ANNUAL PROGRESS REPORT

BREEDING SEED- AND VEGETATIVELY-PROPAGATED TURF BERMUDAGRASSES FOR GOLF COURSES

For the Period

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EXECUTIVE SUMMARY

The turf bermudagrass breeding program at Oklahoma State University is a team effort among scientists in stress physiology, molecular biology, plant breeding, genetics, and turfgrass management aimed at developing superior, fine-textured, cold-tolerant, seed- and vegetatively-propagated varieties.

Molecular research has led to the identification of differentially expressed mRNA's in Midiron control and cold-acclimated plants. Investigations of genetic relatedness of *Cynodon* taxa were also initiated this year. Polymerase chain reaction technology is being employed to assess DNA composition in plant materials. Additional detail was prepared in a manuscript titled: "Molecular Identification Of Cold Acclimation Genes In, And Phylogenetic Relationships Among, *Cynodon* Species." A flow cytometry protocol was developed for bermudagrass, and nuclear DNA contents were determined for four cytotypes. Details were described in a manuscript titled: "Use of Flow Cytometry to Estimate Ploidy Level in *Cynodon* Species."

Two experimental synthetic varieties have performed well in comparison to other seed-propagated varieties in various field tests. OKS 91-11 has consistently ranked high in turf quality and cold hardiness in the 1992 NTEP test and in a field evaluation with Jackpot and Mirage seeded bermudagrasses at OSU. OKS 91-11 exhibited exceptional turf quality at both 0.5- and 1.5-inch mowing heights. Both seedling and mature stands of OKS 91-11 are tolerant to comonly-used postemergence herbicides. We plan to proceed with the formal release of OKS 91-11 during the winter of 1996-97. Seed companies in Oklahoma, Oregon, and Arizona have expressed interest in the variety. OKS (BERPC) 91-3 has performed well in tests conducted in Georgia in terms of turf quality and stand persistence. A decision on release of OKS 91-3 will be delayed until 1997 to permit further evaluation and increase of basic propagating stock. Three bermudagrasses collected from the Peoples Republic of China in 1993 demonstrated very good turf quality and reasonably high fertility in preliminary evaluations. Further evaluations will continue next year. Tolerance to Spring Dead Spot (SDS) disease has been evaluated for several seed- and vegetatively-propagated bermudagrasses and a manuscript describing this research has been prepared. Additional bermudagrass selections were inoculated with a causal organism of SDS for evaluation in upcoming years.

Cynodon transvaalensis selections made over the past 5 years have provided new and potentially valuable germplasm within this species to use both in intra-specific and inter-specific breeding. F_1 hybrid plants from interspecific crosses have been identified which have good turf quality characteristics and these plants are being expanded for further evaluation and potential release in the future. Some interspecific hybrid plants are cytogenetically unique and are proving valuable as parents in breeding. Fifteen *C. transvaalensis* plants selected from screening nurseries over the past 4 years were planted in an isolated polycross in 1996. Polycross seed will be used to produce a new population for further selection. We are also considering a formal release of the resultant population as a germplasm since the *C. transvaalensis* germplasm base in collections in the USA and worldwide is very

narrow. A *C. transvaalensis* genetic population was field planted in 1996 to study genetic variation within the species. Management studies have revealed that *C. transvaalensis*: 1) responds to higher fertility levels, especially nitrogen; 2) is sensitive to higher rates of Dimension, Ronstar, and hormone-type herbicides when mowed at putting green heights-of-cut; 3) possesses an upright growth habit which results in less ball roll and susceptibility to scalping injury; 4) requires frequent topdressing and vertical mowing for maximum turf quality; 5) transitions out of dormancy faster than other bermudagrass species; 6) is severely weakened by winter overseeding; 7) undergoes an unexplainable period of decline during the summer; 8) possesses exceptional winter hardiness and tolerance to SDS; 9) looks best in terms of turf quality in the spring and fall; and 10) has potential for use on golf course putting greens, tees, and fairways.

INTRODUCTION

The turf bermudagrass breeding program at Oklahoma State University 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, cold-tolerant, seed-propagated varieties for the transition zone. The program was expanded in 1990 to include the development of superior vegetatively-propagated varieties. Fundamental research supporting the breeding effort includes the development and 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.

RESEARCH PROGRESS

Molecular Research.

Differentially expressed mRNA's were identified in Midiron control and cold-acclimated plants (Figure 1). Plants were cold acclimated by placing them in a controlled environment chamber maintained at 8C/2°C (day/night) for 4 weeks. Control plants were placed in a chamber maintained at 28/24°C. Photosynthetic photon flux ws ca. 300 :mol$\cdot$m^{-2}s^{-1} during 10 h photoperiods. Plant samples for mRNA extration and analyses were taken on the 2nd and 28th day after plaing the plants in the chambers. Additional plant samples were taken two days after the acclimation period ended. Differential display of mRNA was accomplished using MMLV reverse transcriptase (RNAmap Kit) and two primers, T_{11} MA-AP4 and AP5. Four prominent differentially expressed genes are depicted in Figure 1 representing both up- and down-regulation.

Investigations of genetic relatedness of *Cynodon* taxa were initiated in January 1996. Polymerase chain reaction technology is being employed to assess DNA composition in plant materials. Initially, a few genotypes within most of the *Cynodon* species and taxonomic varieties will be studied. Dr. Senayet Assefa is conducting this work in the laboratory of Dr. Mike Anderson.

Additional detail is found in the manuscript "Molecular Identification Of Cold Acclimation Genes In, And Phylogenetic Relationships Among, Cynodon Species", included in appendix 1.

Bermudagrass Flow Cytometry Analyses.

A flow cytometry protocol was developed for bermudagrass, and nuclear DNA contents were determined for four cytotypes. Diploid (2n=2x=18), triploid (2n=3x=27), tetraploid (2n=4x=36), and hexaploid (2n=6x=54) plants had mean nuclear DNA contents (picograms/nucleus) of 1.11$\pm$0.04, 1.60$\pm$0.04, 2.25$\pm$0.13, and 2.80$\pm$0.14, respectively. Details are contained in the manuscript "Use of Flow Cytometry to Estimate Ploidy Level in *Cynodon* Species" included in appendix 2.

Seed-Propagated Bermudagrasses.

Breeding/ Pending Releases. Two experimental synthetic varieties have performed well in comparison to other seed-propagated varieties in various tests. OKS 91-11 has consistently ranked high in turf quality and cold hardiness in the 1992 NTEP test and in ongoing tests at OSU. OKS (BERPC) 91-3, one of eight experimental bermudagrasses tested by Bob Carrow at Griffin, Georgia, has performed well in terms of turf quality and stand persistence. Performance data for OKS 91-3 are provided in progress reports submitted to the USGA by Dr. Carrow. We plan to proceed with the formal release of OKS 91-11 during the winter of 1996-97. Seed companies in Oklahoma, Oregon, and Arizona have expressed interest in the variety. A decision on release of OKS 91-3 will be delayed until 1997 to permit further evaluation and increase of basic propagating stock.

Three bermudagrasses collected from the Peoples Republic of China in 1993 demonstrated very good turf quality and reasonably high fertility in preliminary evaluations conducted in 1994-95. These accessions were clonally increased and placed in a field polycross in late summer, 1995. Approximately 20 lbs. of seed were produced from the polycross in summer 1996 and is available for establishment of tests in 1997. The respective clonal accessions were further increased in 1996 to provide sprigs for additional types of testing and establishment of larger polycross increase blocks. Additionally, open-pollinated seed from each of the three plants was germinated and approximately 200 seedlings from each accession were started in the greenhouse and will soon be field planted to screen for plant type and fertility. The geographic region of China from which these plant materials originated is similar to the southeastern USA.

Spring Dead Spot Evaluation. Results of 1993-96 Spring Dead Spot (SDS) evaluation are presented in manuscript format in appendix 3. The manuscript is currently in Departmental review and will be submitted to the journal *Plant Disease*.

Fall color retention and spring greenup ratings of the bermudagrass varieties in the SDS evaluation are shown in Table 1. African bermudagrass exhibited the best color retention and greenup of bermudagrass varieties evaluated. Turf visual quality ratings are presented in Table 2. The SDS evaluation will continue through spring 1997.

In September 1996, turfgrasses in the OKS 91-11, vegetative bermudagrass, and African bermudagrass studies were inoculated with *Ophiosphaerella herpotricha* using similar methods described in appendix 3. The inoculum was supplied by Dr. Ned Tisserat, Plant Pathologist at Kansas State University.

OKS 91-11 Evaluation. A field study was initiated in July 1995 to evaluate OKS 91-11 in comparison with Jackpot and Mirage seeded bermudagrasses for potential use on tees, fairways, and/or rough. Fall color retention and spring greenup ratings are shown in Table 3. Compared to older stands of other bermudagrasses at the Turfgrass Research Center, all three varieties exhibited slower greenup possibly due to winter injury. Furthermore, bermudagrass stands from seed are most susceptible to cold injury the first winter after seeding. By the middle of May, it was apparent that OKS 91-11 suffered substantially less winter injury than Jackpot and Mirage during the winter following establishment (Figure 2).

An experiment was initiated in in 1996 to evaluate the bermudagrasses under 0.5 and 1.5-inch mowing heights. Visual quality and color ratings for the seeded bermudagrasses mowed at 1.5 and 0.5 inches are presented in Tables 4 and 5, respectively. No significant differences were observed among the bermudagrasses at either mowing height; however, OKS 91-11 was often rated numerically higher than the other two varieties in terms of visual quality and color.

An experiment was initiated in 1995 to evaluate fall and spring applications and rates of Barricade (prodiamine) and Ronstar (oxadiazon) herbicides for preemergence control of goosegrass in OKS 91-11 bermudagrass turf. No herbicide injury to OKS 91-11 was observed in this study (data not shown).

An experiment was conducted in 1996 at OSU and the University of Arkansas Cooperative Extension Service Lonoke Research and Extension Center in cooperation with Dr. John Boyd. The purpose of the experiment was to evaluate the tolerance of newly-established OKS 91-11 seedlings to postemergence herbicides. Application rates at and below label recommendations of Daconate (MSMA), Basagran (bentazon), 2,4-D, Manage (halosulfuron), DMC (metsulfuron), and Iloxan (dichlofop) were applied at 2, 3, and 4 weeks after seedling emergence. Minimal and short-lived turf injury occurred from Daconate, DMC, and Illoxan (data not shown). Further research is needed to determine OKS 91-11 seedling tolerance at younger growth stages and higher herbicide rates.

In a similar study conducted at OSU, the same herbicides were applied at 1x and 2x rates to a mature stand of OKS 91-11 bermudagrass. Minimal turf injury occurred from Daconate herbicide at one week after treatment (data not shown). No injury was observed at two weeks after treatment.

Vegetatively-Propagated Bermudagrasses.

Breeding. *Cynodon transvaalensis* selections made over the past 5 years provide new and potentially valuable germplasm within this species to use both in intra-specific and inter-specific breeding. The identification of genetically superior germplasm within each of the two species is fundamental to the long-term breeding improvement of turf bermudagrasses for different applications and geographic regions. In 1995, over 50 inter-specific crosses between selected parents of the two species were made. Resultant seed from the crosses were germinated during winter 1995-96 producing approximately 3,000 F_1 hybrid plants transplanted to field nurseries in spring 1996. Many of these exhibited exceptional turf quality during this establishment year.

F_1 hybrid plants from interspecific crosses made prior to 1995 have been identified which have good turf quality and/or unique genetic and reproductive characteristics. Several of twenty-four F_1 hybrids or accessions included in Test 94-1 maintained at 0.75 in height have performed very well in comparison to standards (Tables 6-8). Turf quality ratings for entry six (3200W 18-4) were consistently high in 1995 and 1996. Entries 2, 7, 14, and 19 from Test 94-1 are included in the group of vegetatively-propagated bermudas under evaluation at the Turfgrass Research Center.

F_1 Hybrid Evaluation. A field study was initiated in July 1995 to evaluate vegetatively-propagated bermudagrasses for use on fairways and tees. Fall color retention and spring greenup data of eight experimental F_1 hybrid bermudagrasses from OSU together with Tifway and Midlawn are presented in Table 9. Upon establishment, the bermudagrasses were evaluated for turf quality and color under 0.375- (Table 10) and 0.75-inch (Table 11) mowing heights. F_1 hybrid 19-9 showed exceptional color and turf quality characteristics under both mowing heights.

Some interspecific hybrid plants are cytogenetically unique and are proving valuable as parents in breeding. For example, two of approximately 50 F_1 hybrids from a cross between a *C. transvaalanesis* parent and Tifton 10 had good turf quality and sufficient fertility to be used in breeding. These hybrids are tetraploids (2n-4x=36) presumably with three genomes (27 chromosomes) from Tifton 10 (2n=6x=54) and one full genome (9 chromosomes) from the *C. transvaalensis* parent.

Fifteen *C. transvaalensis* plants selected from screening nurseries over the past 4 years were planted in an isolated polycross in April 1996. Polycross seed will be used to produce a new population for further selection. We are also considering a formal release of the resultant population as a germplasm. The *C. transvaalensis* germplasm base in collections in the USA and worldwide is very narrow and this would make available a population for scientific use including cultural/management, physiological, and genetic investigations. The majority of these 15 plants came from screening nurseries in Florida and were selected on the basis of turf quality and persistence. Though none of the selected plants has the performance stability required in a commercial cultivar for use on upper-scale golf course putting greens, they should produce a population with valuable genetic characteristics and likely mean performance (adaptation and turf quality) higher than that of an unselected population.

A *C. transvaalensis* genetic population was field planted in April 1996 to study genetic variation within the species. The population was constructed by making controlled crosses between eight randomly selected plants within each of four groups. Within each group, four of the plants were randomly chosen to serve as males and the other four served as females. Five F_1 plants of each cross are included in the population and each plant was replicated three times by clonal propagation. Plots were allowed to fully develop during 1996. Data on rate of spread and biomass yield were obtained. Comprehensive data collection will begin next year.

African Bermudagrass Evaluation. A field study was initiated in June 1994 to screen 45 *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 TW72 (Georgia) bermudagrasses on a sand/peat moss (85:15 v/v) research green. Fall color retention and spring greenup, and turf quality data are presented in Tables 12 and 13, respectively. Ctr 2747, 2567, 90-16, and 2306 were selected for superior turf quality and establishment rate and expanded on a 5000-ft^2 sand putting green for future evaluation.

African Bermudagrass Fertility Study. A field study was initiated in April 1995 to evaluate African bermudagrass response to N, P, K, and micronutrients. Spring greenup, visual quality, color, and turf density data are presented in Tables 14-17, respectively. In general, overall turf quality was associated with higher fertility, specifically N, levels.

African Bermudagrass Tee/Fairway Study. 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 on sand and clay loam. Fall color retention and spring greenup data are presented in Tables 18 and 19, respectively. The African bermudagrass genotypes exhibited faster spring greenup than Tifway on clay loam. Upon establishment on clay loam, the bermudagrasses were evaluated for turf quality and color under 0.375- and 0.75-inch mowing heights (Table 20). Although not statistically significant, turf quality and color ratings for Ctr 2567 were numerically higher than Ctr 2747 and equal to or higher than Tifway. Turf establishment on sand was slow (Table 21); consequently, the mowing height treatments were not applied to the sand-grown bermudagrasses in 1996.

African Bermudagrass Herbicide Tolerance Study. A third run of an experiment designed to evaluate the tolerance of African bermudagrass to commonly-applied pre- and postemergence herbicides was conducted in 1996. African bermudagrass injury and root mass data are presented in Tables 22 and 23, respectively. Similar to previous experiments, greatest turf injury resulted from 2,4-D, mecoprop, and dicamba, triclopyr, Dimension, and Ronstar herbicides. Root mass data was variable and did not appear correlated to turf injury. Results from these experiments are being prepared in a manuscript to be submitted to the journal *Weed Technology*.

African Bermudagrass Field Evaluations. African bermudagrass was planted on greens, tees, and collars/approaches at the following locations in 1996: Karsten Creek Golf Club, Stillwater, OK (practice putting green); University of Oklahoma Golf Course, Norman (practice putting green); Coffee Creek Golf Course, Edmond, OK (par 4 championship tee); driving range facility, Tulsa, OK (practice chipping green); Ponca City Country Club (practice chipping green); and T. Boone Pickens' ranch, near Amarillo, TX (putting green). In general, all turf managers at the above locations were pleased with the species' performance. Exceptional care was put into the African bermudagrass green at Karsten Creek and, at one point during the growing season, the African bermudagrass green was almost indistinguishable from a nearby creeping bentgrass green. Although African bermudagrass possesses several less than desirable traits (e.g., scalping, summer decline, slow ball roll), results of the field evaluations warrant further examination of African bermudagrass for potential use on low maintenance putting greens and on tees and/or fairways.

African Bermudagrass Winter Overseeding Study. Ctr 2747 practice putting greens at Karsten Creek Golf Club and the University of Oklahoma Golf Course were overseeded with Seaside creeping bentgrass, Froghair intermediate ryegrass, and *Poa trivialis* in October 1996. One-quarter of each green was not overseeded. In spring 1997, Kerb herbicide will be applied to one-half of the green in order to evaluate chemical and natural transition of African bermudagrass from overseeding.

RESEARCH PLANNED

Molecular Genetics Research

Differential expression of mRNA's in cold acclimated and control tissues of bermudagrass will continue to be studied with different primer combinations. Presently, we are conducting Northern blot analysis to confirm differential expression due to cold acclimation. Cold regulated genes confirmed by Northern analysis will then be cloned and placed into expression vectors.

Seed-Propagated Bermudagrasses.

Breeding. Additional selection will be made within existing broad-genetic base populations including the cold tolerant $C_{3fer4tex}$ and C_{3ct} populations. Narrow base synthetics from the broad base populations and from the germplasm collected in China in 1993 will be evaluated for turf performance. Progeny plants from the elite Chinese clones also will be grown in space-planted nurseries to permit selection for increased seed production and turf quality. Formal release of OKS 91-11 is planned during the winter 1996-97. Preparations for release of OKS 91-3 will proceed with a decision to be made in 1997.

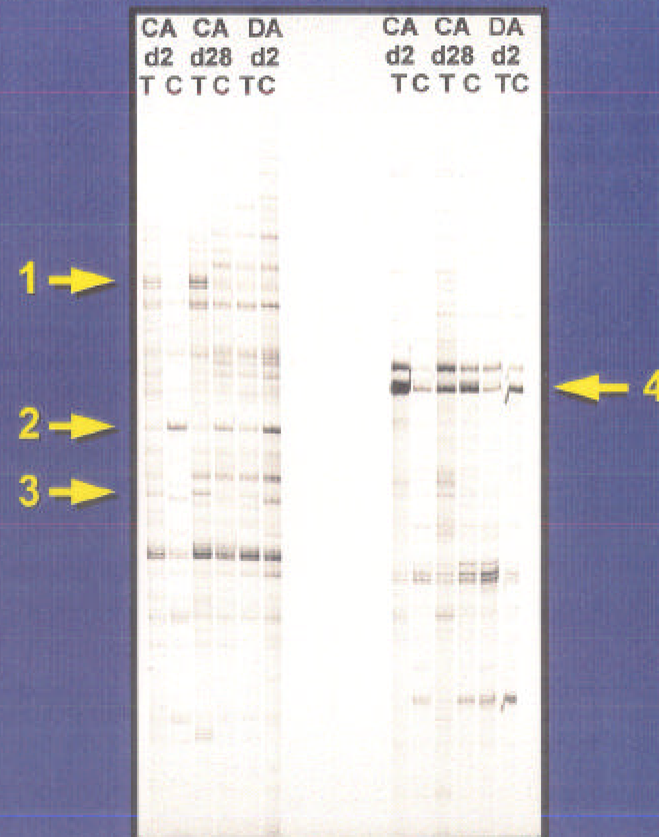
Evaluation. Current and additional studies will be conducted to gather further agronomic information on OKS 91-11 and 91-3 in anticipation of their upcoming release.

Vegetatively-Propagated Bermudagrasses.

Breeding. The approximately 3,000 F_1 hybrid plants from 1995 crosses will be grown in preliminary evaluation nurseries in 1996. These nurseries will be maintained initially at fairway height. Evaluation of previously selected F_1 hybrids will continue. Additional interspecific crosses will be made between selected *C. transvaalensis* and *C. dactylon* plants using mutual pollination techniques.

Evaluation. Current and additional studies will be conducted to gather further agronomic information on vegetative and African bermudagrasses in anticipation of their potential release in the near future. Promising selections will be expanded and evaluated under actual golf course conditions.

Fig. 1. Display gels showing differential expression of mRNA from cold acclimated and control cells of Midiron bermudagrass. Gel on left used primer T_{11} MA-APS, one on right used primer AP5. CA = cold acclimated, DA = deacclimated, d2 = day 2, d28 = day 28, T = treatment, C = control. Arrows 1 and 3 demonstrate up-regulated gene action from day 2 through day 28, with down- regulation evident after 2 days deacclimation. Arrow 2 demonstrates down regulation from day 2 through day 28, with up regulation following 2 days deacclimation. Arrow 4 demonstrates transient up regulation i.e. regulation through day 2, but not through day 28.



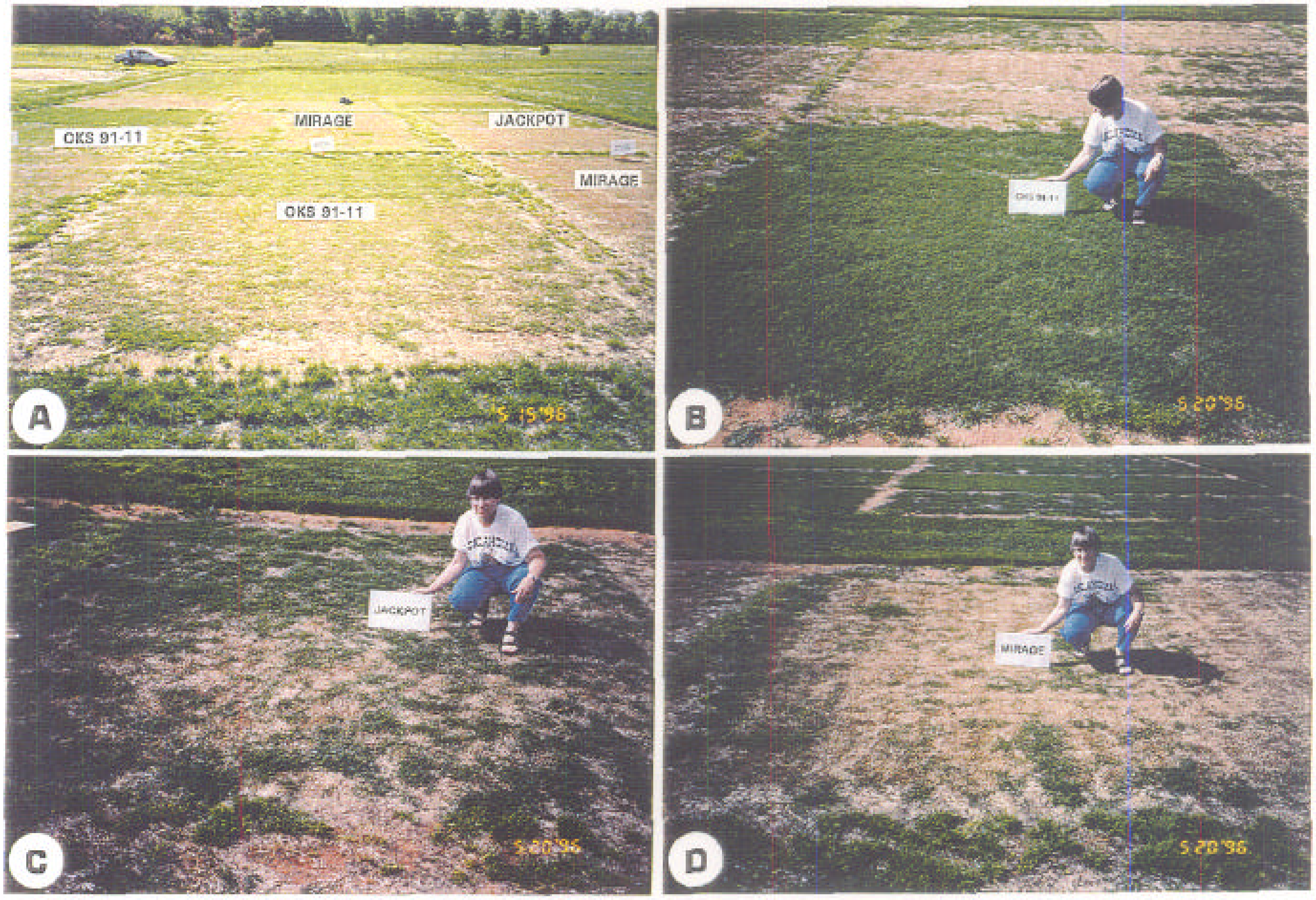


Figure 2. A. Photograph showing the relative greenup of OKS 91-11, Jackpot, and Mirage seed-propagated bermudagrasses on May 15, 1996. B-D. Photographs taken May 20, 1996 showing relative greenup of OKS 91-11, Jackpot, and Mirage, respectively. Taken from OKS 91-11 evaluation seeded July 1995. Turfgrass Research Center, Stillwater, OK.

Table 1. 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	10/27/95	11/10/95	3/21/96	4/10/96
African Bermudagrass	7.7	3.7	1.7	6.0
Midlawn	7.0	2.7	1.3	3.3
Sonesta	6.7	2.3	1.3	3.7
Guymon	6.3	2.3	1.3	3.0
Pyramid	5.7	2.3	1.3	3.7
BERPC 91-12	8.0	2.7	1.0	2.7
BERPC 91-3	7.7	2.7	1.0	3.0
BERPC 89-3	7.3	3.0	1.0	2.7
BERPC 91-13	7.0	3.0	1.0	2.3
C2	7.0	2.7	1.0	4.0
BERPC 91-4	6.3	2.7	1.0	2.7
Arizona Common	6.0	2.3	1.0	3.3
Midfield	6.0	2.0	1.0	3.0
BERPC 91-1	6.0	2.3	1.0	3.0
Sundevil	6.0	2.7	1.0	2.7
Mirage	6.0	2.3	1.0	3.3
BERPC 91-2	6.0	2.0	1.0	3.0
Poco Verde	6.0	2.3	1.0	3.0
Ft. Reno	6.0	2.3	1.0	3.0
Primavera	5.7	2.3	1.0	3.0
BERPC 91-6	5.3	2.0	1.0	3.0
Tropica	5.3	2.0	1.0	3.0
NuMex Sahara	5.3	2.0	1.0	3.0
Jackpot (J-912)	4.7	2.0	1.0	2.7
Cheyenne	4.7	2.0	1.0	3.0
Tifton 10	3.3	2.0	1.0	2.3
LSD (0.50)	**1.7**	**0.7**	**0.4**	**0.8**

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

Table 2. Visual Quality ratings of bermudagrass varieties in the spring dead spot evaluation. Turfgrass Research Center, Stillwater, OK.

	Visual Quality				
Cultivar	5/20/96	6/27/96	7/25/96	8/27/96	9/27/96
African Bermudagr	7.0	7.0	6.7	6.3	7.7
Midlawn	8.7	8.0	7.3	6.7	8.3
Sonesta	5.7	6.3	6.7	7.0	8.0
Guymon	6.7	6.3	6.3	6.0	6.7
Pyramid	6.3	7.3	7.0	7.0	8.0
BERPC 91-12	7.7	7.7	7.0	7.0	6.7
BERPC 91-3	7.3	6.7	6.7	7.0	8.0
BERPC 89-3	7.0	8.0	7.0	6.7	7.3
BERPC 91-13	7.3	7.7	7.0	6.7	6.7
C2	6.3	6.7	6.7	7.3	7.7
BERPC 91-4	7.0	7.3	7.0	7.0	7.3
Arizona Common	6.0	5.7	5.7	5.3	7.3
Midfield	8.0	8.0	6.7	6.3	7.7
BERPC 91-1	6.3	6.0	6.3	6.3	7.7
Sundevil	6.7	7.0	7.0	7.0	7.3
Mirage	7.0	7.7	7.0	7.0	7.7
BERPC 91-2	7.0	8.0	7.3	7.3	8.0
Poco Verde	6.0	6.3	6.3	6.3	7.3
Ft. Reno	7.3	7.3	7.0	7.3	7.7
Primavera	5.7	5.7	6.3	6.3	7.7
BERPC 91-6	6.3	7.3	7.0	6.7	8.0
Tropica	6.3	6.3	6.7	6.7	7.7
NuMex Sahara	5.3	6.0	6.0	6.7	7.3
Jackpot (J-912)	6.7	7.0	6.7	7.0	8.0
Cheyenne	6.3	6.7	6.7	6.7	8.0
Tifton 10	7.7	8.0	7.3	7.3	9.0
LSD (0.50)	**0.8**	**0.9**	**0.8**	**0.9**	**0.7**

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

Table 3. Fall color retention and spring greenup ratings of seeded bermudagrass varieties in the OKS 91-11 evaluation. Turfgrass Research Center, Stillwater, OK.

	Color Retention		Greenup		
Genotype	11/27/95	11/10/95	4/10/96	4/25/96	5/2/96
OKS 91-11	5.0	2.7	2.0	3.3	4.0
Jackpot	4.3	2.0	1.0	2.0	3.0
Mirage	4.3	2.0	1.0	2.0	3.0
LSD (0.05)	**1.5**	**0.8**	**0.0**	**0.8**	**0.0**

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

Table 4. Visual quality and color ratings of seeded bermudagrass varieties mowed at 1.5 inches in the OKS 91-11 evaluation. Turfgrass Research Center, Stillwater, OK.

	Visual Quality				Color
Genotype	6/27/96	7/23/96	8/27/96	9/27/96	8/27/96
OKS 91-11	7.3	7.0	7.0	7.0	7.0
Jackpot	7.0	7.0	7.0	7.0	7.0
Mirage	7.0	6.3	6.3	7.3	7.0
LSD (0.05)	**0.8**	**0.8**	**0.8**	**0.8**	**0.0**

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

Table 5. Visual quality and color ratings of seeded bermudagrass varieties mowed at 0.5 inches in the OKS 91-11 evaluation. Turfgrass Research Center, Stillwater, OK.

	Visual Quality				Color
Genotype	6/27/96	7/23/96	8/27/96	9/27/96	8/27/96
OKS 91-11	7.0	7.0	7.7	7.7	7.7
Jackpot	6.7	6.7	7.3	7.0	7.7
Mirage	6.3	6.7	7.3	7.3	7.3
LSD (0.05)	**1.3**	**1.2**	**1.8**	**0.9**	**0.8**

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

Table 6. Turf quality ratings for vegetatively - propagated bermudagrass hybrids and standard varieties. Turf bermudagrass test 94-1, Agronomy Research Station, Stillwater, OK.[1]

Entry No.	Strain	1996 Rating Date 5/22	6/4	6/18	7/1	7/22	7/31	9/12	10/7		1995	95-96
1	3200W 1-6	6.5	6.5	7.0	7.5	6.0	7.0	6.5	6.0	6.6	6.8	6.7
2	3200W 3-3	7.0	7.0	7.0	6.5	6.5	6.0	7.0	6.0	6.6	6.7	6.7
3	3200W 12-2	7.0	7.0	7.0	6.0	7.0	6.5	7.5	8.0	7.0	6.5	6.8
4	3200W 12-4	7.5	7.5	8.0	8.0	7.0	8.0	6.5	6.5	7.4	6.6	7.0
5	3200W 12-7	6.5	6.0	7.0	5.0	5.0	5.0	5.5	5.5	5.7	5.6	5.7
6	3200W 18-4	7.5	7.5	8.5	7.5	7.5	8.0	8.0	8.0	7.8	7.1	7.5
7	3200W 19-9	7.0	6.5	5.5	5.5	5.5	6.5	6.5	6.5	6.2	5.4	5.8
8	3200W 19-10	8.0	6.5	7.0	7.0	6.5	7.0	7.0	7.0	7.0	6.9	7.0
9	3200W 23-8	6.5	6.5	6.5	5.0	5.5	5.5	6.0	5.5	5.9	6.1	6.0
10	3200W 25-6	6.5	5.5	5.0	4.5	4.0	4.0	5.0	5.0	4.9	4.5	4.7
11	3200W 26-8	5.5	5.5	5.5	5.0	4.5	5.0	4.0	4.0	4.9	4.3	4.6
12	3200W 31-8	7.5	6.5	6.5	7.5	7.0	7.0	8.0	6.5	7.1	6.4	6.8
13	3200W 35-3	6.0	6.5	7.0	5.5	5.5	5.5	7.0	7.0	6.3	6.7	6.5
14	3200W 39-3	6.5	6.5	6.0	4.5	5.0	5.0	6.0	5.5	5.6	6.6	6.1
15	3200W 39-7	5.0	5.0	4.5	4.0	4.0	4.0	4.0	4.0	4.3	4.5	4.4
16	3200W 39-8	6.0	5.5	7.0	5.5	6.5	7.5	6.5	6.5	6.4	7.1	6.7
17	3200W 41-5	6.0	5.5	6.0	5.0	6.0	6.0	6.0	5.5	5.8	6.2	6.0
18	3200W 41-8	7.5	7.0	7.0	6.0	6.0	6.5	7.0	6.0	6.6	6.5	6.6
19	3200W 47-3	7.5	7.0	7.0	6.0	5.0	5.5	5.0	6.0	6.1	6.3	6.2
20	3200W 50-1	7.5	7.0	5.5	5.5	5.5	6.5	6.0	5.5	6.1	6.4	6.2
21	3200W 55-3	6.5	6.0	6.5	5.5	6.0	6.5	4.5	6.0	5.9	6.1	6.0
22	3200W 55-7	6.5	6.5	6.5	5.5	5.5	6.0	6.5	6.5	6.2	6.6	6.4
23	PRC-7	6.5	6.5	6.5	6.0	6.0	6.5	6.0	6.0	6.2	6.1	6.2
24	PRC-55	7.0	7.0	6.5	6.0	6.5	8.0	6.0	5.5	6.6	6.7	6.6
25	Beijing	5.5	5.5	6.0	5.5	5.5	5.5	5.5	6.0	5.6	6.0	5.8
26	Tifgreen	8.0	6.5	6.0	5.5	7.0	7.0	5.5	6.0	6.4	6.5	6.5
27	Midfield	7.0	7.0	6.5	7.0	6.0	6.5	7.0	6.0	6.6	6.5	6.6
28	Midlawn	6.0	7.0	7.0	6.5	6.0	7.5	6.0	6.0	6.5	6.4	6.4
29	U-3	6.5	5.5	6.0	5.0	5.5	5.0	5.5	6.0	5.6	5.2	5.4
30	Tifway	6.5	7.0	7.0	5.5	7.0	7.5	6.5	6.5	6.7	6.4	6.5
5% LSD		1.2	NS	0.9	1.5	0.9	1.1	1.0	0.9	0.4	1.0	0.5

[1] Rating scale 1-9, with 9 representing ideal turf quality.

Table 7. Turf color ratings for vegetatively - propagated bermudagrass hybrids and standard varieties. Turf bermudagrass test 94-1, Agronomy Research Station, Stillwater, OK.[1]

		1996 Rating Date										
Entry No.	**Strain**	**5/22**	**6/4**	**6/18**	**7/1**	**7/22**	**7/31**	**9/12**	**10/7**		**1995**	**95-96**
1	3200W 1-6	7.0	7.0	7.5	7.5	6.0	6.5	7.0	6.0	6.8	7.6	7.2
2	3200W 3-3	6.5	6.5	7.0	6.5	6.5	6.5	7.5	6.5	6.7	7.1	6.9
3	3200W 12-2	7.0	7.5	7.0	6.0	7.0	7.0	7.5	8.0	7.1	7.1	7.1
4	3200W 12-4	8.0	8.0	8.0	8.0	7.0	8.0	6.5	6.5	7.5	7.3	7.4
5	3200W 12-7	6.5	6.5	7.0	6.0	5.0	5.5	6.0	6.0	6.1	6.7	6.4
6	3200W 18-4	8.0	7.5	8.5	7.5	7.5	8.0	8.0	8.0	7.9	7.4	7.7
7	3200W 19-9	7.0	6.5	5.5	6.0	5.5	5.5	7.0	7.5	6.3	6.3	6.3
8	3200W 19-10	8.0	6.5	7.0	6.5	6.5	6.5	7.0	7.0	6.9	7.3	7.1
9	3200W 23-8	6.5	6.5	7.0	5.0	6.0	5.5	6.0	6.0	6.1	6.8	6.4
10	3200W 25-6	6.0	5.5	5.0	4.5	4.0	5.0	7.0	6.0	5.4	5.6	5.5
11	3200W 26-8	6.0	6.5	5.5	5.0	5.0	5.0	5.5	5.5	5.5	6.4	5.9
12	3200W 31-8	8.0	6.5	7.0	7.5	7.0	7.5	8.0	6.5	7.3	7.0	7.1
13	3200W 35-3	5.5	7.0	7.0	5.5	5.5	5.5	7.0	7.0	6.3	7.1	6.7
14	3200W 39-3	6.0	6.0	6.0	5.0	5.5	5.0	6.5	6.0	5.8	6.8	6.2
15	3200W 39-7	4.5	5.5	5.0	5.0	5.0	5.0	6.0	5.0	5.1	7.1	6.1
16	3200W 39-8	6.0	5.5	7.0	6.0	6.5	7.5	6.5	7.0	6.5	7.6	7.0
17	3200W 41-5	6.5	6.0	6.0	5.5	6.0	6.5	6.5	6.0	6.1	6.9	6.5
18	3200W 41-8	8.0	7.5	7.5	6.5	7.0	7.0	7.5	6.5	7.2	7.3	7.2
19	3200W 47-3	7.0	6.5	7.5	6.0	5.0	5.5	5.5	6.0	6.1	6.9	6.5
20	3200W 50-1	7.5	7.0	5.5	5.5	6.0	6.0	7.0	6.0	6.3	6.6	6.5
21	3200W 55-3	6.5	6.5	6.5	5.0	6.0	6.0	5.5	6.5	6.1	6.8	6.4
22	3200W 55-7	6.5	6.0	6.5	5.5	5.5	5.5	7.0	6.5	6.1	6.9	6.5
23	PRC-7	6.5	6.5	7.0	5.5	6.0	6.0	6.5	6.0	6.3	6.9	6.5
24	PRC-55	7.0	7.0	6.5	5.5	6.5	7.5	6.0	6.0	6.5	6.9	6.7
25	Beijing	5.5	6.0	6.0	5.5	5.5	5.5	6.0	6.0	5.8	6.9	6.3
26	Tifgreen	7.5	6.5	6.0	5.5	6.5	7.0	5.5	5.5	6.3	6.9	6.5
27	Midfield	6.5	7.0	6.5	7.0	6.0	5.5	7.0	6.5	6.5	6.4	6.5
28	Midlawn	6.5	7.5	7.0	6.5	6.0	7.5	6.0	6.0	6.6	7.1	6.9
29	U-3	6.0	6.5	6.0	5.5	5.5	5.5	6.5	6.5	6.0	6.1	6.1
30	Tifway	6.5	7.5	7.0	5.5	6.0	7.5	6.5	6.5	6.6	6.9	6.8
5% LSD		1.2	NS	0.9	1.3	1.0	1.1	1.0	1.0	0.4	0.7	0.4

[1] Rating scale 1-9, with 9 representing dark green.

Table 8. Turf heading ratings for vegetatively - propagated bermudagrass hybrids and standard varieties. Turf bermudagrass test 94-1, Agronomy Research Station, Stillwater, OK.[1]

Entry No.	Strain	1996 Rating Date 5/22	6/4	6/18	7/1	7/22	7/31	9/12	10/7		1995	95-96
1	3200W 1-6	9.0	9.0	8.0	9.0	9.0	9.0	8.5	9.0	8.8	8.0	8.4
2	3200W 3-3	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.7	8.9
3	3200W 12-2	9.0	9.0	8.0	8.5	9.0	9.0	9.0	9.0	8.8	7.6	8.2
4	3200W 12-4	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.8	8.9
5	3200W 12-7	9.0	9.0	8.0	6.5	7.0	7.0	7.0	7.5	7.6	6.4	7.0
6	3200W 18-4	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.5	8.8
7	3200W 19-9	9.0	9.0	7.5	7.0	9.0	9.0	8.5	8.0	8.4	6.6	7.6
8	3200W 19-10	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.6	8.8
9	3200W 23-8	9.0	9.0	9.0	7.5	9.0	9.0	8.5	9.0	8.8	8.2	8.5
10	3200W 25-6	9.0	8.0	8.0	8.0	8.5	8.5	7.0	7.0	8.0	5.2	6.7
11	3200W 26-8	9.0	6.5	6.5	7.0	8.0	8.5	6.5	6.5	7.3	3.7	5.6
12	3200W 31-8	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.6	8.8
13	3200W 35-3	9.0	9.0	8.5	9.0	9.0	9.0	9.0	9.0	8.9	8.5	8.7
14	3200W 39-3	9.0	9.0	7.5	6.0	6.5	7.0	7.5	8.0	7.6	7.5	7.5
15	3200W 39-7	9.0	9.0	8.5	6.5	6.5	6.5	6.5	7.0	7.4	4.8	6.2
16	3200W 39-8	9.0	9.0	8.5	7.5	9.0	8.5	8.5	9.0	8.6	8.4	8.5
17	3200W 41-5	9.0	9.0	7.5	6.5	9.0	8.5	8.5	8.5	8.3	7.9	8.1
18	3200W 41-8	9.0	9.0	8.0	8.0	9.0	9.0	8.0	8.0	8.5	7.9	8.2
19	3200W 47-3	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	8.6	8.8
20	3200W 50-1	9.0	8.0	6.5	6.5	7.5	8.0	7.0	7.5	7.5	7.5	7.5
21	3200W 55-3	9.0	7.5	7.5	8.5	8.5	9.0	6.5	9.0	8.2	7.6	7.9
22	3200W 55-7	9.0	9.0	9.0	7.5	8.5	8.0	8.5	9.0	8.6	7.9	8.2
23	PRC-7	9.0	8.5	8.0	7.5	8.5	8.0	7.5	8.0	8.1	6.9	7.5
24	PRC-55	9.0	8.5	8.0	8.5	9.0	8.5	9.0	9.0	8.7	7.6	8.2
25	Beijing	7.0	7.0	7.0	8.0	8.5	8.5	8.0	8.5	7.8	6.9	7.4
26	Tifgreen	9.0	8.0	7.0	8.0	9.0	8.5	8.0	9.0	8.3	7.4	7.9
27	Midfield	9.0	9.0	8.0	9.0	9.0	9.0	8.5	9.0	8.8	8.4	8.6
28	Midlawn	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	8.8	8.2	8.5
29	U-3	9.0	9.0	7.0	6.5	7.0	7.5	7.0	8.0	7.6	5.8	6.8
30	Tifway	9.0	9.0	8.0	8.0	9.0	9.0	9.0	9.0	8.8	7.9	8.4
5% LSD		-	0.9	1.0	0.9	0.9	0.8	1.0	0.8	0.3	1.2	0.5

[1] Rating scale 1-9, with 9 representing few or no heads.

Table 9. Fall color retention and spring greenup of vegetatively-propagated bermudagrasses planted on July 21, 1995. Turfgrass Research Center, Stillwater, OK.

	Color Retention		Greenup		
Genotype	10/27/95	11/10/95	3/21/96	4/10/96	5/25/96
46-8	6.7	3.3	1.7	3.3	7.0
47-3	6.3	3.3	1.3	2.7	4.3
47-10	6.3	3.0	1.3	3.3	6.7
19-9	6.0	2.7	1.3	2.3	4.3
3-3	4.3	2.0	1.3	3.0	4.0
Midlawn	4.0	2.3	1.3	3.3	7.0
Tifway	7.3	3.3	1.0	2.7	5.3
39-3	6.3	2.7	1.0	3.3	5.7
7-2	5.0	2.0	1.0	2.0	4.0
3-1	4.7	2.7	1.0	3.0	5.3
LSD (0.05)	**0.9**	**0.7**	**0.7**	**0.7**	**1.4**

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

Table 10. Visual quality and color of vegetatively-propagated bermudagrasses planted on July 21, 1995 and mowed at 0.375 inches. Turfgrass Research Center, Stillwater, OK.

	Visual Quality				Color
Genotype	23-Jun-96	23-Jul-96	27-Aug-96	27-Sep-96	27-Aug-96
46-8	6.7	7.0	7.7	7.0	7.3
47-3	6.3	6.7	7.0	7.3	7.3
47-10	6.3	7.0	7.3	8.0	7.3
19-9	7.3	8.0	9.0	8.3	9.0
3-3	6.7	6.7	7.7	7.3	6.3
Midlawn	7.3	6.7	7.0	6.3	6.3
Tifway	7.7	7.7	8.3	8.7	8.0
39-3	7.7	7.3	7.7	7.0	7.7
7-2	6.7	6.7	7.0	5.0	7.7
3-1	6.3	6.7	7.3	7.0	6.7
LSD (0.05)	**0.6**	**0.5**	**1.0**	**1.0**	**1.2**

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

Table 11. Visual quality and color of vegetatively-propagated bermudagrasses planted on July 21, 1995 and mowed at 0.75 inches. Turfgrass Research Center, Stillwater, OK.

	Visual Quality				Color
Genotype	23-Jun-96	23-Jul-96	27-Aug-96	27-Sep-96	27-Aug-96
46-8	7.0	7.0	7.7	7.3	7.0
47-3	6.7	7.0	7.7	7.0	7.7
47-10	6.7	7.0	8.0	7.7	7.3
19-9	7.0	8.0	9.0	8.3	9.0
3-3	7.3	7.0	7.0	6.7	6.0
Midlawn	7.7	7.0	7.0	6.7	6.3
Tifway	8.0	8.0	8.7	8.3	8.7
39-3	7.0	7.0	7.7	6.7	8.0
7-2	6.7	6.7	7.0	5.7	7.3
3-1	8.0	7.3	7.3	6.7	6.7
LSD (0.05)	**0.7**	**0.7**	**0.7**	**1.0**	**1.0**

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

Table 12. Fall color retention and spring greenup ratings of African bermudagrass and bermudagrass species planted June 2 and 3, 1994. Turfgrass Research Center, Stillwater, OK.

	Color Retention		Greenup		
Genotype	10/27/95	11/10/95	3/21/96	4/10/96	5/25/96
2420	7.0	4.0	2.0	3.0	5.5
22-4	7.0	3.5	2.0	3.0	7.0
26-5	7.0	3.0	2.0	3.0	6.5
OKC 90-16	7.0	3.0	2.0	3.0	6.5
27-3	6.5	3.0	2.0	3.0	7.0
2552	6.5	3.5	2.0	3.0	7.0
22-3	6.5	3.5	2.0	3.0	5.5
26-2	6.5	2.5	2.0	3.0	7.0
1111	6.5	2.5	2.0	3.0	6.0
2462	6.0	2.5	2.0	3.0	5.0
26-7	6.0	3.0	2.0	3.0	5.5
2302	6.0	3.0	2.0	3.0	6.5
2352	6.0	3.0	2.0	3.0	5.5
24-10	5.5	3.0	2.0	3.0	6.0
2747	5.5	3.0	2.0	2.5	6.0
25-1	5.5	2.0	2.0	3.0	7.0
Fiddlesticks	5.5	3.0	2.0	2.5	6.0
27-2	5.5	2.5	2.0	3.0	6.0
223	5.5	2.5	2.0	3.0	6.0
27-12	5.0	2.0	2.0	3.0	7.0
1120	5.0	2.0	2.0	3.0	6.0
Uganda	5.0	2.0	2.0	3.0	6.0
OKC 90-13	4.5	2.5	2.0	3.5	6.5
24-8	4.5	2.5	2.0	2.5	5.5
OKC 90-10	4.5	3.0	2.0	3.0	6.5
25-9	4.5	3.0	2.0	3.0	6.0
1202	3.5	2.5	2.0	2.5	6.5
3048	3.5	2.5	2.0	2.5	6.0
2306	7.5	2.5	1.5	3.0	6.5
1943	6.5	2.5	1.5	3.0	6.0
27-11	6.5	3.5	1.5	3.0	6.5
2570	6.0	3.0	1.5	3.0	6.0
798	6.0	2.0	1.5	2.5	4.5
18-10	5.5	3.0	1.5	3.0	6.0
21-2	5.5	2.5	1.5	3.0	6.5
OKC 90-14	5.5	2.5	1.5	3.0	5.5
21-4	5.5	2.5	1.5	3.0	6.0
2718	5.0	2.5	1.5	3.0	6.0
25-6	5.0	2.0	1.5	2.5	6.0
2107	5.0	2.0	1.5	2.5	6.0
2849	5.0	2.5	1.5	2.5	5.5
1946	5.0	2.0	1.5	2.5	6.0
2946	5.0	2.5	1.5	2.5	6.0
24-7	4.5	2.5	1.5	3.0	6.5
1264	4.0	2.5	1.5	2.5	6.0
Tifdwarf	4.5	2.0	1.0	1.5	2.0
Tifgreen	4.5	2.0	1.0	2.5	6.5
TifTW72	3.5	2.0	1.0	2.0	5.0
1228	3.5	2.0	1.0	2.0	6.0
LSD (0.05)	**1.7**	**1.3**	**0.8**	**0.9**	**1.3**

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

Table 13. Visual quality of African bermudagrass and bermudagrass species planted June 2 and 3, 1994. Turfgrass Research Center, Stillwater, OK.

	Visual Quality			
Genotype	6/27/96	7/23/96	8/27/96	9/27/96
2420	7.0	6.0	4.5	5.5
22-4	7.0	5.5	4.0	5.0
26-5	7.0	5.5	4.0	4.5
OKC 90-16	7.0	5.5	4.5	5.0
27-3	7.0	6.0	6.0	5.5
2552	7.0	6.0	4.5	4.5
22-3	6.5	5.0	4.0	4.5
26-2	6.0	5.0	4.0	4.5
1111	7.0	6.0	4.5	5.0
2462	6.0	5.5	5.0	5.5
26-7	6.5	5.5	4.5	5.5
2302	7.0	6.0	5.0	5.0
2352	7.0	6.0	4.5	5.0
24-10	6.5	6.0	4.5	5.0
2747	7.5	5.5	4.5	5.0
25-1	6.5	6.0	5.0	5.0
Fiddlesticks	7.0	5.0	4.0	5.0
27-2	7.0	5.5	5.0	4.5
223	7.0	6.0	5.0	5.5
27-12	6.0	5.0	3.5	4.0
1120	7.0	6.0	4.5	4.0
Uganda	6.0	5.5	4.5	3.0
OKC 90-13	6.5	5.5	4.5	4.5
24-8	6.5	6.0	4.5	6.0
OKC 90-10	7.0	5.5	4.5	4.5
25-9	6.0	5.0	3.5	3.5
1202	7.0	6.0	5.0	5.0
3048	6.5	5.5	4.5	5.5
2306	7.5	6.0	5.5	6.0
1943	6.5	6.0	5.5	6.0
27-11	7.0	6.0	4.5	4.0
2570	7.5	5.5	4.5	6.0
798	7.0	6.0	5.0	4.5
18-10	6.5	5.5	4.0	4.0
21-2	6.5	6.0	6.0	5.5
OKC 90-14	6.0	6.0	5.5	6.0
21-4	7.0	6.0	4.5	5.0
2718	7.0	5.0	3.5	5.0
25-6	6.0	5.0	4.0	3.5
2107	7.0	6.0	5.0	4.5
2849	7.0	6.0	5.0	5.5
1946	7.0	5.5	4.5	4.0
2946	7.0	6.0	5.5	4.5
24-7	7.0	6.0	5.0	5.0
1264	6.5	6.0	5.0	5.5
Tifdwarf	2.5	3.0	3.0	4.0
Tifgreen	6.0	6.0	6.0	6.5
TifTW72	5.5	7.0	8.0	8.5
1228	6.5	6.0	5.0	4.0
LSD (0.05)	**1.3**	**1.1**	**1.4**	**1.7**

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

Table 14. Spring greenup ratings for African bermudagrass turf in the fertility study. Turfgrass Research Center, Stillwater, OK.

	----lbs/1000ft^2/yr----			Greenup
N	P_2O_2	K_2O	Micronutrients	4/10/96
3	0	0	0	5.3
3	3	0	0	4.7
3	0	3	0	5.7
3	0	0	4	6.0
3	3	3	0	5.3
3	3	0	4	5.7
3	0	3	4	5.3
3	3	3	4	5.0
6	0	0	0	6.3
6	3	0	0	6.0
6	0	3	0	5.3
6	0	0	4	5.7
6	3	3	0	5.7
6	3	0	4	6.7
6	0	3	4	5.7
6	3	3	4	6.0
12	0	0	0	7.0
12	3	0	0	6.7
12	0	3	0	6.7
12	0	0	4	6.3
12	3	3	0	6.3
12	3	0	4	6.3
12	0	3	4	6.7
12	3	3	4	7.0
LSD (0.05)				**1.2**

Ratings were on a scale of 1-9, with 9 being best.
Micronutrients supplied from Scotts Trace Element Package (STEP)

Table 15. Visual quality ratings for African bermudagrass turf in the fertility study. Turfgrass Research Center, Stillwater, OK.

----lbs/1000ft^2/yr----				Visual Quality			
N	P_2O_2	K_2O	Micronutrients	6/7/96	7/5/96	8/30/96	9/27/96
3	0	0	0	5.3	6.3	3.7	4.3
3	3	0	0	4.7	5.3	3.7	4.3
3	0	3	0	5.3	5.7	4.0	4.7
3	0	0	4	5.3	5.7	3.3	5.0
3	3	3	0	5.3	6.0	4.0	4.7
3	3	0	4	5.3	5.3	4.0	4.7
3	0	3	4	6.0	6.0	4.0	4.3
3	3	3	4	5.0	6.3	3.0	3.7
6	0	0	0	6.7	6.3	4.0	5.0
6	3	0	0	5.7	6.3	4.3	5.0
6	0	3	0	6.0	5.7	4.3	4.0
6	0	0	4	6.0	6.3	3.7	4.3
6	3	3	0	6.4	6.3	3.7	5.3
6	3	0	4	6.0	5.3	4.3	4.7
6	0	3	4	6.0	6.0	4.0	4.7
6	3	3	4	7.0	6.0	3.7	4.7
12	0	0	0	6.7	6.7	4.7	5.0
12	3	0	0	7.0	6.0	4.3	4.7
12	0	3	0	7.0	6.3	4.3	5.0
12	0	0	4	6.7	6.3	4.7	4.7
12	3	3	0	6.7	6.3	4.3	5.3
12	3	0	4	7.0	6.3	4.0	4.7
12	0	3	4	7.0	6.7	4.3	5.3
12	3	3	4	7.0	5.7	4.3	5.3
LSD (0.05)				**0.7**	**1.0**	**0.8**	**0.9**

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

Micronutrients supplied from Scotts Trace Element Package (STEP)

Table 16. Color ratings for African bermudagrass turf in the fertility study.
Turfgrass Research Center, Stillwater, OK.

----lbs/1000ft^2/yr----				Color			
N	P_2O_2	K_2O	Micronutrients	6/7/96	7/5/96	8/30/96	9/27/96
3	0	0	0	5.3	5.7	3.0	4.3
3	3	0	0	5.0	6.0	3.0	4.3
3	0	3	0	5.3	5.7	3.0	4.7
3	0	0	4	5.3	5.7	3.0	5.0
3	3	3	0	5.3	5.7	3.3	5.3
3	3	0	4	5.3	5.3	3.3	4.7
3	0	3	4	6.0	6.7	3.7	4.3
3	3	3	4	5.0	5.7	3.0	3.7
6	0	0	0	6.7	6.3	4.0	5.0
6	3	0	0	6.3	6.7	3.7	5.3
6	0	3	0	6.3	5.7	4.0	4.7
6	0	0	4	6.7	6.0	3.7	5.3
6	3	3	0	6.3	6.3	3.7	5.0
6	3	0	4	6.0	6.0	4.0	5.3
6	0	3	4	6.7	6.3	3.7	5.0
6	3	3	4	6.0	6.0	3.0	5.0
12	0	0	0	8.0	7.3	5.0	6.0
12	3	0	0	7.0	6.0	4.7	5.3
12	0	3	0	7.3	5.7	4.0	5.3
12	0	0	4	7.3	6.7	5.0	5.0
12	3	3	0	7.0	7.0	5.0	5.3
12	3	0	4	7.0	6.7	4.3	5.7
12	0	3	4	7.7	6.0	4.7	5.7
12	3	3	4	7.7	5.3	4.3	5.7
LSD (0.05)				**0.8**	**1.1**	**1.0**	**1.0**

Ratings were on a scale of 1-9, with 9 being best.
Micronutrients supplied from Scotts Trace Element Package (STEP)

Table 17. Density ratings for African bermudagrass turf in the fertility study. Turfgrass Research Center, Stillwater, OK.

----lbs/1000ft²/yr----				Density		
N	P_2O_2	K_2O	Micronutrients	6/7/96	7/5/96	8/30/96
3	0	0	0	5.0	5.7	3.7
3	3	0	0	4.0	6.0	3.7
3	0	3	0	4.7	5.7	4.0
3	0	0	4	4.3	5.7	3.3
3	3	3	0	5.0	5.7	3.7
3	3	0	4	4.7	5.3	4.0
3	0	3	4	5.0	6.7	3.7
3	3	3	4	5.3	5.7	3.3
6	0	0	0	5.7	6.3	4.0
6	3	0	0	4.7	6.7	4.0
6	0	3	0	5.3	5.7	4.0
6	0	0	4	5.7	6.0	3.3
6	3	3	0	5.0	6.3	3.7
6	3	0	4	5.0	6.0	4.0
6	0	3	4	5.3	6.3	4.0
6	3	3	4	5.7	6.0	3.7
12	0	0	0	5.3	7.3	4.0
12	3	0	0	6.7	6.0	4.0
12	0	3	0	6.3	5.7	3.7
12	0	0	4	7.0	6.7	4.0
12	3	3	0	5.7	7.0	3.3
12	3	0	4	6.0	6.7	3.7
12	0	3	4	6.3	6.0	3.7
12	3	3	4	6.3	5.3	3.3
LSD (0.05)				**1.2**	**1.1**	**0.7**

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

Micronutrients supplied from Scotts Trace Element Package (STEP)

Table 18. Fall color retention of African and Tifway bermudagrasses in the African bermudagrass tee/fairway study. Turfgrass Research Center, Stillwater, OK.

	Color Retention			
	10-27-95		11-10-95	
Genotype	Sand	Clay Loam	Sand	Clay Loam
2567	7.3	8.0	3.0	5.0
2747	7.7	8.0	3.0	5.0
Tifway	8.0	8.3	5.0	5.0
LSD (0.05)	**0.9**	**0.8**	**1.3**	**0.0**

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

Table 19. Spring greenup of African and Tifway bermudagrasses in the African bermudagrass tee/fairway study. Turfgrass Research Center, Stillwater, OK.

	Greenup					
	3-21-96		4-10-96		5-25-96	
Genotype	Sand	Clay Loam	Sand	Clay Loam	Sand	Clay Loam
2567	1.3	2.3	2.0	5.7	4.3	9.0
2747	1.0	2.7	1.3	6.0	2.3	8.7
Tifway	1.0	1.0	1.0	2.0	2.0	7.0
LSD (0.05)	**0.8**	**0.9**	**1.2**	**0.8**	**3.4**	**1.2**

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

Table 20. Visual quality and color of African and Tifway bermudagrasses in the African bermudagrass tee/fairway study. Turfgrass Research Center, Stillwater, OK.

	Visual Quality						Color	
	6/27/96	7/23/96	8/27/96		9/27/96		8/27/96	
Genotype	Clay Loam	Clay Loam	Clay Loam		Clay Loam		Clay Loam	
			High	Low	High	Low	High	Low
2567	6.7	7.0	7.3	6.7	8.3	7.3	7.3	6.7
2747	6.3	7.0	6.3	6.3	7.7	6.3	6.3	6.0
Tifway	7.3	7.0	6.3	6.0	8.3	8.0	7.0	6.7
LSD (0.05)	**0.8**	**0.0**	**1.3**	**1.3**	**0.8**	**0.8**	**1.2**	**1.5**

Ratings were on a scale of 1-9, with 9 being best.
High cutting height = 3/8 inch
Low cutting height = 3/4 inch

Table 21. Percent cover of African and Tifway bermudagrasses in the African bermudagrass tee/fairway study. Turfgrass Research Center, Stillwater, OK.

	Percent Cover			
	6/27/96	7/23/96	8/27/96	9/27/96
Genotype	Sand	Sand	Sand	Sand
2567	31.7	55.0	76.7	80.0
2747	8.3	18.3	30.0	43.3
Tifway	5.0	11.7	18.3	20.0
LSD (0.05)	**18.5**	**20.2**	**14.6**	**15.8**

Ratings were on a scale of 0 -100 percent.

Table 22. African bermudagrass phytoxicity in response to herbicide treatments applied on June 24, 96. Turfgrass Research Center, Stillwater, OK.

		African bermudagrass phytoxicity Days after Treatment					
Herbicide	Rate (lb ai/A)	7	14	21	35	49	56
Dithiopyr	0.50	1.0	1.0	1.3	1.3	1.0	1.0
Dithiopyr	1.00	2.0	3.0	3.3	2.3	1.0	1.0
MSMA	2.00	1.0	1.0	1.0	1.0	1.0	1.0
MSMA	4.00	1.0	1.0	1.0	1.0	1.0	1.0
Dichlofop	1.00	1.0	1.0	1.0	1.0	1.0	1.0
Dichlofop	2.00	1.0	1.0	1.7	1.0	1.3	1.0
Prodiamine	1.50	1.0	1.0	1.7	1.0	1.0	1.0
Prodiamine	3.00	1.0	1.0	1.0	2.3	1.3	1.0
2,4-D+	0.60	1.7	1.3	1.3	1.3	1.3	1.0
MCPP+	0.30						
Dicamba	0.06						
2,4-D+	1.20	4.7	1.7	2.3	1.3	1.0	1.0
MCPP+	0.60						
Dicamba	0.12						
Triclopyr Ester	0.50	5.3	3.7	2.3	1.3	1.0	1.0
Triclopyr Ester	1.00	7.7	7.0	5.7	5.3	2.0	1.0
Halosulfuron	0.03	1.0	1.0	1.3	1.0	1.0	1.0
Halosulfuron	0.06	1.0	1.0	1.3	1.0	1.0	1.0
Bensulide+	6.00	1.0	1.3	1.3	1.0	1.0	1.0
Oxadiazon	1.50						
Bensulide+	12.00	1.0	1.0	1.0	1.0	1.0	1.0
Oxadiazon	3.00						
Oxadiazon	3.00	1.0	1.7	2.3	2.7	2.0	3.0
Oxadiazon	4.00	1.0	1.7	3.3	3.7	3.0	3.3
Control		1.0	1.0	1.0	1.0	1.0	1.0
LSD (0.05)		**1.0**	**0.7**	**1.4**	**1.2**	**0.8**	**0.9**

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

Table 23. African bermudagrass root dry mass measurements taken 53 days after herbicide treatments were applied on June 24, 1996. Turfgrass Research Center, Stillwater, OK.

Herbicide	Rate (lb ai/A)	Root Dry Mass (g)
Dithiopyr	0.50	0.042
Dithiopyr	1.00	0.037
MSMA	2.00	0.040
MSMA	4.00	0.044
Dichlofop	1.00	0.045
Dichlofop	2.00	0.040
Prodiamine	1.50	0.040
Prodiamine	3.00	0.032
2,4-D+	0.60	0.041
MCPP+	0.30	
Dicamba	0.06	
2,4-D+	1.20	0.051
MCPP+	0.60	
Dicamba	0.12	
Triclopyr Ester	0.50	0.053
Triclopyr Ester	1.00	0.042
Halosulfuron	0.03	0.056
Halosulfuron	0.06	0.040
Bensulide+	6.00	0.047
Oxadiazon	1.50	
Bensulide+	12.00	0.037
Oxadiazon	3.00	
Oxadiazon	3.00	0.035
Oxadiazon	4.00	0.042
Control		0.038
LSD (0.05)		**0.021**

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.