UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NACOGDOCHES, TEXAS

NOTICE OF RELEASE OF 'Nacogdoches' Eastern Gamagrass

The Natural Resources Conservation Service (NRCS), U.S. Department of Agriculture announces the naming and release of 'Nacogdoches' eastern gamagrass (*Tripsacum dactyloides* (L.) L.). 'Nacogdoches' eastern gamagrass tested under the NRCS Accession number 9043629 and the PI number 595898.

Collection Site Information: 'Nacogdoches' eastern gamagrass seed was originally collected from a native stand in Nacogdoches County Texas, MLRA 133B, (Latitude 31°39'00" Longitude 94°32'00") by NRCS employees Tom Holt and Craig Ziegler. The collection site is 375 feet above mean sea level on Alto clay soil, and receives an average annual rainfall of 48 inches. The mean annual temperature is 66° F, with record maximum and minimum temperatures reaching 112° F and 3°F.

Description: Description and identification courtesy of Dale Kruse, S. M. Tracy Herbarium (TAES) Texas A&M University. 'Nacogdoches' eastern gamagrass: Plants monoecius. Rhizomatous perennial. Culms to 3 meters tall, erect to ascending, glabrous. Leaves mostly basal. Sheaths terete, glabrous, shiny. Ligules 1-2.5 mm long, ciliate or lancerate membrane, truncate. Blades to 70 cm long, to 30 mm wide, flat, prominent whitish midvein. Inflorescences a spicate raceme, or panicle of 2-4 rames, or spicate branches, terminal and axillary. Spikelets unisexual, pistillate below staminate on racemes. Pistillate spikelets 7-10 mm long, solitary, indurate (bead-like). Staminate spikelets 7-11 mm long, coriaceous, paired, florets 2. Sessile spikelets 7-12 mm long. Glumes 7-11 mm long, acute, keeled, lemmas 8-12 mm long. Pedicels 0.5-1 mm long. Pedicellate spikelets to 1mm long. Caryopses 4-8 mm long, conical, yellow. Flowering period is April through November. 'Nacogdoches' is a tetraploid (2n=4x=72) germplasm that reproduces by apomixis. Ploidy level was confirmed by the USDA-Agricultural Research Service Southern Plains Range Research Station Cytogenics Lab in Woodward, Oklahoma.

Potential Uses: 'Nacogdoches' is recommended for forage production. It may be used as a hay crop or grazed. Appropriate management must be used when grazing, allowing adequate periods of recovery between grazing events. It also has application for use in conservation practices such as vegetative buffers, filter strips, wildlife habitat improvement, and restoration of disturbed areas.

Method of Breeding and Selection: 'Nacogdoches' eastern gamagrass is a direct seed increase from a native stand collected in 1985. It was initially evaluated from 1988-1990 with 85 other accessions collected in 65 counties of east Texas. The accessions were evaluated in non replicated plots for visual comparison for apparent forage and seed production, plant vigor, and stand persistence (Table 1). Three accessions, including 'Nacogdoches', were selected for further evaluation in 1991-1994. 'Nacogdoches' and accessions that would later be released as 'Medina' and 'Jackson' were compared to commercial eastern gamagrass releases, 'Pete' and accession 434493, later released as 'San Marcos'. These evaluations focused on the response of the selections to N fertilizer rates of 0, 125, 250, and 500 pounds per acre with a forage clipping interval of 45 days. 'Pete' and 'San Marcos' were used for comparison. Nacogdoches responded favorably to increased N rates, with production equivalent to 'Medina' and 'Jackson', and superior to 'Pete' (Table 2).

Table 1. Top Performing Accessions from Initial Evaluations of Eastern Gamagrass, East Texas Plant Materials Center, USDA-NRCS, Nacogdoches, Texas. 1988-1990 (Adams and Douglas 1990).

Accession	Vigor*	Foliage* Abundance	Foliage Height (cm)	Foliage Width (cm)	Seed Fill	%STD
9043762	1.8	2	137	111	3.2	90
Nacogdoches	2.8	2.3	119	108	3.7	95
9043740	2.3	2.3	147	88	4.8	95
Study Average	4.9	4.9	95.6	80	5.1	73.4

*Indicates qualitative rating on a 1-9 scale with 1 being best and 9 being worst

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Table 2. Nitrogen Response of Eastern Gamagrass Sources at 45 Day Clipping Interval USDA-NRCS East Texas Plant Materials Center, Nacogdoches, Texas 1992-1994 (Adapted from Douglas, 1992; Brakie, 1993-1994).

	N Rate (lbs/acre)			
	0	125	250	500
Variety	45 Day Clipping Frequency			
Medina	9,115	12,539	15,794	16,882
Jackson	7,138	11,631	16,678	16,750
Nacogdoches	7,991	11,354	14,778	14,827
San Marcos	6,641	9,804	10,784	13,782
Pete	6,106	6,523	7,810	6,328
Mean	7,396	10,370	13,169	13,714

Interest refocused on ‘Nacogdoches’ in 2005 due to poor seed yields associated with ‘Jackson’ and ‘Medina’ which limited their acceptance in the commercial market. Harvest records at the East Texas Plant Materials Center showed ‘Nacogdoches’ produced more than double the yield of cleaned seed compare to ‘Medina’ and seven times more compared to ‘Jackson’. Seed yield and quality of ‘Nacogdoches’, ‘Jackson’, and ‘Medina’ were formally evaluated from 2006-2009. Study results indicated ‘Nacogdoches’ had significantly more reproductive tillers than ‘Jackson’ and ‘Medina’, which contributed to significantly increased seed production (Tables 3 and 4).

Visual comparison during the study indicated 'Nacogdoches' had superior resistance to leaf rust, *Puccinia tripsaci*, when compared to 'Jackson' and 'Medina'. Leaf rust affected the 'Medina' plots heavily in 2007 and 'Jackson' to a lesser degree. 'Medina' plots were stunted during the 2008 growing season, which negatively impacted seed yields (Table 4). Such effects were also noted in the literature (Handley et al., 1990).

There were significant differences in seed quality of the three cultivars for seed fill with 'Nacogdoches' producing a higher seed fill than 'Medina' and 'Jackson'. There were no significant differences in germination rates, however the PLS yield for 'Nacogdoches' was significantly improved compared to the other cultivars due to its increased seed fill and yield (Table 4). No significant differences were found between the cultivars for forage quality even though there were significant differences in the percent of vegetative and reproductive tillers (Table 5).

Table 3. Vegetative and Reproductive Tiller Analysis of Three Eastern gamagrass Cultivars in 2007-2009, USDA-NRCS Nacogdoches,TX (Shadow and Brakie 2010).

	Reproductive	Vegetative	Secondary Inflorescence
Cultivar/Accession	----------%----------		Number of inflorescences per reproductive tiller
Nacogdoches	40 a*	60 b	4.3 a
Medina	20 b	80 a	2.5 b
Jackson	22 b	78 a	2.9 b

*Means followed by the same letter are not significantly different at P<0.05.

Table 4. Seed Quality Parameters of Three Eastern gamagrass Cultivars in 2007-2009, USDA-NRCS Nacogdoches, TX (Shadow and Brakie 2010).

	Seed Parameters			
Cultivar/Accession	Yield	Fill	Germ[1/]	PLS[2/]
	lb/acre	----------%----------		
Nacogdoches	288 a	83 a	52 a	138 a
Medina	82 b	77 ab	50 a	27 b
Jackson	105 b	68 b	46 a	37 b

*Means followed by same letter are not significantly different at P<0.05; 1/ Germination; 2/ Pure Live Seed.

Table 5. Average Forage Quality Comparisons of 9043629 and Eastern Gamagrass Cultivars Harvested on 45 day clipping frequency and fertilized with 120 lb/acre N (adapted from Brakie, 1998).

	Forage Quality	
Cultivar/Accession	CP[1/]	TDN[2/]
	----------%	----------
Nacogdoches	9 a[3/]	56 a
Jackson	8 a	56 a
Medina	8 a	56 a

[1/] crude protein; [2/] total digestible nutrients; [3/]means in columns followed by the same letter are not significantly different at P<0.05.

Ecological Considerations and Evaluation: An Environmental Evaluation of Plant Materials Releases was completed using guidelines established by the NRCS (USDA-NRCS, 2010), and the best available information for this species. Results from this evaluation determined that 'Nacogdoches' was suitable for release based on the criterion contained in this document. Eastern gamagrass is a naturally occurring species in the southeastern United States and the release of 'Nacogdoches' for public use would not constitute the introduction of a foreign species to local ecosystems. 'Nacogdoches' was selected from a native stand of eastern gamagrass and has had no genetic modification. It is believed that any negative impact to other native species would be minimal to non-existent.

Conservation Use: 'Nacogdoches' makes excellent native forage both in quality and quantity. In studies at the ETPMC, 'Nacogdoches' produced average dry matter yields of 12,000 lb/acre with an average crude protein of 9% and Total Digestible nutrients of 56% at 125 lb/acre N rate and 45 day harvest interval (Brakie, 1993-1994). 'Nacogdoches' has application for use in filter strips along riparian areas for water quality improvement. As a bunch grass, it is suitable for use in wildlife habitat improvement by providing shelter and foraging areas for a variety of wildlife. It also tolerates moist conditions and heavy soils that might inhibit or reduce the presence of other native warm season grasses. This quality makes it useful for wetland and native prairie restoration.

Area of Adaptation: 'Nacogdoches' is specifically adapted to and shown superior performance in eastern Texas and western Louisiana from I-35 in central Texas to the Red River Valley in Louisiana. Observational plots in Bossier City and Thibodaux, Louisiana have performed well, and it has shown acceptable performance throughout the southeastern United States, excluding Florida and areas with deep, sandy soils. It was established successfully and persisted on silt loam and fine sandy loam soil types from Knox City, Texas (Plant Hardiness Zone 7b; MLRA 78B – Central Rolling Red Plains) to Americus, Georgia (Plant Hardiness Zone 8a; MLRA 133A – Southern Coastal Plain) and as far north as Booneville Arkansas (Plant Hardiness Zone 7b; MLRA 118A – Arkansas Valley and Ridges) (Table 6). Annual rainfall within the intended area of use is 30 inches or greater per year (USDA 2006). 'Nacogdoches' is a facultative wetland plant and prefers moist sites, but will tolerate drier sites with sufficient rainfall.

Table 6. Average Dry Matter Yield of Eastern Gamagrass Accessions from 1996-1998 at Six Southeastern US Locations USDA-NRCS Coffeeville, MS (Adapted from Douglas et al., 2000)

Accession	Booneville, AR	Knox City, TX	Nacogdoches, TX	Coffeeville, MS	Americus, GA	Brooksville, FL
	----------kg/ha----------					
Highlander	14,383	11,155	12,722	18,065	19,133	7,522
Jackson	7,930	*	14,492	12,427**	19,049	3,201
San Marcos	12,830	13,682	8,172	14,041**	18,616	12,898
Nacogdoches	9,032	8,120	14,448	12,121**	12,858	7,398
Medina	13,324	16,423	11,724	*	16,812	9,967
9055975	*	*	2,715	*	7,455	10,957
9059213	*	2,820	9,179	*	14,791	13,306
9059215	*	3,533	6,799	*	16,579	15,131
9058465	11,436	11,269	11,823	15,653**	16,158	9,405
9058495	13,665	12,553	10,261	18,436**	14,508	*
9058569	9,214	8,013	4,742	10,626**	7,204	*
9062708	11,625	8,588	10,691	15,359**	18,040	8,158
9066165	13,707	13,083	11,042	14,723**	18,810	5,942
Mean	11,714	9,631	9,909	14,606	15,385	8,644

LSD (0.05)	2,903	3,586	7,132	------***	2,940	5,969

*Indicates that plants died after first winter
**Indicates plants not harvested in 1998 because they succumbed to disease
***Indicates column contains both two-year and three-year yield averages, no LSD was determined.

Availability of Plant Materials: Foundation class seed will be maintained at the East Texas Plant Materials Center. 'Nacogdoches' seed for commercial production can be obtained through the Texas Foundation Seed Service (11914 Hwy 70S, Vernon, TX 76384, Phone: 940-552-6226).

References:

Adams, M. F. and Douglas, J. L. 1990. 1990 Annual Report East Texas Plant Materials Center. USDA/NRCS East Texas Plant Materials Center. Nacogdoches, Texas. p 13.

Adams, M. F. and Douglas, J. L. 1993. 1993 Annual Report East Texas Plant Materials Center. USDA/NRCS East Texas Plant Materials Center. Nacogdoches, Texas.

Adams, M. F. and Brakie, M. B. 1994. East Texas Plant Materials Center Activity Report. USDA/NRCS East Texas Plant Materials Center. Nacogdoches, Texas.

Brakie, Melinda. 1994. Yield and Quality of Eastern Gamagrass Selections as Affected by Clipping Interval and N Rates. Master's Thesis. Stephen F. Austin State Univ. Nacogdoches, TX.

Douglas, J. L. 1992. Yield and Quality of Eastern Gamagrass Selections as Affected by Clipping Interval and N Rates. Master's Thesis. Stephen F. Austin State Univ. Nacogdoches, TX.

Douglas, J. L., Houck, M. J., Brakie, M. R., Tharel, L. M., Owsley, C. M., Pfaff, S. L. 2000. Yield, Quality and persistence of 13 Accessions of Eastern Gamagrass in the Southern U.S. In Eastern Gamagrass Technology Update. Jamie L. Whitten Plant Materials Center, Coffeeville, MS. 45-55.

Handley, M.K., P.A. Kulakow, J. Henson, and C.L.Dewald. 1990. Impact of two foliar diseases on growth and yield of eastern gamagrass. Eastern Gamagrass Conference Proceedings: 1989 January 23-25: The Kerr Center for Sustainable Agriculture, Poteau, OK. pp: 31-39.

Shadow, R. A. and Brakie, M. R. 2010. East Texas Plant Materials Center 2010 Annual Technical Report. USDA/NRCS East Texas Plant Materials Center. Nacogdoches, Texas. pp: 6-9.

USDA-NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. Agriculture Handbook 296, U.S. Gov. Print. Office, Washington, D.C.

USDA-Natural Resource Conservation Service. 2010. National Plant Materials Manual, Title 190 (Washington, D.C., U.S. Government Printing Office, July 2010).

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Signatures for the release of:
'Nacogdoches' eastern gamagrass (Tripsacum dactyloides L.)

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