Figure 1. 'Windbreaker' big sacaton biomass study being harvested at the Los Lunas Plant Materials Center. Photo by Gregory A Fenchel

'WINDBREAKER' CULTIVAR BIG SACATON

A FOUNDATION CLASS OF CERTIFIED SEED

Danny G Goodson, Gregory A Fenchel, and David R Dreesen

ABSTRACT

A cultivar of big sacaton (*Sporobolus wrightii* Munro ex Scribn. [Poaceae]) has been released for use in the southwestern US. 'Windbreaker' big sacaton, a native, warm-season, perennial bunchgrass is an important native forage grass species for livestock and wildlife. The increased height, width, and amount of forage found in 'Windbreaker' makes it an ideal conservation plant for use in erosion protection, windbreak plantings, improvement of wildlife habitat, bioenergy production, and providing forage production on grazing lands.

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KEY WORDS

Sporobolus wrightii, southwestern United States, windbreak, xeric landscape plant, Poaceae

NOMENCLATURE

Plants: USDA NRCS (2011)
Major Land Resource Areas (MLRA): USDA NRCS (2006)
Animals: ITIS (2011)

CONVERSIONS

1 mm = 0.04 in
1 cm = 2.54 in
1 m = 3.28 ft
1 ha = 2.47 ac
kg/ha * 0.89 = lb/ac

Species | *Sporobolus wrightii* Munro ex Scribn. (Poaceae)
Common name | big sacaton
Accession number | 9066790

The USDA Natural Resources Conservation Service announces the naming and release of 'Windbreaker' big sacaton for use in the southwestern US.

JUSTIFICATION

'Windbreaker' big sacaton (*Sporobolus wrightii* Munro ex Scribn. [Poaceae]) is released as a foundation class of certified seed from the USDA Natural Resources Conservation Service (NRCS) and in cooperation with the New Mexico State University located in Las Cruces. This cultivar release is justified primarily because it can alleviate conservation concerns, allowing ecosystems to stabilize from the effects of erosion processes found in its area of adaption. Propagation of this species is needed to increase its availability to the commercial industry in the southwestern US. There is a high potential for immediate use of this species. This cultivar will be an essential tool for conservationists in the protection of several different land uses.

COLLECTION SITE INFORMATION

'Windbreaker' big sacaton is a synthetic cultivar of the 10 most robust phenotypes from a collection of more than 700 plants of 37 collections. These collections were made by NRCS field personnel from native stands on dry plains, hills, bottom lands, and alluvial fans that are subject to flooding from elevations of 1158 to 1829 m in New Mexico, Texas, and Arizona (Table 1).

DESCRIPTION

Big sacaton is a native, robust, perennial, warm-season bunchgrass (Gould 1975, 1977; Allred 1997). It has large dense tufts; the culms are erect and firm. Big sacaton is 1 to 2 m tall with sheaths sparsely pilose at the throat, pilose ligules, and elongated flat blades that are 3 to 6 mm wide and involute at drying. The panicles are 30 to 60 cm long and are pale, narrow, and open. Branches are crowded, straight, and stiffly ascending with appressed branchlets. The spikelets are 2 to 2.5 mm long with the first glume about a third as long as the spikelet (Hitchcock 1971).

Big sacaton is found growing throughout the southwestern US and typically occurs on low, alluvial flats and flood plains. In New Mexico its occurrence is widespread on dry plains and hills, with flowering taking place from June to August (Martin and Hutchins 1980). Big sacaton is useful for hay and makes good forage for grazing when green foliage is young and healthy (Hitchcock 1971).

METHOD OF SELECTION

'Windbreaker' big sacaton was developed from seed collections made in 37 distinct locations in Arizona, New Mexico, and Texas. These accessions were planted during 1981 into a nonreplicated initial evaluation planting at the USDA NRCS Los Lunas Plant Materials Center in Los Lunas, New Mexico. Each plot consisted of 2 rows of 10 plants spaced on 1-m centers. Evaluations of the initial planting were done each growing sea-

TABLE 1

Collection site information for the 10 selected accessions of big sacaton.

Accession number	County and (or) State	Elevation (m)	MLRA	Collector
9022264	Socorro, New Mexico	1280	42	R Farmer
9022272	Sierra, New Mexico	1280	70	JD Allen
9022273	Dona Ana, New Mexico	1167	42	EH Fuchs
9022335	Guadalupe, New Mexico	1411	70	D Abercrombie
9022339	Lincoln, New Mexico	1585	70	J Anderson
PI 434453	Texas	—	—	Unknown
9022447	Lincoln, New Mexico	1829	39	J Anderson
9022340	Socorro, New Mexico	1737	70	J Anderson
9029401	Arizona	—	—	Unknown
9022352	De Baca, New Mexico	1219	70	R Appel

son, and by the end of the third growing season, the height of the leaf blades of mature plants averaged 1.17 m and the width averaged 0.8 m. The 10 accessions with the most robust plants were identified in 1992 after several annual evaluations. The largest plant from each of the 10 accessions was selected for additional evaluation. These 10 plants displayed an average leaf height of 1.28 m and an average plant width of 0.75 m. The selected plants were approximately 9% taller than the mean height of the plants in the initial evaluation planting.

Clone transplants were then produced from the rootstock of the 10 selected plants. In 1996, these clones were outplanted into a 3-row, 3-replicated hybrid cross planting to assess the general combining ability of the parents for F1 hybrids. The 10 plant selections (considered female) occupied the center row with the 2 outside rows containing the accession PI-434453, which was randomly selected as the male tester. Plants were spaced on 1.8-m centers. In 1998, seed was harvested by accession from only the center row by the second growing season. The half-sib seed of each accession was kept separate. F1 progeny seedlings were produced from this seed, and clonal transplants were produced from root cuttings.

In 1999, progeny seedlings and clonal transplants of the 10 parent plants were outplanted in a semi-random complete block in 8 replicated rows, with parent and progeny plants alternating in position but not paired by lineage. This design gave a total of 160 plants that included 16 of each lineage with 8 clonal parents and 8 progeny from seed. Plants were maintained with irrigation, fertilization, and weed control.

In 2005 and 2006, the plants were evaluated for hybrid effect and long-term vigor based on leaf height and plant width. No significant difference (alpha 0.05) was observed between parent (clones) and half-sib progeny (seedlings) or lineage for each response variable tested. Leaf height of clonal and progeny plants averaged 1.32 and 1.33 m, respectively. The width of clonal and progeny plants averaged 0.80 and 0.78 m, respectively. F1 half-sib (hybrid) plants did not show hybrid depression (less beneficial effects), which supports the use of these parent plants to produce vigorous progeny from seed.

ECOLOGICAL CONSIDERATION

'Windbreaker' big sacaton is a selection of naturally occurring native grass species. Based on the guidelines adopted by the USDA NRCS Plant Materials Program, 'Windbreaker' did not meet the assessment of a plant that would become invasive. 'Windbreaker' big sacaton was determined to be "OK to release" when evaluated by the Worksheet for Conducting an Environmental Evaluation of NRCS Plant Releases.

ANTICIPATED CONSERVATION USE

The potential conservation use of 'Windbreaker' big sacaton includes

- erosion control,
- forage for livestock and wildlife,
- wildlife cover,
- xeric landscape plant, and
- hay mulch for critical area seeding.

Field evaluations began in 1999 with the installation of windstrip plantings to protect valuable cropland from wind erosion. Such erosion has been identified as a critical need by New Mexico NRCS field offices in Deming, Tucumcari, Grants, Tatum, and Hobbs. These NRCS field offices arranged field planting locations on cooperators' farms and at local public facilities and assisted in the evaluations. Their assistance and interest in 'Windbreaker' has been paramount in the development of this release. 'Windbreaker' has also been used successfully for noise barriers and natural fencing.

Big sacaton forage quality is highest in the spring, but it becomes coarse and tough at maturity (Gay and Dwyer 1965). The crude protein content of new growth from defoliated plants in south Texas in the spring averaged between 12 and 13%; digestibility decreased from 50 to 60% in the spring to between 35 and 40% by late winter (Haferkamp 1982). Therefore, areas where big sacaton dominates are best grazed in the spring. Gay and Dwyer (1965) conclude that unpalatable material is readily removed by burning every 3 or 4 y during early spring. Hot, early summer fires have, however, killed big sacaton in southeastern Arizona (Bock and Bock 1978; Bock and Bock 1986).

Big sacaton stands provide cover for wildlife and cattle in summer (Bock and Bock 1978; Cox and others 1989). In Arizona, big sacaton provides cover for Botteri's sparrow (*Aimophila botterii* [Emberizidae]) and other passerines, collared peccaries (Tayassuidae), and many other rodents (Bock and Bock 1978, 1990). Botteri's sparrow reaches maximum densities in big sacaton grasslands (Bock and Bock 1990), while windstrips are common roosting locations for ring-necked pheasants (*Phasianus colchicus* [Phasianidae]) at the Los Lunas Plant Materials Center. To attract wildlife, plantings have been used successfully on the corners of pivot irrigation systems in eastern New Mexico.

Big sacaton has been described by native landscapers as spectacular when the stiff, towering seed stalks push up through the arching upright leaves in late summer. Although a xeric plant, it will grow most vigorously with bimonthly deep watering when rain is scarce. Plant nurseries generally recommend cutting back the grass to 30 cm in early spring.

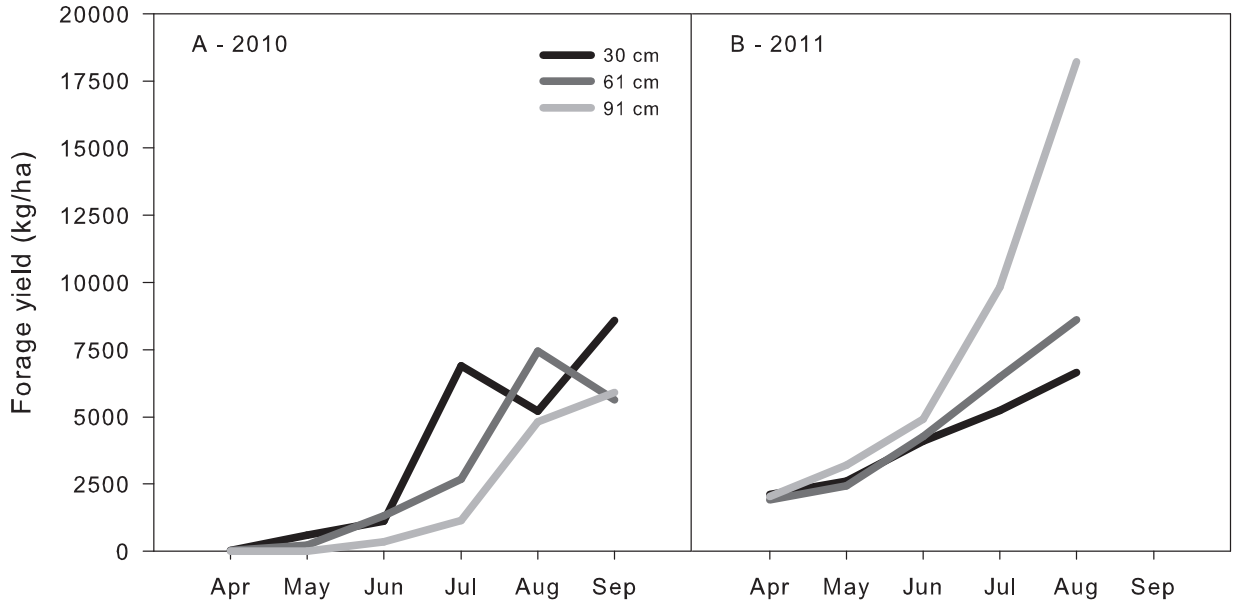

Figure 2. Forage yield (aboveground biomass) of 'Windbreaker' big sacaton as affected by in-row plant spacing of 30, 61, and 91 cm during the first (A [2010]) and second (B [2011]) growing season at Los Lunas Plant Materials Center.

Big sacaton hay provides excellent soil-surface mulch for summer dryland seeding of warm-season grasses in the arid southwest. The relatively thick, long leaves and stems easily crimp (anchor) into the soil surface, and generally without cutting, unlike grains and other short- and medium-height grass species. When the grass is cut in the crimping process, it becomes poorly anchored and generally becomes dislodged and is blown away by moderate winds. Leaves and stems of big sacaton degrade at a much slower rate than does grain straw, making it the preferred hay mulch in studies at the Los Lunas Plant Materials Center (Figure 1).

A biomass production study using 'Windbreaker' was initiated in 2010. Three 0.2-ha fields were established at the Los Lunas Plant Materials Center using a spacing of 30, 61, and 91 cm between plants and 1 m on center between the rows. These plantings were irrigated with 7.5 cm of surface-flooding water 6 times during the 220 d growing season. Forage samples have been clipped monthly to help determine if plant density affects forage production. Biomass production (oven dry) at the conclusion of the first growing season for the 30-, 61-, and 91-cm spaced plants averaged 8584, 5637, 5892 kg/ha, respectively (Figure 2A). During the second growing season, the 91-cm spacing had the highest yield of 18,047 kg/ha while the 61-cm and 30-cm spacing had yields of 7598 and 5446 kg/ha, respectively (Figure 2B).

ANTICIPATED AREA OF ADAPTATION

'Windbreaker' big sacaton is found growing throughout the southwestern US (Figure 3), typically occurring on low, alluvial flats and flood plains. It can grow in sandy, loamy, and heavy soils, but the soils need to be drained. Big sacaton also grows well in acid, neutral, basic, and saline soils; however, it cannot grow in dense shade. 'Windbreaker' has been tested (Table 2) and recommended for use in Major Land Resource Areas 35, 36, 42, 51, 70, and 77 at elevations ranging from 1158 to 1829 m.

When plantings were irrigated, the survival rate of 'Windbreaker' averaged 95%. Biomass production is greatly reduced at higher-elevation locations (> 1829 m) because of shallow soils, a shorter growing season, and cooler temperatures. 'Windbreaker' may also be frost-killed at elevations > 1829 m.

Supplemental water is generally necessary to establish and maintain 'Windbreaker' windstrip plantings for growth that is adequate to achieve maximum performance. Seedling transplants are preferred over seeding for windstrip plantings. Separate individual plants at a minimum of 1-m on center to acquire maximum height. Nonirrigated plantings may be installed if 1) supplemental irrigation is applied during the establishment period; 2) the planting design allows for rainfall harvesting; and 3) a minimum of 356 mm of annual precipitation occurs (piñon pine vegetation zone).

Figure 3. 'Windbreaker' big sacaton seed production field at the Los Lunas Plant Materials Center. Photo by Danny G Goodson

AVAILABILITY OF PLANT MATERIALS

Breeder and (or) foundation seed will be maintained at the Los Lunas Plant Materials Center. Second-y seed production was 165 lb per acre pure live seed. Seed will be distributed to interested certified commercial growers through New Mexico State University Seed Certification.

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TABLE 2

Field evaluations of big sacaton, 1999–2008

Year planted	City in New Mexico/Location	Elevation (m)	Total transplants	Irrigation	Spacing (m)
1999	Columbus/Rancho la Fontera	1289	800	Yes	1.5
2000	Columbus/Rancho la Frontera	1289	400	Yes	1.5
2001	Columbus/Rancho la Frontera	1289	167	Yes	1.5
2002	Deming/Keeler Property	1311	460	Yes	1.5
2002	Tucumcari/Tucumcari Elementary	1256	250	No	1.0
2002	Tatum/Tatum Memorial Cemetery	1216	172	Yes	1.5
2003	Lovington/USDA Service Center	1195	170	Yes	1.5
2003	Tatum/Tatum Town Park	1216	300	Yes	1.5
2004	Isleta/Lujan Farm	1490	38	Yes	1.5
2004	McIntosh/Schwebach Farm	1875	600	Yes	2.0
2004	Clayton/Dellinger Property	1542	200	Yes	1.5
2006	Jal/USDA Service Center	1128	100	Yes	3.0
2006	Deming/Diaz Property	1295	750	No	0.6
2006	Milan/South side of NM Hwy 122 near the State Hwy Building	1987	1400	Yes	1.5
2006	Espanola/County Rural Event Center	1798	100	Yes	1.5
2006	Gap, Arizona/Willie's Property	1795	230	First 2 y	1.5
2007	Hobbs/Hobbs Landfill &Transfer Station	1097	1100	First year only	1.0 - 1.5
2008	Taos/Benson Property	2195	250	Yes	1.0
2008	Taos/Trujillo Property	2073	150	Yes	1.5
2008	Taos/Taos County Extension Office	2103	36	First year only	1.5

[z] Width not measured

Percentage survival rate									Foliage height/width (cm)						
2000	2001	2002	2003	2004	2005	2006	2007	2008	2002	2003	2004	2005	2006	2007	2008
95	95	95	95	95	95	95	95	—	152/91	—	—	—	—	114/107	—
95	95	95	95	95	95	95	95	—	168/91	—	—	—	—	208/107	—
—	—	45		Replanted			100	—	122/122	—	—	—	—	107/102	—
—	—	—	—	—	95	95	95	95	25/na[z]	—	—	—	—	—	127/112
—	—	100	—	—	—	—	100	—	64/38	—	—	—	—	97/81	—
—	—	100	—	—	—	—	95	—	—	36/20	—	—	—	102/89	—
—	—	—	95	—	—	—	—	95	—	38/20	—	—	—	—	152/127
—	—	—	100	—	—	—	100	—	—	25/13	—	—	—	117/102	—
—	—	—	—	100	—	—	—	100	—	—	—	102/61	—	—	142/112
—	—	—	—	100	—	—	—	85	—	—	25/15	—	—	—	112/86
—	—	—	—	100	—	—	—	100	—	—	—	76/25	—	—	122/102
—	—	—	—	—	—	100	100	100	—	—	—	—	—	—	109/86
—	—	—	—	—	—	100	100	100	—	—	—	—	—	—	66/46
—	—	—	—	—	—	95	—	0	—	—	—	—	—	—	0
—	—	—	—	—	90	90	90	—	—	—	—	—	—	86/56	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	114/76
—	—	—	—	—	—	—	98	90	—	—	—	—	—	—	46/23
—	—	—	—	—	—	—	—	100	—	—	—	—	—	—	38/18
—	—	—	—	—	—	—	—	98	—	—	—	—	—	—	23/10
—	—	—	—	—	—	—	—	100	—	—	—	—	—	—	30/13