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
BEEVILLE, TEXAS

NOTICE OF RELEASE OF STN-561 GERMPLASM HOOKERS PLANTAIN SELECTED CLASS OF NATURAL GERMPLASM

Texas A&M University-Kingsville, *South Texas Natives*, U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), and Texas Agrilife Research –Beeville (TAR-B) announce the release of a selected class of natural germplasm of Hookers plantain (*Plantago hookeriana* Fisch. & Mey.) for the south Texas ecoregion.

This plant will be referred to as STN-561 Germplasm Hookers plantain, and is released as a selected plant material class of certified seed (natural track). STN-561 was tested under the USDA-NRCS accession number 9088561.

This alternative release procedure is justified because there are no existing Texas commercial sources of tested and adapted Hookers plantain. The potential for immediate use is high, especially for upland wildlife plantings and for range seeding mixes.

STN-561 Germplasm will be marketed as part of a blend of 2 species of *Plantago* under the name Divot Tallow Weed Blend.

A. Proposed Variety Name and Temporary Designation:

STN-561 GERMPLASM HOOKERS PLANTAIN

B. Family, kind, genus and species:

Family: Plantaginaceae

Kind: Hookers plantain

Genus and species: *Plantago hookeriana* Fisch. & Mey.

C. Origin and breeding history of the variety:

Collection Site Information: Accession 9088561 was collected on May 5, 2002 by Forrest Smith and Cody Lawson from a native population located along county road 749 in Medina County, Texas at 29° 05' 35" N. latitude and 99° 07' 21" W. longitude (MLRA 83). Soil type of the collection site is Divot clay loam.

Breeding history: Plants evaluated in all trials were grown from the original seed collection. No intentional breeding, selection, or genetic manipulation has been carried out on this accession.

D. Objective description of the variety:

Description: STN-561 Germplasm Hookers plantain is a short-stemmed, cool season annual with a slender taproot; leaves linear to narrowly oblanceolate, entire or with small scattered denticulations, callous-tipped at the acute to obtuse apex, to 3 dm. long and 2 cm. wide, usually much smaller, glabrous to lanate; scapes erect or ascending, shorter than to mostly noticeably exceeding the leaves, glabrate to pubescent; spikes capitate to long-cylindric, to 12 cm. long and 8 mm. thick, rarely reduced to only 2 flowers; bracts broad at base, scarious-margined for one third to the entire length of midrib, equal to or shorter than calyces, glabrate to villous; calyx lobes oblong, about 3 mm. long; corolla lobes suborbicular-ovate, whitish with a brown spot at base of each or brown stripes the entire length of each, to 4 mm. long; seeds 2 cymbiform, dull-brown, finely pitted, about 3 mm. long and 1.3 mm wide (Correll and Johnston, 1996). Cleaned seed of STN-561 Germplasm contains 197,816 seeds per pound. Tallow weeds typically take 180 days from planting to seed maturity. The exact mode of reproduction of Hookers plantain is unknown. Many European species of *Plantago* are known to exhibit anemophily, or wind pollination, however the degree of outcrossing is unknown, or varies tremendously by species and population (Sharma et. al., 1993). We have not observed off types or characteristics deviant from the parent population in 3 generations of propagation of 9088561 or other accessions of *Plantago* originating from south Texas. The original evaluation plots at Beeville have shown that offspring from accessions grown adjacent to numerous other accessions of the same species to be identical in morphology and phenology to the parent plants.

Potential Uses: STN-561 Germplasm is recommended for cool season upland wildlife plantings and in range seeding mixes. Hookers plantain seed is consumed by game birds such as bobwhite quail and mourning doves, and the foliage is eaten by bobwhite quail, Rio Grande wild turkeys, white-tailed deer, and cattle (Everitt et. al. 1999).

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* obtained seed of 3 species of Plantago from 27 field locations in South Texas from 2001-2004. These species of *Plantago* were selected for evaluation based on their potential use in revegetation plantings and because of their importance to wildlife (Table 1).

Because little or no information on propagation or seed quality was available for these species, we conducted initial laboratory germination experiments on these accessions in August 2004. Seed was tested for germination characteristics in controlled climate growth chambers for 30 days (12 hrs. light at 86 F, 12 hrs. dark at 68 F). Germination tests consisted of 4 replications of 100 seeds per accession. Results of these tests of the original seed collections showed excellent seed germination characteristics, including high percent active seed germination, and rapid initiation of germination following the onset of favorable conditions (germination < 36 hours). The original seed collection of STN-561 Germplasm had 56% active seed germination in this test.

In December 2005 a greenhouse transplant planting was made of all 26 accessions. Severe drought and adverse planting conditions prevented planting the transplants in the field for evaluation. Plants were allowed to mature in the transplant flats, and seed was collected when ripe. STN-561 Germplasm had 28% active seed germination in this test.

In 2006, another transplant planting was seeded and planted for field evaluation at TAR-B. All plots were planted in a split plot spaced plant (1') design (2 replications x 10 plants of each accession). All plots were irrigated to ensure establishment and weeded as needed. STN-561 Germplasm was selected as one of 7 accessions in this evaluation that showed superior vigor, seed production, and characteristics making mechanical harvest possible (Table 2).

Advanced evaluation

The 7 accessions selected in 2006 evaluation were planted for isolated seed increase at TAR-B in the winter of 2006-2007. Observed greenhouse germination STN-561 Germplasm in this planting was 56%. Evaluation of the 2006 plot in April 2007 showed that STN-561 Germplasm had superior regeneration from seed and persistence in comparison to other accession of Hookers plantain. Seed yield tests from the increase plots showed that STN-561Germplasm produced the greatest amount of seed of the 2 *Plantago hookeriana* accessions in seed increase. Seed yield was estimated at 288 pounds of bulk seed per acre, which was >2x higher than the other accession of Hookers plantain selected for advanced evaluation. Seed increase in 2007 at TAES Beeville yielded seed with 93 % viability, 90 % seed dormancy (highest of all accessions observed), and 79 % pure live seed. (Table 3) Following the Beeville plantings we selected two accessions of redseed plantain (STN-496 Germplasm and 9090507), one accession of Hookers plantain (STN-561 Germplasm), and one accession of bottlebrush plantain (9088672) for additional seed increase and evaluation at Kingsville, Texas in the winter of 2007-2008.

All accessions performed well in this evaluation. STN-561 Germplasm showed good seed yields in comparison to STN-496 Germplasm redseed plantain, the redseed plantain accession chosen for release.

Seed harvested from seed increase of STN-561 Germplasm at Kingsville in June 2008 had 93% pure live seed, with 0% dormancy and 94% active germination. Seed yield from Kingsville plantings was 322 lbs. pure live seed per acre (Table 4). Interestingly, seed produced at Beeville in 2007 had 90% seed dormancy, while seed produced at Kingsville in 2008 had no dormancy. The mechanism behind initiation of dormancy is not understood, but is likely a result of environmental conditions during seed set. Dormancy may be further induced by laboratory conditions.

A trial seeding was also planted at the CKWRI wildlife complex in November 2007 to observe emergence of the four accessions selected for advanced evaluation. In this mixed planting STN-496 Germplasm and STN-561 Germplasm showed excellent performance and emergence, as well as persistence and seed production in competition with the other accessions and several common cool season weed species. Screenings for resistance to several grass specific herbicides were conducted, with no effect observed on STN-561 Germplasm. Seed used in this planting was that harvested from Beeville in 2007, which tested 90% dormant. The stand obtained in the trial plot suggests that this dormancy was broken by field conditions, and not of a significant duration.

Additional transplant plots of STN-561 Germplasm were planted in December 2007 at 2 locations at Rio Farms near Monte Alto, Texas, to assess plant performance and seed production in the Lower Rio Grande Valley of Texas. Data collected from this planting showed STN-561 Germplasm to be well adapted to the region, with good survival, vigor and seed production observed.

Selection

Two accessions were selected from the advanced evaluation to be released, then marketed under the name Divot Tallow Weed Blend. STN-561 Germplasm was included because of excellent seed establishment characteristics, suitability for mechanical harvest and agronomic production, and high seed yields in comparison to other accessions of *Plantago hookeriana.* The two species (STN-561Germplasm and STN-496 Germplasm) have had similar seed yields, which should make formulation of the Divot Tallow Weed Blend feasible, even if separate commercial growers produce each accession.

Seed Increase

Seed harvested from the 2007 isolated advanced evaluation planting was used to establish a seed increase field in 2008. Seed harvested from this planting will be designated as breeder seed and be distributed to commercial seed producers in October 2008.

F. Area of adaptation

Based on the native distribution of *Plantago hookeriana*, best performance of STN-561 Germplasm will likely perform best in the Gulf Prairies and Marshes, Rio Grande Plain, Edwards Plateau, and southern portions of the Oak Woods and Prairies, and Blackland prairie. A series of 10 rangeland seeding trials were initiated in the fall of 2008, which should further define the area of adaptation of this release.

G. Procedure for maintaining stock classes of seed

Breeder seed will be produced and maintained by *South Texas Natives* in conjunction with the Texas Foundation Seed Service.

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

STN-561 Germplasm Hookers plantain will be marketed as part of a Selected Texas Native Ecotype blend of 2 species of plantain released by *South Texas Natives*, and marketed under the name Divot Tallow Weed Blend. STN-496 Germplasm redseed plantain is the other accessions to be marketed as a blend with STN-561 Germplasm. Certified seed will be made up of equal amounts (% PLS) (+/- 10%) of each of the 2 accessions comprising the blend. One accession cannot make up more than 60% (by % PLS), or less than 40% (by % PLS) of the mixture.

I. Additional restrictions, etc.

Each of the 2 accessions must be grown and harvested separately in Foundation and Certified seed fields, but accessions can be grown adjacent to one another. Seed harvested from each accession should be blended following harvest and analysis of quality. Only seedlots comprised of the designated mixture of 2 accessions may be certified for sale as Divot Tallow Weed Blend. Surplus seed of STN-561 may be sold alone as Source Identified Seed, but not as a Selected Texas Native Ecotype or under the Divot Tallow Weed Blend name. Foundation and certified 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: Distribution of royalties and percentages to be determined at a later time.

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-561 Germplasm Hookers plantain was suitable for release based on the criterion contained in this document. This conclusion is mainly due to the fact that Hookers plantain 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 rangeland planting, will provide a good seed source to upland avian wildlife species, and provide unknown benefits by maintaining and contributing habitat that harbors beneficial insects and butterflies.

Conservation Use: STN-561 Germplasm Hookers plantain will provide a cool season native plant species for rangeland plantings and wildlife habitat improvement.

Availability of Plant Materials: Breeder seed will be maintained by *South Texas Natives*, Kingsville, Texas. Breeder seed will be available by October 2008.

References:

Correll, D.V., and M.S. Johnston. 1996. Manual of the Vascular Plants of Texas. The University of Texas at Dallas. Dallas, Texas. Fourth Printing.

Everitt, J.H., D.L. Drawe, and R.I. Lonard. 1999. Field Guide to the Broad-Leaved Herbaceous Plants of South Texas Used by Livestock and Wildlife. Texas Tech University Press. Lubbock, Texas.

Sharma, N., P. Koul, and A.W. Koul. 1993. Pollination biology of some species of genus Plantago L. Botanical Journal of Linnaean Society 111-2:129-138.

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Signatures for release of:

STN-561 Germplasm Hookers plantain
(*Plantago hookeriana* Fisch. & Mey.)

_____ _____

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

_____ _____

Dr. Mark Hussey — Date
Interim Director
Texas Agrilife Research
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Dr. G. Allen Rasmussen — Date
Dick and Mary Lewis Kleberg
College of Agriculture, Natural Resources and Human Sciences
Texas A&M University-Kingsville,
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_____ _____

Don Gohmert — Date
Acting State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
Temple, TX

_____ _____

National Plant Materials Program Leader — Date
United States Department of Agriculture
Natural Resources Conservation Service
Washington, D.C.

Table 1. *Plantago* collections obtained by *South Texas Natives* from 2001-2004.

Accession	Species	County	Location	Soil type
9088676	*Plantago aristata*	San Patricio	Welder Wildlife Refuge	sand
9088672	*Plantago aristata*	Goliad	David Crow Ranch	sandy loam
9091927	*Plantago aristata*	Zavala	Chaparrosa Ranch	sand
9088561	*Plantago hookeriana*	Medina	CR 749	clay loam
9088735	*Plantago hookeriana*	Jim Hogg	Tierra Rojo Ranch	sandy loam
9088775	*Plantago hookeriana*	Jim Hogg	Las Vivaritas Ranch	sandy loam
9090538	*Plantago hookeriana*	Duval	Temple Ranch	loamy sand
9090543	*Plantago hookeriana*	Frio	Half Ranch	sandy loam
9090550	*Plantago hookeriana*	Medina	FM 1343	sandy loam
9090569	*Plantago hookeriana*	La Salle	FM 469	sandy loam
9091847	*Plantago hookeriana*	Maverick	La Bandera Ranch	sandy loam
9091925	*Plantago hookeriana*	Jim Hogg	Palangana Ranch	sandy loam
9086292	*Plantago hookeriana*	Jim Hogg	HWY 16	sand
9086276	*Plantago rhodosperma*	Atascosa	74 Ranch	sandy loam
9088516	*Plantago rhodosperma*	NA	NA	NA
9088595	*Plantago rhodosperma*	Victoria	McCan Ranch	sandy loam
9086260	*Plantago rhodosperma*	Frio	Cato Ranch	loam
9090496	*Plantago rhodosperma*	Bexar	Briggs Ranch	clay
9090507	*Plantago rhodosperma*	Frio	Half Ranch	sandy loam
9090521	*Plantago rhodosperma*	Duval	Sweden Ranch	loam
9090535	*Plantago rhodosperma*	Duval	Temple Ranch	loam
9090541	*Plantago rhodosperma*	Duval	Temple Ranch	loam
9093255	*Plantago rhodosperma*	Medina	Beeville Vetch Plot	clay loam
9090544	*Plantago rhodosperma*	Frio	CR 189	sandy loam
9090614	*Plantago rhodosperma*	Duval	Welder Ranch	clay loam
9090678	*Plantago rhodosperma*	Dimmit	San Pedro Ranch	loam
9091880	*Plantago rhodosperma*	Zapata	Dodier Ranch	clay loam

Accessions selected for release

Table 2. Initial evaluation data collected on 27 accessions of *Plantago* 2004-2006

Accession	Species	2005 Orig. Seed % Germ.	2006 GH Seed % Germ.	March 2006 Beeville Eval.*
9088676	*Plantago aristata*	74	38	Excellent
9088672	*Plantago aristata*	76	38	Excellent
9091927	*Plantago aristata*	64	30	Fair
9088561	*Plantago hookeriana*	71	28	Excellent
9088735	*Plantago hookeriana*	78	37	x
9088775	*Plantago hookeriana*	78	39	Fair
9090538	*Plantago hookeriana*	42	21	x
9090543	*Plantago hookeriana*	75	37	Fair
9090550	*Plantago hookeriana*	30	15	x
9090569	*Plantago hookeriana*	88	44	x
9091847	*Plantago hookeriana*	98	49	x
9091925	*Plantago hookeriana*	46	23	Fair
9086292	*Plantago hookeriana*	74	37	x
9086276	*Plantago rhodosperma*	x	50	x
9088516	*Plantago rhodosperma*	99	x	Good
9088595	*Plantago rhodosperma*	x	24	Fair
9086260	*Plantago rhodosperma*	x	x	x
9090496	*Plantago rhodosperma*	81	41	Excellent
9090507	*Plantago rhodosperma*	70	35	Excellent
9090521	*Plantago rhodosperma*	70	35	Poor
9090535	*Plantago rhodosperma*	28	14	Fair
9090541	*Plantago rhodosperma*	62	31	Fair
9093255	*Plantago rhodosperma*	x	x	Good
9090544	*Plantago rhodosperma*	70	35	x
9090614	*Plantago rhodosperma*	26	15	x
9090678	*Plantago rhodosperma*	40	20	x
9091880	*Plantago rhodosperma*	x	x	x

x indicates no data collected for category due to insufficient original seed amounts or poor greenhouse performance.

*** March 2006 Beeville Evaluation based on a combination of seed production, biomass production, and suitability for harvest with mechanical equipment. Ratings given are: excellent, good, fair, poor.**

Accessions selected for release

Table 3. Advanced evaluation data collected on 7 accessions of *Plantago* planted at Texas Agrilife Research-Beeville, December 2006-May 2007.

Accession	Species	Percent active seed germ. GH	gross seed yield (cleaned lbs./acre)	net seed yield (cleaned lbs. PLS/acre)	Percent viable seed (TZ test %)	Percent active seed germ	Percent dormant seed	% PLS of seedlot	Seed production ranking	Forage production ranking	Re-growth from seed in 2006 plot
9090496	*Plantago rhodosperma*	51	432	387	98	53	45	90	2	2	2
9090507	*Plantago rhodosperma*	71	192	150	94	29	65	78	3	1	1
9088516	*Plantago rhodosperma*	75	106	89	98	56	42	84	5	5	4
9093255	*Plantago rhodosperma*	45	67	48	96	72	24	72	8	5	4
9088561	*Plantago hookeriana*	34	288	229	93	3	90	79	2	1	1
9088676	*Plantago hookeriana*	67	125	x	x	x	x	x	5	5	3
9088672	*Plantago aristata*	56	537	424	91	26	65	79	1	1	1

x indicates no data was collected for this category
Seed production, forage production and re-growth from seed were evaluated by visual estimation, with scores of 1 given to superior performance, and 5 for poor performance.
Accessions selected for release

Table 4. Foundation Seed Production data collected on 4 *Plantago* accessions grown at CKWRI Wildlife Complex, Kingsville, Texas, spring 2008. Seed harvested with a combine and cleaned using a Clipper seed cleaner.

Accession	Species	Gross seed yield (cleaned lbs./acre)	Net seed yield (lbs. PLS/acre)	Percent viable seed (TZ test)	Percent purity	Percent active seed germination	Percent dormant seed	Percent PLS
9090507	*Plantago rhodosperma*	124	98	90	99	72	8.00	79
9090496	*Plantago rhodosperma*	458	400	88	99	79	12.00	87
9088561	*Plantago hookeriana*	354	322	92	100	94	0.00	93
9088672	*Plantago aristata*	458	425	92	100	93	0.00	92

Accessions selected for release