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CAESAR KLEBERG WILDLIFE RESEARCH INSTITUTE
SOUTH TEXAS NATIVES
KINGSVILLE, TEXAS

And

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

NOTICE OF RELEASE OF STN-461 GERMPLASM LITTLE BLUESTEM SELECTED
PLANT MATERIAL

Texas A&M University-Kingsville (TAMUK), Caesar Kleberg Wildlife Research Institute (CKWRI), *South Texas Natives* (STN), and the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), E. "Kika" de la Garza Plant Materials Center (PMC) announce the release of a selected plant material of little bluestem [*Schizachyrium scoparium* (Michx.) Nash var. *scoparium*] (USDA, NRCS 2013).

This release will be referred to as STN-461 Germplasm little bluestem, and is released as a selected plant material class of certified seed (natural track). STN-461 Germplasm was tested under the accession numbers 9064461. In a commercial blend, STN-461 Germplasm in combination with STN-176 Germplasm little bluestem will be identified as Carrizo Blend little bluestem.

This alternative release procedure is justified because there are no existing commercial sources of little bluestem seed tested or have known adaptation in the Rio Grande Plains, Gulf Coast Prairies and Marshes, or Coastal Sand Sheet. Available commercial little bluestem seed originates from wild harvests of unevaluated populations, or originates from varieties developed from seed collected from native plants at distant locations such as OK Select Germplasm (Oklahoma origin), 'Cimmaron' (Oklahoma origin), or 'Pastura' (New Mexico origin) little bluestems (USDA 2002). Prior to this release, and the release of STN-176 Germplasm little bluestem, none of the available sources of little bluestem seed met reasonable definitions of ecotypic seed desired by practitioners, or the specifications of the USDA NRCS Texas Range Planting Specifications (USDA 2007).

A. Proposed Variety Name and Temporary Designation:

STN-461 GERMPLASM LITTLE BLUESTEM

B. Family, kind, genus and species:

Family: Poaceae

Kind: little bluestem

Genus and species: *Schizachyrium scoparium* (Michx.) Nash var. *scoparium*

C. Origin and breeding history of the variety:

Collection Site Information:

Accession 9064461-was collected on November 18, 1993 from a private ranch in Zavala County, Texas by Clyde Hogue. Soil series of the collection site was Antoso-Bobillo association (sand). This site is classified as a Sandy 20-35 PZ ecological site.

Breeding History: Plants evaluated in initial evaluation plantings were grown from the original wild seed collection. Accession 9064461 was collected from “6 plus” plants as noted by the collector, however, based on the size of the original seed collection; it is likely that a large number of parent plants were collected from over a substantial area. Advanced evaluations and seed increases were also started from the original seed collections. Later increases were made using seed harvested from seed production fields established by transplants grown from seed produced in isolation from other little bluestem accessions and wild populations of the plant. Multiple harvests of each accession in the seed increase of each accession were made in an effort to maintain the full spectrum of genetic diversity of each accession. The minimum plant population used to increase the accession was 693 plants. No intentional selection of any kind was conducted on the accession in the development of this release.

D. Objective description of the variety

Description: Little bluestem exhibits considerable variation (Barkworth et al. 2007). In general, little bluestem is a perennial, caespitose or rhizomatous species (Shaw 2012). Shaw (2012) gives the following measurements: Culms to 2 m long, sheaths rounded or keeled, with ligules 0.5-2 mm long, and awns 2.5-17 mm long. Pedicillate spikelets are staminate or sterile, unawned or awned, with awns to 4 mm.

A number of varieties and sub-species of little bluestem are reported by various authorities. Accession 9064461 most closely matches the descriptions and range reported for *Schizachyrium scoparium* var. *scoparium* (Barkworth et al. 2007; Shaw 2012; USDA 2014). Botanical identification of each accession in the release was independently confirmed by examination of specimens by Dr. Stephen L. Hatch of the S.M. Tracy Herbarium at Texas A&M University, College Station, Texas.

Accession 906441 is a robust ecotype of little bluestem with blue-green coloration of leaves and stems throughout the year. Culms are commonly 1.5-2 m at maturity when grown under ideal field conditions. Up to 10% of the plants grown from seed of the accession are divergent in a number of characteristics from the majority of the plants in the accession. We have made no attempt to select out this variability in order to maintain the natural makeup and diversity of the wild populations.

Based on examination of herbarium collections and field observations, accession 9064461 is characteristic of the ecotype of little bluestem found growing on Carrizo Geologic formation outcrops characterized by sandy soils that are scattered throughout the western Rio Grande Plain and western portions of the Coastal Sand Plain.

Potential Uses: STN-461 Germplasm little bluestem is recommended for use in range seeding mixtures, upland wildlife plantings, roadside plantings, and conservation plantings on sand, loamy sand, and sandy loam soils in the Rio Grande Plains and South Texas Sand Sheet ecoregions of Texas. Little bluestem is a dominant, late seral plant of undisturbed sand, loamy sand, and sandy loam sites in these ecoregions. Little bluestem is a preferred nesting substrate for bobwhite quail, and was identified as the nesting substrate in 44 of 97 nests studied in one South Texas study (Arredondo et al. 2006). Everitt et al. (2011) states little bluestem is good forage for cattle, and provides excellent nesting cover for bobwhite quail, wild turkeys, and good fawning cover for white-tailed deer. Since little bluestem is slow to establish from seed and the plants mature slowly, it is recommended that STN-461 Germplasm only be planted in mixtures with other native species, including adapted early successional grasses, forbs, and legumes naturally found in association with little bluestem.

E. Evidence

Method of Breeding and Selection:

Initial Evaluation

As part of an effort to collect, evaluate, and release adapted germplasm of a variety of South Texas native plants for use in habitat restoration activities, seed collections from native populations of little bluestem were obtained from across the region from 2001-2009. Little bluestem collections from the South Texas region available in the USDA NRCS Plant Materials Program seed collections were also evaluated. In total, 95 populations of little bluestem originating from South Texas were evaluated. These populations represented a number of varieties and integrated morphological types of little bluestem, and the closely related species seacoast bluestem (*Schizachyrium littoralis*). Whenever possible, varietal identification of each accession following the best available local taxonomic reference (Hatch et al. 1999) was made. However, many populations we evaluated possessed plants of both seacoast and little bluestem, as well as intermediate plants having characteristics of more than one variety of little bluestem. Standards for evaluation included OK Select Germplasm little bluestem, ‘Cimmaron’ little bluestem, ‘Pastura’ little bluestem and a commercial selection marketed by Turner Seed Company, Breckenridge, Texas sold as “Native” little bluestem. Neither standard was particularly useful in the evaluations, as most had 100% mortality by the end of the 2nd growing season at the initial evaluation locations. All standards were morphologically and phenologically different than the majority of the South Texas origin populations. Notable differences in morphology included smaller stature throughout the growing season and at maturity, and in phenology, earlier flowering and maturity dates. Previously these types of little bluestem were characterized as botanical variety *frequens* (Gould 1965).

Initial evaluations resulting in the selection of STN-461 and STN-176 Germplasm little bluestems were conducted from 2001-2006 by personnel from the *South Texas Natives* Project of the Caesar Kleberg Wildlife Research Institute (STN) and the USDA NRCS E. “Kika” de la Garza Plant Materials Center (PMC). Three sites were used for initial evaluation of plants grown from the wild populations. These sites were the PMC near Kingsville, Texas; Rio Farms near Monte Alto, Texas; and Bladerunner Farms near Poteet, Texas. These sites are representative of the variations in soils and climate along a north to south gradient encompassing the natural distribution of little bluestem in the area of intended benefit from our work.

Based on evaluations at the PMC, Rio Farms, and Bladerunner Farms of 95 little bluestem accessions from 2001-2006, we chose 4 accessions for advanced evaluation. Field evaluations were based on a minimum of 2 replications of ten plants of each accession per location. Field characteristics were scored throughout the evaluation years and averaged by accession/site/year for selection purposes. Criteria ocularly evaluated included survival, disease resistance, foliage density and production, stage of development, seed production, and plant height. Whenever possible, seed was collected from the accessions planted at each evaluation site for tests of active seed germination and comparative seed quality. Original seed collections were also screened for germination by the PMC in greenhouse plantings.

Initial selections were based primarily on field performance scores and plot observations at multiple sites, seed germination potential of original seed collections, collection origin, and remaining amount of original seed available for large scale increase and potential commercialization. Comparing seed quality (measured by seed germination) was difficult in the evaluation plots, and results were highly variable between sites. This variability in results is likely due to high degree of dormant seed produced by little bluestem as confirmed by later TZ test results in the seed increase phase. Some accessions with good performance were identified in the initial field evaluation as seacoast bluestem, thus they were treated separately, and were not considered for the little bluestem release. Populations with plants of both seacoast and little bluestem were also eliminated from consideration, as were populations with extreme variability that would have limited commercialization potential, or resulted in inadvertent selection in seed production settings.

We attempted to select populations from each of the geographic areas in South Texas where little bluestem was collected and represented in the evaluation. Selection decisions for advanced evaluation were based on the following initial evaluation observations

- Accession 9086176-Bexar County was a clear selection based on: 1) original seed germination double that of any other wild collected South Texas accession-and similar to the germination of cultivars ‘Pastura’ and ‘Cimarron’; and 2) best accession in the Bladerunner Farms evaluation study, being scored superior to all other accessions in uniformity, disease resistance, foliage density; and among the top 3 accessions plant vigor and seed production.
- Accession 9064461-Zavala County was selected based on good performance in the Bladerunner Farms and outstanding performance in the Rio Farms evaluation plots. It was ranked equal to 9086176 for seed production potential at Bladerunner Farms, and

was consistently rated the best performing accession in the evaluation at Rio Farms over three years of evaluation.

- Accession 9090266-Goliad County was selected as the best performing accession amongst the collections originating from the Goliad/Refugio Prairie region. This accession had above average original seed germination, and exhibited good field performance at the PMC, Rio Farms, and Bladerunner Farms, although overall it was a weaker accession than 9064461 or 9086176 at all locations. Seed production potential was scored as average, to slightly higher than average amongst the populations evaluated at most sites.
- Accession 9089229-Wilson County was selected as the best performing selection from the northeast portion of the evaluation region. Original seed collection germination was good, and accession was scored highest in the evaluation for seed production potential at the Rio Farms evaluation site, and noted as the second best performing little bluestem accession overall at Rio Farms, behind accession 9064461.

Advanced Evaluation

Advanced evaluations were conducted beginning in 2006 using isolated seed increase plantings at Rio Farms. Each seed increase field was established using transplants grown from original seed of each selection in 2006 and subsequently increased to around 4,000 plants/accession using harvests from the preceding block from 2007-2008. These plantings were intensively managed to produce seed, including applications of irrigation, fertilizer, pesticides, and herbicides. All 4 isolated seed increase plots were on the same soils series, and each was managed the same. Major area of emphasis for the advanced evaluation was to determine if the selections could be successfully grown commercially, and to document the potential for high quality seed production. We also carefully evaluated the uniformity of the accession in the initial generation, and subsequent generations to determine if shifts in plant population variation were occurring. Selected populations maintained generally high levels of within accession variation, but overall each population was relatively stable in genetic make-up through 4 generations of increase conducted at this site. By year 4, differentiation of the original plants grown from the wild seed collections, and subsequent plants grown from harvests of it was impossible.

Seed quality of each accession over a 6 year period under high input production varied tremendously, both by year and by accession in most years. Highest observed germination of the 4 selected accessions was 87% in accession 9064461 in 2007, followed by 75% in accession 9086176 also in 2007. Accession 9090266 produced excellent seed in 2007 (highest observed pure live seed (PLS) value in the evaluation); however, the plants failed to produce any seed in 2008, and produced the poorest quality seed observed in the experiment (1.08% PLS) in 2009. Based on variability in seed quality, production, and observed poor vigor of 9090266 in the seed increase planting, we removed this accession from the advanced evaluation in 2010.

We continued to manage and harvest the remaining 3 accessions through 2011. At the end of 2011, we analyzed the results of 6 years of seed quality data. Bulk seed yields amongst accessions were similar over the 6 years of harvests; however, seed quality did vary by accession

in all years. Mean germination was highest in accession 9064461 (50%), followed by 9086176 (44%), and 9089229 (31%). Percent PLS was similar, ranging from 12-23% across accessions for the 6 years of harvests, however 9089229 averaged slightly higher percent inert matter overall. The two years of highest observed germination (representing maximum potential of the accessions in our estimation) was 87% and 73% in 9064461; 59% and 44% in 9089229; and 75% and 72% in 9086176.

Throughout the advanced evaluation, accession 9089229 exhibited severe lodging problems in the seed production environment. Because of the lodging problems exhibited, indications of slightly lower seed quality and its similarity of origin to 9086176, we chose to eliminate 9089229 from the evaluation at the end of 2011.

Following 2010 harvests, seed of accessions 9064461 and 9086176 was sent to commercial growers for further evaluation. In 2011, accession 9064461 had 50% PLS when grown near Kenedy, TX, representing the highest observed seed quality in a harvest of this accession by >25% PLS. In 2012, accession 9086176 had 28% PLS in seed grown near San Antonio, and accession 9064461 had 28% PLS in seed again grown near Kenedy, Texas. Both growers reported necessary yields for satisfactory production margins at these levels of seed quality and yield. As a result, we made the decision to develop releases of accession 9064461 and 9086176. Carrizo was chosen for the name of a blend of the two releases since each parent accessions originated from sandy soils representative of outcrops of Carrizo geologic formation.

We chose to release each accession individually, but name a specified blend of the two accessions to ensure success of consumer plantings across the South Texas region. Although little bluestem is a common plant on sandy soils in the region, populations vary distinctively by site. The two selected accessions are representative of the major variation in plant types found in the region. Since each accession will be produced in isolation in commercial production, and commercially produced seed will be blended after harvest, consumers on most all sites appropriate for this species will be planting some portion of their seed mix to adapted ecotypic material for their site. In cases where the exact ecotype of the plant needed for a site cannot be confirmed, the blend should allow for success nonetheless. Furthermore, since little bluestem is an outcrossing species, establishment of each pure strain will allow crossing of the accessions, potentially resulting in more fit offspring adapted for novel restoration sites.

By designating that commercial seed production of each component will occur in isolation, we can prevent such crosses between accessions from occurring in the seed production environment, and instead facilitate them on restoration sites, providing potential for adaptation for end users. In cases where the actual ecotype needed for a particular planting site is known, the individual components of Carrizo Blend will be available commercially as will either STN-461 Germplasm or STN-176 Germplasm.

Seed Increase

Seed increase plots are established at Rio Farms, near Monte Alto, Texas, at Pogue Agri Partners (Kenedy, TX) and Douglass King Seed Company (San Antonio, TX). Seed of each of the accessions comprising the Carrizo Blend little bluestem is grown in isolation from the other

selected accession, wild, or other cultivated materials of little bluestem. Seed quality of the 2 selections averaged 15% PLS for 9064461 over 7 years at Rio Farms, and 22% PLS over 7 years for 9086176. Highest PLS observed was 24% in 9064461, and 37% in 9086176. Potential bulk seed yields per acre have been measured at 268 lbs. per acre on 36" bedded rows with a plant population of 14,000 plants per acre (plants established using transplants spaced 1').

Seed Production, Harvest, and Cleaning

Seed production of STN-461 Germplasm little bluestem is best started from greenhouse grown transplants, planted to bedded rows. Seedlings are relatively slow growing, and when direct seeded, most plants will not reach maturity until the end of second growing season, whereas well managed transplant stands will produce a marketable crop in the year of planting. Specific seed lot characteristics such as percent dormant seed, percent active germination, and percent PLS should be carefully evaluated for both greenhouse transplant and direct seeding plantings. Highly dormant harvests will yield poor stands in both greenhouse and field plantings.

Seed production north of a line from approximately Del Rio to San Antonio to Victoria, TX is discouraged. Attempted production north of this line is likely to fail, as these accessions are adapted to flowering in October. Seed set and maturity are rarely complete before November, thus seed likely will not fill and ripen before first frost in the northern two-thirds of Texas. Evaluation plantings of the selected accessions conducted in these areas have consistently failed to produce viable seed. Locations where poor performance has been observed include Knox City and Stephenville, TX, and Ardmore, OK.

Seed harvest is possible using a variety of methods and implements; however we have had excellent results using a Woodward Flail-Vac Seed Stripper (Ag-renewal, Inc., Weatherford, Oklahoma). Seed of both accessions ripens indeterminately, and the Flail-Vac can collect the ripe seed crop without damaging or eliminating the ability to make subsequent harvests of the stand as later flowering florets mature. As many as 5 harvests from October-December may be possible in some production years using a Flail-Vac. Multiple harvest dates also assist in maintaining within accession genetic diversity.

Seed is best cleaned by combinations of debearding, hammer milling, and screening. Large amounts of inert matter in cleaned seed are unavoidable due to the pubescence and hairs of the spikelets of these accessions. This inert matter is generally impossible to remove, and influences the low PLS values associated with these accessions. Seed morphology of 9064461 is distinctly different than many commercial sources of little bluestem because of longer spikelet length and greater pubescence.

G. Area of Adaptation

Based on origin

STN-461 Germplasm little bluestem is likely to perform best on sand, sandy loam, and loamy sand soils in the Rio Grande Plain and South Texas Sand Sheet ecoregions of Texas. Use of STN-461 in adjacent ecoregions to the north is not recommended, as other morphologically and

phenotypically distinct ecotypes of little bluestem naturally occur there, and seed of these ecotypes is generally available commercially. Furthermore, flowering dates of STN-461 make successful reproduction of the plant unlikely north of a line from Del Rio to San Antonio to Victoria because of average first freeze dates.

Based on trial plantings and outside evaluations

A number of trial plantings and evaluations have been performed using the accessions comprising Carrizo Blend little bluestem. Data from these evaluations indicate similar area of adaptation as indicated by germplasm origin and suggested limits on seed transfer (USDA 2007). Plants of accession 9064461 grown under irrigation in Stephenville, TX and Ardmore, OK from 2006-2007 failed to produce viable seed, whereas replicates using the same transplants under the same management in Uvalde, Kingsville, and at Rio Farms produced viable seed in each of those years. In a 6-site, multi-species trial at 6 locations from 2010-2013, accession 9064461 had good vegetative performance at Stephenville, Knox City, Uvalde, Kingsville, and in the Lower Rio Grande Valley, TX. However, in comparison to available commercial sources of the plant also included in the study (e.g. OK Select Germplasm little bluestem, 'Pastura' little bluestem, and a selection from Turner Seed Company), accession 9064461 was superior at just the Kingsville, Rio Farms, Uvalde evaluation sites overall.

Trial plantings within the area of suggested adaptation have had sporadic success, and little bluestem appears to be relatively slow and difficult to establish from direct seeding in the South Texas region. Successful plantings have occurred exclusively on sandy soils with little competition from non-native species, whereas failed plantings have been on clay or tight surface textured soils. Establishment is generally not apparent until the second growing season after seeding.

G. Procedure for maintaining stock classes of seed

G0 seed of STN-461 Germplasm little bluestem will be maintained by *South Texas Natives*.

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

Carrizo Blend little bluestem is a mechanical blend of 2 released accessions of little bluestem, STN-176 Germplasm and STN-461 Germplasm. For each accession in the Carrizo Blend, G0 seed will be made up of the individual accessions, grown in isolation from one another, and maintained by the breeder. G1 seed is harvested by isolated plantings of G0 seed by commercial seedsmen and G2 seed is harvested from plantings of G1 seed. Increase using G2 seed is prohibited. Carrizo Blend is a mixture of equal amounts of certified, G1 or G2 pure live seed (PLS) of accession 9064461 and accession 9086176. Variance of +/- 15%, such that no accession makes up more than 65%, or less than 35%, of the blend is acceptable in seed marketed as Carrizo Blend. Each components of the release may be marketed individually as certified, selected native Texas germplasm seed, and sold as STN-461 Germplasm little bluestem or STN-176 Germplasm little bluestem.

I. Additional restrictions, etc.

G1 and G2 seed fields have a 7 year production limit, after which time, fields must be replanted using the appropriate seed generation (G0 or G1).

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 the 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 STN-461 Germplasm little bluestem was suitable for release based on the criterion contained in this document. This conclusion is mainly based on the fact that little bluestem is a naturally occurring species in Texas and planting it therefore would 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.

Conservation Use: STN-461 Germplasm little bluestem will provide a native plant species for rangeland plantings and wildlife habitat improvement.

Availability of Plant Materials: G0 seed will be maintained by the *South Texas Natives* Project of the Caesar Kleberg Wildlife Research Institute. G0 seed will be released to qualified growers under license agreement stipulating production requirements.

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Signatures for release of:

STN-461 GERMPLASM LITTLE BLUESTEM

Schizachyrium scoparium (Michx) Nash var. *scoparium*

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