TEXAS A&M UNIVERSITY-KINGSVILLE
CAESAR KLEBERG WILDLIFE RESEARCH INSTITUTE
TEXAS NATIVE SEEDS PROGRAM
KINGSVILLE, TEXAS

And

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
JAMES E. "BUD" SMITH PLANT MATERIALS CENTER
KNOX CITY, TEXAS

And

SUL ROSS STATE UNIVERSITY
BORDERLANDS RESEARCH INSTITUTE
WEST TEXAS NATIVE SEED PROJECT
ALPINE, TEXAS

NOTICE OF RELEASE OF PERMIAN GERMPLASM WHIPLASH PAPPUSGRASS SELECTED PLANT MATERIAL

Texas Native Seeds (TNS), Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, Texas; the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), James E. "Bud" Smith Plant Materials Center, Knox City, Texas; and Sul Ross State University, Borderlands Research Institute, Alpine, Texas announce the release of a selected plant material of whiplash pappusgrass (*Pappophorum vaginatum* Buckley) for west Texas.

This plant will be referred to as Permian Germplasm whiplash pappusgrass and is released as a selected plant material class of certified seed (natural track). Seed of Permian Germplasm whiplash pappusgrass will be identified by USDA NRCS accession number 9112266.

This alternative release is justified because there are no existing commercial sources of whiplash pappusgrass for the Southern Desertic Basins, Plains and Mountains (MLRA 42), Southern High Plains (MLRA 77C), and the Central Rolling Red Plains (MLRA 78B) ecoregions of west Texas. The nearest origins of commercially available whiplash pappusgrass are Webb Germplasm whiplash pappusgrass originating more than 300 miles southeast of west Texas, and Pima Germplasm whiplash pappusgrass release originating more than 400 miles west of the west Texas region. The potential for immediate use of this release is high especially for critical site revegetation, right-of-way seedings, erosion control, range seeding mixes, and wildlife plantings.

A. Proposed Variety Name and Temporary Designation:

PERMIAN GERMPLASM WHIPLASH PAPPUSGRASS

B. Family, kind, genus and species:

Family: Poaceae

Tribe: Pappophoreae

Kind: whiplash pappusgrass

Genus and species: *Pappophorum vaginatum* Buckley

C. Origin and breeding history of the variety:

Collection Site Information: All accessions comprising Permian Germplasm whiplash pappusgrass were collected from native populations originating from the Southern Desertic Basins (MLRA 42), Plains and Mountains (MLRA 42); the Southern High Plains (MLRA 77C); and the Central Rolling Red Plains (MLRA 78B) ecoregions.

Accession **9111737** was collected by Colin Shackelford of the West Texas Native Seeds project of Texas Native Seeds. This collection was made on the roadside of Interstate 10 near Allamoore in Hudspeth County (31° 4' 32" N, 105° 0' 53.94" W). The soils at this site are a gravelly loam texture, classified under the Culberspeth-Chilicotal complex. The ecological site at this location is classified as a gravelly desert grassland (MRLA 42 – Southern Desertic Basins, Plains and Mountains) (Web Soil Survey Staff 2014).

Accession **9111603** was collected by Colin Shackelford of the West Texas Native Seeds project of Texas Native Seeds. This collection was made on the roadside of State Highway 118, south of Alpine in Brewster County (30° 0' 19.10" N, 103° 34' 31.6" W). The soils at this site are a clay loam texture, classified under the Martillo-Butchernkife association. This site is classified as a clay loam desert grassland (MRLA 42 – Southern Desertic Basins, Plains and Mountains) (Web Soil Survey Staff 2014).

Accession **9111680** was collected by Colin Shackelford of the West Texas Native Seeds project of Texas Native Seeds. This collection was made along Interstate 20, west of Big Spring, TX, in Martin County (32 9 20.50" N, 101 43 8.02" W). The soils at this site are a loam texture, classified under the Portales Series. This ecological site is classified as a loamy upland (MRLA 077C – Southern High Plains, Southern Part) (Web Soil Survey Staff 2014).

Accession **9111695** was collected by Colin Shackelford of the West Texas Native Seeds project of Texas Native Seeds. This collection was made along Farm to Market (FM) Road 2335, southwest of San Angelo, TX, in Tom Green County (31 19' 43.69" N, 100 38' 25.32" W). The soils at this site are a clay loam texture, classified under the Rioconcho-Spur association. This site is classified as a loamy bottomland ecological site (MRLA 78B – Central Rolling Red Plains, Western Part) (Web Soil Survey Staff 2014).

Breeding history: Plants evaluated in the initial trials were grown from the original seed collections in order to maintain the genetic makeup of respective lines. Breeder seed of each accession was grown in isolation from the original seed collections and from wild populations of whiplash pappusgrass. No intentional breeding, selection, or genetic manipulation has been conducted on these accessions. Combination of accessions should have no effect on the genetic makeup of the release, as whiplash pappusgrass is thought to be an apomictic or self-pollinated species (Garner et al., 2006 and Smith et al., 2010). Each accession in the release should maintain the genetic integrity of the parent population. Plant stature, flowering time, and seed maturation are similar among the selected accessions.

D. Objective description of the variety:

Description: Whiplash pappusgrass is a warm-season perennial bunchgrass with vegetative characteristics similar to *P. bicolor*. Culms are 12 to 40 inches (30-100 cm) tall, stiffly erect, somewhat geniculate, and glabrous. Sheaths have a tuft of long hairs on either side of the collar, and the hairs are deciduous. The ligule is a ring of short hairs 0.5-1.0 inches (0.2-0.4 cm) long. Blades are flat or involute, scabrous on the adaxial surface, 4 to 12 inches (10-30 cm) long and 0.05 to 0.2 inches (0.15-0.5 cm) broad. Panicles are narrow, tightly contracted, whitish or tawny, only rarely with a slight purple tinge, mostly 5 to 10 inches (12-25 cm) long. Spikelets with 1, rarely 2, perfect florets and 2 reduced florets above. The lemma of lower floret has a body 0.08 to 0.12 inches (0.2-0.3 cm) long and awns up to 0.2 inches (0.5 cm) long. Chromosome number is 2n=40, or 60 (Reeder and Toolin 1989). Whiplash pappusgrass flowers from April through November (Gould 1975). Cleaned seed of Permian Germplasm whiplash pappusgrass contains approximately 338,501 seeds per pound and has a planting rate of 2-3 pounds pure live seed (PLS) per acre.

Off-type characteristics have not been observed to deviant from the parent populations. A release of *Pappophorum vaginatum* from Arizona, Pima Germplasm whiplash pappusgrass, is also assumed to be self-pollinated or apomictic (Garner et al. 2006). Similar observations from Webb Germplasm whiplash pappusgrass have been reported (Smith et al. 2010). Plant morphology and phenology are identical within accessions.

Potential Uses: Permian Germplasm whiplash pappusgrass is recommended for upland wildlife, highway rights-of-way, energy related reclamation, and rangeland plantings. Whiplash pappusgrass is tolerant of moderately saline and alkaline sites (Stubbendieck et al. 2017) and can germinate under saline conditions (Martinez et al. 1992). Permian Germplasm can be used for the revegetation of disturbed saline sites in fine textured soils. It is reported to be a fair forage for livestock (Powell 1994).

E. Evidence:

Method of Breeding and Selection:

Initial Evaluation

As part of an effort to collect, evaluate, and release germplasms for commercial seed production of a variety of native plants for west Texas, personnel from the West Texas Native Seeds project of Texas Native Seeds obtained seed collections of whiplash pappusgrass from 20 field locations in west Texas and southwestern Texas from 2011–2012. This species of *Pappophorum* was selected for evaluation of potential use in revegetation plantings on rangelands and highway rights-of-way, and for use in upland wildlife habitat plantings. Pink and whiplash pappusgrass have considerable overlap in range and habit, and often grow together (Reeder 2008). Of the 20 accessions evaluated, one accession was determined to be pink pappusgrass and was excluded from the data analysis as pink pappusgrass is far less common in the west Texas region than whiplash pappusgrass.

The twenty west Texas accessions were seeded in the greenhouse and then transplanted for evaluation in March 2014. Additionally, Pima Germplasm whiplash pappusgrass (released by the USDA-NRCS Tucson Plant Materials Center) and Webb Germplasm whiplash pappusgrass (released by South Texas Natives and the USDA-NRCS E. "Kika" de la Garza Plant Materials Center) were seeded and included in all evaluations for comparison.

Greenhouse plants were transplanted (May 2014) into a randomized complete block with 2 replications. Each block contained 10 plants of each accession planted in a single row at the Sierra la Rana evaluation site in Alpine, Texas (Figure 1). Plots were evaluated monthly under natural precipitation after a two-week irrigation period used to facilitate plant establishment. Each accession was rated 1 to 10 (1 being the best, 10 being the worst) based on visual observations of the following datasets: survival (expressed as a percentage of number of plants present/number of plants initially planted), foliage density, uniformity of the accession as a whole, forage (biomass) production, seed production, plant height, and plant canopy cover. Furthermore, data from each evaluation year was pooled, and mean performance in each category by year was used for selection of superior accessions. Seed was collected from all accessions during both growing seasons for germination tests under irrigated and natural precipitation conditions.

Advanced Evaluation

Following evaluations during the 2014 growing season in Alpine, Texas, the ten best performing accessions were selected for further valuation at the Railway Ranch research site south of Odessa, Texas (Figure 1). Plot design was the same as in Alpine, Texas. Data were collected once per month for one growing season. Seed from each replicated planting was collected throughout the year and combined for germination testing. All accessions, including the commercial releases Webb Germplasm and Pima Germplasm, performed well.

Selection

Differences show selected accessions performed better overall than non-selected accessions except for percent survival, plant height, and plant cover where values for selected and non-selected accessions were nearly identical. Overall, seed germination was over 11% higher in selected accessions compared to non-selected accessions.

An examination of initial and advanced evaluation data from the two sites, seed quality data from seed germination trials, as well as soil texture and ecological site information from the original collection locations, resulted in the selection of four accessions subsequently designated as

Permian Germplasm whiplash pappusgrass. The selections were further based on plant performance and seed quality between evaluation sites (Tables 1-2).

Accession **9111737** was selected as the westernmost-originating accession from a gravelly desert ecological site with good performance in both plant growth characteristics and seed quality. It had the fifth highest active germination rate at both the Alpine and Odessa evaluation sites. Of the accessions evaluated in Odessa it had the highest scores for uniformity, seed production, and forage production as well as the highest scores for all plant performance categories at the Alpine evaluation site.

Accession **9111603** was selected as the southernmost high-scoring accession from a clay loam ecological site. This accession had the second highest active germination rate at the Odessa evaluation site, and the second highest active germination rate for the Alpine evaluation site in 2014, and the fifth highest for 2015. It had the third highest score for vigor as well as the fourth highest score for foliage density at the Alpine evaluation site. At the Odessa evaluation site this accession had the second highest score for seed production and forage production.

Accession **9111680** was selected as the northernmost high performing accession from a loamy upland ecological site. It had the fourth highest rate of active germination in 2014 and 2015 at the Alpine evaluation site. It also had the fourth highest score for seed production and forage production at the Odessa evaluation site.

Accession **9111695** was selected as the easternmost high performing accession from a loamy bottomland ecological site. It had the highest rate of active germination for both evaluation sites.

Table 1. Plant performance of whiplash pappusgrass accessions used in the development of Permian Germplasm from comparative evaluation in 2014-2015 at Alpine, Texas.

Accession	# of Plants	Vigor	Foliage Density	Uniformity	Seed Production	Forage Production	Height (cm)	Cover (%)	2014 Germ	2015 Germ
9111603	10	2	2	2	3	3	80	91	94	77
9111680	10	3	3	3	3	3	77	90	81	80
9111695	10	3	3	2	3	3	75	92	95	96
9111737	10	2	1	2	2	2	83	97	78	81
Pima	10	2	2	2	3	2	81	91	59	64
Webb	10	2	3	2	3	3	77	92	87	79
Mean	10	2	2	2	3	3	79	92	82	80

*Note: Vigor, foliage density, uniformity, seed production and forage production are based on ocular estimates where 1 = best and 9 = poor.

Table 2. Plant performance of whiplash pappusgrass accessions used in the development of Permian Germplasm from comparative evaluation in 2014-2015 at Odessa, Texas.

Accession	# of Plants	Vigor	Foliage Density	Uniformity	Seed Production	Forage Production	Height (cm)	Cover (%)	% Germination
9111603	10	4	4	3	3	4	83	98	64
9111680	10	4	4	3	4	4	75	92	49
9111695	9	6	6	6	6	7	60	71	74
9111737	10	3	3	2	2	3	83	100	52
Pima	10	3	3	2	2	3	88	97	34
Webb	10	5	5	4	4	5	71	98	57
Mean	10	4	4	3	4	4	67	92	55

*Note: Vigor, foliage density, Uniformity, seed production and forage production are based on ocular estimates where 1 = best and 9 = poor.

Seed Increase

Transplants of the 4 selected accessions were grown from the original seed collections and planted in isolated seed increase plots at the Sierra la Rana plant evaluation site in Alpine, Texas, in June 2016. A portion of seed harvested from this planting was used to establish breeder seed increase fields of the 4 accessions.

Seed Production, Harvest, and Cleaning

Seed increase plots are planted on 36-in bedded rows; however, flat plantings may be possible with frequent weeding. Whiplash pappusgrass produces seed throughout the growing season whenever adequate soil moisture is present. Seed is harvested with a Woodward Flail-Vac (Ag-Renewal, Inc., Weatherford, OK) or similar type brush harvester. The use of slow travel and RPM speeds while harvesting results in relatively clean seed needing little cleaning or processing. Seed harvested in this manner averages 89% pure live seed (PLS) between the four accessions. Seed was cleaned with a Clipper Eclipse (Hoffman Manufacturing, Corvallis, OR) to remove stems and other chaff. No attempt has been made to clean any seed down to the caryopsis as seed damage is likely to occur.

Common pests of pappusgrass seed include fall armyworms (*Spodoptera* spp.), thrips (*Thrips* spp.), and rice stink bugs (*Oebalus pugnax*). Control of the pests may be necessary in order to produce seed crops in dry years under irrigation. Pappusgrass seed fields should be mowed or burned annually to promote vigorous growth. Deep soil tillage or frequent close cultivation is also recommended to promote seed production.

F. Area of Adaptation:

Based on the distribution of *Pappophorum vaginatum*, and origin of accessions, best performance of Permian Germplasm is in the Southern Desertic Basins, Plains and Mountains (MLRA 42); the Southern High Plains (MLRA 77C); and the Central Rolling Red Plains (MLRA 78B) ecoregions. Adjacent ecoregions may support this release, but evaluations have not occurred outside of the collection locations.

G. Procedure for maintaining stock classes of seed:

The parent populations of each component of Permian Germplasm is maintained by Texas Native Seeds. Generation (G) 0 seed, equivalent to Breeder seed, is seed harvested from isolated plantings of the parent lines. G0 seed is made up of equal amounts (by %PLS, +/- 10%) of each of the 4 accessions. G0 seed will be distributed to commercial growers. Growers may use Generation 1 and Generation 2 seed for commercial increase. Increase of Permian Germplasm beyond G2 seed is prohibited. G1 (equivalent to Foundation) and G2 (equivalent to Certified) seed fields have a seven-year production limitation. Permian Germplasm whiplash pappusgrass is released as a Selected Texas Native Germplasm by the West Texas Native Seeds project of Texas Native Seeds.

H. Additional restrictions, etc:

All commercial seed fields of Permian Germplasm must be in Texas, and isolated from other cultivated varieties and wild populations of *Pappophorum vaginatum* by a minimum of 300 feet. Release of this variety will be limited to growers who have been selected by Texas Natives Seeds following submission of a written production proposal.

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 ____

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 Permian Germplasm whiplash pappusgrass was suitable for release based on the criterion contained in this document. 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 rangeland planting, will provide a good source of forage for cattle, provide ecological benefits by maintaining and contributing to saline habitats that are often difficult to revegetate, and by providing beneficial habitat to wildlife.

Conservation Use: Permian Germplasm whiplash pappusgrass provides a selected seed source of a native plant species for upland wildlife habitat improvement, critical area revegetation, highway and energy transport rights-of-way, energy exploration and development reclamation, and rangeland plantings for west Texas.

Availability of Plant Materials: Breeder seed is maintained by Texas Native Seeds, Kingsville, Texas. G0 seed will be released to qualified growers under license agreement stipulating production requirements.

References:

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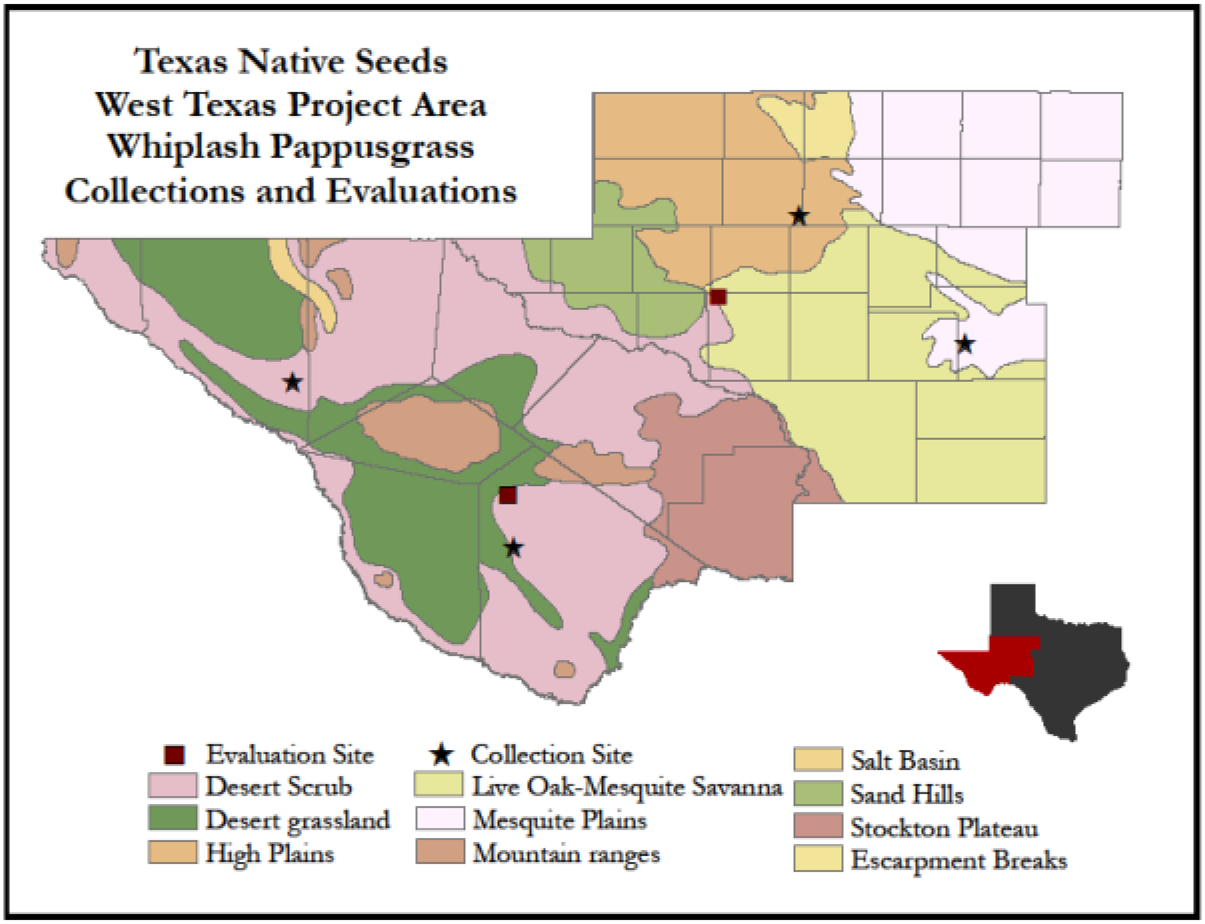
Figure 1. Collection and evaluation sites used in the development of Permian Germplasm whiplash pappusgrass.



MARKETING PLAN

PERMIAN GERMPLASM WHIPLASH PAPPUSGRASS

January 2018

Distribute breeder seed to commercial growers.

January 2018

Finalize and obtain approval for release and print supporting documents (fact sheet & brochure).

Spring/Summer 2018

Draft press release and host celebration of release once seed is commercially available to consumers.

Staff information booths at two landowner and consumer-oriented symposiums or conferences in west Texas.

Winter 2019

Present results and overview of development process at International Meeting of the 'Society for Range Management.'

Publish "notice of release" article in Native Plant Journal.

Signatures for release of:
Permian Germplasm whiplash pappusgrass
***Pappophorum vaginatum* Buckley**

8/25/2020

Dr. David G. Hewitt
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Texas A&M University-Kingsville
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Date

8/25/20

Dr. Shad Nelson
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12/1/2020

Dr. Louis Harveson
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Date

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12/4/2020

~~Clint Evans (acting)~~ Claude Ross, Acting STC
State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
Temple, TX

Date

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1/26/2021

~~Shaun McKinney (acting)~~ Danielle Flynn, Acting Director
Director
Ecological Sciences Division
United States Department of Agriculture
Natural Resources Conservation Service
Washington, D.C.

Date

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