covered in this report will be presented in the May 1996 report. Results of Richard Austin's screening will continue through green-up ratings in spring of 1995. This trial will be concluded immediately following the green-up ratings. Publication of Mr. Austin's work should be achieved by fall 1996.

New Seeded Bermudagrass Trial. A new seeded bermudagrass trial is being planned for planting in summer of 1996. A number of new seeded common bermudagrasses have become commercially available since planting of this trial in July of 1992. We plan to conduct the new trial in a similar manner to Mr. Austin's trial but with only a few of the newer commercial releases as well as OKS 91-11 and other promising seeded types from our program. With fewer entries, we can increase plot size, an important consideration when more than one cutting height and fertility regime are imposed.

Vegetatively-Propagated Bermudagrasses.

Intensive evaluation of selected F_1 hybrid plants in presently established replicated trials will continue. Additional selections will be made from the several hunderd F_1 hybrids presently in preliminary field evaluation nurseries. Seeds from crosses made in 1995 will be started in the greenhouse this winter and field transplanted in spring 1996.

Experiments to estimate genetic variation and heritabilities in *C. transvaalensis* will continue using the genetic population earlier described. This population consists of progeny from 64 crosses. Field evaluations of C. *transvaalensis* will continue in 1996 with increased emphasis on its potential use on tees and/or fairways.

Table 1. Turfgrass quality ratings of seeded bermudagrasses included in the 1992 NTEP bermudagrass test. Data tables are photocopies from NTEP reports for 1993 and 1994 results.

TABLE 1B. MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS GROWN AT TWENTY-ONE LOCATIONS IN THE U.S. 1993 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AZ1	CA2	CA3	FL1	GA1	GA2	IL2	KS2	KY1	LA2	MO2	MS1	NE1	OK1	TX1	TX2	UB1	VA1	VA4	MEAN
OKS 91-11	6.3	7.3	6.8	5.4	6.0	5.5	5.3	5.0	5.5	7.2	5.7	4.8	3.8	4.6	6.5	6.0	5.7	4.2	6.2	4.9	5.1	5.6
JACKPOT (J-912)	6.6	7.3	5.4	5.4	5.4	5.5	5.6	4.8	5.2	7.0	5.0	5.4	3.2	5.0	4.8	7.0	5.8	5.1	6.5	5.8	5.4	5.6
SULTAN (FMC 6-91)	6.3	7.4	5.7	5.2	5.4	6.0	5.8	5.6	5.7	7.1	4.9	5.2	2.2	5.1	5.5	5.7	5.8	4.7	6.2	5.0	5.6	5.5
J-27	5.8	6.5	6.4	5.3	5.6	5.1	5.2	4.8	4.0	7.8	6.3	5.2	4.4	4.7	5.5	5.3	5.8	5.4	5.5	5.4	5.0	5.5
MIRAGE (90173)	6.2	5.8	6.0	5.2	5.4	5.9	5.8	5.2	3.8	7.3	5.9	5.5	4.3	5.0	5.0	6.0	5.6	5.1	6.0	4.8	5.1	5.5
FMC 5-91	5.9	6.8	5.3	5.3	5.5	5.4	5.8	5.1	5.5	7.1	4.9	4.8	2.8	4.9	5.0	7.0	5.8	4.8	4.8	4.8	5.0	5.4
FMC 2-90	6.0	6.8	4.9	5.1	5.3	5.8	6.0	5.2	4.7	6.8	5.0	5.0	2.3	4.8	5.0	6.3	4.9	4.7	6.0	4.5	4.8	5.2
GUYMON	5.8	6.0	6.1	5.3	5.4	4.9	5.9	4.8	2.4	7.3	5.5	5.2	4.6	4.6	4.7	6.3	5.8	4.7	4.7	5.0	4.8	5.2
OKS 91-1	6.1	6.3	5.2	4.8	5.1	5.7	5.8	5.2	4.8	6.6	4.7	4.7	3.1	4.9	.	6.0	5.0	4.9	5.5	4.6	4.7	5.2
FMC 3-91	5.7	5.7	5.8	4.9	5.4	5.5	5.6	5.0	4.6	6.3	4.7	5.3	2.1	4.6	5.0	6.0	5.5	4.9	5.7	4.3	5.1	5.1
NUMEX-SAHARA	6.2	6.1	5.8	4.9	5.3	5.6	5.6	5.1	5.0	6.2	4.8	5.2	1.9	4.6	4.8	6.0	5.2	4.3	5.5	4.0	4.8	5.1
SUNDEVIL	6.0	5.8	5.4	5.1	5.3	5.6	5.7	5.3	4.4	6.6	4.9	4.6	2.9	4.8	4.5	6.3	5.1	4.5	5.5	4.1	4.8	5.1
SONESTA	5.7	5.8	5.7	5.0	5.2	5.9	5.4	4.3	5.2	6.3	4.3	5.0	2.0	4.8	5.3	6.3	5.2	4.7	5.2	4.2	4.5	5.0
PRIMAVERA (FMC 1-90)	5.4	5.8	4.8	4.9	5.3	5.1	5.5	5.1	4.5	6.1	4.5	4.6	1.9	4.6	5.3	6.3	4.9	4.9	5.2	4.2	4.7	4.9
CHEYENNE	5.2	5.8	5.2	4.9	5.2	5.4	5.7	4.5	4.3	5.4	3.9	4.3	2.6	4.8	.	6.0	4.8	4.5	6.0	3.5	4.3	4.8
ARIZONA COMMON-SEED	5.5	5.3	5.1	4.7	5.1	5.5	5.6	5.3	4.1	6.2	3.8	4.4	2.8	4.7	4.5	6.0	4.7	4.1	5.5	3.2	4.3	4.8
LSD VALUE	0.6	0.8	1.0	0.2	0.3	0.5	0.9	0.8	1.1	0.8	0.5	0.5	1.5	0.4	1.3	0.9	0.5	0.6	0.5	1.0	0.5	0.2

TABLE 1B. MEAN TURFGRASS QUALITY RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS GROWN AT TWENTY-THREE LOCATIONS IN THE U.S. 1994 DATA

TURFGRASS QUALITY RATINGS 1-9; 9=IDEAL TURF 1/

NAME	AL1	AR1	AZ1	CA2	CA3	FL1	GA1	GA2	IL2	KS2	KY1	LA2	MD1	MO2	MO3	MS1	OK1	OK2	TX1	TX2	UB1	VA1	VA4	MEAN
MIRAGE (90173)	5.8	5.8	5.9	5.0	5.0	5.5	4.4	3.8	3.7	7.3	8.8	5.7	6.3	5.2	4.0	4.9	5.9	6.2	6.3	1.2	5.1	4.3	5.7	5.3
OKS 91-11	5.9	6.5	6.7	5.5	5.2	5.4	4.0	3.6	4.4	8.0	8.0	5.3	7.0	4.4	3.4	4.7	5.9	5.8	6.1	1.0	5.6	3.5	5.4	5.3
J-27	5.6	5.7	6.0	5.2	4.8	5.1	4.3	3.3	3.5	7.8	8.2	4.9	6.0	5.0	4.0	4.8	5.2	5.5	6.1	1.3	5.5	3.9	5.5	5.1
GUYMON	5.7	5.9	5.9	5.2	4.9	5.1	4.4	3.2	3.3	7.6	8.0	5.3	6.0	4.9	3.2	4.9	6.0	5.8	6.1	1.1	4.9	3.9	5.2	5.1
JACKPOT (J-912)	5.6	5.9	5.4	5.0	4.7	5.5	4.3	3.3	5.2	7.3	7.8	5.4	2.7	3.4	2.8	5.1	5.0	6.0	5.7	1.1	4.5	3.6	5.9	4.8
SUNDEVIL	5.8	5.4	5.3	4.6	4.7	4.6	4.2	3.3	3.6	7.1	7.8	5.2	4.7	3.8	3.3	4.8	4.4	5.3	5.9	1.0	4.1	2.5	5.7	4.7
FMC 5-91	5.6	5.8	4.9	4.7	4.7	5.4	4.5	3.5	4.5	7.5	6.6	5.5	3.0	2.1	1.6	4.9	5.3	6.2	5.9	1.1	5.1	2.0	5.5	4.6
FMC 6-91	5.8	6.2	5.5	4.8	4.6	5.1	4.5	3.8	4.1	7.7	6.7	5.4	2.3	1.6	1.6	5.3	5.5	6.3	6.1	1.1	2.9	1.7	6.1	4.5
OKS 91-1	5.7	5.3	4.7	4.3	4.5	4.7	4.3	3.5	3.4	7.0	7.1	5.3	3.3	2.8	2.9	4.9	5.1	5.7	6.0	1.1	2.1	2.1	5.7	4.4
FMC 2-90	5.6	5.5	4.8	4.9	4.5	5.0	4.4	3.8	3.1	7.3	6.6	5.3	2.0	1.4	1.0	4.9	4.9	5.8	6.0	1.0	3.4	2.5	5.7	4.3
FMC 3-91	5.7	5.3	5.3	4.7	4.7	5.3	4.1	3.7	3.9	6.6	6.3	5.5	2.3	1.1	1.6	5.0	5.1	6.2	6.0	1.0	2.8	1.1	5.8	4.3
SAHARA	5.8	5.7	5.3	4.7	4.8	4.9	4.2	3.6	4.0	6.5	6.3	5.5	2.0	1.3	1.4	4.8	4.3	5.7	6.0	1.0	3.5	2.2	5.7	4.3
CHEYENNE	5.7	5.3	4.5	4.4	4.5	4.7	4.6	3.3	3.9	6.8	6.2	4.8	1.7	1.8	1.9	4.8	4.5	5.2	5.7	1.0	5.3	1.2	5.1	4.2
SONESTA	5.8	5.3	5.1	4.5	4.5	4.8	4.3	3.3	3.3	6.9	6.4	5.3	1.7	1.3	1.4	4.8	3.9	4.5	6.0	1.0	3.2	1.2	5.2	4.1
PRIMAVERA (FMC 1-90)	5.8	5.5	4.5	4.3	4.5	4.7	4.3	3.4	3.6	6.8	6.1	5.1	1.7	1.3	1.2	4.7	3.3	4.3	5.8	1.0	2.3	1.3	5.2	3.9
ARIZONA COMMON-SEED	5.6	5.3	4.9	4.3	4.5	4.6	4.1	3.5	3.3	6.9	5.8	5.3	2.0	1.1	1.1	4.9	3.4	4.3	5.8	1.1	1.7	1.2	5.1	3.9
LSD VALUE	0.2	0.4	0.8	0.3	0.3	0.6	0.7	0.8	1.2	0.7	0.7	0.5	1.7	1.2	1.2	0.3	1.4	1.5	0.5	0.3	1.4	1.3	0.5	0.2

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Table 2. Percent living ground cover (spring) ratings of seeded bermudagrass included in the 1992 NTEP bermudagrass test. Data tables are photocopies from NTEP reports for 1993 and 1994 results.

TABLE 11B. PERCENT LIVING GROUND COVER (SPRING) RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
1993 DATA

PERCENT LIVING GROUND COVER IN SPRING: LOCATIONS 1/

NAME	AR1	FL1	KY1	NE1	TX1	TX2	VA1	MEAN
J-27	80.0	76.7	75.0	60.0	97.7	43.3	71.7	72.0
GUYMON	88.3	77.7	48.3	80.0	99.0	26.7	63.3	69.0
MIRAGE (90173)	85.0	89.0	40.0	33.3	99.0	46.7	38.3	61.6
OKS 91-11	61.7	64.0	33.3	90.0	86.0	30.0	58.3	60.5
JACKPOT (J-912)	86.7	85.3	20.7	20.0	99.0	43.3	55.0	58.6
FMC 2-90	81.7	85.3	21.3	10.0	98.3	40.0	25.0	51.7
SULTAN (FMC 6-91)	81.7	80.3	19.3	3.3	99.0	43.3	23.3	50.0
FMC 5-91	70.0	85.0	18.3	6.7	99.0	43.3	20.0	48.9
OKS 91-1	71.7	88.7	9.3	0.0	99.0	46.7	10.0	46.5
NUMEX-SAHARA	35.0	86.0	10.0	33.3	99.0	43.3	7.7	44.9
FMC 3-91	50.0	87.7	12.3	6.7	99.0	50.0	7.3	44.7
PRIMAVERA (FMC 1-90)	50.0	80.7	6.3	13.3	99.0	43.3	7.7	42.9
SUNDEVIL	43.3	84.3	9.7	13.3	99.0	40.0	7.7	42.5
SONESTA	23.3	90.0	7.0	6.7	99.0	43.3	5.0	39.2
ARIZONA COMMON-SEED	11.7	82.3	3.0	3.3	98.0	43.3	1.3	34.7
CHEYENNE	8.3	89.7	1.7	0.0	97.0	36.7	2.3	33.7
LSD VALUE	22.8	8.5	13.3	30.1	5.9	12.1	21.9	6.9

TABLE 10B. PERCENT LIVING GROUND COVER (SPRING) RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
1994 DATA

PERCENT LIVING GROUND COVER IN SPRING: LOCATIONS 1/

NAME	AZ1	KY1	MO2	TX2	UB1	VA1	MEAN
J-27	40.0	97.7	86.3	3.3	63.3	28.3	53.2
OKS 91-11	38.0	96.3	77.7	2.3	70.0	21.7	51.0
GUYMON	30.7	97.7	83.3	1.3	56.7	28.3	49.7
MIRAGE (90173)	41.7	99.0	80.0	1.7	16.7	20.0	43.2
SUNDEVIL	34.3	88.3	58.3	0.3	5.0	3.3	31.6
JACKPOT (J-912)	23.0	75.0	33.3	1.7	6.7	10.7	25.1
FMC 5-91	22.0	16.7	4.3	1.0	73.3	0.0	19.6
CHEYENNE	33.0	20.0	7.3	0.3	35.0	0.0	15.9
OKS 91-1	20.0	37.7	24.0	1.3	0.0	2.3	14.2
FMC 2-90	26.7	31.7	2.3	1.7	1.7	3.3	11.2
FMC 6-91	26.7	21.0	2.7	0.7	1.7	0.0	8.8
SAHARA	25.7	15.0	2.7	1.3	0.0	5.0	8.3
FMC 3-91	30.3	10.3	1.0	1.3	1.7	0.0	7.4
SONESTA	26.3	14.3	2.3	1.0	0.0	0.0	7.3
ARIZONA COMMON-SEED	28.3	13.3	1.0	0.0	0.0	0.0	7.1
PRIMAVERA (FMC 1-90)	15.0	17.7	4.0	0.7	0.0	0.0	6.2
LSD VALUE	12.8	18.1	22.3	2.5	32.0	13.7	7.8

Table 3. Percent winter kill ratings of seeded bermudagrass included in the 1992 NTEP bermudagrass test. Data tables are photocopies from NTEP reports for 1993 and 1994 results.

TABLE 16B. PERCENT WINTER KILL RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
1993 DATA

PERCENT WINTER KILL RATINGS: LOCATIONS 1/

NAME	NE1	VA1	MEAN
CHEYENNE	99.0	80.0	89.5
NUMEX-SAHARA	93.0	70.0	81.5
ARIZONA COMMON-SEED	96.0	66.0	81.0
FMC 3-91	96.0	58.3	77.2
SUNDEVIL	93.0	56.7	74.8
SONESTA	93.0	55.0	74.0
OKS 91-1	99.0	46.7	72.8
SULTAN (FMC 6-91)	96.0	38.3	67.2
PRIMAVERA (FMC 1-90)	90.0	42.0	66.0
FMC 2-90	90.0	35.0	62.5
FMC 5-91	93.0	31.7	62.3
JACKPOT (J-912)	93.0	15.0	54.0
MIRAGE (90173)	86.7	15.0	50.8
GUYMON	73.3	10.0	41.7
OKS 91-11	53.3	11.7	32.5
J-27	53.0	1.7	27.3
LSD VALUE	19.7	26.7	16.6

TABLE 15B. PERCENT WINTER KILL RATINGS OF BERMUDAGRASS (SEEDED) CULTIVARS
1994 DATA

PERCENT WINTER KILL RATINGS: LOCATIONS 1/

NAME	MD1	OK1	UB1	MEAN
FMC 3-91	99.0	98.0	99.0	98.7
SONESTA	99.0	98.0	99.0	98.7
FMC 2-90	98.7	98.0	99.0	98.6
PRIMAVERA (FMC 1-90)	98.7	98.0	99.0	98.6
SAHARA	98.7	98.0	99.0	98.6
ARIZONA COMMON-SEED	98.3	98.0	99.0	98.4
SUNDEVIL	98.3	98.0	98.0	98.1
OKS 91-1	99.0	95.3	99.0	97.8
FMC 6-91	98.7	95.3	98.7	97.6
JACKPOT (J-912)	99.0	94.3	97.0	96.8
MIRAGE (90173)	97.0	87.3	91.7	92.0
CHEYENNE	98.7	97.7	78.3	91.6
FMC 5-91	98.7	95.3	45.0	79.7
GUYMON	76.7	3.3	56.7	45.6
OKS 91-11	83.3	15.7	31.7	43.6
J-27	78.3	7.0	40.0	41.8
LSD VALUE	8.1	10.8	31.8	11.5

Table 4. Mean shoot density of 18 seeded bermudagrasses grown under 3 mowing heights and 2 nitrogen regimes[1].

	Number of shoots per square decimeter								
	1994						1995		
	1.0 cm		1.3 cm		3.8 cm		1.0 cm	1.3 cm	3.8 cm
Cultivar	FERT1	FERT2	FERT1	FERT2	FERT1	FERT2			
OKSCt-1	1161 a	1333 a	1211 a	1401 a	1148 a	1129 a	1023 a	1196 a	1024 a
AZ common	292 def	324 ef	303 cdef	313 bcd	269 cdef	319 bcd	222 fgh	221 gh	199 de
C2	314 bcdef	334 def	332 bcdef	376 bc	270 cdef	312 bcd	262 defgh	318 bcdef	239 bcde
Cheyenne	301 cdef	350 cdef	297 def	302 bcd	249 def	288 bcd	305 bcdef	242 efgh	247 bcde
DSM 250	321 bcdef	450 bc	411 b	400 b	341 bc	384 b	354 bcd	321 bcde	315 b
Guymon	265 ef	273 f	263 f	250 d	243 def	228 cd	279 cdefg	271 defgh	270 bcde
Jackpot	392 b	434 bcd	397 bc	410 b	349 b	326 bcd	358 bc	378 b	296 bc
OKS 111-1	308 bcdef	316 ef	278 ef	328 bcd	250 def	251 cd	332 bcde	342 bcd	201 de
OKS 89-3	381 bcd	387 bcde	379 bcd	368 bcd	282 bcde	308 bcd	397 b	346 bcd	282 bcd
OKS 91-1	327 bcde	338 def	282 ef	352 bcd	303 bcd	342 bc	292 cdefg	277 defgh	220 cde
OKS 91-2	384 bc	453 b	396 bc	387 b	310 bcd	342 bc	304 bcdef	375 bc	253 bcde
OKS 91-6	336 bcde	332 def	321 bcdef	357 bcd	269 cdef	327 bcd	305 bcdef	306 bcdefg	276 bcde
Poco Verde	305 bcdef	254 f	286 def	322 bcd	259 def	278 bcd	169 h	211 h	187 e
Primavera	332 bcde	383 bcde	369 bcde	379 bc	288 bcd	332 bcd	259 efgh	288 cdefgh	264 bcde
Seed from U3	300 cdef	310 ef	287 def	367 bcd	272 bcdef	280 bcd	208 gh	231 fgh	218 cde
Sonesta	272 ef	335 def	273 ef	359 bcd	205 ef	266 cd	274 cdefg	292 bcdefgh	224 cde
Sundevil	237 f	268 f	265 f	257 cd	198 f	217 d	245 efgh	253 efgh	213 cde
Tropica	292 def	313 ef	311 cdef	349 bcd	317 bcd	319 bcd	240 efgh	260 defgh	259 bcde
LSD(0.05)	89	102	97	123	78	116	94	89	91

[1]Means in the same column followed by the same letter are not significantly different at $p \leq 0.05$.

[2] Fert1 and Fert 2 are 146.5 and 244.1 kg N ha-1 yr-1 or 3 and 5 pounds of nitrogen per 1,000 sq. ft per year from a Nutralene 40-0-0 source.

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Table 5. Mean percent recovery from divoting over time of 18 seeded bermudagrasses[1].

	1994				1995			
	1.0 cm		1.3 cm		1.0 cm		1.3 cm	
Cultivar	2 WAD	4 WAD	2 WAD	4 WAD	2 WAD	4 WAD	2 WAD	4 WAD
AZ common	57.6 ab	95.5 abc	61.9 abcdefg	97.3 abc	48.3 a	81.9 defg	51.0 cdef	86.3 ef
C2	55.4 abc	95.3 abc	72.7 ab	99.0 ab	50.1 a	88.9 abcde	56.0 bcd	93.4 abcde
Cheyenne	57.3 ab	96.6 ab	63.6 abcdefg	97.9 abc	49.9 a	88.5 abcde	51.9 bcdef	89.8 bcdef
DSM 250	52.1 abcd	96.8 ab	70.6 abc	99.6 a	50.2 a	88.6 abcde	55.5 bcde	93.1 abcde
Guymon	44.1 cd	89.8 cde	52.5 fg	94.5 bcd	35.6 cd	80.5 efg	43.1 def	86.3 ef
Jackpot	55.0 abc	97.9 a	66.5 abcdef	99.2 a	54.3 a	93.6 abc	59.4 bc	97.2 ab
OKS 111-1	58.8 ab	98.0 a	66.6 abcdef	95.8 abcd	47.8 a	92.7 abc	42.8 ef	88.4 cdef
OKS 89-3	40.9 d	88.0 e	56.0 defg	96.5 abc	29.2 d	75.3 fg	41.8 f	84.9 f
OKS 91-1	54.7 abc	95.8 ab	61.6 abcdefg	98.1 abc	54.5 a	95.7 ab	57.3 bc	95.8 abc
OKS 91-2	61.9 a	94.7 abcd	75.6 a	99.8 a	46.3 abc	89.7 abcd	72.7 a	96.6 ab
OKS 91-6	57.6 ab	96.7 ab	69.3 abcd	98.4 abc	52.6 a	89.7 abcd	56.4 bc	93.1 abcde
OKS Ct-1	54.5 abc	95.8 ab	62.7 abcdefg	98.3 abc	52.0 a	97.0 a	55.7 bcde	98.3 a
Poco Verde	47.2 bcd	89.0 de	50.2 g	91.7 d	36.1 bcd	94.7 g	51.6 bcdef	84.0 f
Primavera	49.1 abcd	96.3 ab	60.8 bcdefg	99.1 a	50.0 a	86.1 cde	60.8 abc	94.8 abcd
Seed from U3	48.3 bcd	91.1 bcde	54.2 efg	94.0 cd	46.3 abc	87.2 cde	49.0 cdef	85.6 ef
Sonesta	48.3 bcd	92.0 bcde	58.1 cdefg	97.9 abc	47.5 ab	83.6 def	54.9 bcde	91.7 abcdef
Sundevil	49.3 abcd	95.9 ab	66.9 abcde	100.0 a	54.5 a	93.4 abc	64.5 ab	94.4 abcd
Tropica	55.3 abc	94.1 abcd	56.6 cdefg	96.6 abc	47.5 ab	87.7 bcde	50.2 cdef	87.3 def
LSD(0.05)	12.8	5.8	14.1	4.5	11.5	8.5	12.9	7.9

[1]Means followed by the same letter are not significant at the $P \leq 0.05$ level using the LSD test. WAD indicates weeks after divoting.

00398

Table 6. Mean textural ratings for 18 bermudagrasses in 1994 and 1995[1].

Cultivar	1994	1995
OKS Ct-1	9.0 a	9.0 a
Arizona common	6.0 bc	6.0 c
C2	6.0 bc	6.0 c
Cheyenne	6.0 bc	6.0 c
DSM 250	6.0 bc	6.0 c
Guymon	4.5 f	4.1 e
Jackpot	6.0 bc	6.0 c
OKS 111-1	5.8 d	5.8 d
OKS 89-3	6.0 bc	6.3 b
OKS 91-1	6.0 bc	6.0 c
OKS 91-2	6.1 b	6.1 c
OKS 91-6	6.0 bc	6.0 c
Poco Verde	6.0 bc	6.0 c
Primavera	6.0 bc	6.0 c
Seed from U3	6.0 bc	6.0 c
Sonesta	5.9 c	6.0 c
Sundevil	4.8 e	4.2 e
Tropica	6.0 bc	6.0 c
LSD(0.05)	0.2	0.1

[1]Means in the same column followed by the same letter are not significantly different at $p \leq 0.05$. Textural scale is 1-9 with 1 very coarse and 9 being very fine texture.

Table 7. Mean visual color ratings for 18 seeded bermudagrasses in 1994 and 1995[1,2].

	1994						1995		
	Mowing Height						Mowing Height		
	1.0 cm		1.3 cm		3.8 cm		1.0 cm	1.3 cm	3.8 cm
Cultivar	FERT1	FERT2	FERT1	FERT2	FERT1	FERT2			
OKS Ct-1	5.5 b	5.5 g	5.5 e	5.5 e	5.5 g	5.6 h	4.9 d	4.8 d	4.7 e
Arizona common	6.7 de	6.6 de	6.8 d	6.8 d	7.0 cde	7.0 cde	6.6 bc	6.7 c	6.8 cd
C2	6.5 e	6.5 ef	7.0 cd	7.0 cd	6.9 cde	6.9 cde	6.7 bc	6.7 c	6.9 cd
Cheyenne	6.6 e	6.6 e	7.0 cd	7.0 cd	6.9 de	6.9 de	6.7 bc	6.8 c	7.0 cd
DSM 250	6.3 f	6.4 f	6.9 d	6.9 d	6.5 f	6.5 g	6.5 c	6.9 c	6.8 cd
Guymon	6.8 cd	6.8 cd	7.4 b	7.4 b	7.9 a	7.9 a	6.6 bc	7.0 bc	7.6 b
Jackpot	6.7 de	6.7 de	6.9 cd	6.9 cd	6.8 e	6.8 ef	6.9 b	7.0 bc	7.0 cd
OKS 111-1	7.4 a	7.4 a	7.6 ab	7.6 ab	7.7 ab	7.7 ab	6.9 b	7.2 ab	7.6 b
OKS 89-3	7.0 bc	7.0 bc	7.6 ab	7.6 a	7.6 b	7.6 b	6.9 b	7.2 ab	7.5 b
OKS 91-1	6.6 de	6.6 de	7.0 cd	7.0 cd	6.9 de	6.9 def	6.7 bc	6.7 c	6.7 cd
OKS 91-2	6.6 e	6.6 e	7.1 c	7.1 c	7.1 c	7.1 c	6.5 bc	6.7 c	6.9 cd
OKS 91-6	6.6 de	6.6 de	7.0 cd	7.0 cd	6.9 de	6.9 de	6.6 bc	6.7 c	6.8 cd
Poco Verde	6.5 e	6.5 ef	7.0 cd	7.0 cd	7.0 cde	7.0 cde	6.6 bc	6.7 c	6.7 cd
Primavera	6.6 e	6.6 ef	7.0 cd	7.0 cd	6.9 de	6.9 de	6.6 bc	6.7 c	6.9 cd
Seed from U3	6.5 e	6.5 ef	6.9 cd	6.9 cd	6.9 de	7.0 cde	6.6 bc	6.7 c	6.7 cd
Sonesta	6.5 e	6.5 ef	6.9 cd	6.9 cd	6.7 f	6.7 f	6.6 bc	6.7 c	6.7 d
Sundevil	7.1 b	7.1 b	7.7 a	7.7 a	7.9 a	7.9 a	7.3 a	7.5 a	8.0 a
Tropica	6.6 e	6.6 e	6.9 d	6.9 cd	7.0 cd	7.0 cd	6.7 bc	6.8 c	7.0 c
LSD(0.05)	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3

[1]FERT1 and FERT2 are fertility regimes of 3 and 5 pounds of actual nitrogen per 1,000 sq. ft per year respectively. Means in the same column followed by the same letter are not significantly different at $p \leq 0.05$. Mowing heights are 1.0, 1.3 and 3.8 cm or 0.38, 0.5 and 1.5 inches.

[2] Color ratings were made on a 1-9 scale where 1=light green and 9= dark green.

00400

Table 8. Mean visual quality ratings for 18 bermudagrasses grown under three mowing heights in 1994 and 1995[1,2].

	1994			1995		
	Mowing Height			Mowing Height		
Cultivar	1.0 cm	1.3 cm	3.8 cm	1.0 cm	1.3 cm	3.8 cm
OKS Ct-1	5.7 a	6.0 abc 5.2 f	5.9 ab	5.6 bcde	5.6 g	
Arizona common	5.0 cdef	5.5 cdefg	6.1 abcd	4.6 fgh	4.9 e	6.4 ef
OKS 89-3	5.1 bcde	6.1 ab	6.3 ab	4.9 cdefgh	5.6 bcde	6.8 ab
OKS 91-1	5.0 cdef	5.6 bcdef	5.8 bcde	5.3 bcde	5.6 bcde	6.6 abcde
OKS 91-2	5.5 abc	6.4 a	6.4 a	5.5 abc	6.5 a	6.9 a
OKS 91-6	5.1 bcde	5.5 cdefg	5.9 abcd	5.4 abcd	5.7 bcd	6.8 abcd
C2	5.0 cdef	5.8 bcd 6.4 a	4.8 defgh	5.6 bcde	6.8 abc	
Cheyenne	5.2 abcd	5.8 bcd 6.2 abc	5.4 abcd	5.5 bcde	6.7 abcde	
DSM 250	4.9 def	5.8 bcd 5.6 def	5.1 cdefg	6.0 abc	6.7 abcde	
OKS 111-1	5.6 ab	6.0 ab	6.2 abcd	6.0 a	6.0 abc	6.8 abcd
Guymon	4.7 def	5.5 cdefg	6.1 abcd	4.5 gh	5.0 de	6.4 def
Jackpot	5.2 abcd	5.6 bcdef	5.7 cdef	5.9 ab	6.2 ab	6.9 a
Poco Verde	4.6 ef	5.1 fg	5.6 def	4.3 h	4.9 e	6.5 cdef
Primavera	5.2 abcde	5.7 bcde	6.3 abc	5.2 cdef	5.6 bcde	6.7 abcde
Sonesta	4.4 f	5.0 g	5.2 ef	4.7 efgh	5.4 cde	6.3 f
Sundevil	5.1 abcde	5.8 bcd 6.0 abcd	5.1 cdef	5.5 bcde	6.6 abcde	
Tropica	4.9 def	5.4 defg	6.3 abc	5.2 bcdef	5.2 de	6.8 abc
Seed from U3	4.7 def	5.2 efg 5.7 cdef	4.8 defgh	5.0 de	6.5 bcdef	
LSD(0.05)	0.6	0.6	0.6	0.7	0.7	0.3

[1]Means in the same column followed by the same letter are not significantly different at $p \leq 0.05$. Mowing heights are 1.0, 1.3 and 3.8 cm or 0.38, 0.5 and 1.5 inches.

[2] Quality ratings were made on a 1-9 scale with 1being very poor and 9 being very high quality.

00401

Table 9. Fall color retention and spring greenup ratings of bermudagrass varieties in the spring dead spot evaluation. Turfgrass Research Center, Stillwater, OK.

	Color Retention		Spring Greenup	
Cultivar	11-07-94	11-22-94	03-25-95	04-18-95
BERPC 91-12	6.3	4.0	5.0	7.3
BERPC 91-13	6.0	4.0	4.3	7.7
Midlawn	6.3	3.7	4.7	8.0
BERPC 89-3	5.7	3.7	5.0	7.0
Sundevil	5.0	3.0	4.0	7.0
BERPC 91-3	6.3	3.7	5.0	7.7
BERPC 91-4	5.7	4.0	4.3	7.7
Guymon	4.0	2.7	4.0	7.3
Ft. Reno	6.7	3.0	3.3	7.7
African Bermudagrass	5.3	4.0	4.7	8.0
Midfield	6.7	4.0	4.3	8.0
Tifton 10	6.3	2.3	2.0	7.7
BERPC 91-6	5.0	2.3	2.0	7.0
Cheyenne	5.0	2.3	2.3	8.0
91173	6.0	3.0	3.3	7.7
91180	5.0	2.7	2.7	7.7
BERPC 91-2	5.7	2.7	2.7	7.7
Arizona Common	4.7	3.3	3.0	6.7
C2	5.0	3.0	3.3	7.0
NuMex Sahara	4.7	2.7	2.3	6.7
Poco Verde	5.0	2.3	3.0	7.0
Primavera	5.3	3.0	3.0	6.7
Sonesta	4.7	3.0	3.0	6.7
BERPC 91-1	4.7	2.3	2.3	7.7
J-912	5.7	2.3	2.0	7.3
Tropica	5.0	2.7	3.7	7.7
LSD (0.05)	0.8	0.8	0.7	0.8

Ratings were on a scale of 1-9, with 9 being the best.

Table 10. Average SDS area and number of live shoots in SDS area of bermudagrass varieties in the spring dead spot evaluation. Turfgrass Research Center, Stillwater, OK.

	Average Area of SDS(ft^2)	Live Shoots Per Area
Cultivar	04-18-95	04-18-95
BERPC 91-12	0.11	3.9
BERPC 91-13	0.10	3.1
Midlawn	0.11	6.0
BERPC 89-3	0.09	3.0
Sundevil	0.03	1.2
BERPC 91-3	0.08	2.3
BERPC 91-4	0.11	1.4
Guymon	0.05	1.4
Ft. Reno	0.07	1.9
African Bermudagrass	0.11	7.6
Midfield	0.05	1.8
Tifton 10	0.18	1.3
BERPC 91-6	0.16	1.0
Cheyenne	0.20	2.0
91173	0.11	1.9
91180	0.21	1.4
BERPC 91-2	0.26	1.0
Arizona Common	0.25	0.7
C2	0.09	1.9
NuMex Sahara	0.18	1.0
Poco Verde	0.28	1.3
Primavera	0.17	0.4
Sonesta	0.21	1.0
BERPC 91-1	0.21	2.7
J-912	0.24	0.8
Tropica	0.13	0.6
LSD (0.05)	0.1	1.8

Average of dead areas occurring from inoculation with Ophiosphaerella herpotricha.

Table 11. Visual color, density, and percent cover ratings of bermudagrass varieties in the spring dead spot evaluation. Turfgrass Research Center, Stillwater, OK.

Cultivar	Color 05-17-95	Density 05-17-95	Percent Cover 05-17-95
BERPC 91-12	7.0	6.3	81.7
BERPC 91-13	7.0	6.3	83.3
Midlawn	7.3	8.0	96.7
BERPC 89-3	7.0	6.3	86.7
Sundevil	7.0	6.3	78.3
BERPC 91-3	6.7	6.3	83.3
BERPC 91-4	7.0	6.3	81.7
Guymon	7.0	5.7	76.7
Ft. Reno	7.3	7.0	85.0
African Bermudagrass	6.0	8.7	96.7
Midfield	7.0	8.0	100.0
Tifton 10	9.0	7.3	98.3
BERPC 91-6	7.0	6.3	81.7
Cheyenne	6.3	5.7	86.7
91173	8.0	7.0	93.3
91180	7.0	6.3	83.3
BERPC 91-2	7.0	7.0	86.7
Arizona Common	5.3	4.3	60.0
C2	5.3	4.0	61.7
NuMex Sahara	5.7	4.7	68.3
Poco Verde	5.3	5.0	68.3
Primavera	6.0	4.3	73.3
Sonesta	6.7	4.7	70.0
BERPC 91-1	6.0	5.0	75.0
J-912	7.3	6.7	90.0
Tropica	6.3	5.0	76.7
LSD (0.05)	0.8	1.0	13.0

Color and density ratings were on a scale of 1-9, with 9 being the best.
Cover ratings were on a scale of 0-100%.

Table 12. Visual quality ratings of bermudagrass varieties in the spring dead spot evaluation. Turfgrass Research Center, Stillwater, OK.

	Visual Quality					
Cultivar	05-17-95	06-16-95	07-25-95	08-21-95	09-14-95	10-11-95
BERPC 91-12	5.7	6.0	8.0	6.7	6.7	6.7
BERPC 91-13	6.0	6.7	8.0	6.7	6.7	6.7
Midlawn	7.3	8.0	7.0	6.7	7.0	7.0
BERPC 89-3	6.0	7.0	7.3	7.3	7.0	6.7
Sundevil	6.0	6.0	6.0	7.3	6.7	6.0
BERPC 91-3	6.3	6.0	6.7	6.3	6.3	6.7
BERPC 91-4	6.3	6.3	7.0	7.0	7.0	6.3
Guymon	5.0	6.0	6.3	6.7	6.3	6.0
Ft. Reno	6.7	7.0	6.3	7.0	6.7	6.7
African Bermudagrass	6.3	6.0	5.3	6.7	6.3	6.7
Midfield	7.7	7.7	6.7	8.0	7.7	7.7
Tifton 10	7.7	8.0	8.3	7.7	7.7	7.3
BERPC 91-6	6.0	5.7	6.3	7.0	6.7	6.7
Cheyenne	5.3	5.3	6.0	7.7	7.3	6.3
91173	6.7	6.3	6.3	6.7	6.7	6.7
91180	5.3	5.7	6.7	7.3	7.0	6.7
BERPC 91-2	6.7	6.3	6.7	7.7	7.0	7.0
Arizona Common	4.0	4.7	5.3	6.0	6.0	6.0
C2	4.0	4.7	5.3	7.0	6.7	6.0
NuMex Sahara	4.7	5.0	5.7	5.7	5.7	5.7
Poco Verde	4.3	5.0	6.0	6.7	6.7	6.0
Primavera	4.7	5.0	5.7	6.3	6.3	6.3
Sonesta	4.3	4.7	5.7	6.7	6.7	6.0
BERPC 91-1	5.0	5.3	6.0	6.3	6.3	6.0
J-912	6.0	5.7	6.3	7.3	7.0	6.7
Tropica	5.3	5.3	5.7	6.7	6.3	6.0
LSD (0.05)	1.1	0.9	1.0	0.9	0.9	0.8

Visual quality ratings were on a scale of 1-9, with 9 being the best.

Table 13. Growth rate as indicated by seedling count and percent cover, and color ratings of seeded bermudagrass varieties in the OKS 91-11 evaluation. Turfgrass Research Center, Stillwater, OK.

	Seedling Count	Percent Cover		Color
Genotype	07-21-95	09-11-95	10-11-95	10-11-95
OKS 91-11	72.3	83.3	95.0	7.0
Jackpot	67.4	95.0	98.3	8.0
Mirage	77.8	95.0	96.7	8.0
LSD (0.05)	15.1	8.9	4.6	0.0

Seedling counts were made by randomly tossing a 10-in^2 grid and counting the number of shoots contacting the 1-in^2 intersections. Cover ratings were on a scale of 0-100%. Color ratings were on a scale of 1-9, with 9 being best.

Table 14. Performance of vegetatively-propagated turf bermudagrass selections and varieties. Test 94-1, Agronomy Research Station, Stillwater, OK. 1995

Entry	Ground Cover	Sod Density	Turf Quality							
	7/26	7/26	7/26	8/15	8/24	9/5	9/20	9/26	10/11	Avg.
3200W 1-6	97	8.0	7.0	8.0	6.0	6.5	6.5	7.0	6.5	6.8
3200W 3-3	100	8.0	7.5	8.0	6.5	7.0	5.5	6.5	6.0	6.7
3200W 12-2	99	7.0	6.5	8.0	6.0	6.5	6.5	6.0	6.0	6.5
3200W 12-4	100	8.0	8.0	7.5	6.0	6.0	6.0	6.5	6.5	6.6
3200W 12-7	100	8.0	5.0	6.0	5.0	5.5	6.5	6.0	5.5	5.6
3200W 18-4	100	8.0	8.0	8.0	7.5	6.0	7.0	7.5	6.0	7.1
3200W 19-9	94	7.0	6.0	5.5	4.5	5.5	6.0	5.5	5.0	5.4
3200W 19-10	100	8.0	7.5	8.0	7.0	6.5	6.0	6.5	7.0	6.9
3200W 23-8	99	7.5	7.0	6.0	6.5	6.0	5.5	6.0	6.0	6.1
3200W 25-6	100	6.5	5.0	5.0	5.0	5.0	3.5	4.5	3.5	4.5
3200W 26-8	68	5.5	4.0	5.0	5.5	4.0	3.5	4.5	4.0	4.3
3200W 31-8	100	8.0	8.5	7.5	5.5	6.0	5.5	6.0	6.0	6.4
3200W 35-3	97	7.0	7.0	6.5	5.5	7.0	7.0	7.0	7.0	6.7
3200W 39-3	100	8.0	6.0	7.5	7.0	7.5	5.5	7.0	5.5	6.6
3200W 39-7	60	6.0	5.0	5.0	4.5	4.0	4.0	4.5	4.5	4.5
3200W 39-8	100	7.0	7.0	7.5	6.5	7.0	7.5	7.5	7.0	7.1
3200W 41-5	94	7.0	4.5	8.0	6.5	7.0	6.0	6.0	5.5	6.2
3200W 41-8	100	8.5	6.0	7.5	5.5	6.5	6.5	7.5	6.0	6.5
3200W 47-3	100	7.5	6.5	7.0	5.0	6.5	6.0	6.5	6.5	6.3
3200W 50-1	100	8.0	5.5	8.0	6.0	6.5	6.0	7.0	5.5	6.4
3200W 55-3	90	6.0	5.5	7.0	5.0	5.5	7.0	6.5	6.5	6.1
3200W 55-7	100	7.5	6.5	7.5	6.5	6.5	6.5	6.5	6.5	6.6
PRC-7	100	7.0	5.5	7.5	6.5	6.0	5.5	6.5	5.5	6.1
PRC-55	99	8.0	5.5	7.5	6.5	6.5	7.5	7.0	6.5	6.7
Beijing	95	6.0	6.0	7.0	6.0	6.0	5.5	6.0	5.5	6.0
Tifgreen	100	7.5	5.0	6.5	6.5	6.5	7.0	7.0	7.0	6.5
Midfield	100	7.5	5.5	6.5	6.0	7.0	7.0	7.0	6.5	6.5
Midlawn	94	6.5	6.5	7.0	5.5	6.0	7.0	6.5	6.0	6.4
U-3	97	6.5	5.0	5.5	5.5	4.5	5.5	5.5	5.0	5.2
Tifway	99	7.0	6.0	7.0	5.5	6.0	6.5	6.5	7.0	6.4
5% LSD	5.6	1.2	1.6	1.1	1.5	3.4	1.5	1.3	1.2	0.8

Ground cover = %; Sod density and turf quality visually rated on a scale of 1-9 with 1 being best.

Table 15. Performance of vegetatively-propagated turf bermudagrass selections and varieties. Test 94-1, Agronomy Research Station, Stillwater, OK. 1995

Entry	Color*							
	7/26	8/15	8/24	9/5	9/20	9/26	10/11	Avg.
3200W 1-6	7.5	9.0	7.5	7.0	7.5	7.5	7.0	7.6
3200W 3-3	7.5	8.0	7.0	7.0	7.0	7.0	6.0	7.1
3200W 12-2	8.0	8.0	6.5	7.0	7.0	6.5	6.5	7.1
3200W 12-4	8.5	7.5	7.0	7.0	7.0	7.0	7.0	7.3
3200W 12-7	7.0	7.5	6.0	6.5	7.0	7.0	6.0	6.7
3200W 18-4	8.5	8.0	7.5	6.5	7.0	7.5	7.0	7.4
3200W 19-9	6.5	8.0	6.5	6.0	6.0	5.5	5.5	6.3
3200W 19-10	8.0	8.0	7.0	7.0	7.0	7.0	7.0	7.3
3200W 23-8	8.0	6.5	7.5	7.5	6.5	6.0	6.0	6.8
3200W 25-6	6.0	6.0	6.5	6.0	5.0	5.0	4.5	5.6
3200W 26-8	6.0	9.0	7.5	7.5	5.5	5.0	5.0	6.4
3200W 31-8	8.5	8.5	6.5	6.5	6.5	6.5	6.0	7.0
3200W 35-3	7.5	7.0	6.5	7.5	7.5	7.0	7.0	7.1
3200W 39-3	7.0	8.0	7.0	7.0	6.0	6.5	6.0	6.8
3200W 39-7	7.0	9.0	8.0	8.0	6.5	6.5	5.0	7.1
3200W 39-8	7.5	8.5	8.0	8.0	7.5	7.5	6.5	7.6
3200W 41-5	5.5	8.5	7.5	7.5	6.5	7.0	6.0	6.9
3200W 41-8	7.5	7.5	7.0	7.0	7.5	7.5	7.0	7.3
3200W 47-3	7.5	8.0	6.5	7.0	6.5	6.5	6.5	6.9
3200W 50-1	6.0	8.0	7.0	7.0	6.0	7.0	5.5	6.6
3200W 55-3	7.0	8.0	6.0	6.5	7.5	6.5	6.5	6.7
3200W 55-7	6.5	8.0	7.5	7.0	6.5	6.5	6.5	6.9
PRC-7	6.5	8.5	7.0	7.0	6.5	6.0	6.5	6.9
PRC-55	6.5	7.5	6.5	6.5	7.5	7.0	6.5	6.9
Beijing	7.0	7.5	7.5	7.0	7.0	6.5	6.0	6.9
Tifgreen	7.0	7.0	7.5	7.0	7.0	6.5	6.5	6.9
Midfield	6.5	6.0	6.0	7.0	7.0	6.5	6.0	6.4
Midlawn	7.5	7.5	6.5	7.0	7.5	7.0	7.0	7.1
U-3	6.5	6.5	7.0	6.0	6.0	5.5	5.5	6.1
Tifway	7.0	7.0	6.5	6.5	7.5	7.0	7.0	6.9
5% LSD	1.4	1.2	1.1	0.9	1.5	1.4	1.1	0.6

* Visual ratings on a scale of 1-9 with 1 being best.

Table 16. Performance of vegetatively-propagated turf bermudagrass selections and varieties. Test 94-1, Agronomy Research Station, Stillwater, OK. 1995

Entry	Seed Heads*							
	7/26	8/15	8/24	9/5	9/20	9/26	10/11	Avg.
3200W 1-6	3.5	8.0	8.5	9.0	9.0	9.0	9.0	8.0
3200W 3-3	7.5	8.5	9.0	9.0	9.0	9.0	9.0	8.7
3200W 12-2	4.5	8.5	8.5	9.0	8.0	8.0	6.5	7.6
3200W 12-4	8.0	8.5	9.0	9.0	9.0	9.0	9.0	8.8
3200W 12-7	4.0	3.0	7.0	8.5	7.5	8.0	6.5	6.4
3200W 18-4	8.0	8.5	8.5	9.0	9.0	9.0	7.5	8.5
3200W 19-9	7.0	4.5	6.0	8.0	8.5	7.5	5.0	6.6
3200W 19-10	7.0	8.5	8.5	9.0	9.0	9.0	9.0	8.6
3200W 23-8	7.0	7.0	8.0	9.0	9.0	9.0	8.5	8.2
3200W 25-6	6.0	6.5	6.0	8.0	3.5	4.0	2.5	5.2
3200W 26-8	4.0	2.5	5.0	4.0	3.5	4.0	3.0	3.7
3200W 31-8	8.5	8.0	8.0	9.0	9.0	9.0	9.0	8.6
3200W 35-3	8.0	8.0	7.5	9.0	9.0	9.0	9.0	8.5
3200W 39-3	2.5	7.0	9.0	9.0	8.5	9.0	7.5	7.5
3200W 39-7	5.0	3.5	4.0	4.0	4.5	6.0	6.5	4.8
3200W 39-8	7.0	7.5	8.0	9.0	9.0	9.0	9.0	8.4
3200W 41-5	5.0	7.5	8.0	9.0	8.5	9.0	8.0	7.9
3200W 41-8	4.5	7.5	8.5	9.0	9.0	9.0	7.5	7.9
3200W 47-3	7.0	8.0	9.0	9.0	9.0	9.0	9.0	8.6
3200W 50-1	2.5	8.0	8.0	9.0	9.0	8.5	7.5	7.5
3200W 55-3	3.5	7.0	7.5	9.0	8.0	9.0	8.5	7.6
3200W 55-7	3.5	7.5	8.5	9.0	9.0	9.0	8.5	7.9
PRC-7	3.0	7.5	7.5	8.5	8.0	7.5	6.0	6.9
PRC-55	2.0	7.5	8.0	9.0	9.0	9.0	9.0	7.6
Beijing	3.5	7.0	7.5	9.0	7.5	7.0	6.5	6.9
Tifgreen	2.0	6.0	8.0	9.0	8.5	9.0	9.0	7.4
Midfield	4.5	9.0	9.0	9.0	9.0	9.0	9.0	8.4
Midlawn	5.5	8.0	8.0	9.0	9.0	9.0	9.0	8.2
U-3	3.0	5.0	6.5	7.0	6.0	7.0	6.0	5.8
Tifway	3.5	8.0	8.0	9.0	9.0	9.0	9.0	7.9
5% LSD	2.1	1.7	2.0	1.1	1.4	1.0	1.4	0.9

* Visual ratings on a scale of 1-9 with 1 being best.

Table 17. Growth rate as indicated by percent plot cover of bermudagrasses in the African bermudagrass tee/fairway study. Turfgrass Research Center, Stillwater, OK.

	Percent Cover			
	09-11-95		10-12-95	
Genotype	Sand	Clay Loam	Sand	Clay Loam
2567	5.0	13.3	16.7	50.0
2747	5.0	10.0	20.0	40.0
Tifway	10.0	40.0	21.7	88.3
LSD (0.05)	0.0	3.8	11.0	15.1

Cover ratings were on a scale of 0-100%.

Table 18. Visual color, quality, and density ratings for African bermudagrass turf in the fertility study. Turfgrass Research Center, Stillwater, OK.

----lbs/1000ft^2/yr----						Visual Color			Visual Quality	Visual Density
N	P_2O_5	K_2O	Micronutrients	06-07-95	07-06-95	08-04-95	08-31-95	10-12-95	07-15-95	07-15-95
3	0	0	0	6.0	5.3	5.3	5.0	5.0	4.7	6.0
3	3	0	0	6.0	5.3	5.0	5.0	5.0	3.7	5.7
3	0	3	0	6.0	5.7	5.3	4.7	5.0	4.7	6.0
3	0	0	4	6.0	6.0	5.3	5.0	5.3	4.0	5.3
3	3	3	0	6.3	5.7	5.3	5.0	5.0	4.3	5.3
3	3	0	4	6.0	6.0	5.7	5.0	5.0	4.7	5.7
3	0	3	4	6.0	5.7	5.7	5.0	5.0	4.3	5.3
3	3	3	4	6.0	5.0	5.0	4.7	5.0	4.0	6.3
6	0	0	0	6.0	6.0	6.3	5.3	5.3	5.3	6.7
6	3	0	0	6.0	5.7	5.7	5.0	5.0	4.7	6.0
6	0	3	0	6.0	5.7	5.7	5.0	5.7	5.3	6.3
6	0	0	4	6.0	6.0	6.3	5.3	6.0	4.7	6.0
6	3	3	0	6.0	6.0	5.7	5.0	5.3	5.0	5.7
6	3	0	4	6.0	6.0	6.0	5.7	5.7	5.0	6.3
6	0	3	4	6.3	6.3	6.3	5.7	6.3	4.7	6.7
6	3	3	4	6.0	6.0	6.0	5.0	6.0	5.3	5.7
12	0	0	0	6.7	6.7	7.0	7.0	6.3	6.0	6.7
12	3	0	0	6.7	6.7	7.0	6.3	6.7	5.7	6.7
12	0	3	0	6.7	6.7	7.0	7.0	6.7	5.3	6.7
12	0	0	4	6.3	6.7	7.0	6.7	6.7	5.7	6.7
12	3	3	0	6.3	6.7	7.0	5.7	6.3	5.3	7.0
12	3	0	4	6.7	6.7	7.0	6.7	7.0	5.3	6.0
12	0	3	4	6.3	6.3	7.0	6.7	6.3	5.7	6.3
12	3	3	4	7.0	7.0	7.0	6.7	7.0	5.3	6.7
LSD (0.05)				0.6	0.8	0.7	0.8	0.7	0.9	1.1

Ratings were on a scale of 1-9, with 9 being best.

00410

Table 19. Fresh and dry clipping weights for African bermudagrass turf in the fertility study. Turfgrass Research Center, Stillwater, OK.

----lbs/1000ft²/yr----				Fresh Clipping Weight (g)	Dry Clipping Weight (g)	Fresh Clipping Weight (g)	Dry Clipping Weight (g)
N	P_2O_5	K_2O	Micronutrients	**06-30-95**	**06-30-95**	**10-19-95**	**10-19-95**
3	0	0	0	27.87	12.83	17.90	12.20
3	3	0	0	28.53	13.23	19.40	12.47
3	0	3	0	28.43	13.47	9.80	5.50
3	0	0	4	27.57	13.17	18.00	12.37
3	3	3	0	33.33	14.83	17.27	11.20
3	3	0	4	26.47	12.47	13.77	7.10
3	0	3	4	31.30	14.40	20.90	12.97
3	3	3	4	26.73	12.83	19.77	13.37
6	0	0	0	30.13	13.50	26.27	15.07
6	3	0	0	23.03	10.77	30.10	19.43
6	0	3	0	30.97	14.00	25.20	14.57
6	0	0	4	35.87	15.83	29.90	18.67
6	3	3	0	27.57	13.43	22.50	13.73
6	3	0	4	27.73	12.47	20.17	9.80
6	0	3	4	23.97	11.63	32.00	22.17
6	3	3	4	31.03	14.87	17.13	9.13
12	0	0	0	29.77	13.77	39.17	29.00
12	3	0	0	30.73	14.27	26.20	14.00
12	0	3	0	28.97	13.77	29.40	16.73
12	0	0	4	26.73	12.93	32.03	19.00
12	3	3	0	32.33	15.00	34.00	17.70
12	3	0	4	30.87	13.60	30.77	14.90
12	0	3	4	29.60	13.37	34.40	19.47
12	3	3	4	32.07	15.47	29.20	16.40
LSD (0.05)				9.57	4.36	7.86	5.73

00411

Table 20. African bermudagrass phytoxicity in response to herbicide treatments applied on May 19, 1995. Turfgrass Research Center, Stillwater, OK.

		African bermudagrass phytoxicity Days after Treatment				
Herbicide	Rate (lb ai/A)	7	14	21	35	49
Dithiopyr	0.5	1.0	2.3	1.3	1.0	1.0
Dithiopyr	1.0	1.3	1.0	1.0	1.0	1.0
MSMA	2.0	1.0	1.0	1.0	1.0	1.0
MSMA	4.0	1.0	1.0	1.0	1.0	1.0
Dichlofop	1.0	1.0	1.0	1.0	1.0	1.0
Dichlofop	2.0	1.0	1.0	1.0	1.0	1.0
Prodiamine	1.5	1.0	1.0	1.0	1.0	1.0
Prodiamine	3.0	1.0	1.0	1.0	1.0	1.0
2,4-D+	0.6	3.0	1.0	1.0	1.0	1.0
MCPP+	6.3					
Dicamba	0.06					
2,4-D+	1.2	5.0	4.3	2.7	1.7	1.0
MCPP+	0.6					
Dicamba	0.12					
Triclopyr Ester	0.5	6.3	7.3	5.0	3.0	1.0
Triclopyr Ester	1.0	7.7	7.7	6.0	5.7	1.0
Halosulfuron	0.03	2.0	1.0	1.0	1.0	1.0
Halosulfuron	0.06	1.0	1.0	1.0	1.0	1.0
Bensulide+	6.0	1.0	1.7	1.0	1.0	1.0
Oxadiazon	1.5					
Bensulide+	12.0	1.3	1.0	1.0	1.0	1.0
Oxadiazon	3.0					
Oxadiazon	3.0	1.3	1.0	1.0	1.0	1.0
Control		1.0	1.0	1.0	1.0	1.0
LSD (0.05)		1.0	1.5	0.8	0.3	0.0

Phytoxicity ratings were on a scale of 1-9, with 9 being worst.

Table 21. African bermudagrass root dry mass measurements taken 53 days after herbicide treatments were applied on May 19, 1995. Turfgrass Research Center, Stillwater, OK.

Herbicide	Rate (lb ai/A)	Root Dry Mass (g)
Dithiopyr	0.5	0.093
Dithiopyr	1.0	0.082
MSMA	2.0	0.085
MSMA	4.0	0.56
Dichlofop	1.0	0.081
Dichlofop	2.0	0.074
Prodiamine	1.5	0.060
Prodiamine	3.0	0.077
2,4-D+	0.6	0.091
MCDD+	0.3	
Dicamba	0.06	
2,4-D+	1.2	0.067
MCDD+	0.6	
Dicamba	0.12	
Triclopyr Ester	0.5	0.090
Triclopyr Ester	1.0	0.101
Halosulfuron	0.03	0.096
Halosulfuron	0.06	0.111
Bensulide+	6.0	0.058
Oxadiazon	1.5	
Bensulide+	12.0	0.071
Oxadiazon	3.0	
Oxadiazon	3.0	0.091
Control		0.092
LSD (0.05)		NS

Values represent the average dry mass of roots contained with a soil core sampler (0.75 in. diameter x 6.375 in. length). Three samples were taken per plot.

Table 22. African bermudagrass phytoxicity in response to herbicide treatments applied on August 9, 1995. Turfgrass Research Center, Stillwater, OK.

		African bermudagrass phytoxicity Days after Treatment				
Herbicide	Rate (lbai/A)	7	14	21	35	49
Dithiopyr	0.5	2.7	4.0	2.3	1.6	1.3
Dithiopyr	1.0	4.3	4.7	1.7	1.0	1.7
MSMA	2.0	1.0	1.0	1.3	1.0	1.7
MSMA	4.0	1.7	1.3	1.3	1.0	2.3
Dichlofop	1.0	1.3	1.0	1.7	1.0	1.7
Dichlofop	2.0	1.0	1.0	1.0	1.0	1.3
Prodiamine	1.5	1.3	1.7	2.7	1.0	1.7
Prodiamine	3.0	1.3	3.7	3.0	1.7	2.0
2,4-D+	0.6	3.7	2.7	1.0	1.0	1.0
MCDD+	0.3					
Dicamba	0.06					
2,4-D+	1.2	6.3	5.0	1.0	1.0	1.0
MCDD+	0.6					
Dicamba	0.12					
Triclopyr Ester	0.5	6.7	7.3	6.3	2.0	1.0
Triclopyr Ester	1.0	7.7	8.0	8.0	5.7	1.7
Halosulfuron	0.03	1.0	1.0	1.3	1.0	1.0
Halosulfuron	0.06	1.3	1.0	1.0	1.0	1.7
Bensulide+	6.0	1.3	1.3	1.0	1.0	2.0
Oxadiazon	1.5					
Bensulide+	12.0	1.3	1.0	1.0	1.0	2.7
Oxadiazon	3.0					
Oxadiazon	3.0	1.3	2.3	2.3	1.7	2.7
Control		1.0	1.0	1.0	1.0	1.7
LSD (0.05)		0.9	1.3	1.4	0.5	1.6

Phytoxicity ratings were on a scale of 1-9, with 9 being worst.

Table 23. Growth rate as indicated by percent plot cover and greenup ratings of African bermudagrasses and check varieties planted June 2 and 3, 1994. Turfgrass Research Center, Stillwater, OK.

Genotype	Percent Cover 10-14-94	Greenup 03-21-95	03-30-95	04-25-95	05-17-95
OKC 90-10	100.0	2.0	3.0	7.0	7.0
OKC 90-13	100.0	2.0	3.5	7.5	6.5
26-5	100.0	2.0	3.0	5.5	7.0
Tifgreen	100.0	2.5	4.5	7.0	7.0
27-12	100.0	2.0	3.0	6.5	7.0
1111	97.5	2.0	4.0	6.5	7.0
27-11	97.5	2.0	3.5	7.0	7.0
2462	97.5	2.0	3.5	6.5	7.0
Fiddlestick	97.5	4.0	4.5	7.5	7.0
1120	97.5	3.0	3.5	6.5	8.0
1202	92.5	2.5	3.5	5.5	6.0
OKC 90-14	95.0	2.0	3.0	6.0	7.0
OKC 90-16	100.0	1.5	3.0	7.0	7.0
223	97.5	2.5	4.0	6.5	8.0
Uganda	100.0	2.0	3.0	5.0	7.0
1946	95.0	2.5	4.0	6.0	6.5
27-3	100.0	1.5	3.0	6.0	7.0
21-4	97.5	2.0	3.0	5.5	6.0
1943	95.0	2.0	3.0	6.0	7.0
3048	97.5	3.0	3.5	5.0	6.5
1264	95.0	4.0	4.5	6.5	7.0
25-9	95.0	4.0	4.0	5.0	6.5
2352	100.0	2.5	4.0	7.0	7.0
1228	90.0	3.0	4.5	8.0	7.0
25-6	97.5	2.0	3.0	4.0	6.0
2946	90.0	3.0	3.5	4.5	6.5
2570	95.0	3.5	4.0	7.5	7.5
26-7	90.0	3.0	3.5	5.0	6.5
2107	90.0	3.0	3.5	4.0	5.0
TifTW72	82.5	1.0	2.0	2.5	2.5
2302	97.5	3.5	4.0	6.5	7.5
2420	100.0	1.5	3.5	6.0	7.0
2849	100.0	3.5	3.5	7.0	7.5
2747	92.5	4.0	4.0	5.5	6.0
2306	95.0	3.5	4.0	6.0	6.5
18-10	85.0	3.5	4.0	4.5	5.5
2718	95.0	4.0	4.0	6.0	6.5
Tifdwarf	75.0	1.0	1.0	1.5	1.0
27-2	90.0	2.5	3.0	4.0	6.0
22-3	87.5	2.5	3.5	6.5	6.0
24-8	95.0	3.0	4.0	7.5	7.0
24-10	95.0	2.5	2.5	6.0	6.5
24-7	97.5	2.0	3.0	6.0	7.0
798	95.0	2.0	3.5	6.0	7.0
21-2	82.5	3.0	4.5	5.0	5.5
2552	87.5	3.5	4.5	6.0	6.5
25-1	95.0	1.5	3.0	6.5	7.0
26-2	87.5	2.5	3.0	5.5	6.5
22-4	87.5	2.5	4.0	6.5	6.5
LSD (0.05)	8.4	1.1	1.1	1.1	1.0

Greenup ratings were on a scale of 1-9,with 9 being best.

Table 24. Inflorescence percentage and visual quality ratings of African bermudagrass and check varieties planted June 2 and 3, 1994. Turfgrass Research Center, Stillwater, OK.

	Inflorescence %	Visual Quality		
Genotype	06-07-95	07-31-95	09-11-95	10-12-95
OKC 90-10	10.00	6.00	7.00	6.00
OKC 90-13	3.50	6.50	6.50	5.00
26-5	2.00	7.00	6.00	6.00
Tifgreen	35.00	7.00	8.00	7.00
27-12	7.50	7.00	6.00	5.50
1111	22.50	6.50	7.00	5.50
27-11	3.50	7.00	6.00	6.50
2462	12.50	7.00	7.00	5.50
Fiddlestick	7.50	7.00	8.00	6.00
1120	27.50	7.50	6.50	5.00
1202	40.0	6.50	6.50	4.50
OKC 90-14	17.0	6.50	6.50	5.50
OKC 90-16	10.00	6.50	6.00	5.00
223	10.00	7.50	7.00	6.50
Uganda	30.00	7.00	5.00	6.50
1946	37.50	7.00	6.50	6.00
27-3	17.50	7.00	6.00	7.00
21-4	17.50	6.00	7.50	5.00
1943	7.50	7.00	5.50	7.00
3048	87.50	6.50	6.50	6.00
1264	57.50	6.50	5.00	6.50
25-9	92.50	7.00	7.00	5.00
2352	7.50	7.00	7.00	5.50
1228	5.00	7.00	7.00	4.50
25-6	50.00	5.50	6.00	5.00
2946	50.00	7.00	6.00	6.00
2570	12.50	7.00	7.00	6.50
26-7	35.00	7.00	7.00	5.00
2107	87.50	6.50	7.50	4.50
TifTW72	0.00	3.50	5.00	5.00
2302	67.50	7.50	6.50	6.00
2420	25.00	7.00	7.00	5.50
2849	25.00	7.00	5.50	6.50
2747	65.00	7.00	7.00	5.00
2306	50.00	7.50	7.00	6.00
18-10	95.00	6.50	6.50	4.50
2718	70.00	7.50	7.00	7.00
Tifdwarf	0.00	2.00	4.00	2.00
27-2	70.00	7.50	5.50	5.00
22-3	7.50	7.00	6.00	5.50
24-8	65.00	7.50	7.00	6.50
24-10	12.50	7.00	6.00	6.00
24-7	7.50	6.50	6.50	5.50
798	10.0	7.50	6.50	6.00
21-2	92.50	6.00	6.50	5.50
2552	25.00	7.00	7.50	5.50
25-1	5.00	7.00	7.00	6.00
26-2	5.00	7.00	5.50	7.00
22-4	27.50	7.00	6.00	5.50
LSD (0.05)	33.61	0.75	1.29	1.64

Inflorescence percentage on a scale of 0-100. Visual quality ratings were on a scale of 1-9, with 9 being best.

Table 25. Growth rate as indicated by percent plot cover of vegetatively-propagated bermudagrasses planted on July 21, 1995. Turfgrass Research Center, Stillwater, OK.

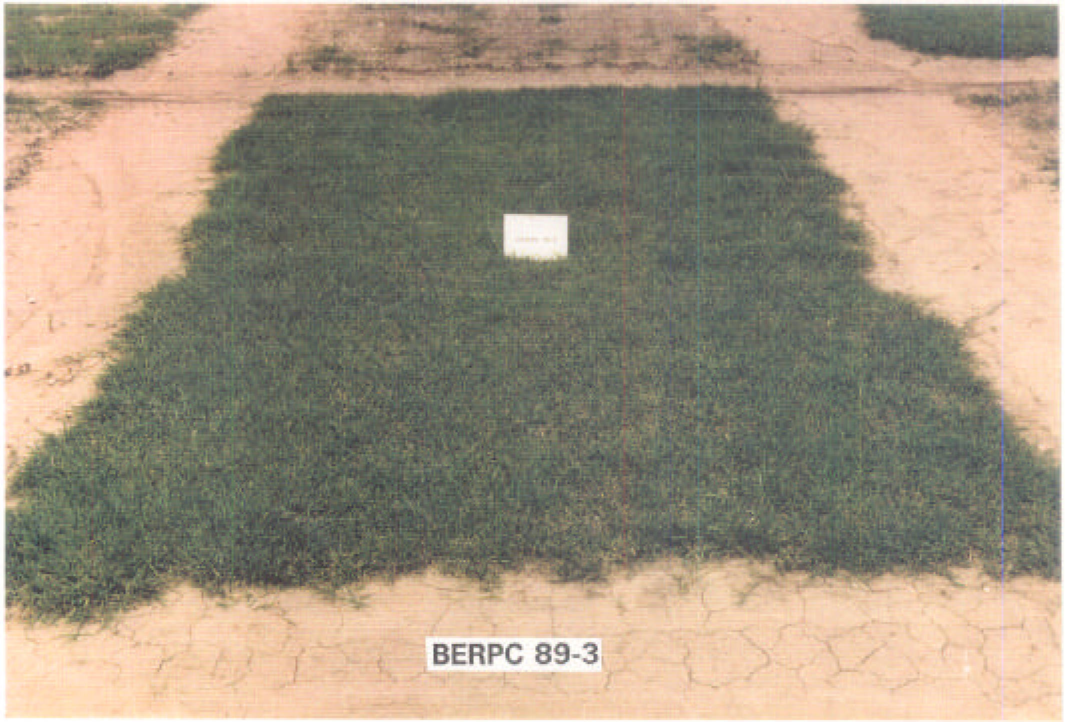
	Percent Cover	
Genotype	09-11-95	10-11-95
3-3	91.7	93.3
3-1	83.3	86.7
Midlawn	75.0	81.7
19-9	56.7	63.3
7-2	51.7	56.7
39-3	50.0	71.7
46-8	50.0	56.7
47-3	46.7	60.0
47-10	43.3	56.7
Tifway	35.0	68.3
LSD (0.05)	18.7	14.3

Cover ratings were on a scale of 0-100%.

Table 26. Greenup ratings for Tifdwarf mutant plants. Turfgrass Research Center, Stillwater, OK.

	Greenup		
Genotype	03-21-95	03-30-95	04-25-95
14-2	1	1	1
15-5	1	1	1
20-5	3	5	5
14-10	2	4	5
14-13	2	5	7
15-3	1	1	1
14-11	1	4	5
14-5	1	1	1
15-13	1	1	1
15-2	1	1	1
15-7	1	1	1
15-4	1	1	1
15-1	1	1	1
15-9	1	1	1
14-4	1	1	1
15-6	1	2	3
Foundation Tifdwarf	1	3	4
15-11	1	1	1
15-8	1	1	1
14-12	3	5	6
15-10	1	1	1
14-1	1	2	2
14-3	1	2	3
14-9	2	3	4
14-6	1	1	2
14-8	1	2	3
20-4	3	4	5
15-12	1	1	1

Greenup ratings were on a scale of 1-9, with 9 being best.



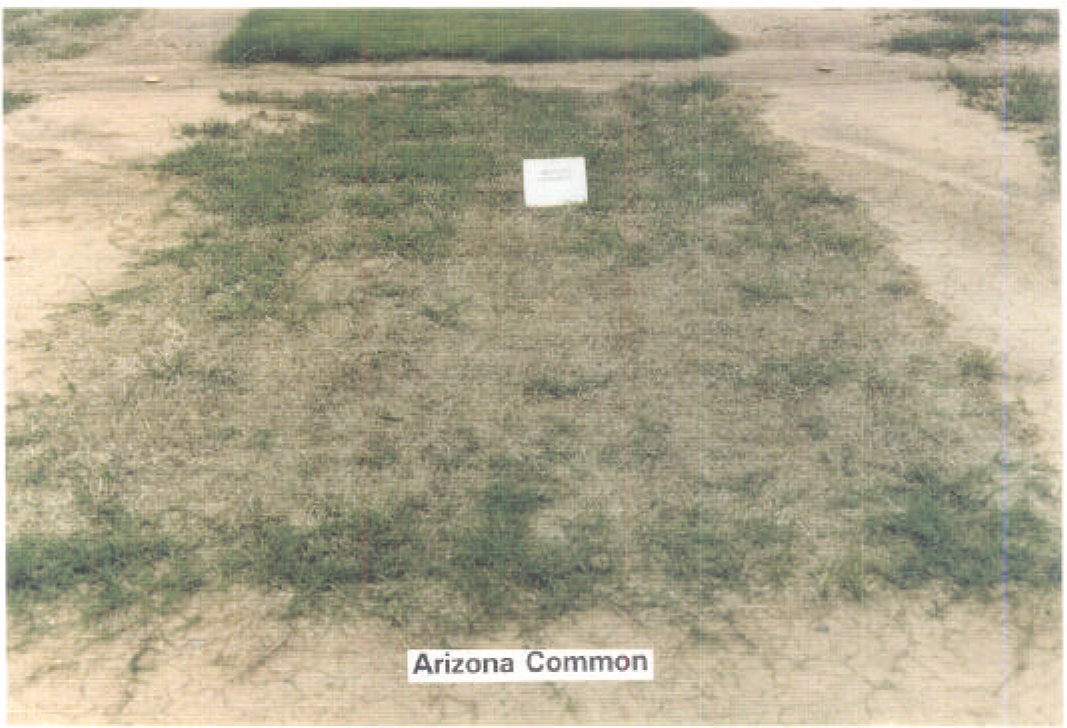


Figure 1. Spring growth of BERPC 89-3 and Arizona Common bermudagrasses in early May 1993. Plots were seeded July 20-23, 1992.

Fig. 2. Wide angle view of the seeded bermudagrass trial on October 21, 1995.

Fig. 3. Wide angle view of the seeded bermudagrass trial on November 24, 1994. Note the greater color retention of the grasses when mowed at the 3/8 and 0.5 inches heights as compared to that mowed at 1.5 inches.

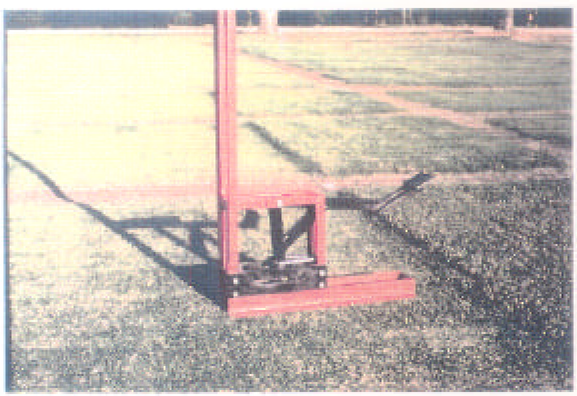


Fig. 4. Divoting machine used to cut uniform divots.

Fig. 5. Cutting head on divoting machine.

Fig. 6. A grid is used to measure recovery from divoting.

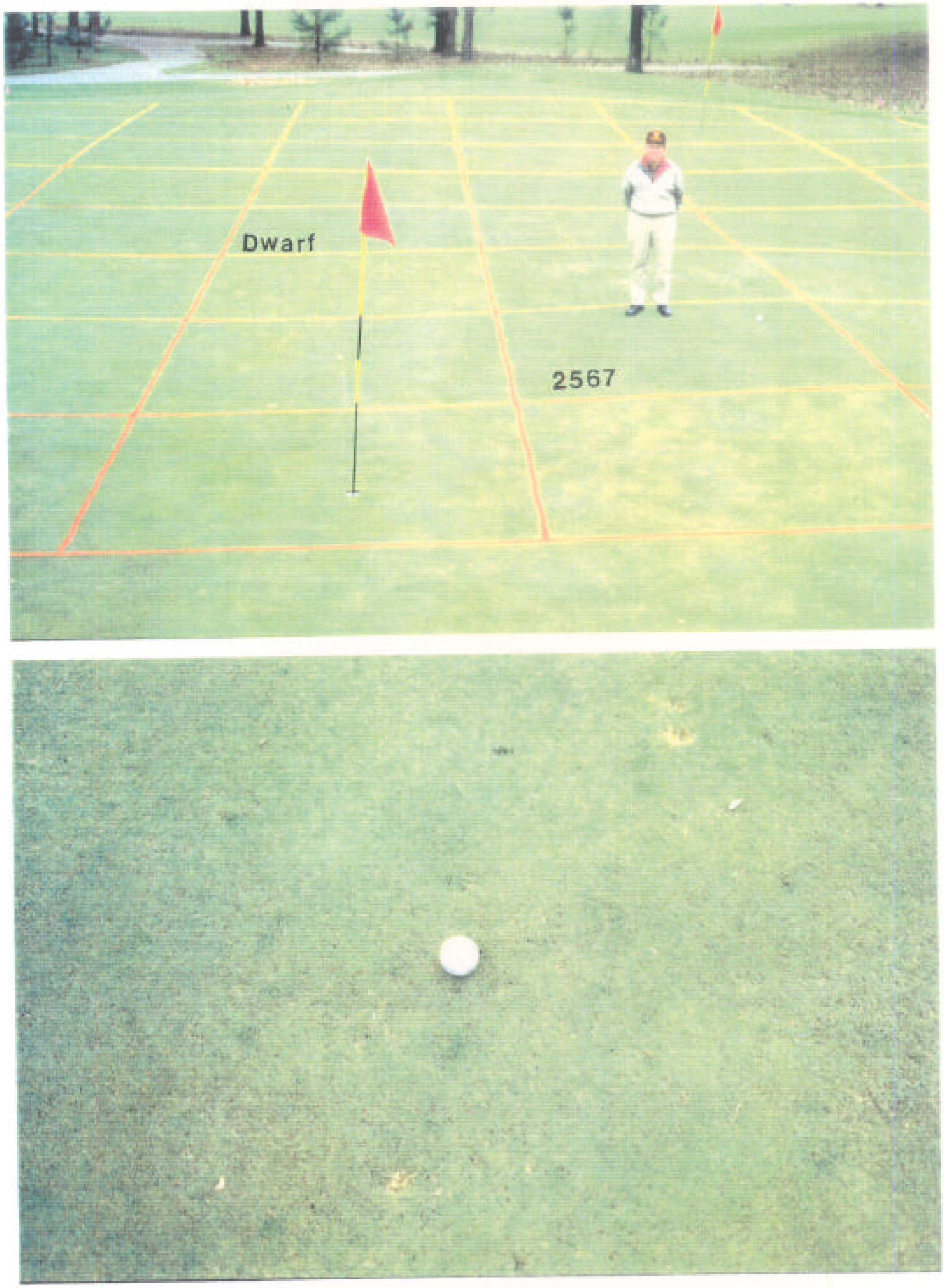


Fig. 7. Cynodon transvaalensis test on the Champions Course, Houston, TX., December 1994. Top: Superintendent Charles Joachim standing in a plot of Ctr selection 2567. This selection has maintained good turf quality and is invading adjacent plots signifying that it is adapted to the humid coastal environment. Bottom: Closeup of Ctr 2567.

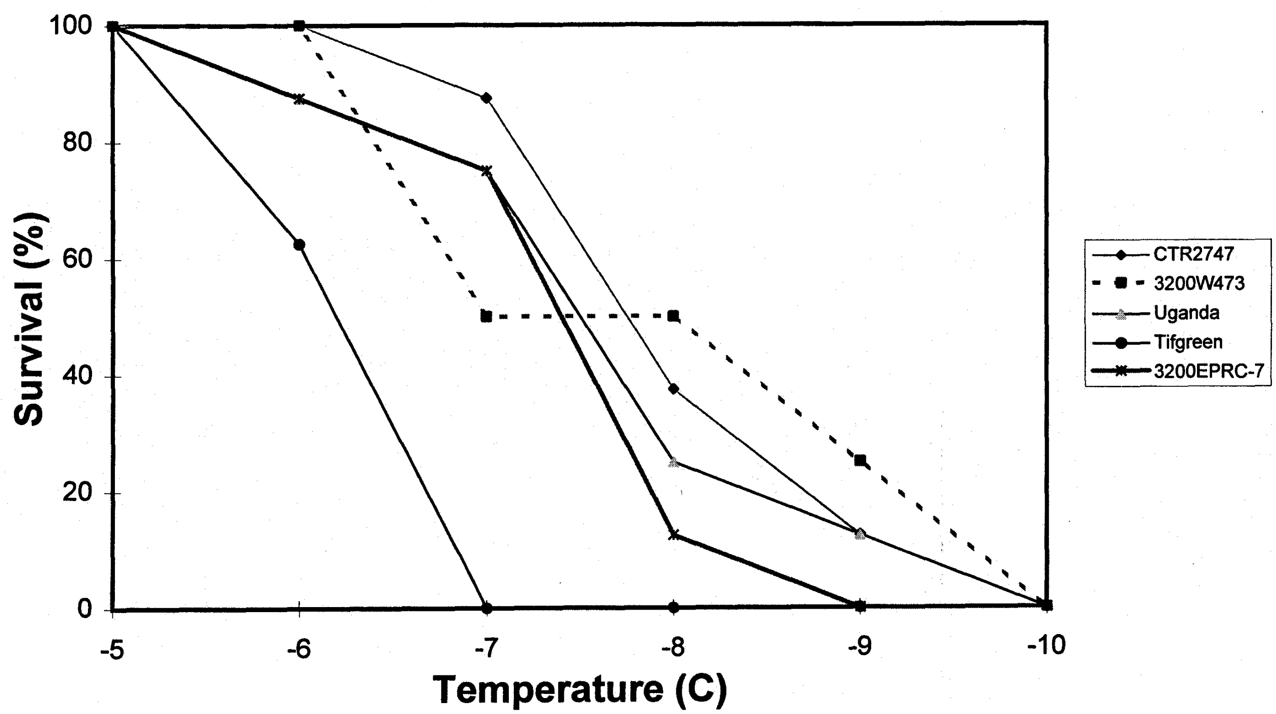


Fig. 8. Survival of five bermudagrasses subjected to temperatures from -5 to -10°C.

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