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Turf Performance of Seeded Bermudagrass Cultivars in Mississippi

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Introduction

The number of seeded turf bermudagrass cultivars has increased enormously in the last decade. Common bermudagrass [*Cynodon dactylon* (L.) Pers.] seed produced in Arizona and California has been marketed for many years for use as turf and pasture. Although millions of pounds of seed were sold, little breeding work was done to improve the turf performance. 'Guymon' (Taliaferro et al. 1983), released in 1982 from the Oklahoma Agricultural Experiment Station, is a general-purpose cultivar used for pasture and erosion control. The first true turf cultivar, 'NuMex Sahara,' was released from the New Mexico Agricultural Experiment Station in 1987 (Baltensperger 1989). Breeders had begun selection for fine leaf texture, high turf density, and enhanced winter survival. In the National Bermudagrass Test-1992, improved cultivars such as NuMex Sahara, 'Sonesta' (Baltensperger and Meier 1993), 'Mirage,' 'Jackpot' (Samudio and Brede 1997), 'Sultan,' 'Cheyenne' (Samudio and Brede 1998), 'Sundevil' (Samudio and Brede 1998), and 'Primavera' (Alderson and Sharpe 1994) performed better than Arizona Common at some locations (Morris 1997). At Mississippi State University under weekly mowing at 2-inch height, these cultivars displayed only slight improvements in leaf texture and overall turf quality over Arizona Common. By 1995, breeders and seed company personnel were no longer satisfied to exceed the performance of Arizona Common. They were ready to bring seeded bermudagrass into higher maintenance areas, including golf course fairways and sports fields — areas that are most often planted with vegetative cultivars.

'Tifway' [*C. dactylon* (L.) Pers. x C. transvaalensis (Burtt-Davy)] (Burton 1966) is the most widely used bermudagrass cultivar on golf fairways and tees, sports fields, and other high-traffic areas. Tifway is a sterile, vegetative cultivar that produces high-density, fine-textured, wear-resistant turf. The consistency and dependability of a single genotype coupled with refinements and success of vegetative planting techniques have allowed Tifway to set the standard for bermudagrass turf. The goal of breeders is to achieve the performance of Tifway with a seeded bermudagrass cultivar.

One problem associated with Arizona Common has been the difficulty in producing harvestable sod from bermudagrass seed. While Tifway often allows two or three harvests in

one season, the sod of Arizona Common may not knit closely enough to achieve the shear strength required for handling during harvest and transplant. The objective of this study was to compare the turf performance of seeded bermudagrass cultivars and Tifway under high-maintenance conditions similar to that of a golf course fairway or sports field.

The number of seeded turf bermudagrass cultivars has increased enormously in the last decade. Common bermudagrass [*Cynodon dactylon* (L.) Pers.] seed produced in Arizona and California has been marketed for many years for use as turf and pasture. Although millions of pounds of seed were sold, little breeding work was done to improve the turf performance. 'Guymon' (Taliaferro et al. 1983), released in 1982 from the Oklahoma Agricultural Experiment Station, is a general-purpose cultivar used for pasture and erosion control. The first true turf cultivar, 'NuMex Sahara,' was released from the New Mexico Agricultural Experiment Station in 1987 (Baltensperger 1989). Breeders had begun selection for fine leaf texture, high turf density, and enhanced winter survival. In the National Bermudagrass Test-1992, improved cultivars such as NuMex Sahara, 'Sonesta' (Baltensperger and Meier 1993), 'Mirage,' 'Jackpot' (Samudio and Brede 1997), 'Sultan,' 'Cheyenne' (Samudio and Brede 1998), 'Sundevil' (Samudio and Brede 1998), and 'Primavera' (Alderson and Sharpe 1994) performed better than Arizona Common at some locations (Morris 1997). At Mississippi State University under weekly mowing at 2-inch height, these cultivars displayed only slight improvements in leaf texture and overall turf quality over Arizona Common. By 1995, breeders and seed company personnel were no longer satisfied to exceed the performance of Arizona Common. They were ready to bring seeded bermudagrass into higher maintenance areas, including golf course fairways and sports fields — areas that are most often planted with vegetative cultivars.

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Materials and Methods

A seeded bermudagrass variety test was established at the Mississippi State University Plant Science Research Center in a randomized complete block design with three replications. The soil type was a Marietta fine sandy loam (fine-loamy, siliceous, Fluvaquentic Eutrochrept) with a pH of 6.6. The site was tilled and fumigated with methyl bromide before planting. Fourteen seeded varieties were planted on June 22, 1995 **(Table 1)**. Hulled seeds were planted at 1.5 pounds per 1,000 square feet. Plot size was 8x9 feet. Tifway plots

Table 1. Seeded turf bermudagrass cultivars evaluated at Mississippi State University in 1995-1998.

Cultivar	Experimental designation	Source	Years evaluated
Solei	ED1	Cascade International Seed Co.	1995-98
Solei	MD2	Cascade International Seed Co.	1995-98
Solei	ED5	Cascade	1996-98

were planted 3 weeks later from 2-inch plugs planted on 1-foot centers to avoid contamination by seed movement.

After severe winter kill in 1995-96, the seeded cultivars required replanting. The few surviving plants were killed by glyphosate to allow establishment from seed only. The seeded cultivars **(Table 1)** were reseeded on June 25, 1996. Tifway plots recovered adequately without replanting.

		International Seed Co.	
Blue-muda	DSM-200	Desert Sun Marketing	1995-98
Pyramid	CD 90183	International Seeds, Inc.	1995-98
Mirage	CD 90173	International Seeds, Inc.	1996-98
Sundance	B14	Lesco	1995-98
Sunstar	B618	Lesco	1995-98
Del Sol	B26-14	Turf Merchants, Inc.	1995-98
Sundevil II		Medalist of America	1995
Sultan	FMC-6	Seeds West, Inc.	1995-98
Princess	FMC-77	Seeds West, Inc.	1995-98
NuMex Sahara	NMS-1	Seeds West, Inc.	1995-98
Arizona Common		Seeds West, Inc.	1995-98
Sonesta	NMS-3	O.M. Scott & Sons Company	1995
Savannah	PST-R64	Pure Seed Testing, Inc.	1996-98
Guymon	GX59	Johnston Seed Company	1995-98

Plots were mowed three times weekly at a height of 0.75 inch during each growing season, using a triplex reel mower. Nitrogen was applied at the rate of 1 pound per 1,000 square feet per growing month throughout the experiment. Ammonium nitrate was the N source except at the dates of planting and spring green-up each year, when 13-13-13 was applied.

Plots were rated for seedling vigor in 1995 and 1996, 20 days after each seeding and before mowing, using a visual rating scale of 1-9. A rating of 9 represented the highest vigor, and 1 represented the lowest. This estimate included germination and seedling growth rate during establishment. Percent winter survival of each plot was estimated in May 1996. After milder winters in 1997 and 1998, plots were rated on a 1-9 scale for spring green-up. This rating indicates the rate at which the cultivars break winter dormancy and begin spring growth. A rating of 9 represented complete green-up, and 1 represented complete dormancy.

Turf quality ratings included several components such as uniformity, density, texture, color, and the presence or absence of seedheads. Quality ratings were done twice each month throughout each growing season, using a visual rating scale of 1-9. The highest turf quality was rated 9, while 1 was the poorest. Visual ratings of shoot density and leaf texture were each conducted individually three times during each growing season. A rating of 9 indicated high shoot density or fine leaf texture. A rating of 1 indicated low shoot density or coarse leaf

texture.

Rhizome density was measured near the end (October or November) of each growing season. Three plugs (2.2 inches in diameter, 2.5 inches thick) were taken randomly from each plot. Shoots were removed with scissors to the soil level. Below-ground portions were washed free of soil, then oven dried for 48 hours at 70oC. Roots were removed and stems were weighed. Dry weights were divided by the volume of the soil samples to arrive at the rhizome density.

Sod strength was evaluated on August 10, 1998, using a stretching device designed to measure the amount of peak force required to shear a sod strip (Goatley et al. 1997). Three 24-inch-long sod strips were sampled from each plot, using an 18-inch-wide sod harvester set at 0.5-inch soil depth. Data were subjected to analysis of variance, and means were separated by least significant difference (LSD).

Seedling Vigor

Because of their rapid upright growth, Arizona Common, NuMex Sahara, and 'Blue-muda' were among the cultivars displaying the highest seedling vigor in each planting **(Table 2)**. Low-growing cultivars, including 'Princess,' 'Sundance,' and 'Savannah' (Fraser and Rose-Fricker 1998), displayed lower seedling vigor. This feature could be important for applications that require rapid establishment or soil stabilization. Seeded bermudagrass has been well known for easy establishment due to rapid germination and growth. Compared with past experience with other warm-season species, none of the cultivars evaluated had unacceptable seedling vigor.

Table 2. Seedling vigor of seeded bermudagrass cultivars evaluated at Mississippi State University.1

Cultivar	1995	1996
Arizona Common	7.7	8.0
NuMex Sahara	8.3	7.0
Mirage	—	7.7
Blue-muda	7.3	7.0
Pyramid	7.7	6.3
MD2	6.0	7.7
Sonesta	6.7	—
Del Sol	7.7	5.0
Sultan	6.3	5.7
Sundevil II	6.0	—
Sundance	5.7	6.3
Solei	5.7	5.7
Sunstar	5.7	5.7
Princess	4.7	6.3
ED5	—	5.3
Guymon	5.3	4.7
Savannah	—	5.0
Mean	**6.5**	**6.2**
LSD(0.05)	**1.4**	**1.7**

1Seedling vigor is based on a 1-9 visual scale: 1 = low, 9 = high.

Winter Survival

During the 1995-1996 winter in Mississippi, bermudagrass cultivars suffered severe injury. Tifway displayed higher survival than any seeded cultivar **(Table 3)**. Among seeded cultivars, Guymon averaged almost 17% survival, while other cultivars displayed only 0-3% survival. After reseeding with most of the same cultivars in June 1996, only minimal

Table 3. Winter survival of seeded bermudagrass cultivars at Mississippi State University in spring 1996.

Cultivar	% Survival
Tifway	55.0
Guymon	16.7
Sundevil II	2.3

winter kill was observed in spring of the two following years.

MD2	1.7
Princess	1.0
Pyramid	1.0
Del Sol	1.0
Solei	0.7
Sultan	0.7
Blue-muda	0.3
Sundance	0.3
NuMex Sahara	0.3
Sonesta	0.0
Arizona Common	0.0
Mean	**4.5**
LSD(0.05)	**15.8**

Spring Green-up

There were significant differences among cultivars in the rate of spring green-up in 1997 and 1998 **(Table 4)**. There was a significant cultivar-by-year interaction. In 1997, Guymon displayed the earliest green-up, while Tifway and Arizona Common ranked near the bottom. In 1998, Tifway displayed early green-up, while Guymon ranked near the bottom with Arizona Common. Savannah displayed improved spring green-up over NuMex Sahara and Arizona Common in both years of rating. Because each winter is different, several years of evaluation are needed to rank the spring green-up tendency of these cultivars properly.

Table 4. Spring green-up of seeded bermudagrass cultivars and Tifway evaluated at Mississippi State University.1

Cultivar	1997	1998
Savannah	5.0	6.7
ED5	6.0	5.7
Guymon	6.3	4.7
Del Sol	4.7	5.3
Sunstar	4.3	5.7
Tifway	3.3	6.3
Sundance	4.0	5.7
Solei	4.3	5.3
Pyramid	4.0	5.3
Mirage	3.3	6.0
Sultan	4.0	5.3
Princess	3.7	5.3
Blue-muda	3.3	5.3
NuMex Sahara	3.0	5.3
Arizona Common	3.0	5.0
MD2	3.0	5.0
Mean	**4.1**	**5.5**
LSD(0.05)	**1.3**	**0.9**

1Spring green-up is based on a 1- 9 visual scale: 1 = dormant, 9 = completely green.

Turf Quality

Seeded cultivars displayed significant differences in turf quality during each year of evaluation **(Table 5)**. There was a significant cultivar-by-year interaction. Princess, Sundance, and Savannah maintained the highest quality scores. ‘Sunstar,’ ‘Sultan,’ ‘Del Sol,’ ‘Solei,’ ‘Mirage,’ ‘Pyramid,’ and MD2

Table 5. Turf quality of seeded bermudagrass cultivars and Tifway evaluated at Mississippi State University.1

Cultivar	1995	1996	1997	1998
Tifway	7.6	7.7	7.7	7.9
Princess	6.4	6.9	6.7	6.9
Sundance	6.5	6.8	6.7	6.9

achieved significantly higher quality than Arizona Common in at least 3 out of 4 years. None of the seeded cultivars achieved the turf quality of Tifway.

Savannah	—	6.4	6.3	6.5
Sundevil II	6.2	—	—	—
Sunstar	5.8	6.2	5.6	6.1
Sultan	6.0	6.0	5.7	5.9
Sonesta	5.8	—	—	—
Del Sol	5.7	5.8	5.4	5.5
Solei	5.8	5.7	5.4	5.2
Mirage	—	5.8	5.3	5.5
MD2	5.8	5.7	5.1	5.0
Pyramid	6.0	5.5	4.9	5.6
ED5	—	5.0	5.3	5.4
NuMex Sahara	5.0	5.8	4.7	4.9
Blue-muda	5.2	5.3	4.4	5.0
Arizona Common	5.0	5.0	4.5	5.0
Guymon	4.7	3.3	3.9	4.0
Mean	**5.8**	**5.8**	**5.5**	**5.7**
LSD(0.05)	**0.4**	**0.5**	**0.5**	**0.2**

1Turf quality based on a visual 1-9 scale: 9 = excellent, 1 = poor.

Shoot Density

Seeded cultivars differed significantly in shoot density during each growing season **(Table 6)**. Genotype-by-year interaction was significant. Seeded cultivars receiving the highest density ratings were Princess, Sundance, and Savannah. Sultan, Sunstar, Mirage, Pyramid, Del Sol, Solei, and MD2 were significantly denser than Arizona Common in at least 3 years. Density of Tifway was significantly greater than that of any seeded cultivar.

Table 6. Shoot density of seeded bermudagrass cultivars and Tifway evaluated at Mississippi State University.1

Cultivar	**1995**	**1996**	**1997**	**1998**
Tifway	—	8.3	8.7	8.0
Princess	7.0	7.3	7.7	7.0
Sundance	7.0	6.8	7.7	7.0
Savannah	—	6.8	7.1	6.8
Sundevil II	6.8	—	—	—
Sunstar	6.3	6.0	6.4	6.4
Sonesta	6.3	—	—	—
Sultan	6.7	5.8	6.6	6.1
Mirage	—	6.0	6.3	5.8
Pyramid	6.5	5.7	5.9	5.8
Del Sol	6.2	5.8	5.8	5.8
Solei	6.2	5.7	6.2	5.4
MD2	6.2	5.8	5.9	4.9
ED5	—	4.3	6.0	5.8
NuMex Sahara	5.8	5.7	5.3	5.0
Blue-muda	5.5	4.8	5.3	4.9
Arizona Common	5.2	4.8	5.0	4.8
Guymon	3.3	3.0	4.0	4.0
Mean	**6.1**	**5.8**	**6.2**	**5.8**
LSD(0.05)	**0.8**	**0.8**	**0.6**	**0.5**

1Shoot density is based on a 1-9 scale: 9 =

highest density, 1 = lowest.

Leaf Texture

Significant differences in leaf texture ratings occurred each year **(Table 7)**. Cultivar-by-year interaction was significant. Princess, Sundance, and Savannah displayed the finest leaf texture among seeded cultivars. Sultan, Del Sol, Sunstar, Solei, Pyramid, and Mirage were also significantly finer than Arizona Common in at least 3 years. Tifway was significantly finer than any seeded cultivar. Guymon bermudagrass had the coarsest leaf texture in this experiment, followed by ED5.

Table 7. Leaf texture of seeded bermudagrass cultivars and Tifway evaluated at Mississippi State University.1

Cultivar	1995	1996	1997	1998
Tifway	8.0	8.5	9.0	8.0
Princess	6.5	6.7	7.4	7.0
Sundance	6.5	6.3	7.3	7.0
Savannah	—	6.5	6.9	6.7
Sundevil II	6.3	—	—	—
Sultan	6.3	5.8	6.3	6.0
Sonesta	6.0	—	—	—
Del Sol	6.0	6.0	5.9	5.8
Sunstar	5.8	5.5	6.0	6.1
Solei	6.3	5.8	5.7	5.4
Pyramid	6.2	5.7	5.7	5.7
Mirage	—	5.8	5.8	5.4
MD2	6.0	5.7	5.2	4.7
NuMex Sahara	5.8	5.5	5.1	4.8
Blue-muda	5.8	5.2	5.0	4.9
Arizona Common	5.2	5.0	4.8	4.6
ED5	—	4.5	4.6	4.4
Guymon	3.7	3.2	3.7	3.3
Mean	**6.0**	**5.7**	**5.9**	**5.6**
LSD(0.05)	**0.3**	**0.6**	**0.5**	**0.5**

1Leaf texture is based on a 1-9 scale: 1 = coarse, 9 = fine.

Rhizome Density

Rhizome density measurements revealed significant differences among bermudagrass cultivars each year **(Table 8)**. When averaged across the three measurements, the rhizome density of Savannah and Guymon was significantly higher than Arizona Common. Tifway produced more rhizomes than any seeded cultivar in all measurements. Rhizome density averaged across all cultivars increased significantly with each year from 1996 to 1998. In this experiment no attempt was made to determine if the rhizomes were viable. Since rhizome density of most seeded cultivars was not significantly different from Arizona Common, it is clear that improvement is still needed in this area.

Table 8. Rhizome density of seeded bermudagrass cultivars and Tifway evaluated at Mississippi State University.

Cultivar	October	November	November	1996-98
1996	**1997**	**1998**		
mg/cm3	*mg/cm3*	*mg/cm3*	*mg/cm3*	
Tifway	5.9	8.7	10.6	8.4
Savannah	2.2	4.7	9.0	5.3
Guymon	4.3	5.3	5.6	5.1
Solei	3.7	4.1	6.5	4.7
Mirage	2.5	4.8	6.5	4.6
Sundance	3.0	5.1	6.2	4.4
Pyramid	2.6	3.1	7.3	4.3
ED5	3.2	4.0	5.7	4.3
Sunstar	3.2	3.5	5.2	4.3
Arizona common	2.2	3.8	4.8	3.6

Sultan	2.0	3.1	5.5	3.5
Del Sol	2.2	3.3	5.0	3.5
Blue-muda	1.9	4.3	4.2	3.5
MD2	1.7	3.2	5.5	3.5
NuMex Sahara	2.2	3.5	4.5	3.4
Princess	1.7	2.6	4.5	2.9
Mean	**2.8**	**4.2**	**6.0**	**4.3**
LSD(0.05)	**1.2**	**1.9**	**2.7**	**1.1**

Sod Strength

Mean sod strength of bermudagrass cultivars in this experiment ranged from 25 to 91 pounds**(Table 9)**. Tifway produced stronger sod than all seeded cultivars. Seeded cultivars with mean sod strength of more than 40 pounds could be successfully harvested and handled. These included Sunstar, Princess, Sundance, Savannah, Sultan, and Blue-muda. These same cultivars, except Blue-muda, received the highest shoot density, leaf texture, and turf quality ratings.

Table 9. Sod strength of seeded bermudagrass cultivars and Tifway measured at Mississippi State University in 1998.

Cultivar	**Sod Strength**
lb	
Tifway	91.6
Sunstar	60.2
Princess	47.7
Sundance	44.2
Savannah	42.7
Sultan	41.2
Blue-muda	40.7
Del Sol	36.3
ED5	34.6
Pyramid	34.6
Guymon	33.3
NuMex Sahara	28.9
Solei	28.2
MD2	27.6
Arizona Common	26.8
Mirage	25.0
Mean	**40.2**
LSD (0.05)	**16.5**

Conclusion

New seeded bermudagrass cultivars offer improvements in shoot density, leaf texture, and turf quality. Lower and more prostrate growth habit enables these new cultivars to perform better at lower mowing heights than Arizona Common. Based upon consistent turf quality in this experiment, Princess, Sundance, Savannah, Sunstar, and Sultan exhibited the best performance. These cultivars may be used in higher maintenance turf areas, including golf course fairways and sports fields. In regions of Mississippi where there is potential for winter injury, survival may be unacceptable in the establishment year. Seeding no later than early summer may increase the chances of success. Late seeding combined with low mowing height resulted in poor winter survival during the establishment year in this experiment in 1996. Rhizome density is a measurable trait for which there has been no direct selection in seeded bermudagrass in the past. Increasing rhizome density would add greater potential for recovery when the turf surface is removed or injured by scalping, wear, disease, and other

factors. Rhizomes have been shown to contribute to winter survival and sod strength of bermudagrass. After commercial sod harvest of vegetatively planted bermudagrass cultivars, regeneration either requires resprigging or relies on regrowth from rhizomes. Seeded cultivars that can be harvested give sod producers new options for establishing sod fields. The future looks promising for seeded bermudagrass. Although seeded cultivars have not met the performance of Tifway, much progress has been made in the past decade.

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