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FINAL STUDY REPORT April, 2026
Golden Meadow Plant Material Center
Galliano, Louisiana

Initial evaluation of *Distichlis spicata* for coastal restoration

Dr. Brian Jordan and Garret Thomassie

ABSTRACT

The purpose of this study was to develop standards and specification for establishing selected coastal wetland plant species as well as eventually providing a commercial plant release to growers to be used in critical area planting. According to the U.S. Geological Survey's analysis in 2011, Louisiana lost an average of 16.6 square miles of coastal wetland per year from 1985 to 2010, equating to roughly a football field loss per hour. In total, the state lost 1,883 square miles of land between 1932 and 2010, an area approximately 1.2 times larger than the state of Rhode Island (Couvillon et al., 2011) (Traywick, 2016). The effects of the state's land loss include decreased flood protection during hurricanes and tropical storms and threats to the state's commercial fishing, oil, and gas industries. Inland saltgrass (*Distichlis spicata)* is a hardy, native, perennial grass with scaly rhizomes whose growth form lends itself to soil protection in salt marshes, acting as a guard between the ocean and the shore. However, there is a lack of commercially available inland saltgrass for coastal conservation in the northern Gulf Coast. The objective of this study was to evaluate 25 inland saltgrass accessions for height, plot coverage (spread), and plant vigor. The accessions were collected from Louisiana coastal regions from 1998 through 2012. The trial was established in 2015 and conducted as a randomized complete block design in 5 ft x 5 ft plots with 3 replications. At the end of the evaluation period in 2021, five accessions (9068306, 9089474, 9089475, 9089480, and 9089517) had greater height, fuller plots, and higher vigor ratings across all evaluations than other accessions. These five accessions will proceed to advanced trials at the Plant Materials Center (PMC) in Galliano, LA.

INTRODUCTION

Coastal wetlands, such as the ones in Louisiana, protect against coastal floods and storm surge caused by hurricanes and tropical storms. These wetlands are areas where the water level hovers around the surface of the soil (EPA, 2006) (LCPRA, 2017). One acre of wetland can store roughly one million gallons of water, according to a 2006 Environmental Protection Agency (EPA) summary of the subject. In addition to its water storage capabilities, wetland vegetation also slows the speed of flood waters (EPA, 2006).

Salt marshes are found adjacent to coastal lands and are regularly tidally flooded and dominated by salt-tolerant grasses. One of the common species found in salt marshes is inland saltgrass (*Distichlis spicata*) (Louisiana Department of Wildlife and Fisheries, 2020). The United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS) field offices, collaborators,

Dr. Brian Jordan, PMC Agronomist and Garret Thomassie, PMC Manager, 438 Airport Rd. Galliano, LA. 70354, Brian.Jordan@usda.gov

and specialists requested more evaluations and recommendations for such species and techniques to stabilize and control erosion in Louisianna's coastal areas.

Inland saltgrass has been found growing across North America from Mexico (Llerena, 1994) through Canada, along the Eastern coast and throughout the Gulf of Mexico (Hitchcock, 1951). In Louisiana, inland saltgrass is a dominant species in coastal marshes (Chabreck, 1972; Gough et al, 1994), Sabine National Wildlife Refuge tidal marsh (Edwards & Proffitt, 2003) and the Lower Pearl River basin (White, 1983). "The thick entangled roots of [inland saltgrass and other species in a marsh] act as a guard between the ocean and the shore, protecting the land from pollutants and other chemicals associated with runoff water" (Skaradek & Miller, 2010).

Inland saltgrass is dioecious (male and female reproductive parts found on separate plants) and the male plant has a denser growth habit with larger inflorescence than the smaller female plants (Parker, 1975). Inland saltgrass tend to grow in separate populations referred to as spatial segregation of sexes (Freas, 1987) with growth habit of 6 to 18 inches in height (Hopper & Nesbitt, 1930). Inland saltgrass can also reproduce asexually by rhizomes and stolons (Hauser, 2006). In a tidal marsh, inland saltgrass can grow when salinity is 1.2% (12 parts per thousand (ppt))to 3.9% (39 ppt) but grows best when salinity content is 1.18% (11.8 ppt) to 1.71% (17.1 ppt) (Adams, 1963). Inland saltgrass can be found in planting zones 7 through 10. It flowers from June through October and "the inflorescence is yellow in color, turning straw brown as it dries" (Newman & Gates, 2005). On the Gulf Coast of Louisiana, the Army Corps of Engineers created salt marshes from 1983 to 1999 to reduce erosion, where inland saltgrass grew to dominate higher marshes (Edwards & Proffitt, 2003).

Inland saltgrass is not commercially available for use along the Louisiana Gulf coast, largely because it is a poor seed producer and is primarily established vegetatively. Ongoing efforts at the Golden Meadows PMC and related initiatives such as CAPMC's saltgrass release of LK 517f Germplasm (adapted for use along the California coast) aim to improve availability through evaluation and selection of strong-performing accessions to provide a commercial vegetative release and usability for coastal marsh plantings.

MATERIALS AND METHODS

Twenty-five accessions of inland saltgrass were collected across the state of Louisiana from Cameron, St. Bernard, Lafourche, Terrebonne, Jefferson, and Iberia parishes from November 1998 to May 2012 (*Table 1*).

Accessions were evaluated for plant height, percent coverage of plots and overall vigor. The accessions were collected as whole plants from multiple Louisiana coastal sites to have a diverse representation of plants along the coastline. Accession 9068004 was used as a control for comparison since growers were using it as a common source for private and local government projects before trials were conducted to develop a plant release.

Once collected, plants were transported to the Golden Meadow PMC and transplanted into 4 x 4 x 5-inch pots (Dillen, Middlefield, OH) with a peat (Promix, Quakertown, PA) and pine bark (Phillips Bark, Brookhaven, MS) planting mix. The planting medium ratio was 0.14 cubic yards of peat to 0.47 cubic yards of pine bark.

Accessions were grown and maintained under greenhouse conditions, watered twice daily on a six hour schedule with McConkey Quantum 2000 (Sumner, WA) mechanized irrigation unit, and manually fertilized with Peters Professional (St. Louis, MO) Peat-lite Special 20-10-20 water soluble fertilizer once per week with a Dosatrom (Clearwater, FL) D14Z2 injection unit with 1-100 injection rate. Fertilizer was discontinued once accessions were moved to the field. Specimens of the accessions were maintained in the greenhouse as a stock source.

Table 1. *Inland saltgrass (Distichlis spicata) accession numbers, collection date, and collection locations. Accessions in bold represent accessions being used in advanced ongoing trials.*

Accession	Collection Date	Location
9067624	12/12/2001	Lafourche
9068003	11/19/2003	Lafourche
9068004	2/13/2004	Terrebonne
9068005	2/13/2004	Terrebonne
9068009	3/18/2004	Terrebonne
9068011	3/18/2004	Terrebonne
9068012	3/19/2004	Jefferson
9068031	6/30/2004	Cameron
9068112	8/19/1998	Cameron
9068113	7/21/1998	Cameron
9068306	**11/24/1998**	**St. Bernard**
9089473	8/17/2011	Cameron
9089474	**8/17/2011**	**Cameron**
9089475	**8/17/2011**	**Cameron**
9089476	8/17/2011	Cameron
9089480	**8/17/2011**	**Cameron**
9089484	9/22/2011	Cameron
9089485	9/14/2011	Cameron
9089487	9/14/2011	Cameron
9089515	9/23/2011	Lafourche
9089516	9/23/2011	Jefferson
9089517	**12/19/2001**	**Jefferson**
9089535	3/28/2012	Terrebonne
9089536	3/28/2012	Terrebonne
9089541	5/29/2012	Iberia

Field plots were randomized using a random sequence generator. Plots were managed for weeds with herbicides on Febuary 12, 2015, and maintained throughout the duration of this trial. Accessions were transplanted by hand to the field in a randomized complete block design with three replications. One plant was placed in the center of each plot on November 17, 2015. Plots were allowed to grow to a 5 ft x 5 ft plot with 5 feet of bare ground in between plots to allow for consistent evaluation and data collection of plant growth (*Figure 1*). This also maintained separation of plots.

Figure 1 Distichlis spicata planted 1 accession per plot.

Percent coverage in each plot was measured to determine each accession's ability to cover in a timely manner (*Figure 2*).

Figure 2 Percent coverage measured in 5 ft x 5 f plot.

A box was built to use as a guide for spraying herbicides to maintain the 5 ft x 5 ft plot (*Figure 3*). Data collection for spread began May 19, 2016. Remaining data collection began August 9, 2016, when the 5 ft x 5 ft plots were fully established. Plant height (*Table 2*), percent plot coverage (*Table 3*), and relative plant vigor ratings (*Table 4*) were taken three times per growing season throughout the years from August 2016 through May 2019.

Plant height was measured in inches when seed heads were not present (*Figure 4*)(*Table 2*). Plant height was a mean of 3 replications in the field.

Canopy covererage was determined by subjective ratings on a scale from 0 to 100 percent (*Table 3*). The canopy coverage ratings were performed three times per year. Visual estimations of only the inland saltgrass accessions were recorded, while any weeds in the plots were considered as bare ground.

Overall plant vigor was determined by the study leader on a scale from 1 to 9 with 1 being best and 9 being worst (*Table 4*). Vigor ratings were a mean across 3 replications.

Figure 3 5 ft x 5 ft box built for coverage of plot while spraying herbicide to maintain plot size.

Disease incidence was monitored and determined with visual rating scales for diseases found. No significant disease pressure was seen. Statistical significance was determined using Statistix 10 software with alpha set at 0.05, showing 95% confidence in the analysis.

Figure 4 Plant height measured in inches.

RESULTS AND DISCUSSION

Across eight dates, the five accessions had superior ratings for plant height (*Table 2*). Accession 9068306 had the best height ratings compared to all other accessions. Height displayed in *Table 2* was an average across three replications.

Table 2. - *Mean plant height of 25 accessions of inland saltgrass (Distichlis spicata) per month and year, USDA-NRCS Golden Meadow Plant Materials Center, Galliano, LA. Asterisk (*) represents accession with the best ratings for plant height. Accessions in bold represent accessions being used in advanced ongoing trials.*

Accession#	Date							
	Aug 2016	Nov 2016	May 2017	Sept 2017	March 2018	May 2018	Aug 2018	May 2019
	----------inches----------							
9067624	14.3	14.6	13.3	10.0	6.3	10.7	15.7	11.3
9068003	13.0	14.0	12.0	8.0	8.6	11.0	12.7	11.0
9068004	19.6	19.3	17.3	23.3	10.6	14.7	20.7	10.7
9068005	12.6	13.6	10.0	18.3	8.3	14.0	18.0	11.3
9068009	20.6	17.3	17.3	26.0	13.3	19.3	24.7	16.0
9068011	23.3	22.6	20.0	28.0	16.3	22.7	24.7	17.3
9068012	14.0	9.0	13.3	20.0	8.3	14.7	18.7	10.0
9068031	21.3	20.0	20.6	26.0	12.6	17.3	19.3	16.7
9068112	24.0	17.6	20.0	24.0	17.3	24.0	25.7	18.7
9068113	22.0	23.6	22.0	26.6	12.6	20.7	23.3	16.7
9068306*	**23.6**	**19.3**	**20.6**	**22.6**	**17.3**	**24.7**	**29.3**	**23.3**
9089473	22.3	21.0	24.6	23.3	15.6	23.0	28.3	18.0
9089474	**24.3**	**23.0**	**22.0**	**23.3**	**16.6**	**20.0**	**22.7**	**16.7**
9089475	**22.3**	**23.3**	**23.0**	**32.0**	**18.0**	**22.0**	**22.7**	**19.3**
9089476	19.0	20.0	18.0	26.6	16.6	22.3	24.0	17.3
9089480	**21.6**	**21.6**	**21.0**	**24.0**	**15.3**	**20.7**	**22.7**	**17.3**
9089484	19.6	16.3	16.6	23.3	10.0	15.3	21.3	13.3
9089485	22.0	16.6	16.6	28.0	11.6	19.3	22.7	13.3
9089487	23.3	23.3	23.3	24.0	13.6	15.7	20.7	16.0
9089515	19.0	20.6	20.0	26.0	19.3	20.0	23.7	16.7
9089516	20.6	22.0	19.0	24.0	13.3	18.7	22.0	15.3
9089517	**17.3**	**16.3**	**19.3**	**20.0**	**14.0**	**20.7**	**23.3**	**18.0**
9089535	19.0	18.6	20.6	19.6	12.3	17.3	22.0	16.7
9089536	17.0	16.6	18.0	16.3	11.3	16.0	14.7	14.0
9089541	21.3	21.6	22.6	21.3	14.6	19.3	24.3	16.0
Mean	19.9	18.9	18.9	22.6	13.4	18.6	17.6	15.5
LSD $_{(0.05)}$	8.3	8.6	9.4	11.4	8.3	4.4	4.7	5.8

Subjective estimations of 0 to 100% were used to determine percent coverage values (*Table 3*). Any weeds in the plots were considered bare ground. Accessions in bold had superior ratings compared to other isolates in *Table 3*. All percentages were an average across three replications.

Table 3. - *Mean percent coverage of 25 accessions of inland saltgrass (Distichlis spicata) by month and year, USDA-NRCS Golden Meadow Plant Materials Center, Galliano, LA. Accessions in bold represent accessions being used in advanced ongoing trials.*

Accession#	Date							
	Aug 2016	Nov 2016	May 2017	Sept 2017	March 2018	May 2018	Aug 2018	May 2019
	----------Percentage----------							
9067624	9.6	18.3	21.6	16.6	15.0	26.7	40.0	21.7
9068003	4.6	6.0	10.0	17.3	8.3	15.0	25.7	6.0
9068004	43.3	65.0	80.0	83.3	70.0	93.3	93.3	53.3
9068005	83.3	51.6	35.0	63.3	41.6	66.7	86.7	31.7
9068009	63.3	36.6	46.6	73.3	53.3	83.3	100.0	66.7
9068011	60.0	75.0	73.3	86.6	80.0	90.0	100.0	83.3
9068012	61.6	55.0	61.6	75.0	48.3	80.0	93.3	33.7
9068031	55.0	31.6	45.0	83.3	63.3	80.0	93.3	56.7
9068112	50.0	51.6	65.0	81.6	75.0	93.3	93.3	78.3
9068113	36.6	36.6	60.0	86.6	76.6	86.7	100.0	61.7
9068306	**78.3**	**73.3**	**65.0**	**78.3**	**83.3**	**93.3**	**100.0**	**83.3**
9089473	50.0	40.0	35.3	81.6	70.0	86.7	100.0	65.0
9089474	**38.3**	**31.6**	**51.6**	**78.3**	**78.3**	**90.0**	**90.0**	**68.3**
9089475	**68.3**	**55.0**	**55.0**	**76.6**	**83.3**	**90.0**	**100.0**	**95.0**
9089476	63.3	73.3	78.3	88.3	85.0	93.3	100.0	85.0
9089480	**50.0**	**41.6**	**56.6**	**93.3**	**81.6**	**93.3**	**100.0**	**90.0**
9089484	56.6	41.6	40.0	78.3	66.6	88.3	100.0	61.7
9089485	81.6	65.0	66.6	76.6	63.3	83.3	96.7	55.0
9089487	51.6	56.6	65.0	76.6	68.3	83.3	90.0	80.0
9089515	46.6	31.6	63.3	85.0	83.3	93.3	93.3	75.0
9089516	33.3	50.0	61.6	70.0	73.3	86.7	83.3	61.7
9089517	**40.0**	**33.3**	**45.0**	**86.6**	**75.0**	**90.0**	**100.0**	**86.7**
9089535	23.3	45.0	58.3	83.3	70.0	80.0	100.0	80.0
9089536	32.3	41.6	48.3	64.0	50.0	66.7	70.0	48.3
9089541	36.6	46.6	68.3	78.3	85.0	90.0	100.0	78.3
Mean	48.7	46.2	54.3	74.5	65.9	80.9	89.9	64.3
LSD $_{(0.05)}$	61.8	52.4	52.5	61.4	39.7	19.3	22.0	28.3

Overall plant vigor was subjectively assigned on a scale of 1 to 9, where 1 is best and 9 is worst (*Table 4*). Vigor ratings were based on aggressive plant growth. Accessions in bold were chosen to move forward to the advanced trials. Accessions 9068306 and 9089475 had the best vigor ratings compared to other accessions across the different rating dates in *Table 4*. The ratings were an average of three replications.

Table 4. - *Mean vigor rating of 25 accessions of inland saltgrass (Distichlis spicata) per month and year using 1-9 scale, USDA-NRCS Golden Meadow Plant Materials Center, Galliano, LA. Asterisk (*) represents accessions with the best ratings for plant vigor. Accessions in bold represent accessions being used in advanced ongoing trials*.

Accession#	Date							
	Aug 2016	Nov 2016	May 2017	Sept 2017	March 2018	May 2018	Aug 2018	May 2019
	----------1-9 vigor scale ratings----------							
9067624	7.7	5.0	7.3	8.0	8.0	7.7	8.0	8.0
9068003	8.7	8.0	8.0	8.7	8.7	7.7	8.0	8.5
9068004	4.3	3.0	2.3	3.7	4.7	3.0	2.7	6.0
9068005	2.3	7.0	6.0	5.7	6.7	3.7	4.0	8.3
9068009	3.0	5.3	5.0	4.0	5.3	3.3	3.3	4.7
9068011	3.7	2.7	3.0	2.7	3.0	2.3	2.7	3.0
9068012	4.0	5.0	4.3	5.0	6.3	3.3	4.0	7.3
9068031	4.3	6.3	5.0	3.0	4.7	3.0	3.7	6.0
9068112	3.7	3.7	3.3	3.3	3.7	2.3	2.3	3.3
9068113	4.7	4.3	4.3	2.7	3.3	3.0	3.7	5.7
9068306*	**2.3**	**3.7**	**3.3**	**3.7**	**3.0**	**2.3**	**2.0**	**1.7**
9089473	4.3	3.0	4.3	3.7	4.0	2.7	2.7	4.3
9089474	**4.7**	**4.7**	**5.0**	**3.7**	**3.3**	**2.7**	**4.0**	**4.7**
9089475*	**3.7**	**3.0**	**4.3**	**2.7**	**3.3**	**3.0**	**2.0**	**1.7**
9089476	3	3.7	3.0	2.3	3.3	2.0	1.7	3.3
9089480	**4.3**	**4.3**	**4.3**	**2.0**	**2.7**	**2.7**	**2.7**	**2.0**
9089484	4.3	6.7	5.7	4.0	5.0	3.7	2.7	6.3
9089485	2.3	4.3	3.7	3.7	5.7	3.0	2.7	6.0
9089487	4.3	3.7	4.0	3.3	4.0	3.0	4.0	4.0
9089515	5.7	4.7	4.0	2.7	2.7	2.7	3.0	3.3
9089516	4.7	3.3	4.0	4.7	4.0	3.0	4.7	5.0
9089517	**5.0**	**3.3**	**5.0**	**3.0**	**3.3**	**2.7**	**3.0**	**2.7**
9089535	6.3	2.7	4.0	3.3	4.3	3.0	2.3	3.0
9089536	6.3	4.0	4.7	4.3	5.0	4.3	5.0	5.3
9089541	4.0	3.7	4.0	4.0	3.0	2.7	2.0	4.3
Mean	4.5	4.4	4.5	3.9	4.4	3.3	3.5	4.7
$LSD_{(0.05)}$	2.2	2.4	1.9	2.5	1.7	1.3	1.9	2.4

Final ratings were taken May 2019. The final ratings data for height, coverage and vigor was averaged across three replications (*Table 5*). Accessions in bold were chosen to move to advance trials. Across height, coverage and vigor, they outperformed other accessions in this trial.

Table 5. *Final ratings of inland saltgrass (Distichlis spicata) accession numbers by, mean height, cover percentage, and mean vigor rating. Accessions in bold represent accessions being used in advanced ongoing trials*.

Accession	Height	Cover	Vigor
9067624	11.33	21.67	8.0
9068003	7.33	4.0	9.0
9068004	10.67	53.33	6.0
9068005	11.33	31.67	8.33
9068009	16.0	66.67	4.67
9068011	17.33	83.33	3.0
9068012	10.0	33.67	7.33
9068031	16.67	56.67	6.0
9068112	18.67	78.33	3.33
9068113	16.67	61.67	5.67
9068306	**23.33**	**83.33**	**1.67**
9089473	18.0	65.0	4.33
9089474	**16.67**	**68.33**	**4.67**
9089475	**19.33**	**95.0**	**1.67**
9089476	17.33	85.0	3.33
9089480	**17.33**	**90.0**	**2.0**
9089484	13.33	61.67	6.33
9089485	13.33	55.0	6.0
9089487	16.0	80.0	4.0
9089515	16.67	75.0	3.33
9089516	15.33	61.67	5.0
9089517	**18.0**	**86.67**	**2.67**
9089535	16.67	80.0	3.0
9089536	14.0	48.33	5.33
9089541	16.0	78.33	4.33

Percent coverage (P=0.0000) ranged from 4 to 95%. Plant height (P=0.0011) ranged from 7.33 to 23.33 inches tall. Plant vigor (P=0.0000) ratings ranged from 1.67 to 8.33. Significant differences of the five accessions chosen to be planted in the advanced trials compared to the other 20 accessions were detected in plant height, percent plant coverage and plant vigor. Although all accessions were collected from native stands, five accessions proved to have potential to be eventually released for growers. In addition to ratings collected through out the trial period, final data collection demonstrated that accessions 9068306, 9089474, 9089475, 9089480, and 9089517 had a combination of superior ratings across plant height, percent of plot coverage, and relative vigor ratings. Significant differences in plant height, plot coverage and vigor resulted in the choice to move these accessions forward to advanced trials. These five accessions will be taken to the field for further observation and testing.

CONCLUSION

The five accessions chosen to move to advanced trials were 9068306, 9089474, 9089475, 9089480, and 9089517. These had superior phenotypic ratings for plant height, percent plant coverage,and overall plant vigor. All five were collected in Cameron, St. Bernard, and Jefferson Parishes in coastal wetlands. Inland saltgrass is to be used for coastal wetland restoration and conservation projects and has the potential to accelerate restoration of coastal wetlands, making it an ideal candidate to fill this niche. The five selected accessions will be used in advanced trials located in private and public locations. One field at the Golden Meadow Plant Materials Center in Galliano, LA will be dedicated to this trial as a control.

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