TEXAS A&M UNIVERSITY-KINGSVILLE
CAESAR KLEBERG WILDLIFE RESEARCH INSTITUTE
SOUTH TEXAS NATIVES
KINGSVILLE, TEXAS

And

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
E. "KIKA" DE LA GARZA PLANT MATERIALS CENTER
KINGSVILLE, TEXAS

And

TEXAS AGRILIFE RESEARCH STATION
BEEVILLE, TEXAS

NOTICE OF RELEASE OF SOUTH TEXAS GERMPLASM SIDEOATS GRAMA SELECTED PLANT MATERIAL

Texas A&M University-Kingsville, Caesar Kleberg Wildlife Research Institute, *South Texas Natives* (STN), the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) E."Kika" de la Garza Plant Materials Center (PMC) and Texas AgriLife Research Station Beeville (TARSB) announce the release of a selected plant material of sideoats grama (*Bouteloua curtipendula* (Michx.) Torr. var. *caespitosa* Gould & Kapadia) for the Rio Grande Plains, Gulf Coast Prairies and Marshes, and Coastal Sand Plains ecoregions of Texas.

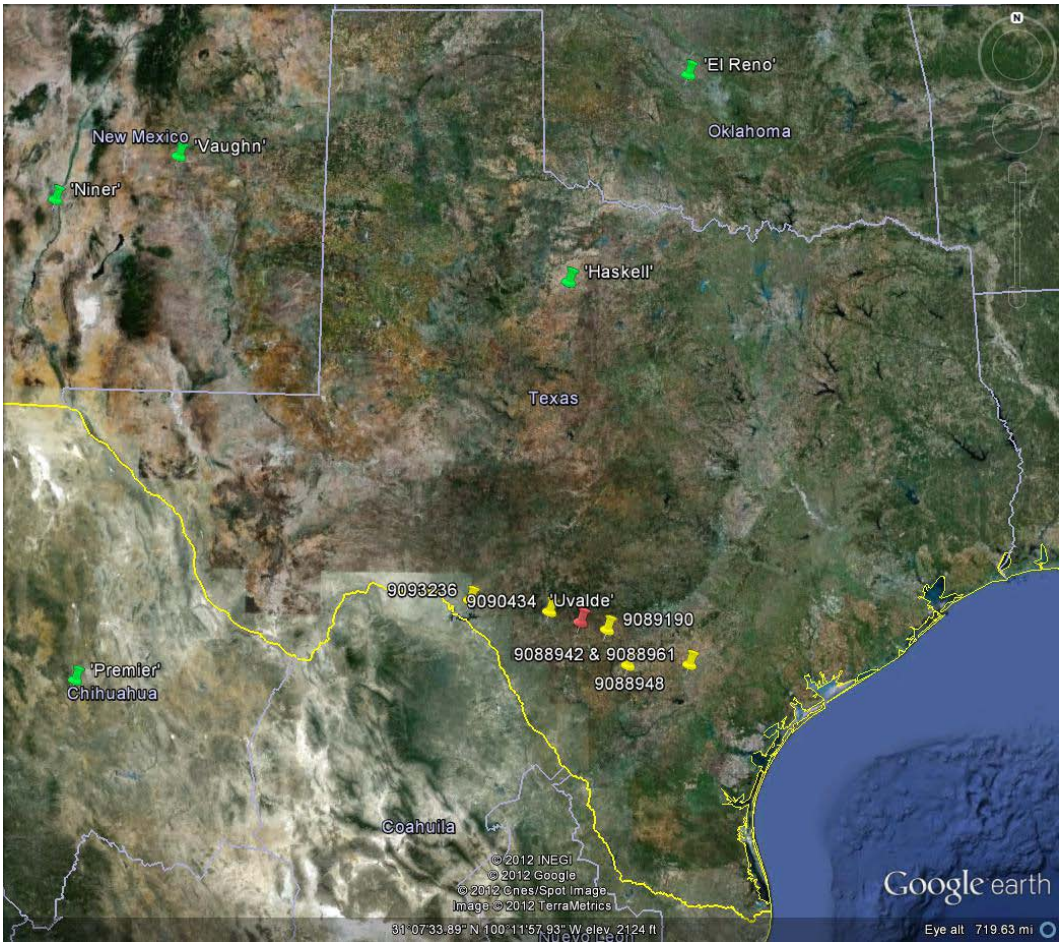
This plant will be referred to as South Texas Germplasm sideoats grama, and is released as a selected plant material class of certified seed (natural track). South Texas Germplasm was tested under the USDA NRCS accession numbers 9093236, 9090434, 9088948, 9089190, and 9088942 & 9088961 (combined and treated as one accession). Seed of South Texas Germplasm sideoats grama will be identified by USDA NRCS accession number 9109632.

This release procedure is justified because there are no existing commercial seed sources of sideoats grama that are ecotypic to the Rio Grande Plains, Gulf Coast Prairies and Marshes, and Coastal Sand Plains ecoregions of south Texas. The name and origin of other commercially available sideoats grama seed sources are: 'Haskell'-originating from more than 200 miles north (Haskell County, TX) (SCS 1983) of the Rio Grande Plains ecoregion; and 'Premier'-originating from more than 300 miles west (Chihuahua, Mexico) of the Rio Grande Plains ecoregion (Smith et al. 2004, USDA NRCS 2010).

'Uvalde' is an extinct variety of sideoats grama from the Rio Grande Plains. It was released in 1950 by the Arizona Agricultural Experiment Station and NRCS. At one time it was commercially produced; however this cultivar has not been maintained by the developers or commercial industry. We were unable to obtain even a small quantity of 'Uvalde' for evaluation. Other cultivar releases evaluated against South Texas Germplasm in various stages of

development included ‘Niner’ (SCS 1984), ‘Vaughn’ (USDA NRCS 2011) and ‘El Reno’ (USDA NRCS 2011). ‘Haskell’ sideoats grama is frequently used in south Texas range seedings but is a distinctly different botanical variety of sideoats grama (e.g. var. *curtipendula*) than what (e.g. var. *caespitosa*) naturally occurs in south Texas. The potential for immediate use of South Texas Germplasm is high, especially for use in upland wildlife, highway rights-of-way, energy exploration reclamation, and range plantings in south Texas.

Figure 1. Origin of accessions comprising South Texas Germplasm sideoats grama (yellow pins) and origin of other commercially available cultivars (green pins). Origin of an extinct variety, ‘Uvalde’ sideoats grama, is noted with a red pin**.**



A. Proposed Variety Name and Temporary Designation:

SOUTH TEXAS GERMPLASM SIDEOATS GRAMA

B. Family, kind, genus and species:

Family: Poaceae

Tribe: Bouteloua

Kind: sideoats grama

Genus and species: *Bouteloua curtipendula* (Michx.) Torr. var. *caespitosa* Gould & Kapadia

C. Origin and breeding history of the variety:

Collection Site Information:

Accession 9088942 was collected by Forrest Smith and Cody Lawson on August 22, 2002 from native plants at the Smith Ranch in Atascosa County, Texas at 28º 45' 50" N latitude and 98º 13' 1" W. longitude. The soil type of the collection site was Imogene fine sandy loam (USDA NRCS 2012). This accession was combined with accession 9088961 during later stages of evaluation.

Accession 9088948 was collected by Forrest Smith and Cody Lawson on August 21, 2002 from native plants at the Shiner Ranch in Frio County, Texas 28º 47' 05" N. latitude and 99º 1' 34" W. longitude. The soil type of the collection site was Duval loamy fine sand (USDA NRCS 2012).

Accession 9088961 was collected by Forrest Smith and Cody Lawson on August 22, 2002 from native plants at the Smith Ranch in Atascosa County, Texas at 28º 46' 26" N. latitude and 98º 13' 25" W. longitude. The soil type of the collection site was Weigang sandy clay loam (USDA NRCS 2012). This accession was combined with accession 9088942 during later stages of evaluation.

Accession 9089190 was collected by Forrest Smith and Cody Lawson on October 19, 2002 from native plants along County Road 5235 in Medina County, Texas at 29º 11' 52" N. latitude and 99º 17' 35" W. longitude. The soil type of the collection site was Olmos gravelly loam (USDA NRCS 2012).

Accession 9090434 was collected by Forrest Smith and Paula Maywald on December 18, 2002 from native plants along Farm to Market road 674 in Uvalde County, Texas 29º 24' 50" N. latitude and 100º 2' 33" W. longitude. The soil type of the collection site was Ector gravely loam outcropping (USDA NRCS 2012).

Accession 9093236 was collected by Forrest Smith, Keith Pawelek, Cody Lawson and Charity Lawson on November 17, 2004 from native plants along US Highway 90 in Val Verde County, Texas at 29º 32' 53" N latitude and 101º 4' 47" W. longitude. The soil type of the collection site was Zorra clay loam (USDA NRCS 2012).

Accessions 9088961 and 9088942 were combined and considered as one accession following initial evaluations due to similar performance and collection location.

Breeding history: Plants evaluated in all trials were grown from the original seed collections, or isolated increases of the original collections. Breeder seed of each accession was produced in isolated increase plots that were derived from original seed collection. All seed increase plots of

each accession were grown in geographic isolation from other *Bouteloua curtipendula* accessions and wild populations of the species. No intentional breeding, selection or genetic manipulation has been carried out on components of this release. South Texas Germplasm is a blend of seed (by equal percent pure live seed (PLS), +/-10%) of each of the contributing accessions.

D. Objective description of the variety:

Description:

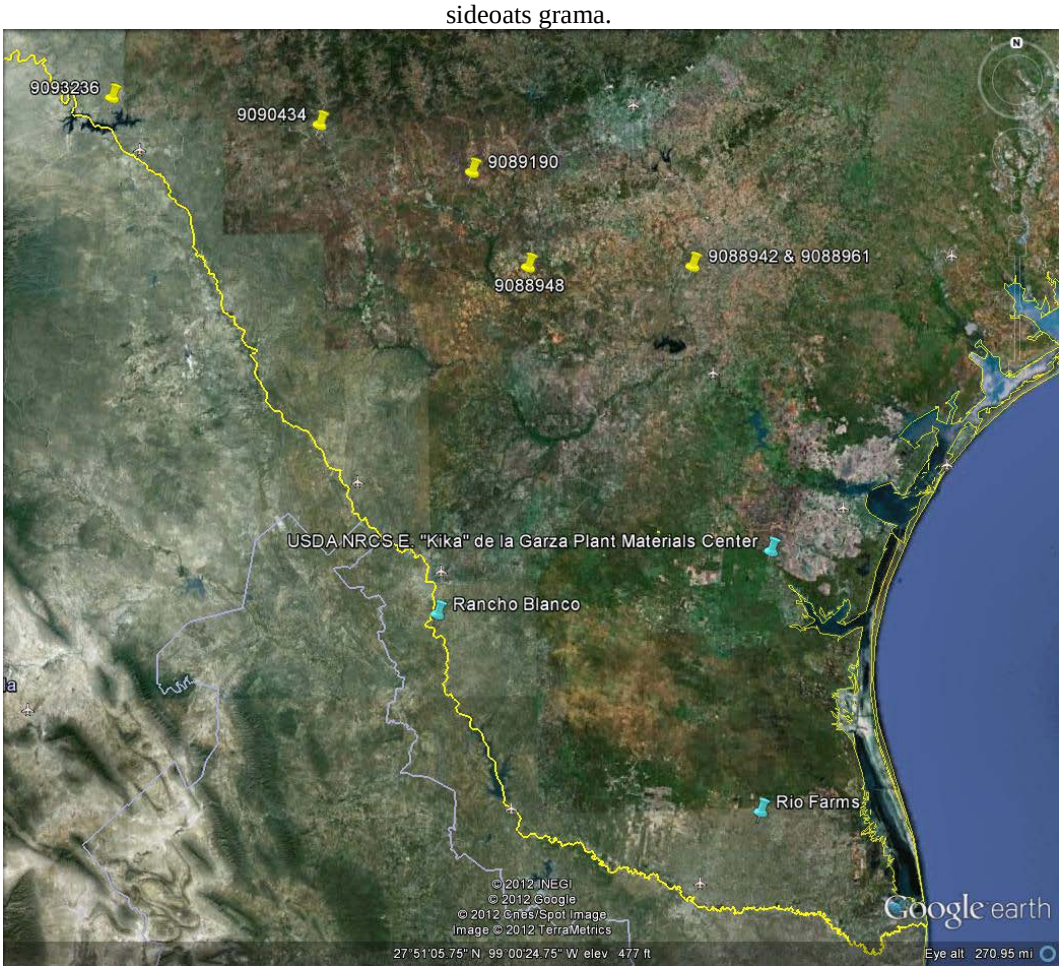
Plants perennial, caespitose without rhizomes, and plants reaching heights up to 110 cm. Culms 8-80 cm, erect or decumbent usually erect and mostly aerial, solitary or in small to large groups. Leaves evenly distributed; sheaths mostly glabrous, sometimes with hairs distally; ligules 0.3-0.5 mm, membranous, ciliate; leaf blades 2-30 cm long and 1-3 cm wide, flat or folding when dry, usually smooth abaxially and scabrous adaxially, occasionally pubescent, bases usually with papillose-based hairs on the margins. Panicles 13-25 cm, secund, with 20-60 reflexed branches 10-30 mm, deciduous, with 2-7 spikelets, axes terminating 3-5 mm beyond the base of the terminal spikelets, apices entire; disarticulation at the base of the branches. Spikletes appressed, all alike, with 1 bisexual and 1-2 sterile, rudimentary florets. Glumes unequal, glabrous or scabrous; lower glumes 2.5-6 mm half or more as long as the upper glumes; upper glumes 5.5-8 mm; lowest lemmas 3-6.5mm, glabrous or scabrous-strigose, often minutely rugose, acute or inconspicuously 3-loped, 3-veined, veins usually extending as short mucros or awns to 6 mm; central mucros or awns not flanked by membranous lobes; lowest paleas acute, unawned; anthers 1.5-3.5 mm yellow, orange, red, or purple; distal floret 0.5-3.5 mm, sterile, variable, usually a glabrous lemma having a short membranous base, no palea, and 3 unequally-developed awns, central awns 1.5-7 mm (Barkworth et al. 2007). South Texas Germplasm sideoats grama contains approximately 165,000 seeds per pound.

Sideoats grama is variable morphologically, ecologically, and in terms of chromosome numbers (Diggs, Jr. et al 1999). Apomixis occurs in the southern range of sideoats grama, mostly within the range of *Bouteloua curtipendula* var. *caespitosa*. Accessions comprising this release originated from within the ranges of apomictic and sexual reproduction as reported by Gould (1959). However, essentially no within-accession variation has been observed in the populations comprising South Texas Germplasm during evaluation or seed increase of the components. All plants within accessions are extremely uniform, if not identical. Morphologically, each accession is unique, with minute, but measurable differences in a number of characteristics. Leaf-color varies greatly amongst accessions. These differences result in South Texas Germplasm being diverse in appearance once constituted as a blend. Seed yields and quality are highly variable in all accessions; however maturity date(s) of the selected accessions are similar. All accession comprising South Texas Germplasm sideoats grama have been confirmed to be *Bouteloua curtipendula* var. *caespitosa* (Hatch pers. comm.).

Chromosome numbers of sideoats grama are variable across the species' range, ranging from 2n=58-103. Specific chromosome numbers of accessions being released are unknown.

Bouteloua curtipendula occurs throughout North America from southern Canada, through Mexico and into South America. Sideoats grama is found on a variety of soils, but is most common on medium textured soils (Barkworth et al. 2007). It is found throughout Texas, except the extreme eastern forests (Correll and Johnston 1996). In south Texas, sideoats grama is common on rocky uplands in the north portion of the region, is locally abundant on well-managed rangelands in the Coastal Prairies (Everitt et al. 2011), and is occasionally found on well managed sandy loam soils. Plants in eastern portions of south Texas are var. *curtipendula* (Hatch et al. 1999, Gould and Box 1965), whereas accessions comprising South Texas Germplasm has been determined to be var. *caespitosa* by S.L. Hatch of the S.M. Tracy Herbarium at Texas A&M University (pers. comm.). The published range of non-rhizomatous (var. *caespitosa*) forms of sideoats grama within south Texas (Gould and Kapadia 1962) is inclusive of the region where populations comprising South Texas Germplasm originated.

Figure 2. Initial evaluation locations (blue pins), and origin of accessions comprising South Texas Germplasm sideoats grama.



Potential uses: South Texas Germplasm sideoats grama is recommended for use in upland wildlife, range, energy exploration reclamation, and highway rights-of-way plantings. Sideoats grama provides good forage for livestock, and seeds are eaten by turkeys and quail (Everitt et al. 2011).

E. Evidence

Method of Breeding and Selection

Initial Evaluation

As part of an effort to collect, evaluate, and release germplasms of a variety of plants native to south Texas, personnel from *South Texas Natives* and collaborating agencies obtained and evaluated seed of sideoats grama from 47 field locations in south Texas from 2001-2007. The cultivar releases 'Haskell' and 'Premier' were compared to these collections in initial evaluations, as these varieties of the species are commonly used and recommended for south Texas. Another commercial selection from Pogue Agri Partners (Kenedy, TX) originating from northern Mexico was also included in initial evaluation studies at two sites.

Our goals in the initial evaluation studies were to determine if ecotypic populations of sideoats grama differed significantly in morphology and phenology from existing commercial seed sources, and if so, determine if an ecotypic commercial seed release of sideoats grama could be developed.

The original collections were evaluated at three locations in the area of interest (Figure 2). These sites represented three widespread soil textures (clay, silt loam, and sandy loam), and are representative of three of the four major ecoregions comprising the area commonly referred to as south Texas (Gulf Coast Prairies and Marshes, Coastal Sand Plains, and Rio Grande Plains)

In December 2002, we seeded greenhouse flats using seed from the original field collections of each population to produce transplants for evaluation. In 2004, additional accessions that were obtained, or that did not establish in 2003 were added to the evaluation plots. Some accessions had no germination and were eliminated from consideration. Accessions that produced plants were planted in a randomized, complete block design with two, 10-plant replications of each accession at two locations: Rio Farms (Hidalgo County), Rancho Blanco (Webb County), and in paired row planting of 50 plants of each accession in a complete block design at the USDA NRCS E. "Kika" De La Garza Plant Materials Center (Kleberg County).

At each location accessions were evaluated monthly throughout the growing season under fully irrigated conditions in the first year after transplanting and bi-monthly under rain-fed conditions in subsequent evaluation years. Data was collected on important traits for commercial production and ecological function including: survival, plant vigor, foliage density, uniformity, forage (biomass) production, seed production, and plant height. Each replication of each accession was scored using a numerical ranking system whereas 1=best performance in the category at the site at the evaluation period, and 9= worst performance in the category. Data from each evaluation year were pooled, and mean performance in each category by evaluation year

was used to guide selection of superior accessions. In the initial evaluation year of each accession, under fully irrigated conditions, seed was collected from each accession at each location to determine active seed germination percentage. Seed collections were also obtained and tested when rain-fed conditions resulted in seed production of the majority of the populations.

Based on germination trials, field evaluation rankings, and in comparison to 'Haskell' and 'Premier', we chose 11 accessions for advanced evaluation. While evaluation plots included commercial varieties of sideoats grama with known ability to produce seed with good germination, all accessions including these commercial standards had relatively poor seed germination in our trials. Accessions originating from south Texas had similar survival to cultivars and the commercial source from Pogue Agri Partners; however vigor, seed production, and biomass production scores were generally superior for the local collections vs. the standards. The south Texas collections generally scored better than the standards. An exception was the Pogue selection at Rancho Blanco and the PMC, where similar performance to the south Texas accessions was observed. Tables 1, 2, and 3 present survival, vigor, seed production, and biomass production scores of the accessions selected for increase and standards at each evaluation location in 2005, which was at least the second year after establishment of each accession. Table 4 lists the accessions chosen for further evaluation and the basis for selection. In addition to performance data, some weight in selection was given to the geographic origin and soil texture where the parent accession was collected, so as to include representative populations from major habitat associations and ecological sites found in south Texas.

Table 1. Mean annual survival, vigor, seed production, and biomass production scores (1=best) for selected accessions and available cultivars of sideoats grama at Rio Farms (Hidalgo County, TX) in 2005.

Accession	Survival	Plant vigor	Seed production	Biomass production
9093236	100%	2.6	2.3	2.9
9088518	100%	2.9	3.5	2.7
9089178	100%	2.8	2.5	2.5
9088961	80%	2.1	1.7	1.9
9088942	95%	2.4	2.8	2.4
9088634	91%	2.7	3.0	3.1
9088948	80%	1.5	1.3	1.8
9089167	98%	2.8	2.9	2.3
9090402	98%	2.8	3.4	2.7
9089190	97%	3.0	4.4	3.2
9090434	33%	2.8	3.2	2.8
Mean (selected accessions)	**88%**	**2.6**	**2.8**	**2.6**
Haskell	**99%**	**3.6**	**2.8**	**4.3**

Table 2. Mean annual survival, vigor, seed production, and biomass production scores (1=best) for selected accessions and available cultivars of sideoats grama at Rancho Blanco (Webb County, TX) in 2005.

Accession	Survival	Plant Vigor	Seed production	Biomass production
9093236	100%	2.5	2.4	2.7
9088518	98%	3.2	3.1	3.4
9089178	99%	2.5	3.1	2.8
9088961	71%	2.4	3.0	2.3
9088942	98%	2.4	3.4	2.4
9088634	100%	2.8	3.0	2.9
9088948	95%	2.7	2.3	2.6
9089167	96%	2.5	3.1	2.8
9090402	91%	2.8	3.1	2.8
9089190	99%	2.7	3.8	2.5
9090434	93%	2.5	3.1	2.2
Mean (selected accessions)	**95%**	**2.6**	**3.0**	**2.7**
Haskell	**99%**	**4.3**	**4.5**	**5.0**
Pogue	**87%**	**2.4**	**3.1**	**2.6**
Premier	**60%**	**2.9**	**3.3**	**3.4**

Table 3. Mean annual survival, vigor, and seed production scores (1=best) for selected accessions and available cultivars of sideoats grama at the USDA NRCS Plant Materials Center (Kleberg County, TX) in 2005.

Accession	Survival	Plant vigor	Seed production
9088634	97%	5.8	5.2
9088942	100%	5.3	6.4
9088948	100%	5.8	4.9
9088961	100%	5.8	4.9
9089167	99%	5.8	5.7
9089178	100%	5.7	5.2
9089190	100%	5.3	5.9
9090402	100%	5.3	5.2
9090434	100%	5.0	5.5
9093236	100%	4.0	4.0
Mean (selected accessions)	**100%**	**5.3**	**5.3**
Haskell	**100%**	**8.0**	**8.0**
Pogue	**100%**	**5.0**	**5.5**
Premier	**100%**	**6.0**	**5.0**

Table 4. Accessions selected for advanced evaluation and rationale for selection. * denotes accessions included in South Texas Germplasm sideoats grama.

Accession	Basis for selection
9089178	• Excellent vigor, foliage density, uniformity, seed production, and forage production at Rio Farms (2005) • 5th best (tie) overall evaluation rankings at Rancho Blanco (2004-2005)
9089167	• Excellent original seed collection germination (2003) • High vigor and foliage density rankings at PMC (2003) • Good evaluation plot seed germination at PMC (2004) • Excellent vigor, foliage density, uniformity, and seed production at Rancho Blanco (2005) • Excellent vigor, foliage density, uniformity, seed production, and forage production at Rio Farms (2005) • 3rd best overall evaluation ranking Rancho Blanco (2004-2005) • 4th best overall evaluation ranking Rio Farms (2004-2005)
9088961*	• Excellent foliage density and seed production rankings at PMC (2005) • Excellent vigor, foliage density, uniformity, seed production and forage production at Rancho Blanco (2005) • Excellent vigor, seed production, and forage production at Rio Farms (2005)
9088942*	• Good evaluation plot seed germination at PMC (2004) • Excellent vigor, foliage density, uniformity, and forage production at Rancho Blanco (2005) • Excellent vigor, foliage density, uniformity, and forage production at Rio Farms (2005)
9090402	• Exceptional original seed collection germination (2003) • High foliage density ranking at Rancho Blanco (2005) • Excellent vigor, foliage density, and forage production at Rio Farms (2005)
9090434*	• Exceptional original seed collection germination (2004) • Excellent vigor, foliage density, uniformity, and forage production at Rancho Blanco (2005) • Excellent vigor, foliage density, uniformity, and forage production at Rio Farms (2005)
9089190*	• Exceptional original seed collection germination (2003) • Excellent vigor, foliage density, uniformity, and forage production at Rio Farms (2005) • Best overall evaluation ranking Rio Farms and Rancho Blanco (2004-2005)
9088634	• Good evaluation plot seed germination at PMC (2004)
9093236*	• Exceptional vigor, foliage density, and seed production rankings at Rancho Blanco (2005) • Excellent vigor, uniformity, and seed production at Rio Farms (2005)
9088518	• Exceptional original seed collection germination (2003) • Good evaluation plot seed germination at PMC(2004)
9088948*	• Noted for exceptional seed production at PMC (2003) • High seed production and foliage density ranking at PMC (2004) • Good evaluation plot seed germination at PMC (2004) • High seed production ranking at PMC (2005) • Excellent vigor, foliage density, uniformity, seed production, and forage production at Rio Farms (2005) • 2nd best overall evaluation ranking Rio Farms (2004-2005) • 5th best (tie) overall evaluation ranking Rancho Blanco (2004-2005)

Advanced Evaluation

In autumn 2005, we planted half of each remaining original seed collection of the selected accessions in greenhouse flats to produce plants for advanced evaluation. We chose to combine accessions 9088942 & 9088961, and 9089167 & 9089178 respectively, since each pair of collections were extremely similar and originated from near one another on similar soils from the same land management units. Thus we had 9 lines for increase and advanced evaluation. Accessions 9088518 and 9088948 were planted at the TARSB, as very few plants for increase were produced because of small original collection size. The other 7 selected populations were planted on similar soils at Rio Farms, near Monte Alto, TX, but geographically isolated from one another to prevent cross-pollination. Initial population increase plot sizes in 2006 ranged from 2,500 plants to less than 50 plants. From 2006-2011, each accession was increased until plots of +/- 4,000 plants per accession were established of each selection. Accession 9093236 was added in 2008 following completion of data collection in the initial evaluation. Accession 9088518 performed poorly at TARSB, producing seed with little to no viability and was culled from consideration. Conversely, accession 9088948 had excellent seed production and viability at TARSB, and was eventually established at Rio Farms. Once established at Rio Farms, all plantings were similarly irrigated, fertilized, and managed to evaluate seed production potential of each selection, compare performance between accessions, and to provide seed for experimental plantings, additional evaluations, further comparisons with available releases, and to provide seed for a possible release of a blend of accessions for commercial production and use in south Texas.

2006 Rio Farms Seed Yields

Plots of 5 of the accessions grown at Rio Farms in 2006 were harvested 4 times with a Flail-vac seed harvester in 2006 (Table 5). The mean annual production of these accessions was 86 lbs. per acre after cleaning, which is notably less than other commercial varieties of sideoats grama. However the Flail-vac harvest method compares poorly to combine harvesting of sideoats grama in our experience. With the Flail-vac harvester only fully mature and disarticulating seeds are obtained, as opposed to "green" seeds that after-ripen when obtained with the combine. Furthermore, the September seed crop was missed because of rainfall prohibiting field entry. We conservatively estimate yields from combine harvests would have exceeded 200 lbs/acre/yr. In comparison, accession 9088634 established in a small plot in the same production year at Rio Farms that was hand harvested at the same intervals yielded 371 lbs/acre.

Table 5. Bulk seed yields of 5 accessions of sideoats grama at Rio Farms, 2006. * denotes accession included in South Texas Germplasm sideoats grama.

Accession	Harvest (date) bulk lbs/acre				Annual yield lbs/acre
	1 (6/30)	2 (7/18)	3 (8/24)	4 (10/23)	
9088942 & 9088961*	36	36	10	49	**131**
9089178 & 9089167	11	x	46	17	**74**
9090402	15	49	32	x	**96**
9089190*	x	20	37	13	**70**
9090434*	11	14	16	16	**57**
Mean annual yield (all acc.)	**18**	**30**	**28**	**24**	**86**

Seed quality at Rio Farms 2007-2011

Harvest samples from a variety of seed increase harvests at Rio Farms were sent to commercial seed labs for seed quality analyses. Results of these tests indicated seed quality of these accessions to be extremely variable (Table 6). Production conditions were not consistent across growing seasons and likely explain much of the variation.

Table 6. Seed quality sideoats grama selections at Rio Farms 2007-2011. * denotes accessions included in South Texas Germplasm sideoats grama.

Accession	Harvest date	% purity	% germination	TZ test %	% PLS
9090434*	2008	56	16	80	45
	2009	44	22	45	20
	2010-2011	51	8	25	12
9088948*	2010-2011	49	4	17	8
9089190*	2008	58	12	84	49
	2009	47	20	52	24
	2010-2011	34	24	37	12
9089178 & 9089167	2007	79	2	39	30
	2008	75	19	78	59
9088634	2009	60	10	21	12
	2010-2011	49	1	18	8
9088942 & 9088961*	2007	87	3	46	40
	2008	70	36	86	60
	2010-2011	44	7	24	10
9093236*	2009	43	10	60	26
	2010-2011	39	7	20	7
9090402	2007	72	4	31	22
	2008	72	10	30	21
	2009	40	3	21	8

Texas AgriLife Research Center Uvalde 2006 Seed Yield Trial

In spring 2006, we planted replicated plots of 5 of the selected accessions and 2 cultivars to assess seed production in the northwestern portion of south Texas. Each replicate consisted of 10 transplants and plots were fully irrigated throughout the production year. A single seed harvest was made in September 2006 by hand harvesting all ripe seeds, and bulk seed yields were calculated on a per acre basis for each accession or variety. Harvested seed was also tested for active seed germination (4 replicates of 100 seeds per accession) (Table 7). Seed yields and percent active seed germination of the south Texas accessions were superior to 'Haskell' and 'Niner' in this trial. Seed yields measured for 'Haskell' and 'Niner' were consistent with those reported (256 lbs/acre and 132 lbs/ac, respectively) for these varieties in the release publications for each (SCS 1983, SCS 1984). Net yields of germinating seed produced per acre show large difference in seed production of the local populations vs. two standards in this trial.

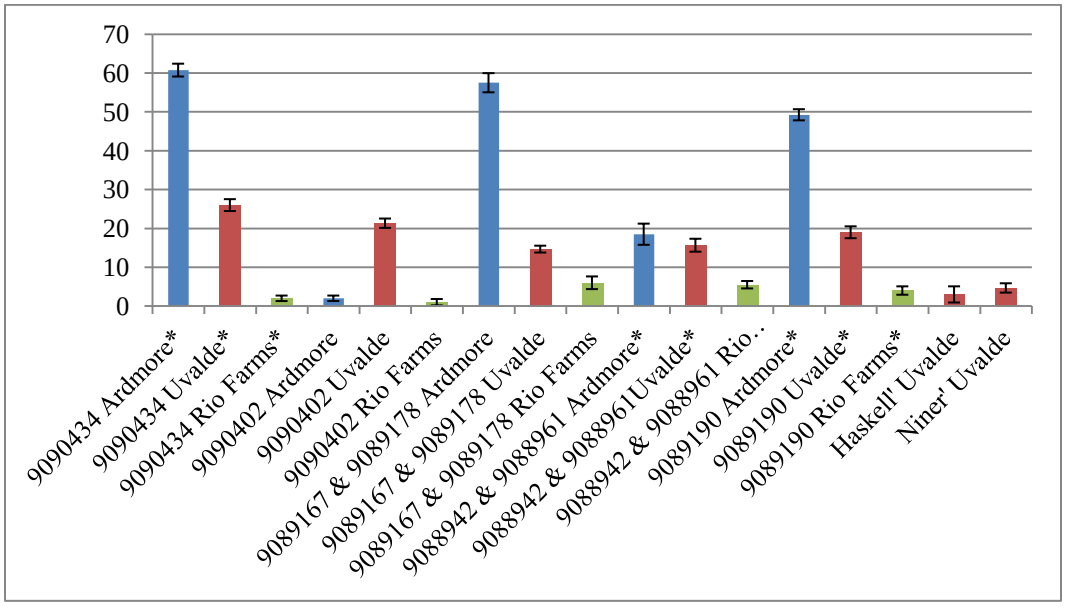
Table 7. Seed yields and germination of 7 accessions of sideoats grama at Texas AgriLife Research Center Uvalde. * denotes accession included in South Texas Germplasm sideoats grama.

Accession	Bulk yield lbs/ac	% germination	Net yield lbs/ac (bulk yield x % germ)
'Haskell'	240	2	5
'Niner'	196	5	10
9090402	566	21	119
9090434*	522	26	136
9089178 & 9089167	435	11	48
9088942 & 9088961*	718	16	115
9089190*	631	19	120

Advanced Evaluation Germination Trial

Also in spring 2006, we planted replicated transplant plots of the selected accessions at the Noble Foundation near Ardmore, OK, Texas AgriLife Research Center Uvalde (TARCU), and Rio Farms in the Lower Rio Grande Valley of Texas. This trial was conducted to determine if seed production along a north to south gradient influenced seed germination. All plantings were fully irrigated. The final seed crop of the year was tested for active seed germination (3 replicates of 100 seeds/accession/location). At TARCU, cultivars 'Niner' and 'Haskell' were also harvested and planted for comparison (Table 7). In general, germination was highest in seed produced at Ardmore, OK followed by Uvalde and Rio Farms respectively (Figure 3). Accession 9090402 was an exception, having the highest germination of seed produced at Uvalde. At Uvalde, where south Texas accessions were compared to cultivars 'Niner' and 'Haskell', the south Texas accessions had higher germination than the cultivars. In general, this experiment indicated that seed germination of the selected accessions is enhanced with production location along a south-north gradient. However, survival of the south Texas selections was 0% for greater than 2 yr in the Ardmore OK plots, whereas survival was near 100% in both the Uvalde and Rio Farms plots.

Figure 3. Germination at 3 locations in 2006. * denotes accessions included in South Texas Germplasm.



Selection

Based on the advanced evaluation data, we selected 5 (6) accessions for inclusion in a blend of sideoats grama for use in south Texas (accessions 9088942 & 9088961 are considered one accession). Selection was based in part on yield data, seed quality data, and observations in the seed increase fields, as well as initial evaluation observations and origin of the accessions.

Variety Trials

In 2010-2011, as part of a statewide research effort funded by the Texas Department of Transportation, we planted South Texas Germplasm sideoats grama, as well as the cultivar releases 'Haskell', 'Premier', and 'Vaughn' in six locations throughout Texas for comparison. At each location, three plots of 10 transplants of each accession were established in fully irrigated rows, and five of the six locations, three seeded plots (100 ft^2 ea.) of each variety were installed. Data on plant performance at each location were collected, including plant height, cover, and biomass measurements in the transplant experiment, and seedling density at 1, 3, and 6 months after rainfall >1" in the seeded plots. Seed was collected from each accession when ripe in the transplant experiment, tested for active seed germination, and sent to commercial labs for tetrazolium tests. While 2011 was an exceptional drought year throughout the evaluation area, the irrigated plots provided good data on comparative plant morphology and percent seed germination of seed of the entries produced in a common setting. The seeded experiment yielded excellent comparative emergence values in extremely adverse conditions. At one of the 6 evaluation locations (Imperial, TX), none of the sideoats grama varieties planted survived in the transplant experiment, or emerged in the seeded experiment. This site is characterized by high soil salinity and alkalinity, and sideoats grama appears to be poorly adapted to this type of site.

All data from these trials are presented Tables 8-12. Evaluation categories noted with * indicated statistical significance (α=0.05) at the evaluation site in the category. Parametric data were analyzed using ANOVA, and means separated by a Tukey Test. Non-parametric data were analyzed using a Wilcoxon Test, and means separated by a Kruskall Wallace Test. Our interpretation of these data by analyses of the evaluation categories in which statistical differences were present indicates no clear superior variety at the Stephenville, Knox City, or Rio Farms evaluation sites. Collectively, we suggest our data clearly indicate South Texas Germplasm was the superior variety at the Uvalde and Kingsville sites.

Table 8. Sideoats grama variety trial at Texas AgriLife Research Center Stephenville, 2011.

Texas AgriLife Research Center Stephenville, TX				
Evaluation Category	**Haskell**	**Premier**	**South Texas Germplasm**	**Vaughn**
***Survival (p=0.0013)**	86% B	93% AB	100% A	85% B
***Plant vigor score (p=0.0178)**	4.58 AB	3.41 B	4.25 AB	4.91 A
Foliage density score (p=.2673)	4.41	4.16	4.41	4.75
Uniformity score (p=0.0416)	3.41 A	2.75 A	3.00 A	3.25 A
Development stage score (p=0.01069)	4.16 A	4.50 A	3.83 A	4.25 A
Seed production score (p=0.2473)	3.83	4.22	5.57	5.22
Forage production score (p=0.0747)	6.08	5.16	5.58	6.08
90 day seedling emergence (plants/ft2) (p=0.0576)	0.58	0.58	1.42	2.53
***Height at maturity (cm) (p=0.0014)**	21.36 AB	28.00 A	24.13 A	16.93 B
***Cover at maturity (p=0.0019)**	49% AB	63% A	29% B	26% B
*** Germination (p=0.0317)**	14% AB	7% AB	27% A	5% B
TZ test (not statistically analyzed)	15%	6%	24%	11%
Live seed yield (g/10 p) (not statistically analyzed)	3.33	3.27	6.94	4.58

Table 9. Sideoats grama variety trial at USDA NRCS James E. “Bud” Smith Plant Materials Center, 2011.

USDA NRCS James E. "Bud" Smith Plant Materials Center Knox City, TX				
Evaluation Category	**Haskell**	**Premier**	**South Texas Germplasm**	**Vaughn**
***Survival (p=0.0221)**	35% B	61% A	54% A	60% A
Plant vigor score (p=0.1302)	6.71	5.93	5.40	6.26
Foliage density score (p=0.0974)	6.71	5.27	5.20	5.60
***Uniformity score (p=0.0437)**	2.00 B	2.80 AB	3.00 A	2.73 AB
Development stage score (p=0.6006)	3.79	4.20	4.07	4.40
Seed production score (p=0.6515)	6.88	6.86	6.00	6.62
Forage production score (p=0.0231)	7.42	6.80	6.20	7.60
30 day seedling emergence (plants/ft2) (p=0.4086)	1.25	2.00	3.08	3.25
***Height at maturity (cm) (p=0.0222)**	24.17 A	9.88 B	18.89 AB	12.5 AB
***Cover at maturity (p=0.0205)**	57% A	21% B	36% AB	20% B
***Germination (p<0.0001)**	0% D	8% B	3% C	36% A
TZ test (not statistically analyzed)	0%	5%	14%	63%
Live seed yield (g/10 p) (not statistically analyzed)	0.00	1.45	10.91	21.55

Table 10. Sideoats grama variety trial at Texas AgriLife Research Center Uvalde, 2011.

Texas AgriLife Research Center Uvalde, TX				
Evaluation category	**Haskell**	**Premier**	**South Texas Germplasm**	**Vaughn**
***Survival (p<0.0001)**	60% B	86% A	98% A	89% A
Plant vigor score (p=0.1769)	4.25	4.12	3.50	4.33
***Foliage density score (p=0.0084)**	3.83 AB	3.86 AB	2.75 B	4.08 A
***Uniformity score (p<0.0001)**	5.33 A	3.75 BC	2.58 C	4.83 AB
Development stage score (p=0.5863)	3.33	3.25	3.00	3.50
Seed production score (p=0.7939)	3.67	3.75	3.33	3.75
***Forage production score (p=0.0318)**	3.75 AB	3.88 AB	3.17 B	4.17 A
***30 day seedling emergence (plants/ft2) (p<0.0001)**	0.00 B	0.33 B	0.25 B	1.16 A
***90 day emergence (plants/ft2) (p=0.0046)**	1.00 B	0.50 B	6.42 A	1.67 B
***Height at maturity (cm) (p=0.0422)**	64.60 AB	61.00 AB	66.33 A	49.67 B
***Cover at maturity (p=0.0020)**	79% AB	77% AB	92% A	55% B
***Germination (p<0.0001)**	15% A	2% BC	0% C	5% B
TZ test (not statistically analyzed)	8%	5%	5%	0%
Live seed yield (g/10 p) (not statistically analyzed)	0.98	0.42	0.63	0.00

Table 11. Sideoats grama variety trial at *South Texas Natives* Farm, Kingsville, TX, 2011.

South Texas Natives Farm, Kingsville, TX				
Evaluation category	**Haskell**	**Premier**	**South Texas Germplasm**	**Vaughn**
Survival (p=0.4283)	98%	94%	94%	97%
***Plant Vigor (p=0.0081)**	3.60 AB	3.40 AB	3.07 B	4.13 A
Foliage density score (p=0.0535)	3.13	3.46	3.33	4.13
Uniformity score (p=0.2577)	3.33	3.07	3.87	3.80
***Development stage score (p=0.0087)**	5.93 AB	5.40 AB	5.00 B	6.07 A
***Seed production score (p=0.0049)**	3.71 AB	3.50 B	3.21 B	4.40 A
***Forage production score (p=0.0075)**	3.26 B	3.26 B	3.13 B	4.47 A
***30 day seedling emergence (plants/ft2)(p<0.001)**	1.00 B	1.16 B	3.91 A	0.66 B
60 day seedling emergence (plants/ft2) (p=0.0601)	1.25	0.75	1.75	0.43
***90 day seedling emergence (plants/ft2)(p=0.0001)**	1.46 B	2.13 B	5.82 A	0.75 B
***Height at maturity (cm) (p<0.0001)**	68.33 C	98.33 A	88.33 AB	81.66 BC
***Cover at maturity (p=0.0026)**	97% AB	100% A	83% B	100% A
***Germination (p<0.0001)**	17% A	2% B	4% B	9% B
TZ test (not statistically analyzed)	43%	15%	14%	38%
Live seed yield (g/10 p) (not statistically analyzed)	1.72	0.73	0.45	1.48

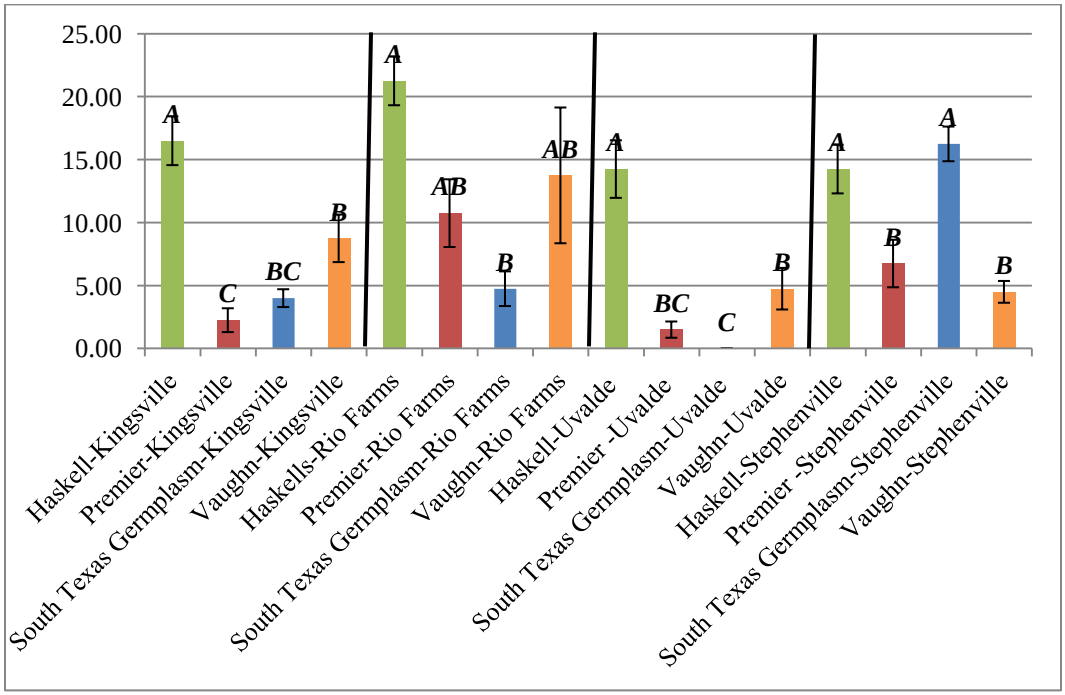
Table 12. Sideoats grama variety trial at Rio Farms, Monte Alto, TX 2011.

Rio Farms, Monte Alto, TX				
Evaluation category	**Haskell**	**Premier**	**South Texas Germplasm**	**Vaughn**
Percent survival (p=1.00)	100%	100%	100%	100%
***Plant vigor score (p=0.0434)**	3.73 A	4.06 AB	4.00 AB	4.60 B
***Foliage density score (p=0.0050)**	3.47 B	3.87 B	3.73 B	4.80 A
***Uniformity score (p=0.0061)**	2.73 B	2.60 B	3.00 AB	3.53 A
Development stage score (p=5875)	6.06	6.00	5.80	6.20
***Seed production score (p<0.0001)**	4.64 AB	3.87 BC	3.40 C	5.47 AB
***Forage production score (p<0.0001)**	4.00 B	3.93 B	3.53 B	5.46 A
***Height at maturity (cm) (p<0.0001)**	62.67 BC	70.33 AB	71.33 A	55.33 C
***Cover at maturity (p=0.0003)**	73% A	74% A	76% A	46% B
***Percent germ (p=0.0267)**	21% A	9% AB	5% B	15% AB
TZ test percent (not statistically analyzed)	32%	7%	12%	15%
Live seed yield (g/10 p) (not statistically analyzed)	1.72	0.66	1.01	0.46

Seed Germination in 2011 variety trial

Percent germination was calculated as the total number of germinating seeds in each test. Data were Arcsine transformed to normalize, and analyzed using ANOVA. When significant differences were detected, means were separated by a Tukey test. Across sites, seed germination of 'Haskell' was significantly higher (F=17.38, p<0.0001). There was also a significant difference in germination x site (F=7.8, p<0.0001), whereas Rio Farms and Stephenville plantings had the highest germination. At Stephenville, South Texas Germplasm and Haskell had similar germination which was significantly higher than Premier and Vaughn (Figure 4).

Figure 4. Germination (±SE) of 4 sideoats grama varieties at 5 locations in Texas in 2011. Statiscal differences (α=0.05) between varieties at <u>*each site*</u> are noted with different letters.



Seedling emergence in 2011 variety trial

Each variety of sideoats grama was direct seeded at 5 locations in spring 2011. One site, Imperial, TX had no significant seedling emergence of any variety in 2011. At 3 of the other 4 sites, 30, 60, and 90 day seedling counts after rainfall greater than 1" were obtained in 2011, and at one site (Knox City) a 30 day seedling count was obtained only as a result of late-season rains. At Knox City (30 day count) and Stephenville (90 day count), there was no significant difference in seedling density of the 4 varieties. However at Kingsville and Uvalde, South Texas Germplasm had significantly higher seedling emergence than the other 3 varieties (Figure 5, 6) at the 90 day counts.

Figure 5. Ninety day seedling emergence of 4 sideoats grama varieties at Kingsville, TX, 2011. Statiscal differences (α=0.05) between varieties are noted with different letters.

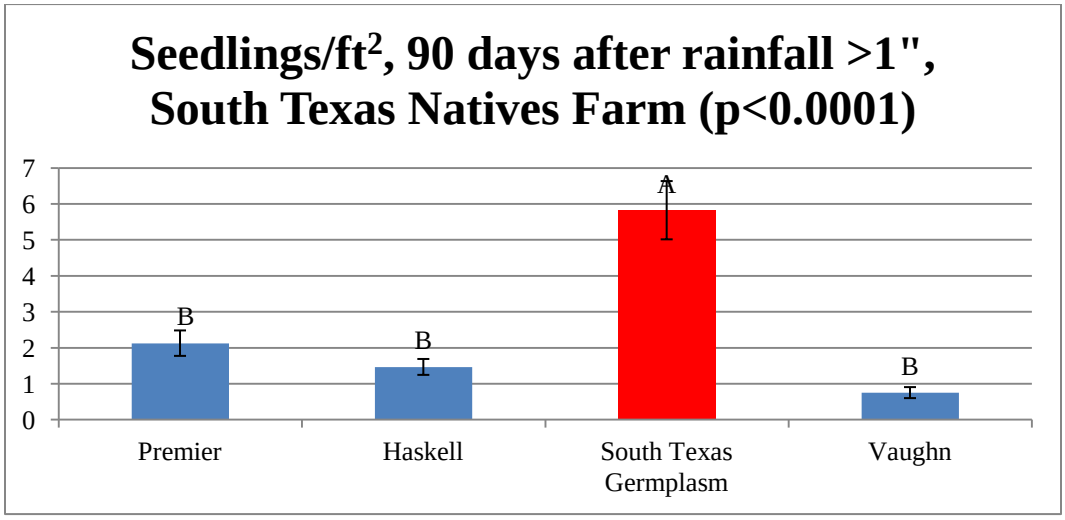
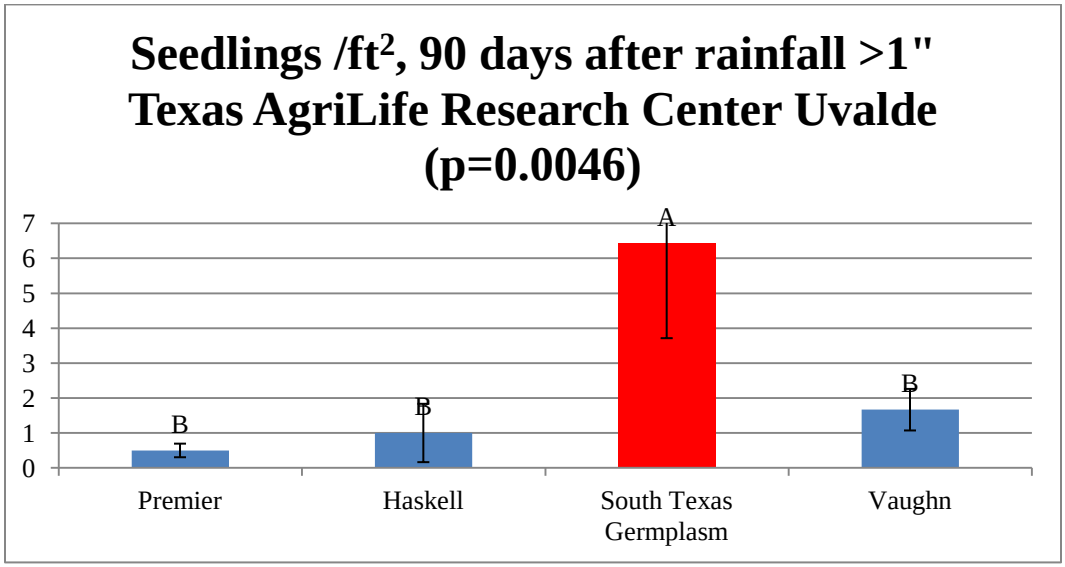


Figure 6. Ninety day seedling emergence of 4 sideoats grama varieties at Uvalde, TX, 2011. Statiscal differences (α=0.05) between varieties are noted with different letters.



Seeding trials

South Texas Germplasm sideoats grama was seeded as a monoculture, or as part of a native seed mix on more than 30 dry land planting sites in the Rio Grande Plains, Coastal Sand Plains, and Gulf Coast Prairies and Marshes Ecoregions of Texas. Nineteen of these sites have been sampled beyond 1 yr after planting for emergence and persistence. South Texas Germplasm emerged and produced surviving plants at 17/19 sites, or 89% of plantings that have been monitored. Successful plantings were made in 8 south Texas counties, including Duval, La Salle, Jim Wells, Webb, Cameron, Hidalgo, San Patricio, and Kleberg counties. Soil textures of successful plantings include fine sandy loam, clay loam, clay, silt loam, and sandy clay loam.

Based on these observations, we conclude that this germplasm readily establishes and persists by drill or broadcast plantings methods across a large variety of soils in south Texas. It is poorly adapted to saline and alkaline soils, and coarse sand or loamy sand surface textures. Limited trial plantings in the Edwards Plateau, Cross Timbers and Prairies, and Rolling Plains Ecosystems of Texas have demonstrated acceptable establishment and longevity, but have not been sufficiently replicated to make definitive recommendations for use of this seed source in these areas. Furthermore, 'Haskell' sideoats grama is known to have acceptable performance in these areas and is recommended for use there. South Texas Germplasm may also have some utility in the Trans Pecos Ecoregion, especially the eastern portion where one component of the germplasm did originate from near the boundary of this region, but this use has not been tested.

Seed Increase

Seed increase of South Texas Germplasm sideoats has been primarily conducted at Rio Farms in the Lower Rio Grande Valley of Texas. Our testing indicates sideoats grama seed production is highly variable in this area, and consistently higher seed yields and quality have been obtained in plantings made in more northern portions of south Texas, or central Texas. However, long term survival of this germplasm north of the Rio Grande Plain Ecoregion has not been definitively determined. Increases at Rio Farms were made by plantings of transplants grown from the original wild seed collections, which were harvested, and replanted (as transplants) alongside the parent plants until needed field sizes were obtained. Breeder seed of the germplasm will be comprised by blending seed of the selected accessions on a percent PLS basis, resulting in the G0 seed blend of South Texas Germplasm. G1 field harvests have shown good seed quality when grown near Kingsville, TX, with 61% PLS observed in 2010 harvests, and 37% PLS in 2011 harvests. All seed increase plantings to date have been conducted on 36" bedded rows, using transplants on 12" plant spacing.

Seed Production, Harvest, and Cleaning

South Texas Germplasm sideoats grama is extremely drought hardy, and will produce seed with modest irrigation after establishment. Frequent close cultivation stimulates seed production, and dormant season prescribed fire results in greater seedhead density in following year in comparison to unburned or mowed plots. Standard fertilization regimes for grasses are compatible with sideoats grama seed production. Frequent pests that we documented in seed fields include thrips (*Thripidae spp.)* and rice stink bugs (*Oebalus pugnax*). Control of these pests is difficult and requires repeated insecticide applications from the boot stage through seed

maturity. A number of herbicides can be used for weed control once plants are well established, including 2, 4-D based herbicides for post-emergence broadleaf weed control, and pendamethelin and atrazine based herbicides for pre-emergence weed control. Atrazine can be used for post-emergence control of grass weeds in established production stands.

F. Area of adaptation

Based on our trial plantings and evaluations, South Texas Germplasm is recommended for use in the Rio Grande Plains, Gulf Coast Prairies and Marshes, and Coastal Sand Plains Ecoregions of Texas. Good performance is likely in adjacent areas of northern Mexico, the southern Edwards Plateau, and eastern Trans Pecos Ecoregions of Texas; however this use has not been extensively tested.

G. Procedure for maintaining stock classes of seed

Parent populations of each selection included in South Texas Germplasm will be maintained by *South Texas Natives* in conjunction with the Kingsville PMC. G0 seed is a blend of seed of the germplasm that has been harvested from isolated plantings of each parent line, or fields where equal numbers of contributing plants of each accession have been established by transplanting. G1 seed is that which is harvested from plantings made using the blend of accessions (G0). G1 seed can be replanted for production of G2 seed. Increase using G2 seed is prohibited.

H. Description of how variety is to be constituted, etc.

G0 seed of South Texas Germplasm sideoats grama will be made up of 20% (by PLS, +/-10%) of each of the 5 accessions included in the release. No accession can contribute more than 30% by PLS to the blend, or less than 10%.

I. Additional restrictions, etc.

Commercial seed production of South Texas Germplasm is restricted to the State of Texas. All commercial seed fields of South Texas Germplasm must be isolated from other cultivated varieties and wild populations of the *Bouteloua curtipendula* by a minimum of 900 feet.

G0 and G1 seed fields have a 7 year production limit.

Will application be made to the Plant Variety Protection Office? YES__ NO_X__

If yes will the application specify that the variety is to be sold by variety name only as a class of certified seed? YES__ NO___

Royalty distribution: A royalty of 2% of net sales of Certified Pure Live Seed sold will be collected by the TAMU Office of Technology and Commercialization, and placed in a project account with discretionary spending authority requiring approval for expenditures by the *South Texas Natives* Project Director, Manager of the USDA NRCS E. “Kika” de la Garza Plant

Materials Center, and Resident Director of the Texas AgriLife Research Center Corpus Christi for the benefit of native seed development research for south Texas.

Ecological Considerations and Evaluation: An Environmental Evaluation of Plant Materials Releases was completed using guidelines established by NRCS, and the best available information for this species. Results of this evaluation determined that South Texas Germplasm sideoats grama was suitable for release based on the criterion contained in this document. This conclusion is mainly because sideoats grama is a naturally occurring species in Texas and planting it would therefore not constitute an introduction of an exotic species into local ecosystems. Any negative impacts on other native plant species would likely be minimal to non-existent. Also, release of this species will make available an additional native species for restoration and reclamation plantings and will provide a native seed source beneficial for restoration of native habitats in south Texas.

Conservation Use: South Texas Germplasm sideoats grama will provide a seed source of a native plant species for upland wildlife, highway rights of way, energy exploration reclamation, and range plantings in south Texas

Availability of Plant Materials: Breeder Seed will be maintained by *South Texas Natives*, Kingsville, Texas. Breeder seed has been distributed to Douglass W. King Seed Company, San Antonio, TX for production. At this time release of the germplasm will be distributed to a single commercial grower. A non-exclusive license agreement for production of South Texas Germplasm will be negotiated with the assistance of the Texas A&M University System Office of Technology and Commercialization.

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MARKETING PLAN:
SOUTH TEXAS GERMPLASM SIDEOATS GRAMA

February 2012-Distribute G0 seed for 10 acres of commercial production to Douglass King Seed Company, San Antonio, TX; to be established with vegetative transplants.

July 2012-Complete release document and submit to collaborators for review and approval.

Autumn 2012/Spring 2013-Announce release once seed is commercially available and release document has been approved, via STN Website, STN enewsletter, STN hard copy newsletter, and presentations.

Winter 2012-Negotiate non-exclusive production license with grower with help of TAMU System Office of Technology and Commercialization.

SEED AVAILABILITY:
SOUTH TEXAS GERMPLASM SIDEOATS GRAMA

As of March 1, 2012, +/- 25 lbs. of pure live seed of South Texas Germplasm is available for distribution to a commercial grower. Ten pounds pure live seed of the release has been distributed to Douglass King Seed Company for production by establishment of greenhouse grown transplants to increase seed of the selection under a memorandum of agreement. Additional seed for establishment of transplants and renovation of breeder lines comprising the blend is in cold storage at the E. “Kika” de la Garza Plant Materials Center and South Texas Natives Farm Facility.

SEED PRODUCTION ESTIMATE/PLAN:
SOUTH TEXAS GERMPLASM SIDEOATS GRAMA

As of March 1, 2012, 0.20 acre (e.g. 4,000 transplants on 1’ plant x 36” row spacing) isolated seed increase fields of each of the 5 accessions that comprise the blend are established at Rio Farms, Inc. near Monte Alto, Texas. Total production acreage for the blend components is 1 acre, which if harvested 3x annually yields an average of 100 pounds pure live seed/year. This production level will be sustained until November 2013, when fields will be reduced to 0.10 acres each, or removed if commercial production has reached an acceptable level, and seed for establishment of at least 50 acres of commercial seed fields is in cold storage. An additional nursery plot containing 250 plants of each of the 5 selected accessions planted in adjacent rows is established at the *South Texas Natives* Irrigated Farm near Kingsville, Texas. This plot is used to produce seed for research and demonstration plantings. Hand harvests from each of the 5 isolated fields will be obtained annually and stored at the E. “Kika” de la Garza Plant Materials Center in Kingsville to provide material for re-establishment of the germplasm increase fields if needed.

Figure 7. Isolated seed increase field of one component of South Texas Germplasm sideoats grama.

Figure 8. Representative plant of South Texas Germplasm sideoats grama.

Signatures for release of:

SOUTH TEXAS GERMPLASM SIDEOATS GRAMA

***Bouteloua curtipendula* (Michx.) Torr. var. *caespitosa* Gould & Kapadia**

_____ _____

Dr. Fred C. Bryant Date
Leroy Denman, Jr. Director of Wildlife Research
Caesar Kleberg Wildlife Research Institute
Texas A&M University-Kingsville
Kingsville, TX

_____ _____

Dr. George Allen Rasmussen Date
Dean
Dick and Mary Lewis Kleberg College of
Agriculture, Natural Resources and Human Sciences
Texas A&M University-Kingsville
Kingsville, TX

_____ _____

Dr. Craig Nessler Date
Director
Texas AgriLife Research
College Station, TX

_____ _____

Salvador Salinas Date
Texas State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
Temple, TX

_____ _____

Terrell Erickson Date
Director
Ecological Sciences Division
United States Department of Agriculture
Natural Resources Conservation Service
Washington, D.C.