Final Report to the Maryland Department of Natural Resources
on
Dune Diversity Plantings at 128th Street, Ocean City, Maryland.


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Project History

Army Corps Beach Replenishment Project: In the late 1980's, the Army Corps of Engineers-Baltimore District worked with the USDA-SCS Plant Materials Program on planting specifications for the 7 mile stretch of the newly created dune in Ocean City, MD. In addition to 'Cape' american beachgrass that was planted, 'Atlantic' coastal panicgrass was recommended to be seeded between the rows of American beachgrass. It is a tall native warm season grass which will dominate after the beachgrass loses vigor when the sand becomes stabilized. However, it has done too well and is dominating a large percentage of the dune to the exclusion of other species. This monocultural stand is also susceptible to being lost from insects and/or disease. Also, due to it's height, some homeowners on the back side of the dune do not like the obstruction of the ocean view.

Solution: Plant diversity on the sand dunes is most desirable for long term sustainability of the ecosystem.

Result: This objective of this cooperative project with the Maryland DNR was to evaluate lower growing back dune species which would still be as effective in vegetating and stabilizing the dunes as the taller more dominant coastal panicgrass.

The various trials/studies conducted from 2003-2006 were designed to show the following:

Effectiveness of a water absorbing root gel (Terrasorb) on survival
Effectiveness of mycorrhizae fungi inoculation on survival
Interspecies competition at various plant spacings
Which plant form (i.e. 4" deep book planter plugs vs 2" deep plugs vs bare root) results in increased survival.

Plant Species Descriptions:

American beachgrass (*Ammophila breviligulata*)- this native, cool season grass also known as dune grass grows most prolifically in the zone of accretion in the fore dune area. Once the sand becomes stabilized, it loses vigor and yields to other species that provide long term cover and stabilization. However, it should still be a component of back dune plantings as a quick cover or nurse crop.

Saltmeadow cordgrass (*Spartina patens*) – This native warm season grass species is commonly associated with tidal marshes occurring in slightly higher elevations than the intertidal smooth cordgrass. However, it is often found on high and dry back dune areas and spreads rhizomatously just like beachgrass. It does not require the sand accumulation that beachgrass does and in fact will not tolerate too much deposition. It is one of the species that invades dune overwash areas after storm events.

Bitter panicgrass (*Panicum amarum*) - This native, warm season grass is closely related to the upright coastal panicgrass but is much more prostrate in it's growth habit. This species is less adapted to accreting sand than beachgrass so it is better adapted to secondary dunes or the backside of primary dunes. It is rather slow to establish from vegetative culms, but should at least be a small component in back dune plantings. Unlike coastal panicgrass, it does not produce a large quantity of viable seed in the Mid-Atlantic region.

Coastal little bluestem (*Schizachyrium littorale*) – This native, warm season grass is a coastal variant of the inland little bluestem. It only occurs in back dune areas where the sand has been stabilized. Because it is a bunch type grass (unlike the three species described above) it usually occurs in open stands with bare sand between the clumps. Maximum height is 1.5 to two feet tall. A Mid-Atlantic ecotype will be released by the USDA-NRCS, Cape May Plant Materials Center in 2007, partially based on the trials in this project and the fact that it is not available in large quantities through commercial nurseries.

Coastal little bluestem in backdune

Study Descriptions

USDA-NRCS 2003-2004 Survival Study for coastal little bluestem

June 10, 2003- Various forms (bookplanters, 2"x 2" plugs, bareroot) of coastal little bluestem were planted with and without the use of Terrasorb gel which maintains root wetness. (5 rows of each, 9 plants/row). This was not statistically designed so no significant differences were identified.

Product Descriptions

Bookplanters- these plugs are grown in inserts that open like a book for easy retrieval. We used a 4" length plug for this planting. This product costs about

2" x 2" plugs – these are the nursery standard plugs generally grown in flats of 32. These plugs are rooted in a potting medium and are 2" deep and 2" across diagonally. This product costs about $0.70/plant from commercial nurseries.

Bareroot – these are plants that are field dug with most of the native soil shaken off for easy transport to the planting site. Bareroot materials are generally cheaper than pot grown material, however they show decreased survival especially when planted later than recommended. This product costs between $0.20-$0.30 per plant depending on quantity purchased.

 Bare-root plant

Planting Amendments

Terrasorb – brand name product of a product that keeps roots moist when transplanting bareroot seedlings and helps water maintain water absorption to roots during dry periods. It is good insurance and adds minimal cost to the planting. 1 pound of crystalline product which costs $6.00-$7.00 added to about 30 gallons of water will treat 15,000 bareroot seedlings.

The percentage survival was as follows:

1 year old bookplanter w/ Terrasorb- 71%
1 year old bookplanter w/o Terrasorb- 58%

2 year 2"x2" plugs w/ Terrasorb - 49%
2 year 2"x2" plugs - w/o Terrasorb – 31%

Bare root w/Terrasorb – 11%
Bare root w/o Terrasorb – 0 %

Result: This shows that Terrasorb has utility at a minimal expense to increase survival especially when planting is late in the planting season (early summer as opposed to early spring). Also, the deeper-rooting bookplanter plugs were more effective than the shallow plugs and bare root plants, especially at the later planting date even when Terrasorb was not used.

DNR Project Study 2005-2006 Results:

Wagon Wheel Design Study

Planting date: 6/6/05
Evaluation Date: 9/5/05
No fertilizer applied

Purpose: To study survival and interspecies competition for 4 major dune species. To test shorter growing back dune species to broaden plant diversity and provide an adequate substitute for coastal panicgrass.

Species planted: 'Cape' American beachgrass (*Ammophila breviligulata)*, 'Avalon' saltmeadow cordgrass (*Spartina patens*), 'Northpa' bitter panicgrass (*Panicum amarum*), and coastal little bluestem *(Schizachyrium scoparium var. littorale)*

Design: Wagon wheel spokes where plants are on tighter spacing at the "axle" and wider spacing at the "tread". The first growing season survival was the only criteria collected. The second year, survival, spread and competitiveness were evaluated.

"Wagon Wheel" Planting Design

Table 1. First Year Wagon Wheel Results:

Plant Species	% Survival				**Average**
	Rep 1	Rep. 2	Rep. 3	Rep. 4	
Cape American beachgrass	100	90	80	85	**88.75**
Avalon saltmeadow cordgrass	100	100	90	90	**95**
Northpa bitter panicgrass	100	85	55	40	**70**
Coastal little bluestem	90	90	35	80	**73.75**

September 2005. Additional Observations:

Sandbur volunteering in cleared areas.

Coastal panicgrass root stock still present after site clearing, so scattered plants are returning into the project area.

Cocklebur and seaside goldenrod volunteering outside of plot are invading into the planting area.

September 2005 growth on one of the replicated plots.

Table 2. 2006 Wagon Wheel Results:

Plant Species	% Survival				**Average**
	Rep 1	Rep. 2	Rep. 3	Rep. 4	
Cape American beachgrass	50	10	25	45	**32.5**
Avalon saltmeadow cordgrass	100	90	75	100	**91.25**
Northpa bitter panicgrass	100	65	35	30	**57.5**
Coastal little bluestem	65	85	10	30	**47.5**

Second year growth of one wagon wheel replication

September 2006. Additional Observations:

Beachgrass was not spreading and is declining in vigor.

Bitter panicgrass, when surviving is somewhat competitive to other species.

Coastal little bluestem flattened down only 30% of plants flowering and producing seed.

Coastal panicgrass is starting to recolonize the area from rootstock present in the sand.

*Shining star is Avalon saltmeadow cordgrass. It is surviving well, spreading but not too competitively as to exclude other species. Below is a photo showing a close up of saltmeadow cordgrass spreading beyond the initial planting row.

Avalon saltmeadow cordgrass spreading by rhizomes

Mycorrhizal Inoculum Study

Planting Design

10 plants of each species were planted in two rows. One row was dipped in a commercially available mycorrhizal inoculum, the other was not. Because these are not replicated plots, no statistical analysis could be done.

The product we used was a Bio/Organics Mycorrhizae Inoculum. Mycorrhizae fungi promote plant vigor, add disease resistance, and can increase survival while improving soil for future crops. As a rule, fertilizer inputs can be substantially reduced for mycorrhizal plants, particularly phosphorus. A 3-lb. jar of inoculant will treat about 1500 plants at a cost of $80.00. This adds about $0.05/plant to the cost of the planting.

2005 Mycorrhizal Treatment Data

Results were as follows:

Coastal little bluestem w mycorr. – 80 % survival
Coastal little bluestem w/o mycorr. – 40 % survival

Bitter panicgrass w/mycorr. – 100%
Bitter panicgrass w/o mycorr – 50%

Saltmeadow cordgrass w/mycorr – 100%
Saltmeadow cordgrass w/o mycorr – 100%

2006 Mycorrhizal Treatment Data

Second year survival was as follows:

Coastal little bluestem w mycorr. – 50 % survival
Coastal little bluestem w/o mycorr. – 10 % survival

Bitter panicgrass w/mycorr. – 30%
Bitter panicgrass w/o mycorr – 50%

Saltmeadow cordgrass w/mycorr – 100%
Saltmeadow cordgrass w/o mycorr – 80%

Study Recommendations:
Although these observations were somewhat inconclusive, mycorrhizae fungi has been documented in other research studies to be beneficial to the survival and growth of plant species in this "desert" environment. The Cape May PMC in cooperation with the David Douds, a soil microbiologist with the USDA-Agricultural Research Service in Wyndmoor, PA is producing "home grown" mycorrhizal fungi which may be more species specific to our plants than the commercially available product. Future studies comparing home grown versus commercial inoculum will be conducted by the Cape May Plant Materials Center.

Summary Recommendations

1. Until further study is completed and commercial plants become available for the Mid-Atlantic ecotype release of coastal little bluestem, we recommend planting 'Avalon' saltmeadow cordgrass between rows of amercian beachgrass from the crest of the primary dune landward through the secondary dune on an 18" spacing between plants within the row.
2. If planting bareroot saltmeadow cordgrass, use a hydro-absorbing gel such as Terra-Sorb for extra survival insurance.
3. The jury is still out on the effectiveness of the commercially produced mycorrhizal inoculant. If an additional $0.05 per plant is not a problem from a project budget standpoint, it won't hurt to add the inoculum at planting time.
4. Considering the late planting date on most of these trials, we got fair-good survival on most species. However, we generally recommend planting no later than the end of April in most years. Depending on temperature/rainfall patterns in a particular year, extending the planting to mid-May is feasible with all species tested with the exception of American beachgrass. This should be planted by mid-April at the latest.
5. We did not use fertilizer in any of these trials. A slow release fertilizer that supplies a small amounts of nitrogen and moderate amount of phosphorus would be beneficial.

Future Studies to be Conducted by the Cape May Plant Materials Center

Additional studies comparing various plant forms (bare root, 4"deep plugs, 2" plugs) versus planting time.

Interplanting saltmeadow cordgrass with amercian beachgrass in the late fall versus spring.

Mixing slow release fertilizer with TerraSorb gel.

Commercial versus "home grown" mycorrhizal inoculum.