United States Department of Agriculture

Natural Resources Conservation Service

Development of Virginia Saltmarsh Mallow, Amberique Bean, and Bushy Bluestem Conservation Plant Releases

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Virginia saltmarsh mallow (*Kosteletzkya virginica*)

Virginia saltmarsh mallow is an herbaceous, flowering perennial forb with a lengthy and striking bloom period of rosy, pink inflorescences. It is listed as an obligate wetland plant for all regions in which it occurs by the US Army Corps of Engineers' National Wetland Plant List. The New Jersey Plant Materials Center (NJPMC) is working with emeritus professors at the University of Delaware (UD), Jack Gallagher and Denise Seliskar, to develop a Mid-Atlantic Virginia saltmarsh mallow conservation plant release. Jack and Denise assembled 67 collections from coastal areas in Texas, around the Gulf of Mexico, and up the Atlantic coast to Delaware. They conducted trials examining radicle emergence, terminal growth, duration of flowering period, seed weight, and seed yield under fresh and saltwater treatments. Collections with superior performance could have beneficial applications in areas experiencing saltwater intrusion and aid in wildlife habitat improvement. A conservation plant release of Virginia saltmarsh mallow could be used in several NRCS Conservation Practices including Wildlife Habitat Planting (420), Restoration of Rare or Declining Natural Communities (643), and Conservation Cover (327). NJPMC staff established a seed production field of two high performing Mid-Atlantic collections to increase seed stock for trials to examine the agronomic potential of Virginia saltmarsh mallow.

Figure 1: The NJPMC Virginia saltmarsh mallow production field is a popular stop for invertebrates during the flowering period.

Seed Production Trials

Irrigation

Data collected from irrigated and non-irrigated seed production plots at the NJPMC show regularly scheduled irrigation events increase plant height, stem diameter, and seed yields (Table 1).

Table 1: Average height, stem diameter, and seeds per plant of Virginia saltmarsh mallow grown in irrigated and non-irrigated trials at the NJPMC in 2015.

Treatment	Height (in)	Stem diameter (in)	Seeds per plant
Irrigated	36.7^{A}	0.35^{A}	227^{A}
Non-irrigated	22.16^{B}	0.21^{B}	55^{B}

Means in the same column with the same letter are not significantly different according to Dunn's test at P<0.05.

Seed Harvest and Cleaning Process

Seed may be harvested by hand or on a greater scale with mechanical agricultural equipment. NJPMC staff successfully harvested seed production plots (up to 73 lb/ac) using a plot harvester with a standard grain head. Seed cleaning methods depend upon the harvest method. If harvested by hand, seed capsules are shattered using a hammer mill (0.25 inch round hole screen) before chaff is separated from seed. Seed capsule of small harvest amounts can be mechanically shattered using a slightly modified kitchen blender or manually using rubbing board. Air and screen seed cleaning equipment readily separates chaff from seed using 0.19-0.16 inch round holes for the top screen and 0.06-0.07 inch round holes for the bottom screen.

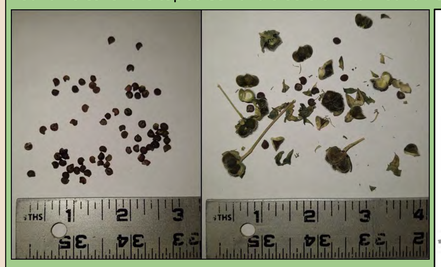

Figure 2: Cleaned Virginia saltmarsh mallow seed (left), hand harvested seed capsules prior to seed cleaning process (right).

Decision Making

Genetic analysis

Eight accessions were analyzed by the USDA-Agricultural Research Service Forage & Range Research Lab, Logan, Utah, to determine how each accession relates to others. Results indicate the accessions come from two broad groupings (Fig. 3). Data from seed production trials, field evaluations, and genetic analysis, is used to make informed decisions about which accessions will be included in a Virginia saltmarsh mallow conservation plant release.

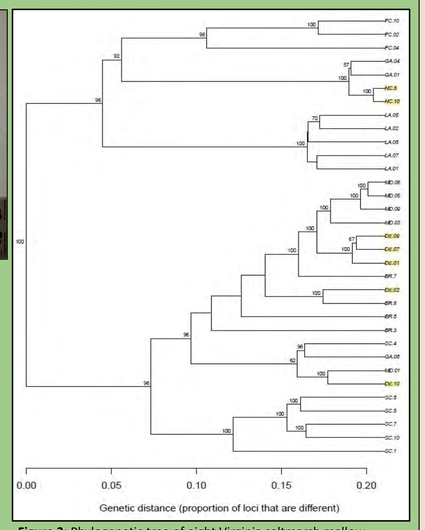

Figure 3: Phylogenetic tree of eight Virginia saltmarsh mallow collections (DE and NC highlighted).

Figure 4: Amberique bean interseeded between American beachgrass rows.

Amberique bean (*Strophostyles helvola*)

Amberique bean, a member of the legume family (Fabaceae), is an annual, native forb with a trailing vine growth habit. It is assigned the facultative wetland indicator status for the Atlantic and Gulf Coastal Plain region. NJPMC staff are conducting trials and demonstrations to assess the performance of 10 amberique bean accessions that were selected for seed production from a broader collection of 35 accessions. A variety of plant attributes including seed viability, seed yields, vine length, and root length, along with direct seeding trials are evaluated to determine if accessions can perform in critical area planting applications such as coastal dune revegetation and mined land reclamation.

Seeding Rate and Depth Trials

Direct seeding trials to determine appropriate seeding rates and planting depths for successful establishment of amberique bean between established rows of common dune stabilization species will aid in developing appropriate technology for the use of amberique bean.

NJPMC staff drilled amberique bean 1.6 inches deep between rows of recently planted American beachgrass (*Ammophila breviligulata*) at two rates (2.5 and 5.0 PLS/ft) on 6 April 2014 in a replicated seeding rate trial on sand dunes in Avalon, NJ. The resulting average plant establishment rates were 1.2 and 2.9 plants/ft respectively. The seeding trial methods were replicated in a Downer sandy loam at the NJPMC (Cape May Court House, NJ). The average plant establishment rates in the native sandy loam were 1.4 and 3.8 plants/ft respectively.

Replicated plots to evaluate planting depths for direct seeding dunes were established on 5 April 2013 in Cape May Point, NJ. NJPMC staff drilled seed to 1.0 and 1.6 inch seeding depths. Results showed similar seedling establishment rates for both depths (3.5 and 3.6 plants/ft respectively) that are not significantly different according to Dunn's test at P<0.05.

Vegetative Establishment Versus Direct Seeding

Amberique bean readily establishes via direct seeding but establishment via vegetative plugs may be warranted especially if site conditions are especially harsh or challenging. In replicated trials examining vegetative and direct seeding establishment methods, vegetatively established plots displayed greater vegetative cover, plant survival, and fruit production averages than direct seeded plots. Results also suggested that seeding dates impact establishment rates with planting dates later than May resulting in reduced establishment rates.

Table 2: Percent cover, percent survival, and seed yield per amberique bean plant in 2018-2019 trial at the Egg Harbor Township Nature Reserve, NJ. Change in percent coverage in study plots was from the time of spring establishment to September for two growing seasons.

Treatment	Change in coverage 2018 (%)*	Change in coverage 2019 (%)*	Survival (%) †	Fruit production per plant*
Vegetative establishment	25^{A}	38^{A}	90^{A}	0.8^{A}
Direct seeded	3^{B}	-2^{B}	73^{B}	0.2^{B}
Control	1^{B}	-3^{B}	NA	NA

**Means with the same letter are not significantly different according to Dunn's test at P<0.05.*
†Means with the same letter are not significantly different according to Tukey's HSD at P<0.05.

Seed Scarification Trial

Scarification is a common method to increase germination rates while also accelerating the rate of germination. In trials conducted by NJPMC staff, amberique bean germinated faster and at a greater rate in brushed seed compared to unbrushed seed (48 and 18% respectively).

Figure 5: Mike Yacovelli operates brush machine at the NJPMC.

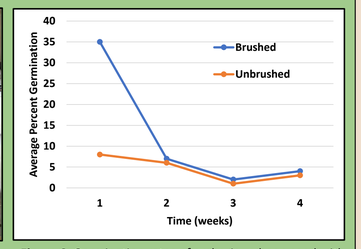

Figure 6: Germination rates of amberique bean seed with scarification treatments. Average germination rates were significantly different according to Tukey's HSD at *P*<0.05.

Bushy bluestem (*Andropogon glomeratus*)

Bushy bluestem is a native, warm season, perennial bunchgrass that can be found growing along brackish and freshwater marsh borders, moist roadside ditches, and grassland swales. It is adapted to soils with poor drainage and is assigned the wetland indicator status facultative wetland for the Atlantic and Gulf Coastal Plain region. Although commercial sources of seed are rare, bushy bluestem is recommended for 15 NRCS Conservation Practice Standards. Readily available commercial seed sources of bushy bluestem would make its use for NRCS conservation practice standards more feasible.

NJPMC staff conducted a study to assess and characterize 34 bushy bluestem accessions. Data collected includes length of time until emergence, height, root length, biomass production, and survival rate. Results from this series of studies may contribute to the development of a conservation plant release.

Figure 7: A mature bushy bluestem seedhead. Photo credit: Robert Glennon, USDA-NRCS Partner Biologist.

Seedling Vigor Study Results

Height and root length data of the top 15 performing bushy bluestem accessions produced from a greenhouse comparison study of wild collections conducted at the NJPMC to evaluate seedling vigor are displayed in the charts below.

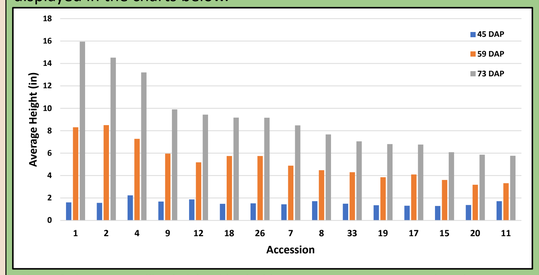

Figure 8: Average seedling height of bushy bluestem accessions measured on three occasions to evaluate seedling vigor in a greenhouse comparison study of wild collections conducted at the NJPMC.

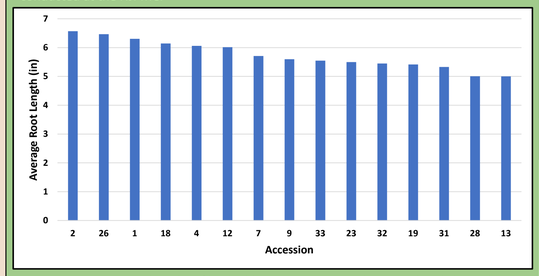

Figure 9: Average root lengths of bushy bluestem accessions harvested and cleaned 78 DAP to evaluate seedling vigor in a greenhouse comparison study of wild collections conducted at the NJPMC.

Figure 10: Mike Yacovelli (left) and Dan Mull (right) conduct seedling height measurements.

Figure 11: Dan Mull (left) and Mike Yacovelli (right) inspect field trial planting.

Advanced Field Trial

Replicated plots to examine additional plant attributes (stem diameter, stem density, plant height, and dry matter yield) of top performing bushy bluestem collections were established at the NJPMC fall 2024.

Figure 12: Field of mature bushy bluestem seed heads. Photo credit: Robert Glennon, USDA-NRCS Partner Biologist.

Figure 13: Flooded pit used for advanced field trials of top performing bushy bluestem collections from seedling vigor study.

Final Study Report available here →