UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
BROOKSVILLE, FLORIDA

NOTICE OF RELEASE OF OSCEOLA BLUE GERMPLASM LOPSIDED INDIANGRASS SELECTED CLASS OF NATURAL GERMPLASM

The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), announces the release of Osceola Blue Germplasm, a selected-class release of lopsided indiangrass [*Sorghastrum secundum* (Elliot) Nash]. Osceola Blue Germplasm has been assigned the NRCS accession number 9060564. No PI number has been requested for this material.

Collection Site Information: Osceola Blue Germplasm is the result of a polycross of three accessions of lopsided indiangrass collected as seed in October 1996, from three different counties in Florida. Accessions 9060186 and 9060197 were collected by Sharon Pfaff, former Agronomist at the NRCS, Brooksville Plant Materials Center (PMC). Accession 9060186 was collected in Marion County 8 miles west of I-75 on SR 200 in empty lot on the side of SR 200. Accession 9060197 was collected on the east side of U.S. Highway 41, 14.5 miles north of Dunnellon in Levy County. Soil type at both of these collection sites was Candler sand. Accession 9060205 was collected in Gilchrist County by Gene Fults, when he was the Range Conservationist at the NRCS Field Office in Kissimmee. The collection site was on the east side of U.S. Route 129, 5.6 miles north of the junction with County Road 340, near NW 93rd Lane. The soil type at this location was Penney fine sand. All accessions were found on sites described as supporting a dry, longleaf pine (*Pinus palustris*)/turkey oak (*Quercus laevis*) community.

Description: Lopsided indiangrass is a native, warm season, perennial bunchgrass that does not have rhizomes. Culms usually reach between 90- to 180-cm (35- to 70-inches) tall. Internodes are glabrous, or if pubescent, pubescent just beneath the nodes. Sheaths also are usually glabrous, although in young plants, sheaths are occasionally pubescent. The membranous ligules are pointed and usually between 2.5- to 4-mm (0.1- to 0.2-inches) long, but can be as long as 12 mm (0.5 inch). Leaves are generally cauline with blades between 20- to 50-cm (8- to 20-inches) long and 3- to 6- mm wide; blades are scabrous, particularly on the upper surfaces. The seedhead is a somewhat open, straight to slightly arching, secund (spikelets borne on one side) panicle that is 15- to 40-cm (6- to 15-inches) long. Individual spikelets are lanceolate, 6- to 8-mm (0.25- to 0.30-inches) long and 0.8- to 1.2-mm wide. When mature, spikelets are dark to golden brown. The dark brown, twice geniculate (sharply bent) awns are 30- to 40-mm (1.1- to 1.6-inches) long, which makes them 4 to 5 times longer than the spikelets, $2n = 20$ (Leithead, Yarlett, and Shiflet, 1971; FNA, 2003).

Method of Breeding and Selection: Initial evaluation of lopsided indiangrass was conducted at the USDA, NRCS Plant Materials Center in Brooksville, Florida, on an assembly of 132 accessions collected from throughout the state of Florida in October 1996. Seed from the 132 accessions and 'Lometa' yellow indiangrass (*S. nutans*), which was used as a control, was hand planted at 5 lb/acre between 22-24 Jan. 1997 at two locations at the PMC. One site was on a Blichton loamy fine sand and was irrigated, while the other site was on a Sparr fine sand and was

not irrigated. Plots consisted of single 10-ft rows, three feet apart and were arranged in a randomized complete block design with three replicates. In addition to natural rainfall (Table 1), the irrigated planting received approximately 1 inch of supplemental water each week. Direct-seeded plantings were evaluated during the growing seasons of 1997, 1998, and 1999. An additional evaluation using transplants (n=6 per accession per rep) was planted in November 1997 adjacent to the irrigated, direct-seeded study. Plants were spaced 1 foot apart in the row with a three-foot row spacing. This study was evaluated during the growing seasons of 1998 and 1999. Percent stand (based on linear foot of row), plant size (foliage height X foliage width, ^{2}cm), vigor (1=good, 9=dead), seed head production and uniformity of seed head height (1=poor, 9=good), disease incidence (1=none, 9=heavy), and lodging (1=none, 9=heavy) was determined for all plantings.

Table 1 Rainfall (inches) at Brooksville Plant Materials Center, 1996-1999

	1996	1997	1998	1999
January	7.52	2.16	4.[illegible]	4.75
February	2.49	1.58	1.[illegible]	0.2
March	9.91	3.33	6.[illegible]	1.95
April	6.14	4.19	0.[illegible]	1.23
May	4.55	1.91	1.[illegible]	1.65
June	11.75	9.54	1.[illegible]	9.07
July	4.86	6.46	9.[illegible]	5.59
August	8.51	4.99	6.[illegible]	9.87
September	6.64	9.65	10.[illegible]	4.73
October	2.93	6.66	5.[illegible]	2.75
November	1.20	4.89	0.[illegible]	4.06
December	3.54	10.65	0.[illegible]	1.21
Total	70.04	66.01		47.06

Of the 133 accessions that were planted, approximately 78% established in 1997 in the non-irrigated, direct planting. There was a slight trend for survival to decline over years with only 73 and 70% of the original 133 accessions alive in 1998 and 1999, respectively. A similar pattern for establishment (80%) and survival (76%) in 1997 and 1998 was noted for the irrigated, direct planting, but by the fall of 1999 only 20% of the accessions were still alive. The interaction of year and irrigation also can be seen as stable to increasing size for the non-irrigated site vs. declining plant size for the irrigated site (Table 2 and 3). As would be expected, when started in the greenhouse and transplanted, 95% of the original 133 accessions survived the first growing season (1998) in the transplant study, but there was a survival pattern similar to that of the direct-seeded studies with numbers declining the second year. By the end of the growing season in 1999, only 84% of the accessions survived. The poor survival of the direct-seeded lopsided indiangrass accessions in the irrigated plantings was attributed to diseases associated with high soil moisture due to rainfall and irrigation. Lopsided indiangrass is classified as a FACU- according to the U.S. Fish and Wildlife Service Wetland Indicator Status (USDA, NRCS, 2009). The effect of excess soil moisture could not be substantiated with the transplant study because it was only rated for two years. Sharp declines in percent stand of the individual accessions between the 1998 and 1999 (Table 4) suggest the plants in this study were suffering from excess moisture also.

Table 2. Lopsided Indiangrass Evaluation - Direct-Seeded, Non-Irrigated

Accession	Year	Stand, %	Plant Size, [2]cm	Vigor Rating[1]	Lodging Rating[2]	Disease Rating[2]	Seed Head Production Uniformity[3]	Seed Head Height Uniformity[3]
9060186	1997	5	1050	4	-[4]	3	-	-
	1998	85	1800	5	5	6	4	5
	1999	80	2500	5	5	6	6	6
9060197	1997	30	1000	5	-	5	-	-
	1998	50	2000	6	3	6	7	6
	1999	30	2100	5	3	6	6	6
9060205	1997	50	1050	4	-	5	-	-
	1998	50	2000	4	3	6	6	5
	1999	50	2500	4	5	5	5	3
Average All	1997	37	1048	4	-	5	-	-
	1998	42	1727	5	4	6	6	5
	1999	36	1995	5	5	6	5	6
Lometa	1997	26	706	5	-	5	-	-
	1998	30	785	7	3	6	5	5
	1999	14	1556	5	4	5	5	5

[1]1=most, 9=worst.
[2]1=none, 9=heavy.
[3]1=good, 9=poor.
[4]Not determined because essentially all accessions failed to flower in 1997.

Table 3. Lopsided Indiangrass Evaluation - Direct-Seeded, Irrigated

Accession	Year	Stand, %	Plant Size, [2]cm	Vigor Rating[1]	Lodging Rating[2]	Disease Rating[2]	Seed Head Production Uniformity[3]	Seed Head Height Uniformity[3]
9060186	1997	75	4200	3	-[4]	4	-	-
	1998	80	2000	4	6	6	4	5
	1999	-	-	-	-	-	-	-
9060197	1997	90	3900	3	-	5	-	-
	1998	90	1500	4	5	6	4	6
	1999	-	-	-	-	-	-	-
9060205	1997	90	4225	3	-	5	-	-
	1998	80	1400	5	4	6	5	6
	1999	-	-	-	-	-	-	-
Average All	1997	41	2000	4	-	5	-	-
	1998	45	1873	5	5	6	5	5
	1999	-	-	-	-	-	-	-
Lometa	1997	66	1107	5	-	6	-	-
	1998	35	1075	6	3	6	6	5
	1999	-	-	-	-	-	-	-

[1]1=most, 9=worst.
[2]1=none, 9=heavy.
[3]1=good, 9=poor.
[4]Not determined because essentially all accessions failed to flower in 1997 or had died in 1999.

Table 4. Lopsided Indiangrass Evaluation – Transplants, Irrigated Site

Accession	Year	Stand, %	Plant Size, [2]cm	Vigor Rating[1]	Lodging Rating[2]	Disease Rating[2]	Seed Head Production Uniformity[3]	Seed Head Height Uniformity[3]
9060186	1998	94	2400	4	4	6	5	5
	1999	72	2727	4	4	9	6	4
9060197	1998	100	2391	4	4	7	4	5
	1999	78	2283	4	4	9	5	5
9060205	1998	94	2100	4	4	6	3	6
	1999	67	2433	4	3	9	6	3
Average All	1998	70	1459	5	5	7	5	6
	1999	52	1809	5	4	9	4	6
Lometa	1998	71	445	6	5	7	4	6
	1999	33	1233	6	3	6	6	5

[1]1=most, 9=worst.
[2]1=none, 9=heavy.
[3]1=good, 9=poor.

The objective of the initial lopsided indiangrass evaluation was to develop a synthetic variety of lopsided indiangrass that had superior vigor and seed production characteristics for rangeland restoration. Although the breeding mechanism of lopsided indiangrass is not known, the top 25 accessions from the initial evaluations were selected for inclusion in a polycross nursery. This method for developing a synthetic variety was chosen because it was assumed that lopsided indiangrass is to some degree self-incompatible like yellow indiangrass, a tetraploid outcrossing autopolyploid relative (McKone, Lund, and O'Brien., 1998; Gustafson, Gibson, and Nickrent, 2004). Coincidentally within the top 25 accessions, three accessions (9060186, 9060197, and 9060205) consistently showed a bluish tint to the foliage. No other accessions in the studies, consistently exhibited this foliar characteristic. Because this characteristic was unique, stable across years, and did not appear to compromise fitness, it was decided that these three accessions would be put into a separate polycross nursery with the intent of developing a synthetic variety of blue lopsided indiangrass for use in urban conservation.

Seed from the original 1996 collections of accessions 9060186, 9060197, and 9060205, that had been in cold storage, were used to produce seedlings in 2001. These were planted in field in randomized manner for a study to determine the effects of residue management on stand longevity and seed production in lopsided indiangrass. Most of the seedlings produced seed in 2001, and this seed was hand collected and bulked together and assigned the accession number 9060564. A portion of the 9060564 seed was used to establish seedlings in 2002, which were planted out at a separate site to observe stability of the blue foliage characteristic. A similar

planting was made in 2003 using 2002-produced seed collected from the 9060564 planting to further validate stability of the blue foliage characteristic for a third generation.

Ecological Considerations and Evaluation: An environmental evaluation was completed for Osceola Blue Germplasm to assess its potential to adversely impact the environment. Osceola Blue Germplasm does not spread vegetatively by rhizomes or stolons. Its main mode of spread is by seed, but work by Penfield (2006) suggested that lopsided indiangrass has a low potential to recolonize, taking up to 50 years to disperse 100 ft. There is no evidence that it is capable of spreading by seed into ecosystems other than those in which it is currently found. Although the level of ecotypic variability has not been documented in this species, the degree of risk Osceola Blue Germplasm would pose to native populations in other parts of its range would likely be minimal. Although as an ornamental, it may be used in entirely different types of sites than when planted for restoration use, it would still present little, if any, chance of escaping and becoming a problem plant.

Conservation Use: Osceola Blue Germplasm lopsided indiangrass is being released as an ornamental for landscape use. Selections of native grasses are widely planted in the southeastern U.S. for this purpose, mainly because of their reduced need for water, fertilizer, and regular maintenance. The pendulous inflorescence of lopsided indiangrass has spikelets arranged all on one side of the panicle, which creates an attractive visual. Although wild-type material is available from some native plant nurseries, there are no named selections of lopsided indiangrass available. Which may explain why lopsided indiangrass is not being planted in Florida landscapes as often as other native grasses [e.g., muhlygrass (*Muhlenbergia capillaris*), sand cordgrass (*Spartina bakeri*), and eastern gamagrass (*Tripsacum dactyloides*) or, as it is called in Florida, fakahatcheegrass]. Another reason for this lack of more widespread use is that, although the seedhead arrangement of lopsided indiangrass is very attractive, it is only displayed during the fall flowering season. Therefore, to provide visual appeal during the rest of the growing season, plants with attractive foliar characteristics would be desirable. This accession with its distinctive blue foliage color can provide this long-term aesthetic interest. In addition to savings associated with lower water and fertilizer requirements, increased ornamental plantings of lopsided indiangrass may serve as refugia for the larvae of the Argos Skipper (*Atrytone arogos arogos*), an extremely rare and declining butterfly in the eastern United States, whose larvae are dependent on lopsided indiangrass for food (Minno and Minno, 2006). Declining habitat due to fire suppression threatens this butterfly species, but ill-timed or excessive burning can extirpate colonies from sites in natural areas because the larvae have no means of avoiding fire (Minno and Minno, 2006). Ornamental plantings would not be subjected to prescribed burning regimes used on Florida rangelands. Osceola Blue Germplasm is being released as a selected class material because further advanced testing was not deemed necessary. This was because the foliar characteristics for which Osceola Blue Germplasm was selected have remained stable through at least three generations and additional information was not needed to determine its usefulness as an ornamental.

Area of Adaptation: Lopsided indiangrass is native to the southeastern US and is a component of the Pine Flatwoods/Dry Prairie communities of Florida and High Pine communities of Florida and other states in the Southeast (Leithead, Yarlett, and Shiflet, 1971; Myers and Ewel, 1990; Penfield, 2006; Wunderkind and Hansen, 2008; USDA, NRCS, 2009). Many of the more

palatable grasses, such as lopsided indiangrass, that are native to these communities are believed to constitute a much more minor component of the ecosystem now than they did pre-European settlement due to the introduction of grazing livestock and fire suppression (Kalmbacher, 1984; Kalmbacher et al., 1994; Penfield, 2006). Work by Penfield (2006) suggested that once extirpated from a site, lopsided indiangrass has a low potential to re-colonize, taking up to 50 years to disperse 100 ft. The Flatwoods and Dry Prairie communities of Florida both occur on poorly drained areas of nearly level topography and differ vegetatively only in the amount of trees, predominantly pines, that were present (Myers and Ewel, 1990). Shrubs such as wax myrtle (*Myrica cerifera*), gallberry (*Ilex glabra*), fetterbush (*Lyonia lucida*), and saw palmetto (*Serenoa repens*) are present in both communities, but as with the trees, they occur to a lesser extent on Dry Prairie sites. Herbaceous material commonly found in both communities included wiregrass (*Aristida stricta* or *A. beyrichiana*) and other three-awn grasses (*Aristida* spp.), lovegrasses (*Eragrostis* spp.), and bluestems (*Andropogon* spp. and *Schizachyrium* spp.) (Myers and Ewel, 1990; Kalmbacher, 1984; Kalmbacher et al., 1994). The High Pine community has been greatly reduced in size due to human activity, but was thought to have been a savanna-like ecosystem having an overstory of longleaf pine with a ground cover of perennial grasses, predominantly wiregrass, piney woods dropseed (*Sporobolus junceus*), bluestems, and lopsided indiangrass, and forbs such as grassleaf golden aster (*Pityopsis graminifolia*) and blazing star (*Liatris* spp.) (Myers and Ewel, 1990). Although not tested off the PMC, the three blue accessions that the parent material of Osceola Blue Germplasm compared well to the over 100 accessions collected state wide. This indicates that Osceola Blue Germplasm should be adapted throughout Florida at least. Although data from the PMC suggests, it should not be planted in locations that are to be irrigated frequently.

Availability of Plant Materials: A breeder block of Osceola Blue Germplasm lopsided Indiangrass will be maintained at the Brooksville Plant Materials Center in Brooksville, FL. Limited quantities of G0 planting stock are available for production purposes by request to the Florida Plant Materials Specialist.

References:

Flora of North America (FNA) Editorial Committee. 2003. Magnoliophyta: Commelindidae (in part): Poaceae, part 2. Flora of North America North of Mexico, Volume 25. Oxford University Press, New York. Available at http://herbarium.usu.edu/webmanual/. (accessed 10 August 2009). Intermountain Herbarium, Utah State Univ. Logan, UT.

Gustafson, D.J., D.J. Gibson, and D.L. Nickrent. 2004. Conservation genetics of two co-dominant grass species in an endangered grassland ecosystem. J. Applied Ecol. 41: 389-397.

Kalmbacher, R.S. 1983. Distribution of Dry Matter and Chemical Constituents in Plant Parts of Four Florida Native Grasses. J Range Manage. 36:289-301.

Kalmbacher, R.S., F.G. Martin, W.D. Pitman, and G.W. Tanner. 1994. South Florida flatwoods range vegetation response to season of deferment from grazing. J. Range Manage. 47:43-47.

Leithead, H.L., L.L. Yarlett, and T.N. Shiflet. 1971. 100 native forage grasses in 11 southern states. USDA-SCS Agric. Handb. 389. U.S. Gov. Print. Office, Washington, D.C.

McKone, M.J., C.P. Lund, and J.M. O'Brien. 1998. Reproductive biology of two dominant prairie grasses (*Andropogon gerardii* and *Sorghastrum nutans*, Poacae): Male-biased sex allocation in wind-pollinated plants? Amer. J. Bot. 85(6): 776-783.

Minno, M.C., and M. Minno. 2006. Conservation of the Arogos Skipper, *Atrytone arogos arogos* (Lepidoptera: Hesperiidae) in Florida. p. 219-222. *In* R.F. Noss (ed.) Land of Fire and Water: The Florida Dry Prairie Ecosystem. Proc. Florida Dry Prairie Conf., Sebring, FL. 5-7 Oct. 2006. Available at http://www.ces.fau.edu/fdpc/proceedings.php. (accessed 11 August 2009).

Myers, R. L., and J.J. Ewel. 1990. Ecosystems of Florida. Univ. Central Florida Press, Orlando.

Penfield, S. 2006. Notes on Some Characteristics of Lopsided Indiangrass. p. 176-181. *In* R.F. Noss (ed.) Land of Fire and Water: The Florida Dry Prairie Ecosystem. Proc. Florida Dry Prairie Conf., Sebring, FL. 5-7 Oct. 2006. Available at http://www.ces.fau.edu/fdpc/proceedings.php. (accessed 11 August 2009).

USDA, NRCS. 2009. The PLANTS Database [Online]. Available at http://plants.usda.gov/ (accessed 6 August 2009). National Plant Data Center, Baton Rouge, LA.

Wunderlin, R.P., and B.F. Hansen. 2008. Atlas of Florida Vascular Plants [Online]. Available at http://www.florida.plantatlas.usf.edu/. (accessed 6 August 2009). [S.M. Landry and K.N. Campbell (application development), Florida Center for Community Design and Research.] Institute for Systematic Botany, Univ. of South Florida, Tampa, FL.

Prepared by:

M. J. Williams
USDA, NRCS
2614 N.W. 43rd Street
Gainesville, FL 32606-661

Janet M. Grabowski
USDA, NRCS Brooksville Plant Materials Center
14119 Broad Street
Brooksville, FL 34601

Signatures for the release of:

Osceola Blue Germplasm Lopsided Indiangrass [*Sorghastrum secundum* (Elliot) Nash]

D.B.H., Acting

8/20/09

Carlos Suarez
State Conservationist
United States Department of Agriculture
Natural Resources Conservation Service
Gainesville, Florida

Date

National Program Leader - Plant Materials

Sept 3, 2009

for Mike Hubbs
Director, Ecological Sciences Division
United States Department of Agriculture
Natural Resources Conservation Service
Washington, D.C

Date