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PMC Annual Technical Report

Cape May Plant Materials Center

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Introduction

The mission of the Cape May Plant Materials Center (PMC) is to provide plant materials and conservation technical assistance to the public, government agencies, non-profit organizations, and commercial growers in a nine-state area that includes Connecticut, Delaware, Maryland, Massachusetts, Long Island-New York, New Jersey, North Carolina, Rhode Island, and Virginia. The Cape May PMC was established in 1965 in response to shoreline restoration needs following Hurricane Donna, and has focused on developing plant technologies for specific concerns pertaining to coastal shoreline protection, sand dune establishment, restoration of mined lands and critical areas, and enhancement of Coastal Plain habitat. Because the Cape May PMC is uniquely situated in close proximity to coastal dune communities, wetlands, and large tidal marsh estuaries, it is able to be a leader in product and technology development for coastal ecosystems and conserving the health and productivity of Coastal Plain soils.

Location and Site Description

The Cape May PMC is located in Cape May County and is New Jersey's southern-most county. The nearest tidal marsh, Great Sound, is only 500 feet east of the PMC. The average annual maximum and minimum temperature is 63°F and 44°F respectively, with an annual average precipitation of 40 inches.

The Cape May PMC service area consists of Mid-Atlantic Coastal Plain soils that are threatened by wind, water, and streambank erosion that can degrade plant and water resources in tidal estuaries, marshes, freshwater wetlands, bays, river inlets, and coastlines. The soils at the Cape May PMC are low to moderately fertile, well-drained, nearly-level, sand to loamy sand. The predominant soil series at the PMC are Downer and Sassafras; with Fort Mott, and Woodstown also represented.

The predominant agricultural operations in the service include cash row crops, orchards, truck crops, specialty crops, and poultry. Other important industries are fisheries, sand and gravel mining, recreational and wildlife tourism, and industrial and residential development. These land uses are critical to the local economy and can directly benefit from conservation plant products and seeding technology.

Plant Development and Evaluation

DEVELOPMENT OF SHORTBEARD PLUMEGRASS AND SUGARCANE PLUMEGRASS

BACKGROUND

The NJPMC collected shortbeard plumegrass (*Saccharum brevibarbe*) and sugarcane plumegrass (*Sacharum giganteum*) to initiate studies to develop a tested or selected release to restore native grasslands along the Atlantic Coastal Plain. These tall prairie grasses occur on the Atlantic Coastal Plain but are not widely distributed by commercial growers.

Shortbeard plumegrass grows on well-drained to poorly-drained soils from Delaware (Plant Hardiness Zone 7a) south to the Florida Panhandle. Sugarcane plumegrass grows mainly in wetlands on very poorly-drained soils, further north to Plant Hardiness Zone 6b. Shortbeard plumegrass is not as dominant on the landscape.

METHODS

45 accessions were collected from Virginia and 23 accessions were collected from North Carolina in October and November, 2011. Bob Glennon, retired PMC manager, collected 40 accessions of shortbeard plumegrass and 28 accessions of sugarcane plumegrass.

There will be qualitative and quantitative data collection over the next three years to determine differences between the accessions. These variables include seed yield, seed germination, stem counts, and dates of boot and flower emergence. Collected seed was grown in the greenhouse during early spring 2012, and later transplanted into the field the following summer.

RESULTS

Pending on future evaluations.

COLLECTION AND EVALUATION OF GIANT CANE

BACKGROUND

Giant cane, (*Arundinaria gigantean*) is a perennial, cool-season woody grass that was once widespread throughout much of Midwestern and Eastern North America. It is unique in that it is the only bamboo native to the United States. Giant cane grows in dense stands (canebrakes) on the East Coast from Florida to New York and New Jersey, west to Texas, and north to Kansas and Missouri. It bears evergreen foliage and can reach heights of up to 30 feet. It is well adapted as an understory plant of forests as well as to alluvial floodplains and on riverbanks (Anderson and Oakes 2011).

Prior to European settlement, monotypic stands of giant cane were an expansive and dominant feature of the landscape in the Southeastern United States. Platt and Brantley (1997) reported numerous historic descriptive accounts of extensive canebrakes described as “vast cane meadow”, “many miles in extent”, and “an endless wilderness of canes”. Records of travels indicate that these canebrakes could be upwards to 20 miles long. Although monotypic stands of giant cane can still be found throughout the distribution range, the expansive canebrakes once described by settlers no longer exist. It is estimated that the area of canebrakes has been reduced to less than 2% of what it once was covered (Noss et al., 1995). These substantial losses are commonly attributed to changes in land management from Native American agriculture to a more intensive European agriculture that included land clearing, heavy grazing, and alternative burning schedules (Gagnon et al., 2007; Platt and Brantley, 1997).

Canebrakes provide many important cultural and ecological services. Riparian canebrakes provide water quality benefits by reducing groundwater nitrate (Schoonover and Williard, 2003), while its high stem density (16-26 culms/m^2) and rhizomatous growth make giant cane an excellent candidate for stream bank stabilization. Giant cane stands also act as a refuge for game species, neotropical migratory birds, and cane-obligate butterfly species (Platt et al. 2001). Canebrakes provide fuel and materials to make shelter, hair ornaments, game sticks, musical instruments, toys, weapons, and tools (Anderson and Oakes 2011) for a variety of Native American tribes.

Although giant cane is a very important native grass that serves many critical conservation and restoration purposes, it is not widely available through commercial sources.

METHOD

On June 14, 2011, PMC staff collected giant cane clumps from a small remnant canebrake patch in Cape May Court House, NJ (39.052202,-74.842858) between the Garden State Parkway and Route 9 (see collection map). On average, each clump had 12 culms. Several of the largest clumps were wrapped in burlap for holding and transported to the Norman A. Berg PMC in Beltsville, MD on June 21, 2011. On the collection day, the remaining 40 propagules were planted in a floodable pit at the Cape May PMC, in Ingleside sandy loam. They were planted in rows on 2 foot spacing, with 10 feet between rows. The day after collection, the pit was flooded once to assist establishment. Weeds were manually controlled for the remainder of 2011. Weeds between transplants were sprayed with a tank mix (1% Round Up Weather Max and 1% Prowl H2O) the following 2012 growing season, while weeds were suppressed mechanically in the interrows.

The survival of the transplants at the Cape May PMC was evaluated 78 DAP on August 31, 2011 and again after a full growing season on October 23, 2012. After a full growing season (2012), the surviving transplants were evaluated in the early spring (March 28) of 2013. The transplants were evaluated for height, number of culms, culm diameter, and culm area. Culms per square foot were then calculated from this information. Height was measured from soil level to the highest point of the propagule. The 3 tallest culms were measured and averaged. Culm diameter was recorded by averaging the measurements of the 3 most dominant culms per propagule, measured 3 inches above soil level. Culm area was recorded as the product of the distance between the bases of the two furthest culms and the greatest distance of two culms perpendicular to the first pair.

Survival Counts

Date	Count	% Survival
August 31, 2011	34/40	85
October 23, 2012	34/40	85
March 28, 2013	33/40	82.5

Fig. 1 Field plot of giant cane (*Arundinaria gigantea*) in constructed wetland pit (early spring).

Fig. 2 Early spring regrowth of perennial, cool-season, evergreen giant cane.

EVALUATION OF LONG ISLAND ECOTYPE OF PRAIRIE CORDGRASS (SPARTINA PECTINATA) (NJPMC-P-0903)

BACKGROUND

The NJPMC received Long Island ecotype prairie cordgrass (*Spartina pectinata*) from the Big Flats PMC for further development. Prairie cordgrass is a native, warm-season perennial grass useful for stabilizing shorelines, and creating riparian buffers, windbreaks, wildlife cover, and nesting habitat. It can be propagated by rhizome divisions or by seed. Although prairie cordgrass has a wide distribution in the United States, 'Red River' and 'Atkins' are the only known releases developed by the NRCS. The 'Red River' release was developed from germplasm collected in Minnesota, North Dakota, and South Dakota, and 'Atkins' was developed from germplasm collected in Nebraska. The NJPMC is interested in developing a Long Island local ecotype for restoration needs specific to the Northeast.

OBSERVATION NURSERY (NJPMC-P-0707-OT)

BACKGROUND

The NJPMC continues to monitor the progress of a variety of plant releases acquired for demonstration purposes in its observation nursery.

Table 1
Current list of trees, forbs, and grasses present in the NJPMC observation nursery (2012).

TREES and SHRUBS	FORBS
Midwest Manchurian Crab Apple	Narrowleaf Silkgrass
'Roselow' Sargent Crab Apple	**GRASSES**
Seaside Alder	Sweet Vernalgrass
Indigo Silky Dogwood	Riverbank Wildrye
Cornelian Cherry Dogwood 'Redstone'	Icy Blue Wildrye
'Riverbend' Silky Willow	Prairie Sandreed
Spike Hybrid Poplar	Saltmeadow Cordgrass
'Catskill' Dwarf Sand Cherry	Bitter Panicgrass

Technology Development

LATE SEASON SEEDING/PLANTING TRIAL: SMOOTH CORDGRASS (SPARTINA ALTERNIFLORA) (NJPMC-T-1002)

BACKGROUND

Smooth cordgrass (*Spartina alterniflora*) is an important perennial species for coastal marsh restoration in intertidal zones in the Northeast. While it is commonly planted in plugs for restoration with a high success rate, working with plugs is expensive, time consuming, and labor intensive. Direct seeding *S. alterniflora* lowers costs and increases the efficiency of restoration work when the appropriate conditions exist (Woodhouse 1979). Previous success in direct seeding trials at a location farther north and beyond the end of the recommended planting window may suggest the need to reevaluate established seeding dates. By performing a late season seeding trial, the PMC hopes to determine if extending the seeding timeframe is a feasible option for future marsh restoration.

The suggested planting window for vegetative establishment of smooth cordgrass is wider than that of direct seeding, and has the potential to span the entire growing season (Mullens, 2007; Woodhouse et al., 1976). The PMC conducted a late season vegetative planting of smooth cordgrass to determine the potential for successful late season planting in the mid Atlantic region.

METHOD

PMC staff conducted a late season seeding and planting trial of *Spartina alterniflora* at the Cape May PMC (39.1° N) in a constructed shallow pit (1.5–2.5 ft deep) in Ingleside sandy loam soil. The 14,000 ft² ≈ 0.32 acre planting area was occasionally flooded by pumping water, with a water salinity reading of 2‰, from an adjacent freshwater pond.

Prior to seeding or planting, the trial area was prepared to create a clean, weed-free seedbed and to minimize weed competition following planting. The planting site was infested with yellow nutsedge (*Cyperus esculentus*), and termination of this species was necessary prior to trials. The PMC conducted multiple mechanical and chemical treatments over a 4 month period to control yellow nutsedge.

The seed was collected in September 2011 from multiple locations within Gateway National Recreation Area. It was ripened for 3 weeks in ambient air temperature, cleaned, and stored wet in a 5–10 ‰ saline solution at 40°F for 10 months. On August 6, 2012 seed was drained and mixed with a carrier to absorb excess moisture. The carrier, hammer-milled warm season grasses, was mixed with the seed at a 1:1 ratio by weight to prevent clumping and ensure a steady and consistent flow of seed through the seeding equipment. The *S. alterniflora* seed mixture was evenly spread over the seedbed using a PTO driven broadcast spreader. The entire seedbed was lightly disked to incorporate the seed and then pressed with a cultipacker to improve seed to soil contact. Results from lab analysis of the *S. alterniflora* seed were used to calculate the PLS of the seed and the seeding rate.

The *S. alterniflora* plugs for the planting trial were started from the same seed lot on February 13, 2012 after 4 months of cold wet storage. The plugs were propagated in a greenhouse and grown in a hoop house until the planting date of August 31, 2012, after 6 months growth. The plugs were grown in 2" x 2" x 5" cells and were planted using a tree planter. The in row spacing measured approximately 2.5 ft and between row spacing was 3.5 ft. A total of 9 rows were planted. These vegetative plugs were transplanted directly into the previously seeded planting area. The pit was flooded twice a week from the seeding date until October. The pit was flooded once per week for the month of October as the seedlings and plugs began entering dormancy. Flooding was discontinued November–April until the plants began to break dormancy.

During the growing season 2013, data will be collected on plant height, stem diameter, and stem density of both the seeding and planting trials. For the stem density sampling, 5 randomly placed 1 meter square quadrats will be sampled for each plot, counting the number of *S. alterniflora* seedlings per quadrat. Fifteen randomly selected individual seedlings within each sampling quadrat will be measured to obtain stem diameter and plant height data. Stem diameter measurements will be taken at 3 inches above soil surface.

RESULTS

Results are pending and will be collected during the growing season, 2013.

REFERENCES

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Woodhouse Jr. WW, Seneca ED, Broome SW. 1976. Propagation and Use of Spartina Alterniflora for Shoreline Erosion Abatement [Internet]. Fort Belvoir(VA):United States Army Corps of Engineers Coastal Engineering Research Center; [cited 2013 March 13] Available from: http://nsgl.gso.uri.edu/ncu/ncut76010.pdf

S. Alterniflora PLS Calculation					
Bulk Dry Wt. (lbs)	Purity %	Germ %	PLS (lbs)	Planting Area (ft²)	PLS (lbs)/ Acre
53	0.7466	0.8	31.66	14,000	98.51

Seedbed Preparation and Planting Schedule for *S. alterniflora*					
Date	Treatment	Chemical	Concentrate	Total Mix	% Mixture
3/20/2012	Disked	NA	NA	NA	NA
5/16/2012	Spray	Rodeo	36 oz	9 gallon	0.03
5/29/2012	Spot Treat Spray	Round Up Weather Max	5 oz	1 gallon	0.04
6/26/2012	Disked	NA	NA	NA	NA
7/16/2012	Spray	Rodeo	25 oz	5 gallon	0.04
7/27/2012	Spot Treat Spray	Rodeo	2.5 oz	0.5 gallon	0.04
8/03/2012	Disked	NA	NA	NA	NA
8/06/2012	*S. alterniflora* seed and carrier was broadcast seeded, lightly disked in, and cultipacked.				
8/31/2012	*S. alterniflora* plugs were planted in the high elevation side of the seeded pit.				

DEVELOPMENT OF A DUNE RESTORATION SEEDING MIX USING LEGUMES, GRASSES, AND FORBS

BACKGROUND

The PMC initiated a study to determine the seasonal effect on a native beach seeding mix of legumes, grasses, and forbs. The purpose of the study was two-fold: 1) to create and evaluate the performance of a diverse native dune seed mix that would help introduce more biodiversity into traditional restoration plantings, and 2) to see what time of year would be best for planting. The species selected for this dune planting trial were: trailing wild bean (*Strophostyles helvola*), beach pea (*Lathyrus japonicus*), 'Dune Crest' little bluestem (*Schizachyrium scoparium*), and 'Monarch' seaside goldenrod (*Solidago sempervirens*).

METHODS

PMC staff initiated a late fall/winter-planted dune cover mix in Avalon, New Jersey, in December, 2012. This direct seeding was planted in the inter-dune area between the frontal dune and back-dune, adjacent to a previous 2010 PMC planting of sea oats (*Uniola paniculata*). The layout was a randomized complete block (RCB) design with 3 replications at 2 seeding depths (shallow and deep). The forbs and the grasses were planted at 15 mm for the "shallow" depth, and 25 mm for the "deep" planting depth. The legume was planted at 20 mm for the shallow depth and 40 mm for the deep depth. All seeds were sown using a hand-planter with several disc sizes to accommodate the differences in seed size and weight.

DISCUSSON

This project will have to be reinstalled at a new location due to recent sand dune restoration in the wake of Hurricane Sandy.

Fig. 3 Dune damage caused by Hurricane Sandy

BEACH PEA INCREASE FIELD INSTALLED

BACKGROUND

Using vegetative plugs or bare-root transplants continues to be a high-cost option for beach restoration planners. These costs could be minimized if a successful dune seeding mix could be developed and adopted. This native seeding mix could not only reduce costs, but could also add needed diversity to dune restoration projects, that too often, consist of a monoculture of American beachgrass (*Ammophila breviligulata*). Beachgrass continues to be the plant of choice as the most expeditious way to get dunes initially established, especially when large amounts of materials are required in the wake of destructive storms or hurricanes. However, the long term efficacy of this strategy is questionable, as beachgrass stands tend to weaken and die over time, threatening the longevity of the dune. By increasing native biodiversity in these restoration sites, the longevity of the dune restoration project can be preserved while the dune can provide increased wildlife functions.

The continued demand for greater diversity in dune plantings has encouraged the NJPMC to install a new production field for the increase of beach pea (*Lathyrus japonicas*). The PMC has tested beach pea in the past as a potential restoration plant, but never in the context of direct seeding mixes. This increase field will serve as a readily accessible seed source for our continued work creating direct-seeded dune mixes.

METHODS

Seed was collected from North Cape May in Fall 2011, cleaned at the NJPMC, stored in cold storage, and grown as vegetative starts in the greenhouse the following Spring, 2012. The plants were transplanted into a weed-free bed in late May, 2012. After the plants reached sufficient size in early August, they were trained onto a supporting trellis. The following Fall, various clover species (crimson, red, white, rose, yellow sweetclover, and a mix of 5 clovers) were planted in the inter-rows to help suppress weed, fix nitrogen, and to keep the field covered through the winter. The percent cover for the clover will be measured in the Spring 2013 to determine which species will work best in this particular trellised cover crop scenario.

Fig. 4 Photo of red and crimson clover planted in the alleyways of beach pea planting

DEVELOPMENT OF AGROFORESTRY DEMONSTRATION PLOTS

WHITE CEDAR, PERSIMMON, CHESTNUT, AND BLACK LOCUST

BACKGROUND

Agroforestry practices are long-term investments which are perceived to yield little short-term payoff to farmers. To make these practices more attractive to growers it is important to find ways to exploit an agroforestry system's multi-functional nature. Trees and tall shrubs can be used as windbreaks or shelterbelts to reduce wind erosion and crop damage from wind, while conserving moisture. Trees can also provide fruits, nuts, timber, fuel wood, mulch, or food and shelter for wildlife. Depending on the specific species planted, these benefits may not be seen for several years. In the interim, it is important to take advantage of the alleyways between agroforestry rows by planting agronomic, horticultural, or forage crops.

Agroforestry demonstration plots were installed in 2009 to develop plant materials that would help meet the demand for conservation practice standard 380 Windbreak/Shelterbelt and standard 311 Alley Cropping. The desire was to find suitable quick growing tree species to reduce potential for wind erosion, reduce crop damage from wind, and conserve moisture, while providing another marketable crop in the alleys and increasing wildlife habitat value.

METHODS

PMC staff planted 25 Atlantic white cedar and 105 persimmon, from February to March; and 36 American chestnut trees in May. The white cedar was planted in two rows with staggered spacing, on 30 ft centers, with 10 ft between rows. The persimmon trees were also planted in two rows with staggered spacing, on 15 ft centers, and 20 ft between rows. The chestnut trees were planted in a single row on 20 ft centers. Tree heights were recorded in May 2009. No persimmon trees survived the original 2009 planting and 100 persimmons were replanted in April 2011. They were planted in two staggered rows, on 16 ft centers, with 30 ft between rows.

Black locust seedlings were grown in the PMC greenhouse on February 2011 from seed collected at the PMC from the Steiner group. These plants were transplanted into the field in August, in 3 rows, with 6 ft center spacing, and 12.5 ft between rows. In 2012, red cedars were added to the white cedar row and transplanted on 8 ft centers, with 10 ft between rows. The alleys of the black locust area were sprayed in late March and the persimmon alleys were sprayed in April. Orchard grass and soy were no-tilled into the black locust alley at 13.5 lb pls/ac and 23.5 lb/ac respectively. Buckwheat was no-tilled into the persimmon alleys at 129 lb/ac. The 2009 American chestnut planting had no survival in 2011, and 37 Austree Hybrid willows (*Salix matsudana x alba*) and 42 redosier dogwood (*Cornus sericea*) were planted as replacement.

DISCUSSON

There were challenges to establishing successful agroforestry rows in fields with a long history of cultivation. It is not clear why the American chestnut and persimmon trees fared so poorly but problems could have been due to the poor root mass of the wild persimmon cuttings, or the fact that the American chestnut was grown without irrigation. In the case of the black locust, the survival rate could have been better perhaps, if it wasn't grown for so long in the greenhouse, where it had become root-bound in "book" roottrainer trays.

The PMC had greater success establishing no-till buckwheat and orchard grass as cover in the alleyways. Buckwheat was fast growing and successfully smothered spring grasses. Orchard grass is a perennial cool season grass, so although it was successfully established and survived, it did not compete well with fast-growing annuals in the first year of establishment. Future evaluations will determine if the buckwheat cover volunteers from last year's seed, and whether the orchard grass is more vigorous in the second year.

SLENDER WOODOATS

BACKGROUND

In early Spring 2012, PMC staff installed an experimental plot of slender woodoats (*Chasmanthium laxum*) in the alley of an older stand of black locust (Steiner group) on the center. The project goal was to establish a perennial companion grass cover in a black locust understory that would require less maintenance while providing a source of potential forage or food and shelter for wildlife. The objective of the study was to determine vigor, survival, height (cm), and spread (cm) of vegetative transplants planted at two densities, under field conditions.

METHOD

Slender woodoats seed was collected in 2008 from Atlantic County, New Jersey and grown in the PMC greenhouse in Spring 2010. A total of 312 vegetative plugs were grown and transplanted into the field in late April, 2012. The field was an agroforestry plot of black locust (Steiner group) with alleys predominately filled with cool season tall fescue. The alleyways were sprayed with herbicide and the slender oats transplanted into the dead grass residue. Plants were transplanted in 12 plots at 2 ft and 1 ft spacing intervals (6 plots for each). Evaluations were taken in May and July 2012.

RESULTS

Initial results indicate a difference in height between spacing intervals, with closer spacing exhibiting greater growth. Data collection will continue in Summer 2013.

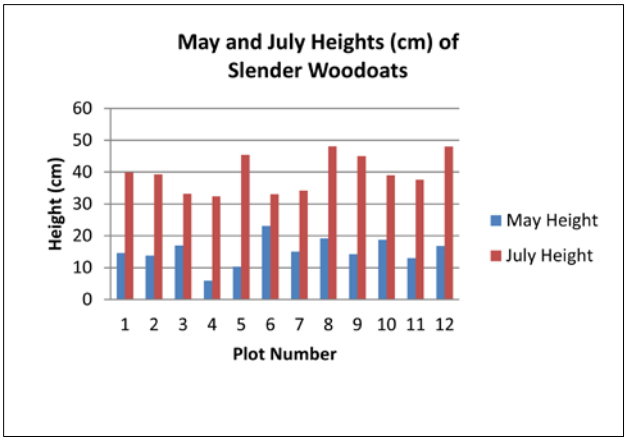


Fig. 5 Slender woodoats plots under a black locust canopy.

Height (cm) for 1 and 2 foot Spacing Intervals of Slender Woodoats 3 Months After Transplant.		
Spacing	**Mean**	**Homogenous Groups**
1 foot	41.41	A
2 foot	32.82	B

SEED GERMINATION TESTING

GERM TEST: SEASIDE GOLDENROD

BACKGROUND

For several years the PMC experimented with methods of direct seeding seaside goldenrod (*Solidago sempervirens*) into well-prepared beds under regular field conditions with little success. While the PMC continues to experiment with seeding rates, time of planting, and planting depth, not much is known about how storage and temperature effects seed germination under controlled environments. This germination study investigates the effect that temperature and wet storage might have on germination rates to help determine the optimal conditions for seed growth in the field.

METHODS

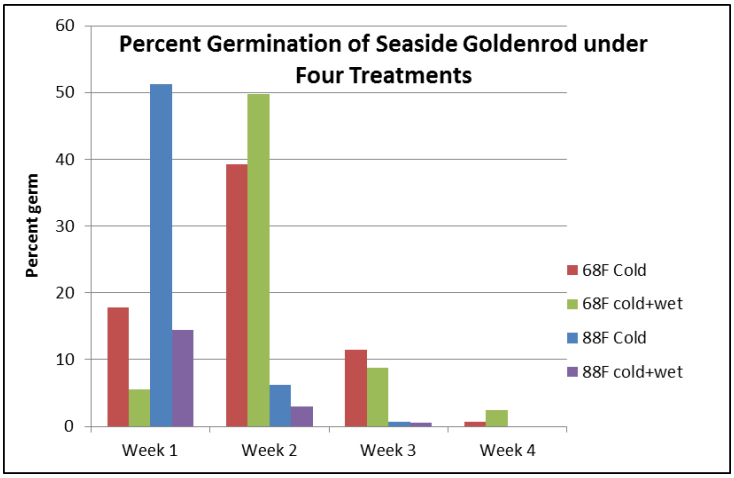
PMC staff conducted a germination trial of seaside goldenrod seed with a sample size of 100 seeds replicated 4 times for 4 separate treatments. Germination counts were conducted at 7, 14, 21, and 28 days. Treatments were: 1 yr cold storage followed by germ at 68°F, 1 year cold storage + 30 days wet storage followed by germ at 68°F, 1 yr cold storage followed by germ at 88°F, 1 year cold storage + 30 days wet storage followed by germ at 88°F. Each treatment was conducted in a controlled germinator that cycled light and dark (day and night) periods, with the light period lasting 14 hours, and the night period lasting 10 hours at 58°F.

DISCUSSION

Under both temperature regimes, the cold storage plus wet storage did not significantly improve germination rates in seaside goldenrod. In one case, when seed was first stored in cold and wet conditions and germinated under 88°F, the germination rate was significantly lower. Seaside goldenrod seed seems to be highly sensitive to storage and temperature conditions. The data here seems to suggest that seed tends to be more sensitive (more likely not to germinate) when the temperature range is greatest between day and night temperatures (88°F and 58°F respectively) coupled with a period of wet storage. The most optimal conditions for seed germination was a 1 year cold storage follow by four weeks of germination at 68°F. Thus, the most favorable conditions for growth of seaside goldenrod seed under field conditions coincide with the optimal conditions for the growth in cool-season grasses. Even when sown in a well-prepared seedbed, seaside goldenrod seed may have a difficult time outcompeting grasses due to its slower growth. If the producer waits until summer to sow seaside goldenrod seed (when cool-season weed competition lessens), the heavy spring rains followed by higher day temperatures may create weather conditions ill-suited for seed growth.

Tukey HSD All-Pairwise Comparisons Test of Germ by Treatment

Treatment	Mean	Homogenous Groups
Cold germ at 68F	69.25	A
Cold +Wet at 68F	66.5	AB
Cold germ at 88F	58.25	B
Cold +Wet at 88F	18	C



GERM TEST: SMOOTH CORDGRASS

BACKGROUND

Smooth cordgrass (*Spartina alterniflora*) is an important perennial species for coastal marsh restoration in intertidal zones in the Northeast. While it is commonly planted in plugs for restoration, there has been less success in germinating the plant from seed in field trials. Part of this difficulty is due to site-specific conditions such as frequency and duration of wave action that washes away seeds after a period of flooding. Prior research conducted by the PMC in 2007 found greater stem densities when direct seeding in low energy sites compared to high energy sites.

These challenges to successful establishment imply that some of the seed for restoration will be lost to tidal flooding and that projects based on direct seeding may have to depend on a large amount of stored seed. Large amounts of seed have been collected by the PMC in 2011 and 2012 (see table below) and stored under wet plus cold (40°F) conditions and successfully germinated. While one season of storage (3–5 months) did not negatively affect germination rates in the following spring, it is unclear whether the seed would still germinate after more than one year of wet storage plus cold
storage. This germination test was performed to test three methods of germination after 14 and 16 months of wet storage. Standard germination tests were also performed by a local seed lab for comparison.

Earlier germination trials on smooth cordgrass (Pihl et al., 1978, Garbisch, 1974) indicated that 10 hour dark cycles and 14 hour light cycles should be used with temperatures of 55.4°F and 93.2 °F respectively. For this study, we recreated similar conditions to these earlier trials by setting dark cycles for two treatments at 45°F and light cycles at 90°F. Germination tests performed by Pihl et al. (1978) indicated that best germination rates were associated with longer storage times of greater than 4 months (112 days) for germ trials at 44.6–80.6° F and 55.4°F–93.2°F. Typical seasonal wet plus cold storage of smooth cordgrass at the PMC lasts from harvest in October through March (5 months of cold + wet storage). Pihl et al. (1978) also observe that germination rates are sensitive to thermoperiod cycling, and suggest that better germination results were found in the 55.4°F–93.2°F cycle as opposed to lower 44.6–80.6° F cycle. While the range in temperature is approximately the same between these two temperature cycles, the cycle that resulted in better germination (55.4°F–93.2°F) is significantly warmer.

METHOD

PMC staff conducted a germination trial of smooth cordgrass seed with a sample size of 100 seeds replicated 4 times for 3 separate treatments. Seed was collected in September 2011, cleaned, and stored wet in a 1:10 part solution of salt to tap water at 40°F for 14 months and 16 months. Typical seasonal storage lasts from harvest in September or October through March (5 or 6 months of cold + wet storage).

Germination counts were conducted at 7, 14, and 21 days. Each treatment was conducted in a controlled germinator that cycled light and dark (day and night) periods, with the light period lasting 14 hours, and the dark period lasting 10 hours. Treatments were: germination at 80°F (light cycle) to 70°F (dark cycle) on one sheet of blotter paper, at 90°F (light cycle) to 45°F (dark cycle) with seed placed between two pieces of blotter paper, and 90°F (light cycle) to 45°F (dark cycle) with seed submersed in distilled H_2O.

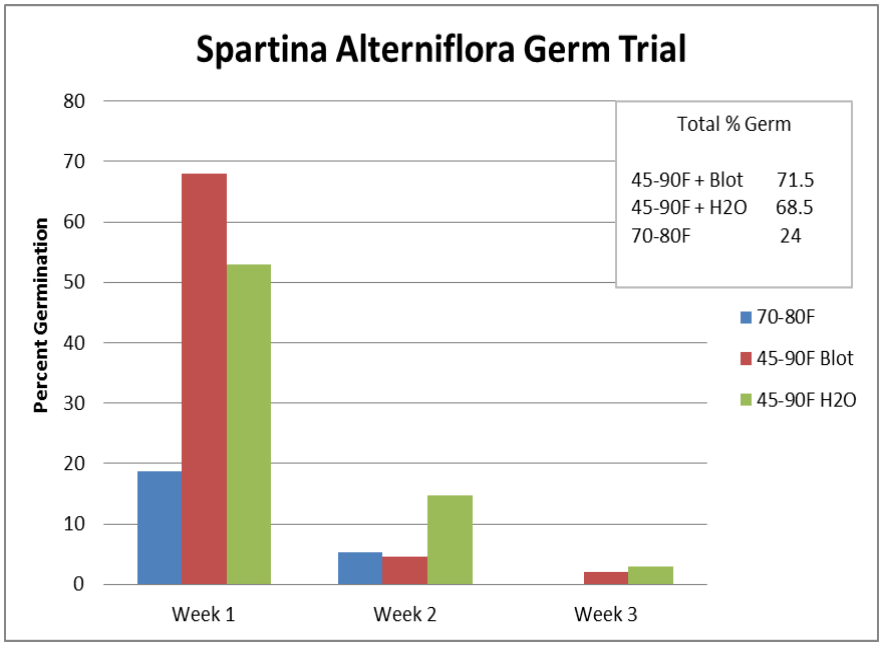
CONCLUSION

Results indicate that the thermoperiod 45-90°F had a significantly higher germination rate (68.5–71.5%) than the thermoperiod between 70-80°F (24%). These results were in agreement with previous findings by Pihl et al. (1978) that found higher germination rates (93%) with a thermocycle of 55.4°F –93.2°F. In both studies, the range of temperatures represented by the thermocycle with the highest germination rate had both a colder dark cycle temperature and warmer light cycle than the thermocycle with the smallest germination rate. This finding suggests that temperature cycling plays a significant role in germination of *Spartina alterniflora* seed. There were no significant differences between *S. alterniflora* seed germinated between two pieces of blotter paper and in distilled H_2O, and the treatment using two blotter papers had the highest germ rate (71.5%). Differences in germination rates between 70-

80°F thermoperiod (24%) and 45-90°F thermoperiod (68.5–71.5%) are not likely to be the result of storage length, as prior research has found that germination rates increase after 112 days of seed storage. It is most likely that this dramatic difference in germination rate is the result
of using one blotter paper in the germination trial plus the narrower range of the thermoperiod. By using only one piece of blotter paper, there was an increased likelihood of the seed drying out. At this point, it is not clear whether the poor germination rate was the result of the germination treatment (using one blotter) or the narrow thermoperiod (70-80°F), or some combination of both. The lower germination rate of this study 68.5–71.5% compared to 93% was most likely due to the additional length of storage used for this study. The seed used in Pihl et al. (1978) was stored for approximately 4 months, while seed used in this study was over 14 months old. The age of the seed used in this study could have lowered the germination rate.

REFERENCES

Pihl, K. B, D.M. Grant, and G.F. Somers. 1978. A Delaware sea grant technical report: germination of seeds of selected coastal plants. University of Delaware.



Treatment	Mean	Homogenous Groups
Germ 45-90F between 2 blotter papers	71.5	A
Germ 45-90F in H2O	68.5	A
Germ at 70-80F	24	B

Seed Collection, Distribution Amounts, and Germination Rates of *S. alterniflora* for Years 2011 and 2012.

Year of Harvest	Dry Seed Collected (Lb)	Amount Distributed	Germ Rate %						
			After 3 month storage (Oct-Jan) (lab)	After 5 month storage (Oct-Mar) (NY seed lab)	After 14 month 1 blotter (PMC)	After 15 month storage (Oct 2011-Jan 2012) (NY seed lab)	After 16 month 2 blotter (PMC)	After 16 month Distilled H_2O (PMC)	After 17 month storage (NJ Dept of Ag-retest)
2011	450	290	na	81	25	25	71.5	68.5	40
2012	140	na	22	na	na	na	na	na	na

FIELD-BASED TECHNOLOGY

RUTGERS NATIVE BEE POLLINATION STUDY (NJPMC-0901)

BACKGROUND

The NJPMC is working on a native bee pollination study with Dr. Racha Winfree and PhD candidate Molly MacLeod. Eighteen native, perennial plant species are being tested for their attractiveness to native bees. This research will support NRCS pollinator-friendly conservation programs by providing data for jobsheets, tech notes, and plant guides.

METHODS

Eighteen native, perennial plant species were arranged in equal relative abundance in a RCB design. Over a two-year period, each bee visiting a flower during the sampling period was collected and identified. Aggregate abundance and species richness was compared across plants from April to September. Separate analyses were performed to identify key crop pollinators or rare species. "Rare species" were those species that accounted for 10% or less of all bee species in the region. Using data from previous research on visitation frequency to 14 crop species, 12 species were identified as key crop pollinators.

RESULTS

After 1 year of data collection 4,913 bee specimens of 106 total species were collected. In the "Early" April–June period, butterfly milkweed, blackeyed susan, and swamp verbena scored highest (top-ranked) in bee abundance. Butterfly milkweed and swamp verbena would also provide suitable habitat for crop bees. During the "Middle" June–July period, swamp milkweed and narrowleaf mountainmint both scored highest (top-ranked) in bee abundance and would provide suitable habitat for crop bees. During the "Late" August–September period stiff goldenrod and cutleaf coneflower scored highest (top-ranked) in bee abundance but only stiff goldenrod also would provide suitable habitat for crop bees.

	Common name	Scientific name	Abundance	Richness	Rare Bees	Crop Bees
Early	Butterfly milkweed	*Asclepias tuberosa*	**	**		*
	Common St. Johnswort	*Hypericum perforatum*				
	Hairy beardtongue	*Penstemon hirsutus*		*	*	
	Blackeyed Susan	*Rudbeckia hirta*	**	*		
	Swamp verbena	*Verbena hastata*	**	*	*	*
	Golden zizia	*Zizia aurea*				
Mid	Culver's root	*Veronicastrum virginicum*				
	Purple giant hyssop	*Agastache scrophulariifolia*	*			
	Swamp milkweed	*Asclepias incarnata*	**			*
	Narrowleaf mountainmint	*Pycnanthemum tenuifolium*	**	*	*	*
	Spotted Joe Pye Weed	*Eupatoriadelphus maculatus*	*	*	*	
Late	Great blue lobelia	*Lobelia siphilitica*	*	*	*	*
	Flat-top goldentop	*Euthamia graminifolia*				
	Stiff goldenrod	*Oligoneuron rigidum*	**	**		*
	Cutleaf coneflower	*Rudbeckia laciniata*	**	**		
	Wrinkleleaf goldenrod	*Solidago rugosa*				
	New England aster	*Symphyotrichum novae-angliae*				*
	New York ironweed	*Vernonia noveboracensis*				

Data provided by Molly MacLeod, 2012.

XERCES POLLINATOR SEEDBED PREP

BACKGROUND

Treatments and evaluations continue on the Xerces seedbed preparation project. The objective is to test different organic methods of weed-suppression prior to planting pollinator plots. These are methods that would be suitable for small growers who want to install pollinator plots but who are unwilling or unable to use conventional sprays or machinery. Treatments consist of using buckwheat as a smother cover crop at two rates, cultivation with light tillage, controlled burn, plastic solar covering, and a vinegar spray as an organic herbicide.

METHODS

The test area was cultivated and a uniform seedbed was created on April 17, 2012. After initial tillage, treatments that were cultivated were shallowly tilled once every three weeks using a walk behind rototiller. Solarization plots were covered using a clear polyethylene greenhouse film secured with lawn staples. Controlled burn plots were spot-treated using a propane backpack torch once every three weeks. The organic herbicide plots were spot-treated using horticultural organic vinegar (20% acetic acid) once every two weeks. Buckwheat (*Fagopyrum esculentum*) was broadcast at 70 and 130 lb/ac as a smother crop following the initial seed bed cultivation. Percent weed coverage was collected after 29 weeks (203 days) for total weeds, and forbs and grasses separately. The time spent applying treatments and amounts of materials (vinegar and propane) used were recorded.

RESULTS

So far good results were found using tillage and burn treatments. These treatments are not prescriptive however, as there remains general concern regarding the negative impact tillage has on soil health and how burn treatments may be efficiently used on a larger scale. Field mustard (*Brassica rapa*) was the weed species most abundant in burn treatment plots (12% weed coverage). This initial result could have been high because the timing of the sampling period coincided with field mustard's period of rapid fall growth. Also, soil disturbance and fire have been known to increase populations of field mustard, rather than deplete them. So there is some question as to how much the burn treatments in this study encouraged weed growth, rather than suppressed it. There also remain larger questions regarding what characteristics constitute "weed species" suitable for termination, given that field mustard is often promoted as a helpful weed-suppressing cover crop and is readily winterkilled.

November 8, 2012			
Treatment	**Average Percent Grass Coverage**	**Average Percent Forb Coverage**	**Total Average Percent Weed Coverage**
Burn	0.00	12.14	12.14
Vinegar	97.11	0.17	97.22
Tillage	0.00	0.38	0.38
Solarization	46.33	3.67	49.22
Smother (high)	99.44	1.50	100.00
Smother (Low)	99.11	3.11	99.78
Control	99.44	1.67	100.00

This project is being coordinated with Xerces Society for Invertebrate Conservation and is beingreplicated on several farms throughout the region.

Fig. 6 Photographs taken of pollinator seedbeds on Nov. 8, 2012 of burn, tillage, and solarization treatments (from left to right).

COVER CROP TIME TRIAL

BACKGROUND

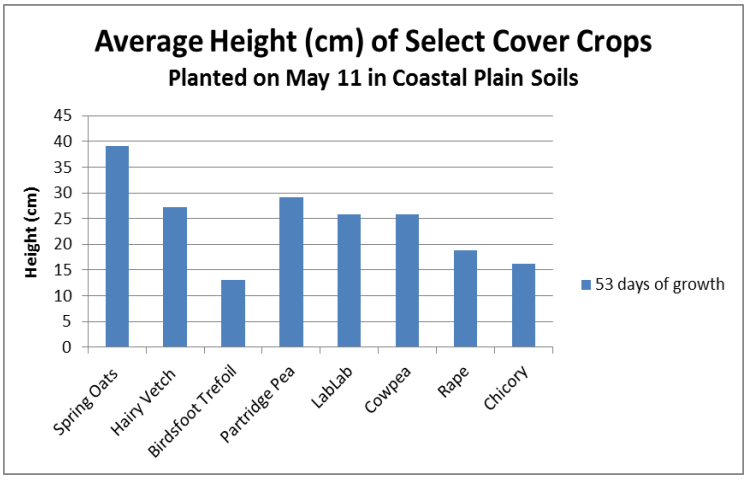
In support of the NRCS Soil Health Initiative the NJPMC installed a demonstration plot of spring and summer cover crops for potential use in Coastal Plain soils. The objective of the planting was not only to demonstrate basic growth characteristics of a variety of cover crops, but also to test the limits of the window for optimal time of planting.

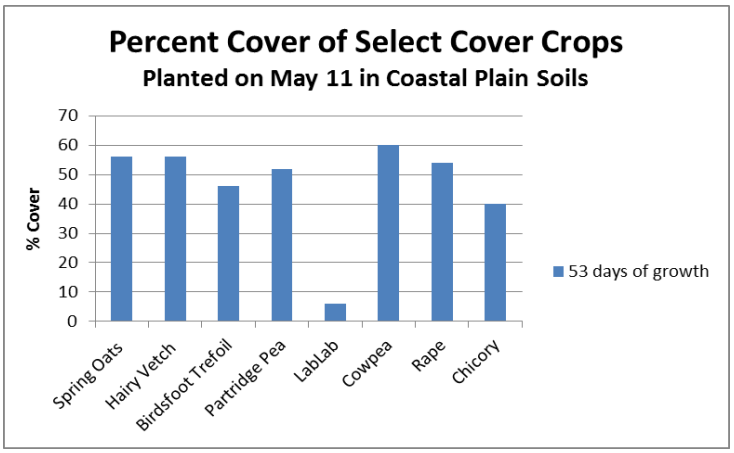
METHODS

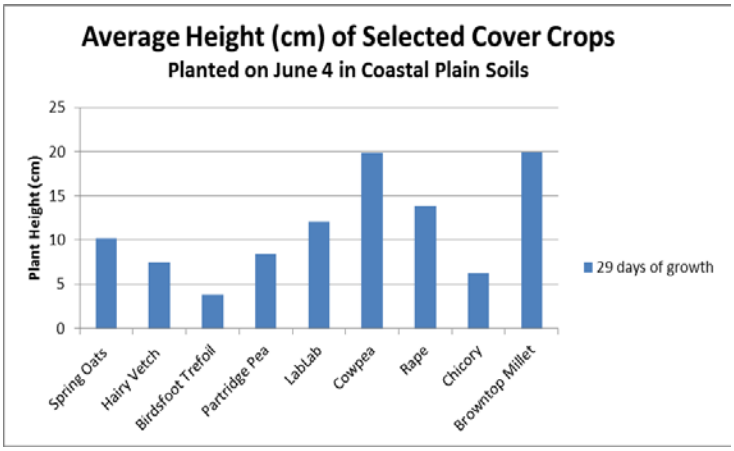
Plots were planted on May 11, June 04, and June 26 with 12 different cool and warm season cover crops. The seed was broadcast at recommended rates into a well-prepared bed, and rolled with a cultipacker to incorporate seed. The crop species were: spring oats, hairy vetch, birdsfoot trefoil, browntop millet, partridge pea, soybean, lablab, cowpea, sunn hemp, festulolium, rape, and chicory.The planting on May 11 was eventually terminated due to poor establishment. Although it is often recommended to broadcast and pack larger seed like cowpea and lablab, there were large amounts of uncovered seed in the field after the initial seeding. The seed for the second planting on June 04 was broadcast, disked, and then cultipacked. The third seeding on June 26 was drilled with a hand-planter and cultipacked. The last planting method on June 26 had the best stand establishment and is recommended for future plantings. Broadcasting larger seeded cover crops is not recommended.

RESULTS

The cover crop planting on May 11 was measured after 53 days of growth, and although considered an "earlier" planting, several cool season species produced good height and cover up to early July. Spring oats produced cover quickly and grew to approximately 39 cm, with 56% coverage. When planted several weeks later on June 4th, spring oats, did not grow tall (only an average 10 cm, but it still provided a large amount of cover, approximately 42%, comparable to a fast-growing summer cover like cowpea, which only had 30% cover when planted at the same time. This not only suggests the hardiness of spring oats in the region, but also gives farmers a fast-growing, relatively inexpensive option for suppressing weeds with vegetation. Rape appeared as another hardy "cool season" spring option for quick growth and weed suppression.



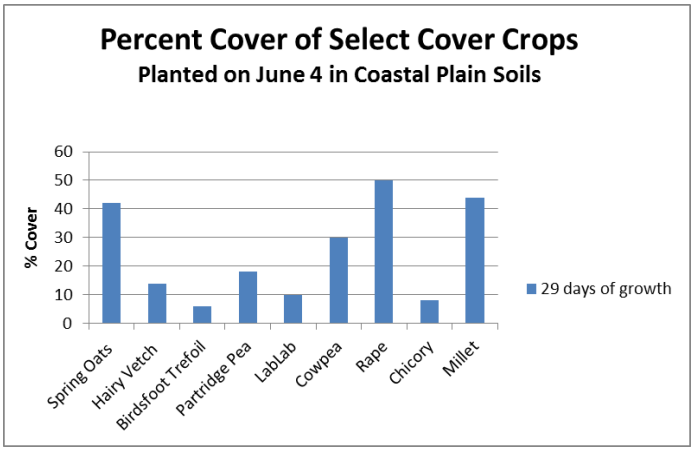




While rape could only produce an average height (19 cm) after 53 days of growth in this trial, its wide-spreading fleshy vegetation provided significant soil coverage (54%), comparable to spring oats (56%) and cowpea (60%).

Overall, in both the earlier May and later, June 04 planting dates, cowpea and partridge pea had the greatest plant height for warm season crops at 26 cm and 29 cm respectively, when planted in May and after 53 days of growth. Cowpea also had the greatest percent cover after 53 days (60%) even though the seed was not fully incorporated.

Lablab, being a larger seed, proved to be more sensitive to poor seeding methods, and failed to provide an adequate stand although where it was successfully established it reached similar heights as cowpea when planted in May (26 cm). Browntop millet was added to the evaluation in the June 04 and June 26th plantings. After 29 days of growth browntop millet had the greatest percent cover (44%) of warm season covers and the greatest height (20 cm) of all other selected crops.



DISCUSSION

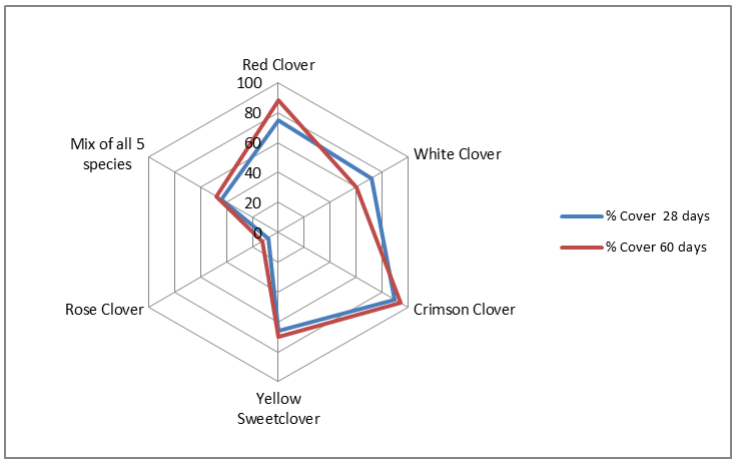
Future cover crop time trials will focus on comparing only the cool season and warm season crops that performed best in this observational trial. The cool season best performers based on plant height and percent cover were spring oats and rape. The warm season covers that performed best were partridge pea, cowpea, lablab, and browntop millet.

FALL-PLANTED CLOVER TRIAL

BACKGROUND

In anticipation for the NJPMC Cover Crop Field Day, PMC staff planted a cover crop trial with popular clover and clover-type species for a demonstration project. The purpose here was to observe and measure percent cover after 37 days and 74 days of growth. PMC staff broadcasted seed at recommended rates into a disked bed, lightly disked-in the seed with a dewdrop drill, and then packed the soil down with a 300 lb drum. The 28 x 27.5 ft plots were planted on 09/09/2012 and percent cover was measured on 10/16/2012 and 11/15/2012. There was successful stand establishment in all plots except the rose clover. As the same rose clover seed failed to grow in other areas at the center, and it was old seed, it was supposed that the rose clover seed had lost viability in storage.

Percent Cover of 5 Fall-Seeded Clovers Measured at 28 and 60 Days.



The PMC staff discussed the specific niches that each species grows best in, which soils and time of planting (earlier or later) are best suited for each particular species, and relative seed costs. Crimson clover had the greatest percent coverage (90%) after 37 days, and crimson clover (94%) and red clover (88%) had the greatest coverage after 74 days.

SOUTHERN COVER CROP FIELD EVALUATION

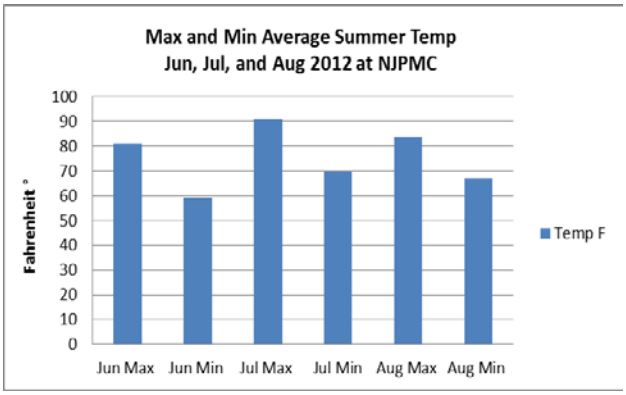
BACKGROUND

In support of the NRCS Soil Health Initiative the NJPMC installed an initial evaluation of several cover crops more commonly used in southern, subtropical, and tropical regions. The cover crops were pigeon pea (*Cajanus cajan*), cowpea (*Vigna unguiculata*), velvet bean (*Mucuna pruriens*), lablab (*Lablab pupureus*), and jack bean (*Canavalia ensiformis*). Given Cape May's moderate climate and Coastal Plain soils several of these species were known to have potential for hardy, summer vegetative growth in the region, however less was known about their reproductive capabilities. The inability for an introduced cover crop to set seed and reproduce would not necessarily be seen as a negative factor to adoption as the plant would be less likely to be weedy or invasive.

Given the importance of improving soil quality, the curiosity for novel ways to build SOM in Coastal Plain soils, the relative moderate climate of South Jersey, access to a 'southern' cover crop seed source, and customer's noted interest in southern cover crop species (Northern Organic Farmers Association), the PMC initiated this evaluation.

METHODS

All seeds were obtained from ECHO (Ecological Concerns for Hunger Organization), Ft. Myers, Florida, in May 2011 (http://www.echonet.org/). Seeds were planted in the greenhouse at Cape May PMC in mid-March 2012. Seedlings were transferred from the greenhouse into field plots on May 8th after being "hardened" outside of the greenhouse from April 26th– to May 8th. The plants were severely damaged during the first two nights of low temperatures (33°F), but all plants survived to the transplanting stage. The field layout was a randomized complete block of three replications, comparing two varieties of cowpea ('Thailand Long Bean' and '83060') and two of pigeon pea ('2 B Bushy' and 'ICPL 92016'). There were 24 plants in each rep for a total of 72 plants per variety. The other species in this study were transplanted into rows with 2 ft between transplants. Heights, spread, bloom time, and seed yield were recorded.



Height and Width of 4 Southern Legume Cover Crops 50 Days After Transplant

	Height (cm)	Width (cm)
Pigeon Pea 'Bush'	42.65 a[1]	29.17 c
Pigeon Pea 'ICPL'	32.49 b	18.9 d
Cowpea '060'	31.36 b	51.41 a
Cowpea 'Thai'	22.47 c	43.14 b
Mean	32.24	35.66

[1] means within a column followed by the same letters are not significantly different according to Tukey's HSD at P<0.05.

Height and Width (cm) of Selected Cover Crops 6 weeks (42 days) After Transplant

	Height (cm)	Width (cm)
Velvet Bean '90 Day'	22	46
Velvet Bean 'Tropical'	20	34
Velvet Bean 'Bush'	24	47
LabLab 'Highworth'	37	60
LabLab 'Rongai'	38	52
Jackbean	33	42

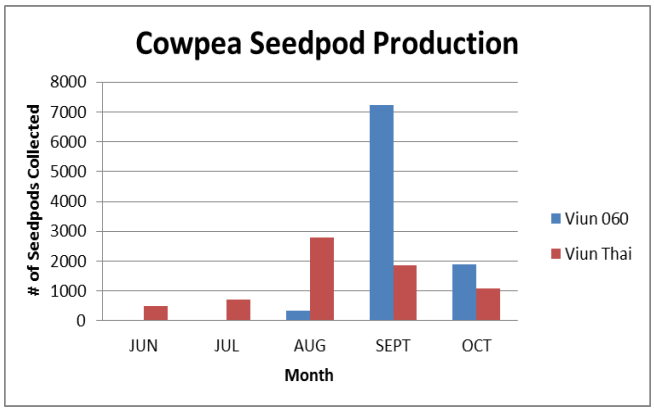
RESULTS

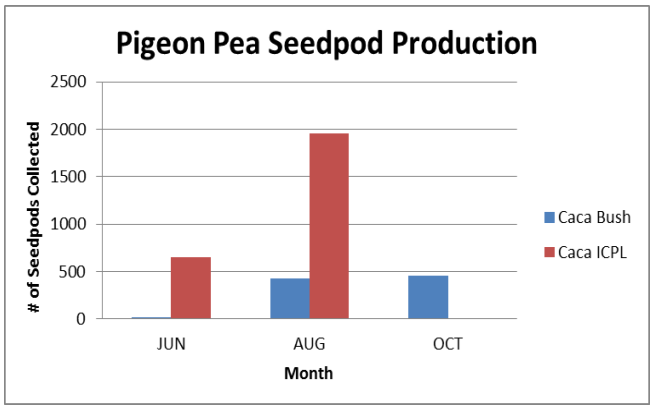
All plants in this initial observation produced good vegetative growth. In the first 50 days after transplant the pigeon pea 'Bush' had the greatest amount of growth in height at 42.65 cm or approximately 1.5 ft. The height of the pigeon pea 'ICPL' was not significantly different than the cowpea '060' at 32 cm and 31 cm respectively. The cowpea 'Thai' had the least amount of height but this variety was also the first to flower (17 days after transplant) and produced the earliest seedpods. The plant with the greatest vegetative spread after 50 days was cowpea '060' at 51.4 cm and the least was the pigeon pea 'ICPL' at 18.9 cm.

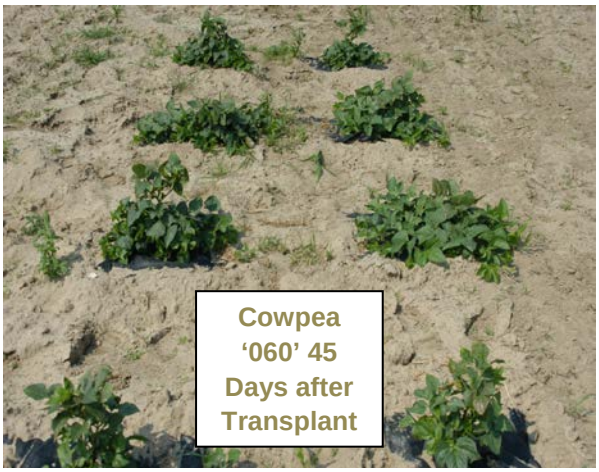
Both lablab varieties surpassed cowpea in both height and width after 42 days of growth and proved particularly promising as a potential cover crop, yet yielded no seed.

Pigeon pea 'Bush' produced the greatest number of seedpods at 249 seedpods per plant. Cowpea '060' produced the second greatest amount at 132 seedpods per plant and also produced the greatest weight of cleaned seed. The cowpea plants produced enough early seed to reseed themselves successfully within a single season. The cowpea 'Thai' produced the greatest amount of seed earliest in the season but did not have strong vegetative growth, and the leaves were first to become discolored with age. The pigeon pea 'Bush' grew rapidly into 6 ft trees producing a surprising amount of seed, and showed potential for windbreak uses. The smaller pigeon pea 'ICPL' variety grew to a consistent height of 3–3.5 ft, had a bushier habit, and produced greater amounts of finer stems than 'Bush'. This smaller variety of pigeon pea was more susceptible to wind damage, and several seedlings were destroyed during midsummer 'Derecho' storms. Both cowpea and pigeon pea were especially popular with pollinators and have great potential as summer pollinator habitat. The extra floral nectaries of cowpea attracted several species of wasp and other beneficial insects like ladybugs and praying mantids.

The velvet bean 'Echo Bush' variety produced more per plant than the '90 day' variety, however the latter was the earliest to flower and produce seed. The velvet bean 'Tropical', the two varieties of lablab, and the jackbean grew vigorously but did not produce any seed. Cleaning the velvet bean seed was challenging due to its fleshy thick seedpods that are not easily dried out







DISCUSSION

Pigeon pea 'Bush' and cowpea '060' produced an impressive amount of seed and biomass and future studies will focus on these two varieties in particular. Along with robust ground cover and impressive height, these varieties produced a large number of consistent blooms throughout the trial, serving as important pollinator habitat from early summer through fall. Both species produced abundant seed, so with proper management they have the potential to be used as reseeding annuals/perennials. By collecting seed during this first observational trial, we have begun to select for the germplasm that will grow most vigorously in the area. Lablab and velvet bean also produced an impressive amount of biomass, however challenges in acquiring affordable seed or cleaning harvested seed may prevent wider adoption. Tests will continue with velvet bean to determine best harvesting and cleaning methods. Future studies with lablab should focus on seeding rates, biomass production, percent cover and costs of seed. Although jackbean eventually grew vigorously and produced flowers, it was very slow growing and would not be effective as a weed suppressing cover in this region.

	Total Seedpod Produced	Av Number of Seedpods per Plant	Av Length of Seedpod (cm)	Av # of Seed per Pod	Total Seedpod Wet Weight (lb)	Total Av Seedpod Wet Weight per Plant (lb)	Total Dry Weight Clean Seed (lb)	Total Dry Weight Clean Seed per Plant (lb)	Total # of Seed Harvested	Total Number of Seeds Harvested per Plant
Cowpea 'Thai'	6925	96	23	15	43.38	0.6	18.16	0.25	58,039	806
Cowpea '060'	9529	132	na	na	53.86	0.75	24.96	0.35	101,537	1410
Caca 'Bush'	17947	249	na	na	16.2	0.22	7.28	0.1	31,566	438
Caca 'ICPL'	907	12	na	na	1.48	0.02	na	na	na	na
Mucuna '90 day'	1814	101	11	5	77.8	4.32	4.52	0.25	4,882	271
Mucuna 'Echo Bush'	2473	118	6	4	37.7	1.79	1.12	0.05	918	43

CARBON SEQUESTRATION IN THE CONVERSION FROM C-3 TO C-4 PASTURE PLANTS

BACKGROUND

A study was initiated at the USDA-NRCS Cape May Plant Materials Center in 1999 to quantify soil carbon sequestration changes with the conversion from a cool season grass to native warm season grasses in a sandy, coastal plain soil (Downer sandy loam). Five native warm season grasses ('Shelter' switchgrass (*Panicum virgatum*), 'Atlantic' coastal panicgrass (*Panicum amarum var. amarulum*), 'Niagara' big bluestem (*Andropogon gerardii*), indiangrass (*Sorghastrum nutans*) and 'Pete' eastern gamagrass (*Tripsacum dactyloides*) were no-till drilled into a spray-killed tall fescue/red fescue sod.

METHODS

The plots are 16' x 20' and replicated 4 times. Soil cores were obtained to 36 inches prior to establishment in 1999 and again in 2003 and 2010.

RESULTS

Initial soil organic C concentrations averaged 1.7, 0.9, 0.4, 0.3, and 0.3% in the 0-2, 2-6, 6-12, 12-24, and 24-36 inch depths. The only significant increases in soil C measured between 1999 and 2003 were in the 24-36 in depths under switchgrass and eastern gamagrass and those increases were small (>0.2%).

DISCUSSION

The 2003 data suggests that initial soil C concentrations in the upper 24 in of the soil profile may have already been near the saturation point for our sandy coastal soil with the previous cool season grass, but the deeper rooting of some warm season species creates the potential to increase sequestration at deeper depths where initial C concentration is very low.

OFF-CENTER EVALUATIONS

SEA OATS (DISCONTINUED)

In 2010, PMC staff, along with Donald Hamer (retired Plant Materials Manager and Conservation Agronomist), installed a planting of sea oats (*Uniola paniculata*) grown from a previous 1991 planting made off 60th street, in Avalon, NJ. Although the original 1991 accessions could no longer be identified, seed was collected in a mixed accession that seemed to exhibit good cold tolerance. This seed was collected and stored, and later seeded in flats in the NJPMC greenhouse in Spring, 2010.

METHODS

80 bare-root sea oat seedlings were planted in a narrow and low spot between front and back dunes and fertilized with Osmocote slow release fertilizer (18-6-12). The planting's survival rate and vigor was evaluated after 34, 44, 79, and 142 days from June–October. A border of saltmeadow cordgrass (*Spartina patens*) was also installed with the sea oat planting. There was an additional planting of sea oats in June 2011, from one-year old potted plants. These were planted in 3 Reps of 138 plants each.

DISCUSSION

The initial planting was followed by a prolonged period of hot and dry weather. The site was not irrigated, so this weather may have negatively impacted stand survival and vigor. The stand survival rate was 85% after the first evaluation, falling only a little by October. Some of the plants were damaged by rabbits, but overall the plants showed good plant vigor going into winter. The saltmeadow cordgrass plot showed poor vigor throughout the project, and died by the last evaluation. The following winter 2011, was a mild one. The survival rate the following Spring was > 90%.

The June 2011 planting of 3 replications showed fair to good vigor and a survival rate > 95% during the following spring 2012 evaluation. Adding 10-10-10 slow release fertilizer at a rate of 500 lb/ac in July 2012 seemed to help establishment during the first year. By August, 5 plants produced seed heads which PMC staff collected. All 3 Reps continued to exhibit good vigor into late fall 2012, when Hurricane Sandy made landfall in South Jersey. Windblown sand seemed to severely damage Reps 1 and 2, while Rep 3 seemed to be negatively affected by debris. In January 2013, the Army Corp of Engineers rebuilt the dunes in Avalon, destroying the study site. Several of the second-year seed-producing plants were salvaged before dune reconstruction, and will be increased at the PMC greenhouse in Spring 2013.

Fig. 7 Photograph of sea oats plot taken after Hurricane Sandy.

JAMAICA BAY MARSH ISLAND RESTORATION

The Cape May PMC continues to assist the NY District Corps of Engineers, NGOs, and community volunteers restore the Gateway National Recreation Area Jamaica Bay unit. This year, a community-led effort was made to collect smooth cordgrass (*Spartina alterniflora)* coordinated by the American Littoral Society, Ecowatchers, and Jamaica Bay Guardian. These three groups put together a large volunteer staff that the NJPMC staff assisted. While the amount of smooth cordgrass collected was comparable to last year's harvest, the timing of the collection may have been too early to secure an equal amount of viable seed (the harvest window is only a few weeks).

Total seed yield after cleaning last year was 450 lb while this year it was only 140 lb. Approximately 290 lb of stored seed was distributed to growers last year. Since we will be relying on more stored seed to fill any deficit from this year's harvest, we are monitoring the effect of long-term cold and wet storage on seed germination. Seed has been sent away to a testing lab for both collection years and germ tests are being conducted at the PMC to determine change in germ rates from year to year. In anticipation for future demand, the PMC staff planted 53 lb of seed in a constructed wetland pit at the PMC with the rationale of having a readily available supply of seed on-site.

PMC staff also had an opportunity to experiment with direct seeding methods at Elders East, a marsh island that undergoes strong wave and tidal influence. Past plantings close to the shoreline failed except in a few places where loose, tide-swept seeds were accidentally established in coir logs. Inspired by this example, PMC staff decided to try to mimic this method of establishment by cutting the coir log fiber with a garden edger and then using an Earthway vegetable row seeder to press seed into the cut. The top of the coir log was then covered with burlap that was staked down to prevent seed from rising out of the cut during the tidal cycles. A subsequent visit to the site in early summer determined that most of the burlap covering remained in place, approximately 75%, but at this point it has not been determined if plants were successfully established.

SPECIAL DEMONSTRATION PLANTINGS

DELAWARE BAY EASTERN TIGER SALAMANDER WETLAND RESTORATION

The Cape May Plant Materials Center is cooperating with the US Fish and Wildlife Service (USFWS) and the New Jersey Department of Natural Resources to create and maintain natural vegetation habitat for the state listed endangered eastern tiger salamander (*Ambystoma tigrinum)*. Approximately 250 plants of switchgrass (*Panicum virgatum* var. "Timber", "Hightide"), eastern gamagrass (*Tripsicum dactyloides*), and shortbeard plumegrass (*Saccharum brevibarbe*) were planted in a vernal pool in the Delaware Bay Division of the Cape May National Wildlife Refuge.

After one year, numerous egg masses were found on dead-limb debris piles constructed in the vernal pool. Conversely only a small number of egg masses were found on the transplanted wetland grasses. Greater egg recruitment is expected in the future when the native grasses become larger and more structurally suitable as habitat. The vernal site continues to be monitored by USFWS. Although the transplants grew slowly, there was a good survival rate, especially for the switchgrass transplants. This would suggest the importance of both live and dead plant matter for a quick and long-term solution for wetland restoration.

DIRECT SHRUB SEEDING TO BENEFIT MIGRATORY SONGBIRDS

BACKGROUND

The Cape May PMC is working together with the US Fish and Wildlife Service (USFWS) to direct seed native shrubs in efforts to restore 3 agricultural fields (45, 15, and 10 acres). This wildlife planting with help provide needed food and shelter for migratory songbirds during autumn migration. While the largest field was planted with warm season grasses, the two smaller fields were planted with shrub seed. The rationale for planting with seed was the desire to identify cost-effective options to seedling transplants for large restoration areas. Other options, such as deferring to the natural processes of succession, would not provide the diversity of food sources required for berry and insect-eating birds. The fields will be surveyed for breeding and migratory bird activity to assess the value of the shrub habitat.

METHODS

The USFWS purchased 13 lb of shrub seed to achieve the goal of establishing 3,000 shrubs/acre. Shrub species were: spicebush (*Lindera benzoin*), staghorn sumac (*Rhus typhina*), arrowwood viburnum (*Viburnum dentatum*), grey dogwood (*Comus racemosa*), shadblow serviceberry (*Amelanchier canadensis*), black chokeberry (*Aronia melanocarpa*), winterberry holly (*Ilex verticillata*), sweet pepperbush (*Clethra alnifolia*), and 2 lb of black- eyed susan (*Rudbeckia hirta*). The seeds were grouped based on size and sown with sterilized plant carriers. PMC staff used a Tye Pasture Pleaser no-till drill to plant the seed at ¼ inch deep at 4 ft spacing.

RESULTS

The initial planting failed, but at this point, the cause of failure is unknown. Complicating factors could have been the late timing of the planting, planting depth, scale of the planting, or negative effects of the carrier. The project is scheduled to be reseeded on a smaller scale (5 acre plots), with a different carrier, and earlier in the season. Currently these plots are being prepped with weed-control herbicide treatments.

ASSISTANCE TO RESOURCE-POOR FARMER IN ORGANIC TRANSITION

BACKGROUND

Many small growers interested in developing niche markets through organic farming face considerable challenges accessing the equipment, seed, and information technology required for the implementation of organic practices. The PMC, working together with the NJ NRCS Soil Quality Specialist, entered into a 3-year agreement (2010-2013) with a NJDA certified organic grower in Cumberland County, NJ to help restore 1 ½ acres by using cover crops for weed control and soil quality improvement. Organic weed management is a continuous challenge requiring, at times, a combined approach of crop rotation, cover crop use, and tillage. This study was designed to help the PMC and local growers better understand the challenges and opportunities organic farmers face when implementing organic weed management. With a better understanding of these challenges the PMC can more effectively promote the use of cover crops as a way to improve soil quality in concurrence with vegetative practices cover crop (NJ 340), conservation crop rotation (NJ 328), residue and tillage management (NJ 329), field border (NJ 386), and access road (NJ 560).

METHODS

The Cape May PMC supplied the equipment and operator, seed, soil test, lime, and organic fertilizer for the project. Equipment included a tractor, Truax no-till drill, disk, moldboard plow, and roller crimper.

RESULTS

Initial results indicate an improvement in soil tilth and a reduction in weeds in the restored fields.

WILLEVER LAKE WHIP RESTORATION

BACKGROUND

Last winter, the Cape May PMC cooperated with NRCS staff, USFWS, and NJ Audubon on a WHIP lake restoration project after the removal of a dam. The lake bottom required new vegetation to prevent erosion and to enhance its wildlife value.

METHODS

PMC staff used live silky willow (*Salix sericea*) stakes grown and collected at both the PMC and the Pinelands Nursery. Most of the installation consisted of live stakes, but there was also enough material to fashion fascines (wattles) and to conduct a trial at two distances along the streambed.

RESULTS

Subsequent visits by NRCS staff last spring indicated that the plantings held and the fascines were successful.

INFORMATION-BASED TECHNOLOGY

PUBLICATIONS

PUBLICATIONS 2012

Miller Christopher F., Dr. Curtis Dell 2012. Quantifying the Role of Native Warm Season Grasses in Sequestering Soil Organic Carbon. Proceedings of the 8th Eastern Native Grass Symposium, Oct 2012., Cape May Court House, NJ. September 2012. 1p.

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Christopher Sheahan, Scott Snell 2012. Monarch Germplasm release brochure. Cape May PMC, Cape May Court House, NJ. March 2012. 2p.

Christopher Sheahan 2012. Agastache scrophulariifolia Fact Sheet. Cape May, NJ. 07/2012. 2p.

Christopher Sheahan 2012. Agastache scrophulariifolia Plant Guide. Cape May, New Jersey. 07/2012. 3p.

Christopher Sheahan 2012. Coastlines-Cape May PMC Winter Newsletter. Cape May PMC, Cape May Court House, NJ. January 2012. 3p.

Christopher Sheahan 2012. Euthamia graminifolia Fact Sheet. Cape May, NJ. 07/2012. 2p.

Christopher Sheahan 2012. Euthamia graminifolia Plant Guide. Cape May, NJ. 07/2012. 3p.

Christopher Sheahan 2012. Hypericum perforatum Fact Sheet. Cape May, NJ. 07/2012. 2p.
Christopher Sheahan 2012. Hypericum perforatum Plant Guide. Cape May, NJ. 07/2012. 4p.
Christopher Sheahan 2012. Pycnanthemum tenuifolium Fact Sheet. Cape May, NJ. 07/2012. 2p.
Christopher Sheahan 2012. Pycnanthemum tenuifolium Plant Guide. Cape May, NJ. 07/2012. 2p.
Christopher F. Miller, Matt Pelligrine 2012. Cape May Point State Park-A Case Study for Improving the Maritime Forest. New Jersey Sea Grant, July 2009. 4p.
Cape May PMC 2012. Timber Germplasm switchgrass. Cape May PMC, Cape May Court House, NJ. March 2012. 2p.

Publications 2011

Novy, Ari, Peter Smouse, Jean Marie Hartman, Lena Struwe, Joshua Honig, Chris Miller, and Stacy Bonos 2011. Genetic variation of Spartina alterniflora in the New York Metropolitan Area and it's Relevance for Marsh restoration. Botanical Society of America, St; Louis, MO. Botany 2011 Conference Proceedings. 1p.
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Miller, C.F., 2006. Beach Plum Fact Sheet. Cape May PMC, Cape May Court House. 2p.
Christopher Miller 2011. Developing Plant Technologies for a Changing Climate. Cape May Court House, NJ. 1p.
Barbara Phillips, Christopher Miller 2011. Cape May Plant Materials Center Receives Coastal America Spirit Award. News release, Somerset, NJ. 1p.

PRESENTATIONS

PRESENTATIONS 2012

Miller, C. 2012. Seeding/Transplanting equipment demonstration. 3 Mar. 2012. Cape May PMC, NJ.
Miller, C. 2012. NJ Antique Auto Club. 11 May 2012. Cape May PMC, NJ.
Miller, C. and J. Dollar. 2012. Tour of PMC for Mt. Cuba Arboretum. 17, Jul. 2012. Cape May PMC, NJ.
Miller, C. and PMC Staff. 2012. Cover crop workshop. 18 Oct. 2012. Cape May PMC, NJ.
Snell, S. 2012. Pesticide safety and exotic/invasive plant ID training. 25 May 2012. Sandy Hook Unit - Gateway NRA, NJ.

PRESENTATIONS 2011

Miller, C. 2011. The Role and Function of the Cape May PMC. 11 Oct. 2011. Cape May Point, NJ.
Miller, C. 2011. Coastal Vegetation/Shoreline Stabilization training for NJDEP Land Use regulators. 26 Oct. 2011. Cape May PMC, NJ.
Miller, C. and J. Dollar. 2011. Cape May PMC Activities. 21 Nov. 2011. Stockton College, NJ.
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Miller, C. 2011. Plant Selection for Stormwater BMP's. 3 Mar. 2011. Rehobeth Beach, DE.
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Miller, C. 2011. Cape May Extension-Master Gardener Program training. 17 Jun. 2011. Cape May PMC, NJ.
Miller, C. 2011. Pollinator Field Day. 30 Sept. 2011. Cape May PMC, NJ.

SEED CLEANING TECHNICAL GUIDE

The Cape May Plant Materials Center is currently working on a detailed, step by step, seed cleaning photo guide. The document, under the working title *Seed Cleaning: A Photographic Guide of Select Species*, is a compilation of over four years of seed cleaning notes, methods, and experience. For each species included, the guide will cover the overall process of seed cleaning: harvest method, seed processing equipment used, equipment settings, cleaning time for each phase, alternative methods, as well as the resulting purity of the final product determined by lab analysis. Additionally, to assist the user, the guide will provide photos of both the seed and the vegetative waste material being removed throughout the process.

The idea for a seed cleaning guide arose as a result of the ongoing partnerships between the Cape May PMC and nonprofit partners such as The Long Island Native Plant Initiative, and more recently D & R Greenway Land Trust. The Cape May PMC has provided both groups technical assistance and access to seed cleaning equipment. The increased demand for technical assistance in the seed cleaning process coupled with the lack of available information prompted this guide's creation. Initially, the guide will cover the warm season grasses: switchgrass, Indiangrass, big bluestem, little bluestem; multiple woody species: beach plum, northern bayberry, American persimmon; and several forbs: seaside goldenrod, common marshmallow. Depending on the reaction and level of interest, the guide could become a long term working document and amended with additional plant species.

Excerpt from: Seed Cleaning: A Photographic Guide of Select Species (pg 5) below.

Big Bluestem
(Andropogon gerardii)

Total Cleaning Time = 7.3 min. / 1 lb of bulk material
9.8 min. / 1 lb of clean seed

Purity = 94.76%
Harvest Date ≈ September 25

Process

1. Westrup Brush Machine (33.5% of cleaning time)
   - Mantle: 7
   - Door: ½" open
   - Brushes: stiff
2. Westrup Brush Machine (39% of cleaning time)
   - Mantle: 10
   - Door: ½" open
   - Brushes: stiff
3. Clipper 67D (27.5% of cleaning time)
   - Screen Sizes
     - 20
     - 10
     - Blank
   - Wind Setting
     - Slowest
     - Intake one - blocked, intake two - 25 in^2 opening
     - Top deflector board 1.5" below lip, full open

Photo by Jennifer Anderson @ USDA-NRCS PLANTS Database

Photo Guide

The starting bulk plant material harvested by combine can be seen in Figure 1. It is important to note the relatively large pieces of stem and leaf in comparison to the seed. Also of note is the hair like awns attached to the seed.

Figure 1 shows the bulk plant material harvested by combine.

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