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Natural Resources Conservation Service

# Conservation Plant Establishment to Support Field Elevation Increase Through Beneficial Use of Dredge Material Sediment Application

**Scott C. Snell**

**New Jersey Plant Materials Center, USDA Natural Resources Conservation Service, 1536 Route 9 North, Cape May, NJ.**

## Project Overview

The New Jersey Plant Materials Center (NJPMC) partnered with a local turf production farm and the DelAtlantic Soil Conservation District to conduct a conservation field trial examining the applicability of NJPMC conservation plant releases for use as temporary cover or as an alternative production crop at a site receiving dredge material sediment. The primary goal of the project for the sod farm operation was to use the dredge material sediment to raise the elevation of the fallow turf production field and replace the topsoil lost from years of turf production. The dredge material sediment was dewatered on site in constructed pits prior to spreading and incorporation into the native field soil. When the elevation is restored to the intended level and the soil conditions are appropriate, the fields may be reverted to turf production. The primary conservation concern of this project was the potentially high erosion rate if the fields were left unvegetated after the saline dredge sediment was incorporated. The addition of the saline dredge material was expected to negatively impact agronomic parameters, increasing soil salinity and acidity. Selecting the appropriate plant species that could successfully establish and maintain vegetative cover given the altered soil chemical properties was a major concern. The selected plant species would have to withstand the harsh conditions caused by the introduction of dredge material sediment into the native soil of the fallow field and successfully spread to mitigate potential erosion.


**Figure 1:** NJPMC conservation plant releases tested at a dredge material sediment reception site at the time of dormant planting (lower right) and 7 months after planting (prairie cordgrass upper left, saltmeadow cordgrass upper right, and American beachgrass lower left).

## Role of the New Jersey Plant Materials Center

NJPMC staff planned the conservation field trial planting and provided seed and vegetative materials. Vegetative plants were harvested and the entire trial planting was installed on December 14, 2018. The trial planting consisted of three vegetatively established treatments: 'Cape' American beachgrass (*Ammophila breviligulata*), 'Avalon' saltmeadow cordgrass (*Spartina patens*), and Southampton Germplasm prairie cordgrass (*Spartina pectinata*). A fourth treatment was a broadcast seeded multispecies mix. The seed mix (Table 1) consisted of partridge pea (*Chamaecrista fasciculata*), Virginia saltmarsh mallow (*Kosteletzkya virginica*), 'Atlantic' coastal panicgrass (*Panicum amarum* var. *amarulum*), Southampton prairie cordgrass (*Spartina pectinata*), amberique-bean (*Strophostyles helvola*), and barley (*Hordeum vulgare*).

NJPMC staff conducted monitoring, data collection, and analysis efforts for conservation technology transfer purposes. Soil properties (pH and salinity) were monitored using field testing equipment in addition to laboratory tested samples. Plant performance was evaluated by monitoring survival, chlorophyll content, and collecting samples for laboratory forage value analysis.

**Table 1:** Seed mix used for the dredge material sediment recipient site conservation trial at a sod farm in Tuckahoe, NJ.

| Common name | Scientific name | Variety | Bulk seeding rate (lb/ac) |
|---|---|---|---|
| partridge pea | *Chamaecrista fasciculata* | VNS* | 6.5 |
| Virginia saltmarsh mallow | *Kosteletzkya virginica* | Delaware germplasm | 15.2 |
| coastal panicgrass | *Panicum amarulum* | 'Atlantic' | 17.4 |
| prairie cordgrass | *Spartina pectinata* | Southampton Germplasm | 38.0 |
| amberique-bean | *Strophostyles helvola* | NJPMC development germplasm | 15.2 |
| barley | *Hordeum vulgare* | VNS* | 17.4 |

**VNS = variety not stated*

## Soil Properties

Soil properties were monitored during the conservation field trial. Soil samples were collected at 10 randomized locations of the trial area from surface to a depth of 8 inches. Early samples (2018 and 2019) were tested for pH and salinity using field test instruments. Salinity of field-tested samples was determined by measuring soil electrical conductivity (EC) following the EC1:1 method described in the 2014 USDA NRCS Soil Electrical Conductivity Guide for Educators. Later samples (2023 and 2025) were sent for laboratory analysis. From the start of the conservation field trial, soil salinity (Figure 2) decreased from the strongly saline range to nonsaline while soil pH (Figure 3) consistently remained in the extremely to very strongly acidic ranges.

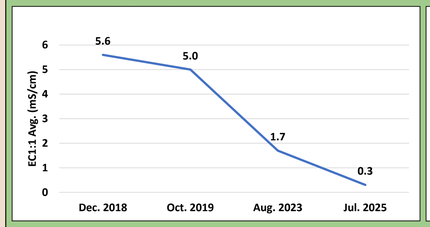


**Figure 2:** Soil salinity results over the course of the conservation field trial at a dredge material sediment trial site (Tuckahoe, NJ)

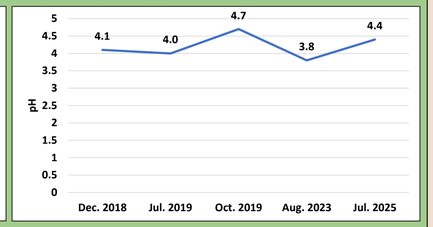


**Figure 3:** Soil pH results over the course of the conservation field trial at a dredge material sediment trial site (Tuckahoe, NJ).


**Figure 4:** Photos documenting dominant species change of American beachgrass plot - Nov. 2019 (left) and Aug. 2022 (right).

**Figure 5:** Small area of well established direct seeded Atlantic coastal panicgrass (left), vegetatively established eastern gamagrass (middle), vegetatively established seaside goldenrod (right) – Aug. 2022.

## Planting Establishment and Survival

The direct seeding trial resulted in poor establishment of the seeded species. Amberique-bean, partridge pea, and Atlantic coastal panicgrass seedlings were the only species observed during monitoring visits. Nearly all the seedlings that emerged were concentrated at the lowest elevation of the trial area on the field edge. The distribution of emergent seedlings suggests that seed was translocated with water movement. Improved seeding techniques may have improved results. Due to the poor direct seeding establishment performance, seedling count data was not recorded. To prevent erosion and trial additional plant species, NJPMC staff vegetatively established rows of eastern gamagrass (*Tripsacum dactyloides*) and Monarch Germplasm seaside goldenrod (*Solidago sempervirens*) on June 16, 2021. Both species established readily with high survival rates.

Vegetatively established treatments displayed a far higher level of success than the direct seeding trial. Cape American beachgrass and Avalon saltmeadow cordgrass both established readily with high survival rates. Southampton prairie cordgrass was slower to establish and had a lower survival rate. Statistical analysis of the survival data showed no significant difference between Cape American beachgrass and Avalon saltmeadow cordgrass while Southampton prairie cordgrass survival was significantly less (Figure 7). However, by the end of the second growing season (2020) Southampton prairie cordgrass was well established and displayed vigorous spread encroaching on the adjacent Cape American beachgrass plot. By August 2022, Southampton prairie cordgrass had become the more dominant species in the Cape American beachgrass plot (Figure 4). This shift in species performance could be the result of each species' degree of salinity tolerance with higher soil salinity conditions favoring Cape American beachgrass allowing it to outcompete the less tolerant Southampton prairie cordgrass.

**Figure 6:** Clear signs of erosion were apparent at the low elevation edge of the direct seeded trial plot where most seedlings occurred.

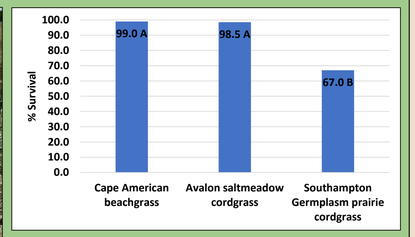


**Figure 7:** Average survival of the three NJPMC conservation plant releases tested at a dredge material site 7 months after planting. Means with the same letter are not significantly different according to Dunn's test at $P<0.05$.

## Forage Value

NJPMC staff collected a sample of trial grass species at the dredge materials sediment test site on August 30, 2023 for laboratory analysis to assess forage quality. Additional samples were collected for comparative evaluation purposes from plants grown at the NJPMC (Cape May Court House, NJ) and saltwater intrusion research plots located on abandoned agricultural fields in Somerset County, MD. Samples were sent to Midwest Laboratories (Omaha, NE) to determine forage quality estimates (crude protein, fiber, digestible nutrients, and net energy). Based on Penn State Extension and Oklahoma State Extension forage recommendations, only one sample of prairie cordgrass (DTS) and eastern gamagrass (NJPMC) met crude protein requirements (> 9%). Both saltmeadow cordgrass samples, one coastal panicgrass sample (NJPMC), and one prairie cordgrass sample (NJPMC) failed to meet the average forage quality range for total digestible nutrients (52%-59%). All samples failed to meet the acid detergent fiber test Penn State Extension recommendation (< 35%).

**Table 2:** Forage value laboratory results of grass samples collected from NJPMC production fields (Cape May Court House, NJ), dredge material sediment trial site (Tuckahoe, NJ) , and saltwater intrusion research plots in Maryland.

| Species | Variety | Location* | Protein (crude) % | Fiber (acid detergent) % | Total digestible nutrients % | Net energy (lactation) Mcal/lbs | Net energy (maint.) Mcal/lbs | Net energy (gain) % |
|---|---|---|---|---|---|---|---|---|
| coastal panicgrass | Atlantic | NJPMC | 5.25 | 45.2 | 51.0 | 0.51 | 0.48 | 0.27 |
| coastal panicgrass | Atlantic | DTS | 7.91 | 44.0 | 52.4 | 0.53 | 0.50 | 0.28 |
| coastal panicgrass | Atlantic | MD | 5.69 | 41.4 | 55.3 | 0.56 | 0.53 | 0.31 |
| prairie cordgrass | Southampton | NJPMC | 8.08 | 46.2 | 49.9 | 0.50 | 0.47 | 0.26 |
| prairie cordgrass | Southampton | DTS | 10.1 | 43.5 | 53.0 | 0.54 | 0.50 | 0.28 |
| prairie cordgrass | Southampton | MD | 7.16 | 43.0 | 53.5 | 0.54 | 0.51 | 0.29 |
| saltmeadow cordgrass | Avalon | NJPMC | 6.64 | 45.3 | 50.9 | 0.51 | 0.48 | 0.26 |
| saltmeadow cordgrass | Avalon | DTS | 5.29 | 48.1 | 47.7 | 0.48 | 0.44 | 0.23 |
| eastern gamagrass | VNS† | NJPMC | 9.7 | 42.1 | 54.5 | 0.55 | 0.52 | 0.30 |
| eastern gamagrass | VNS† | DTS | 8.01 | 43.7 | 52.7 | 0.53 | 0.50 | 0.28 |
| eastern gamagrass | VNS† | MD | 6.24 | 42.6 | 54.0 | 0.55 | 0.52 | 0.29 |

**location key: NJPMC = New Jersey Plant Materials Center, DTS = Dredge Trial Site, MD = MD saltwater intrusion research plots.*
*†VNS = variety not stated*

## Chlorophyll Concentration

NJPMC staff measured chlorophyll concentration data in July and October from the dredge materials sediment test site and NJPMC production fields. Statistical analysis showed no significant difference between sites within species groups for July averages. Prairie cordgrass was the only species to show a significant difference between sites for October averages. The similar or higher chlorophyll content averages displayed at the dredge materials sediment test site suggests that all three species can withstand the acidic and saline conditions of the soil without severe impacts to photosynthetic capacity.

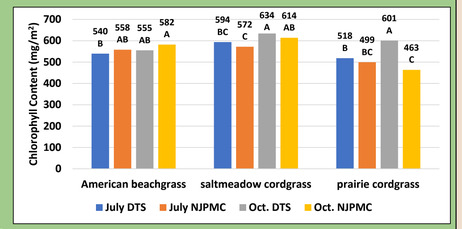


**Figure 8:** Average chlorophyll content results of three NJPMC conservation plant releases tested at a dredge trial site (DTS) and NJPMC production fields at two dates. Means with the same letter within the species group are not significantly different according to Dunn's test at $P<0.05$.

## Alternative Production Options

An alternative land use option explored by the turf production farm managing the dredge materials sediment field is to convert it to conservation plant production. This option is more readily obtainable and requires fewer inputs than returning the field to turf production. A small demonstration of a novel saltmeadow cordgrass and prairie cordgrass harvest and dune planting method was conducted on the Strathmere, NJ dune system. Rather than follow standard practice, harvesting and planting bare root materials, turf farm staff harvested sod slabs (approximately 4.5x5 ft) of the conservation plants in a manner similar to a sod harvest and installed sod slabs.

**Figure 9:** Photos of Strathmere demonstration planting: trailer of conservation plant sod slabs (left), saltmeadow cordgrass slab transported to dune (top right), and sod slab trial plot (bottom right).

## Conclusion

This conservation field trial demonstrated the successful application of NJPMC conservation plant releases to support the implementation of USDA NRCS Conservation Practice Standard Critical Area Planting (342) at a dredge material sediment recipient site. With appropriate plants, an alternative beneficial use of dredge material sediment was achieved while minimizing erosive impacts. This information could also assist planners handling Wetland Reserve Easement projects when dredge material sediment is used to raise marsh elevation.