5

United States
Department of
Agriculture

Soil
Conservation
Service

Cape May Court House,
New Jersey

1982 Annual Technical Report of the Cape May Plant Materials Center

A Summary of the North Atlantic Coastal Area Activities

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

INTRODUCTION

This report covers the plant materials activities of the Cape May Plant Materials Center for the calendar year 1982. Established in 1965, the Cape May PMC is located approximately 24 miles south of Atlantic City, New Jersey on US Route 9. The property consists of 88 acres having soil types of Sassafras sandy loam and Downer loamy sand. Slopes are less than 1 percent. Elevation varies from 12 to 22 feet above sea level. Average precipitation is 41 inches. The mean annual temperatures are 62°F maximum and 44°F minimum. The climate is semi-humid and semi-maritime. The average growing season is 190 days and the plant hardiness zone is 7b.

The PMC serves the northeast coastal plain region extending from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. Most of the land served by the Center lies within Major Land Resource Areas: the Northern Coastal Plain (149), the Atlantic Coastal Flatwoods (153) and the Southern Coastal Plains (133), north of the 35th parallel. Two plant materials specialists normally provide assistance for the coastal area served by the center. One is located in North Carolina and one in New Jersey. In the absence of the plant materials specialist in North Carolina, plant science specialists act in that capacity. The states of North Carolina and Virginia are serviced out of Raleigh, North Carolina. The specialist located in Somerset, New Jersey provides plant materials guidance to the states of Delaware, Maryland, New Jersey, Connecticut, Massachusetts and Rhode Island. Operations of the center are conducted according to the Long Range Plan developed from the needs of the various states which the center serves.

Several items were purchased during the year. The Center had one underground tank and pump which was used to store and issue regular grade gasoline. This pumping system was determined to be unsafe because of its close proximity to a building used for automotive and other equipment repairs. Considering this, three new 1,000 gallon tanks and fuel pumps were installed a safe distance from all buildings. A 40' x 60' metal building with a concrete floor was constructed to house the combine and other equipment which need to be sheltered from the weather. An inoperable slide projector was also replaced with a new unit.

A major problem in the area served by the Cape May PMC is the erosion of tidal streambanks. Spartina patens (saltmeadow cordgrass) and S. alterniflora (smooth cordgrass) are the two grass species which occur immediately above and within the tidal zone. They are logical choices to stabilize these areas. S. patens grows above the high tide elevation along the mid-Atlantic coast. During 1976, an assembly of 78 accessions was collected and planted at the PMC to evaluate their performance. Three superior accessions have been selected for final evaluation and are growing on saline tidal stream sites in several states.

S. alterniflora grows in the intertidal zone of the saline streams and like S. patens is well adapted to the Atlantic Coast. In the spring of 1977, 111 accessions were collected and planted on the PMC. This number was reduced to 25 accessions which are currently being tested to determine their performance on tidal stream bank areas.

Recently, cropland erosion was identified as a major problem. Late maturing crops that produce little residue such as soybeans are harvested in the late fall. This allows insufficient time to establish an adequate cover crop before cold weather stops growth. The stubble and residue from the soybean crop provide inadequate soil cover during winter. The Cape May PMC will be evaluating various plant species and establishment methods for solving cropland erosion problems.

Purpose and Objectives of the Cape May PMC

To develop and put into use new or improved plants for the conservation of soil, water and related resources. Develop sound culture methods and management techniques for the more effective use of plants and land.

Functions

-- Collects and initially evaluates new plant materials to include native collections, foreign plant introductions and strains from plant breeders.

-- Increases promising materials.

-- Makes advanced evaluations of selected accessions under simulated field conditions in comparison with a standard variety.

-- Determines cultural requirements of needed plant materials.

-- Makes a field evaluation planting on selected problem sites off the center, in order to obtain information on plants at sites typical of eventual use.

-- Provides seeds and plants for field plantings in soil and water conservation districts where final evaluation of a new plant is made.

-- Jointly, names and releases new varieties or species with the New Jersey Agricultural Experiment Station.

-- After release, maintains and produces breeder or foundation seed or stock at the center in accordance with standards of the cooperating agency.

Note: Trade names used herein are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

PERSONNEL

Manager	Cluster R. Belcher
Assistant Manager	Donald W. Hamer
Soil Conservationist	Philip L. Koch
Foreman	Wilson J. Merrick
Biological Technician	Vacant
Secretary	Barbara A. Turnier

In addition, several people worked at the PMC under the Young Adult Conservation Corps (YACC) and the Comprehensive Employment and Training Act (CETA) programs. These employees received special training in PMC field operations as well as plant material processing and seed cleaning techniques.

CAPE MAY PMC STATE CONSERVATIONISTS' ADVISORY COMMITTEE

Plater T. Campbell, NJ State Conservationist

Coy A. Garrett, NC STC

Manly S. Wilder, VA STC

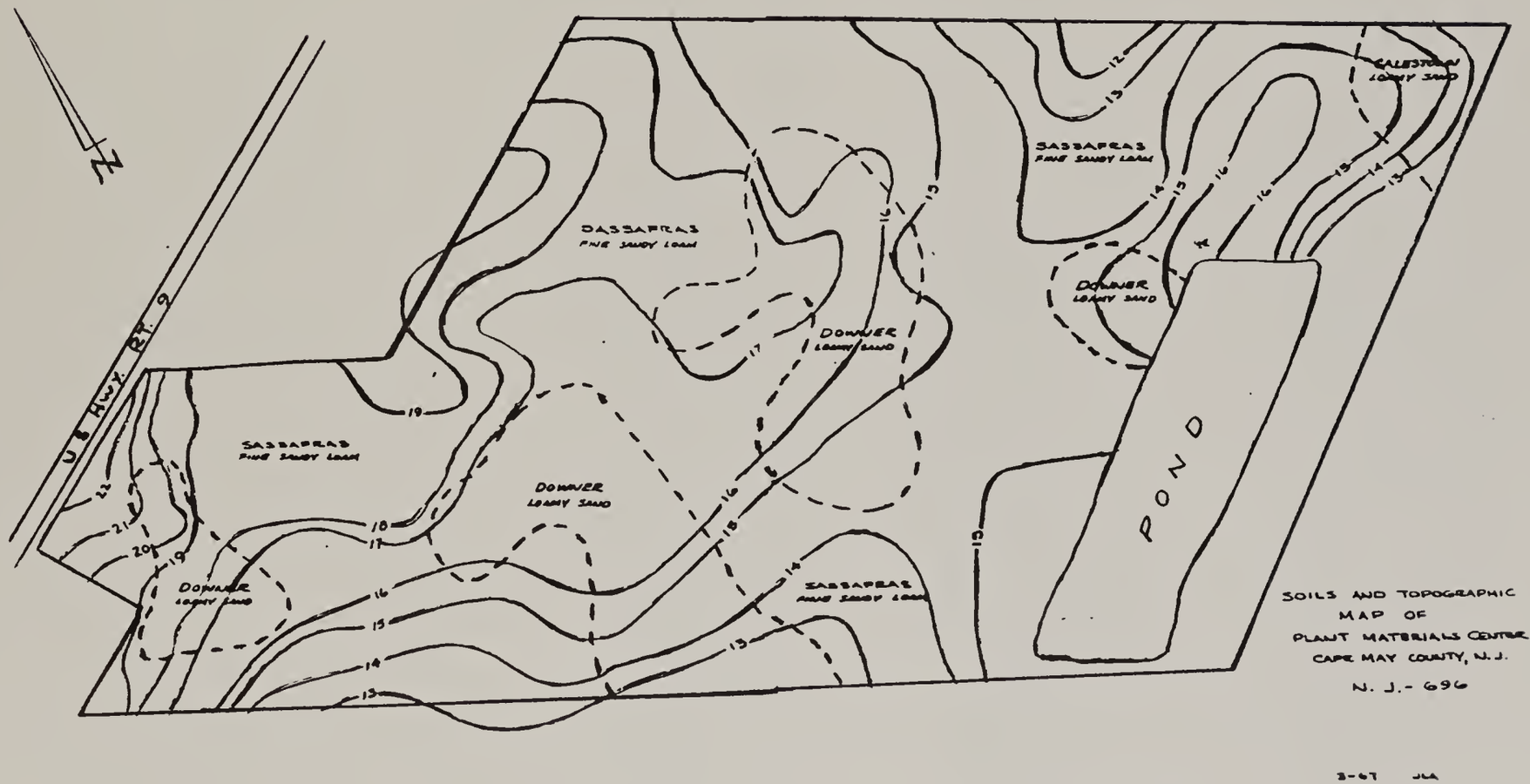
Obie D. Ashford, NJ State Resource Conservationist

W. Curtis Sharp, NETSC Plant Materials Specialist

Frank H. Webb, NJ Plant Materials Specialist

(Vacant), NC Plant Materials Specialist

CAPE MAY PLANT MATERIALS CENTER PROPERTY



Soils and Elevation Map

Legend:

------ = Soil boundary.

15 = Elevation above sea level in feet.

Soils:

Sassafras - fine sandy loam

Downer - loamy sand

Galestown - loamy sand

Soil Descriptions

DOWNER LOAMY SAND, 0 to 5 percent slopes

Nearly level to gently sloping well-drained soils that have a loamy sand surface and sandy loam subsoil. Natural fertility and available water holding capacity is moderate. Permeability is moderately rapid. This soil is subject to severe wind erosion when exposed in fields. Irrigation is generally needed when growing vegetable crops.

GALESTOWN LOAMY SAND, 0 to 5 percent slopes

This nearly level to gently sloping well-drained soil has a thick sand surface soil exceeding 20 inches. It has a sandy loam subsoil. Natural fertility is low and available water capacity is moderate. Sandy surface is droughty. Permeability is rapid in the upper 2 ft. and moderate in the sandy loam subsoil.

SASSAFRAS SANDY LOAM, 0 to 2 percent slopes

Nearly level well-drained soils that have sandy loam surface soils and sandy clay loam subsoils. It has medium natural fertility. This soil has moderate permeability. This soil is subject to minor wind and water erosion. Irrigation is generally needed during extended dry periods.

Weather Records at Cape May Plant Materials Center for 1982

1982 Month	Air Temperature °F Maximum Ext.	Maximum Av.	Maximum Deviation	Minimum Av.	Minimum Ext.	4" Soil Temperature °F Maximum Ext.	Maximum Av.	Maximum Deviation	Minimum Av.	Minimum Ext.	Precipitation Total Inches	Deviation	Grtst. Daily	No. Days
Jan.	58	36	-3	-4	18	-3	46	36	-3	-2	35	33	4.01	+0.57	1.05	14
Feb.	61	43	+2	-2	22	11	47	39	0	0	37	33	2.10	-1.11	.55	13
March	64	50	0	0	33	19	51	46	-1	0	42	37	2.89	-0.25	.80	7
April	75	59	-1	-2	39	10	61	54	-2	-1	49	40	4.15	+1.10	1.33	11
May	87	71	+3	+4	54	40	72	67	+1	+2	62	53	2.80	-0.86	.75	13
June	90	78	+1	0	60	50	79	74	-2	0	70	65	3.41	-0.10	1.36	12
July	95	85	+2	+2	67	51	85	80	-2	+1	77	71	1.20	-1.55	.41	10
Aug.	92	83	0	0	64	42	82	80	-1	-1	75	70	.74	-3.17	.22	9
Sept.	88	77	0	0	58	48	78	74	-2	0	71	66	1.22	-1.34	.46	9
Oct.	83	67	+2	+2	48	29	72	65	+1	+2	62	54	2.20	-1.36	1.26	6
Nov. D	80	60	+8	+3	42	23	65	56	+2	+2	53	45	4.68	+1.59	1.86	6
Dec.	66	51	+5	+5	34	9	59	49	+4	+4	46	40	2.91	-1.14	.86	9
1982	95	63			45	-3	85	60			57	33	32.31	-7.62		119
Normal*		62			44			60			56		40			

*Normal based on:

17 yr. Air Temperature Average; 13 yr. Soil Temperature Average; 17 yr. Precipitation Ave.

Frost free days 178 - April 23 to October 18, 1982 - Normal 190 days.

20.40 inches of snow were measured; this fell in January, February and December.

Fresh Water Planting
Maryland and Duck, North Carolina

34I003F

FINAL REPORT

The banks of fresh water river estuaries and bays are exposed to storms and fluctuating water levels. The resulting erosion removes valuable land and creates the clogging of narrowing channels as well as the formation of new points of land. The loss of valuable land, generally, cannot be replaced and severe clogging of channels is a hazard to water traffic and expensive to remove. The erosion of tidal banks is less severe in fresh water mainly because there are fewer miles of shoreline, reduced exposure and less water fluctuation during the tidal cycle.

Vegetation is an effective and inexpensive method which can be used to help control the erosion of soil caused by wave action. However, at present, no known plant variety exists which can be recommended to successfully help stabilize fresh water tidal banks.

A preliminary assembly consisting of several genera was collected in the fall of 1978 and the spring of 1979. The purpose of this assembly was to screen various species in order to select one or more that have potential for stabilization of fresh water tidal banks.

In early 1980, a slightly brackish site was selected in North Carolina and 2 replications of 17 accessions were planted on it. The tidal cycle on this site is influenced by wind rather than lunar action. The normal daily tidal cycles do not exist and the wind creates long periods of dry or flooding conditions. Consequently, this site failed to yield much useable data.

In the spring of 1981, an additional planting was made along the Sassafras River in Kent County, Maryland. Two replications were planted. Initial establishment was poor in both replications. The surviving accessions were: Scirpus americanus (American bulrush), 'Shoreline' Phragmites australis (common reed), Spartina alterniflora (smooth cordgrass), and S. patens (saltmeadow cordgrass). S. americanus exhibited the best stand, which is effective during the growing season but when this species goes dormant much of the above ground vegetation breaks off and rapidly decomposes leaving almost no soil cover. P. australis is thriving very vigorously with a good stand, however, for several reasons it is not well accepted by the public. While S. patens and S. alterniflora are normally well adapted to tidal areas, they are only rated as fair in stand and vigor at this location under the given circumstances.

At the end of the second year, nine accessions were successful. As with the 1980 planting, *S. patens*, *P. australis* and *S. americanus* were among those which survived and exhibited the best performance.

A third planting was installed in 1982 along the Chester River in Chestertown, Maryland. Due to excessive boat traffic, a narrow beach and other factors, this planting was almost a complete failure. Only a few of the 15 planted accessions survived, yet, *S. alterniflora* remained in all 3 replications with good stand and vigor.

The objective of this project is to select one or more species for additional testing along fresh water tidal streams. To date, three plantings have been made with little to no success. These failures are mostly the result of improper site conditions which fail to meet the description for problem sites which plants will solve. Adequate available sites to install test plots upon are not easily located. Also, results from recent studies indicate that in most circumstances the plant species which are used to stabilize saline sites can be used successfully on fresh water sites.

Table 1

Evaluations for eighteen accessions of fresh water tidal plants, 1982[1/]

Acc. No.	Species	Percent Survival[2/]	Foliage Prod.	Ht. (cm)	Width (cm)	Vigor
K-24	Tripsacum dactyloides	3	5	70	80	6[3/]
PI-434199	Phalaris aquatica	0				
PI-254903	P. aquatica	29	4	100	60	4
'Kents'	P. arundinacea	29	3	70	60	2
T-2792	Scirpus americanus	-	7	35	6	5
T-2781	Phragmites australis	-	1	170	-	2
T-2692	Juncus balticus	0				
T-2789	S. americanus	-	8	45	6	7
T-2825	Typha angustifolia	4	5	100	35	5
	Spartina alterniflora	0				
'Rise'	P. arundinacea	25	2	90	60	2
T-2927	Leersia oryzoides	8	7	30	50	6
PI-421238	S. patens	23	4	50	50	3
'Garrison'	Alopecurus arundinaceus	0				
T-2824	T. angustifolia	0				
T-2739	L. oryzoides	0				
T-2823	T. dactyloides	0				
'Shoreline'	P. australis	0				

1/Various numbers of plants were established/accession along the Sassafras River at Chestertown, Maryland on May 14, 1981; data recorded June 23.
2/Dash (-) indicates that the formation of plant growth made it difficult to evaluate.
3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 2

Evaluation for eighteen accessions of fresh water tidal plants, 1982[1/]

Acc. No.	Species	Stand[3/]	Spread[3/]	Vigor[3/]	Ave. Height[2/] (cm)	Sand Accr.[4/]	Erosion Control Potential[3/]
K-24	Tripsacum dactyloides	-[5/]	-[3/]	-[3/]	-	-[4/]	-[3/]
PI-434199	Phalaris aquatica	-	-	-	-	-	-
PI-254903	P. aquatica	5	6	5	80	M	5
'Kents'	P. arundinacea	3	6	3	70	M	4
T-2792	Scirpus americanus	3	1	3	60	L-M	3
T-2781	Phragmites australis	2	1	1	190	A	
T-2692	Juncus balticus	-	-	-	-	-	-
T-2789	S. americanus	8	4	5	75	L	6
T-2825	Typha angustifolia	9	7	7	85	L	9
	Spartina alterniflora	-	-	-	-	-	-
'Rise'	P. arundinacea	5	5	2	85	M	4
T-2927	Leersia oryzoides	9	9	9	25	N	9
PI-421238	S. patens	3	3	3	60	M	2
'Garrison'	Alopecurus arundinaceus	-	-	-	-	-	-
T-2824	T. angustifolia	-	-	-	-	-	-
T-2739	L. oryzoides	-	-	-	-	-	-
T-2823	T. dactyloides	-	-	-	-	-	-
'Shoreline'	P. australis	-	-	-	-	-	-

1/Various numbers of plants were established/accession along the Sassafras River at Chestertown, Maryland on May 14, 1981; data recorded Sept. 1.
2/Measurements taken in the undisturbed position. Seedheads were not included.
3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.
4/Ratings are - A=Abundant; M=Moderate; L=Little; N=None.
5/Dash (-) = all plants are dead or missing.

Table 3

Relative rating for accessions of freshwater tidal plants, 1982[1/]

	Accession No.	Species
Best[2/]	PI-421238	Spartina patens
2nd Best	T-2781	Phragmites australis
3rd Best	'Rise'	Phalaris arundinacea
4th Best	'Kents'	P. arundinacea
5th Best	T-2792	Scirpus americanus

1/All accessions were established along the Sassafras River at Chestertown, Maryland on May 14, 1981; data recorded September 1.

2/Ratings are based on plant growth, vigor and ability to adapt.

Table 4

Stand ratings for five fresh water plant accessions, 1982[1/]

Species	Accession	R-I	R-II
Phragmites australis	'Shoreline'	3[2/]	3
Scirpus americanus	T-2792	2	1
Spartina alterniflora	PI-421175	4	4
S. patens	PI-421238	4	-

1/Planting established at the Corps of Engineers Duck, NC Field Research Facility in 1980; evaluated June 14.

2/Stand rated 1-10; 1=excellent, 10=poor.

Table 5

Survival and vigor for fresh water tidal plants, 1982

Plot No.	Acc. No.	Species	Number Planted	Survival (No.)	Vigor
		R-I			
Border	T-2824				
1	T-2823	Tripsacum dactyloides	40	0	-
2	K-24	T. dactyloides	40	0	-
3	'Rise'	Phalaris arundinacea	40	4	7
4	T-2789	Scirpus americanus	40	16	7
5	T-2927	Leersia oryzoides	32	2	7
6	'Kents'	P. arundinacea	40	4	8
7	T-2739	L. oryzoides	40	2	8
8	T-2826	Juncus roemerianus	40	0	-
9	T-2824	Typha angustifolia	40	0	-
10	'Halifax'	Panicum hemitomen	40	0	-
11	T-2792	S. americanus	40	31	7
12	T-2825	T. angustifolia	40	7	8
13	PI-421238	Spartina patens	40	9	8
14	PI-421169	S. alterniflora	40	35	4
15	T-2692	J. balticus	40	8	8
Border	T-2824				

Table 5
(cont.)

Survival and vigor for fresh water tidal plants, 1982

Plot No.	Acc. No.	Species	Number Planted	Survival (No.)	Vigor
		R-II			
Border	T-2824				
1	T-2792	S. americanus	32	12	8
2	T-2692	J. balticus	32	6	8
3	T-2927	L. oryzoides	36	0	-
4	K-24	T. dactyloides	32	0	-
5	T-2789	S. americanus	32	27	6
6	PI-421169	S. alterniflora	32	24	5
7	T-2825	T. angustifolia	36	5	9
8	T-2824	T. angustifolia	32	0	-
9	T-2739	L. oryzoides	32	0	-
10	'Kents'	P. arundinacea	40	1	9
11	'Rise'	P. arundinacea	36	0	-
12	PI-421238	S. patens	40	4	9
13	T-2826	J. roemerianus	36	11	9
14	PI-254903	P. aquatica	36	0	-
15	T-2823	T. dactyloides	44	0	-
16	'Halifax'	P. hemitomen	32	0	-

Table 5
(cont.)

Survival and vigor for fresh water tidal plants, 1982

Plot No.	Acc. No.	Species	Number Planted	Survival (No.)	Vigor
		R-III			
1	K-24	T. dactyloides	40	0	-
2	PI-254903	P. aquatica	40	0	-
3	'Kents'	P. arundinacea	44	0	-
4	T-2792	S. americanus	40	16	8
5	T-2692	J. balticus	40	0	-
6	T-2789	S. americanus	44	6	9
7	T-2825	T. angustifolia	44	9	7
8	PI-421169	S. alterniflora	40	33	6
9	'Rise'	P. arundinacea	38	2	9
10	'Halifax'	P. hemitomen	32	0	-
11	T-2927	L. oryzoides	32	2	9
12	PI-421238	S. patens	36	12	8
13	T-2824	T. angustifolia	32	0	-
14	T-2739	L. oryzoides	32	1	9
15	T-2823	T. dactyloides	32	0	-
16	T-2826	J. roemerianus	32	3	9
Border	T-2824				

1/Sixteen accessions/replication with various number of plants per accession were planted along the Chester River in Chestertown, Maryland. R-I was planted on May 20 - R-II and III on May 19, 1982; data recorded June 23.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None; - = Not recorded.

Juniperus virginiana for Screens and Windbreaks

34I004K

Extensive damage to numerous crops occurs annually in New Jersey and other coastal states when high velocity winds blow across the land. People, animals and buildings are also affected. Soil texture, field width and condition of the soil surface are the primary factors associated with this erosion problem. Fine soil particles begin to blow when a wind of 12 to 15 miles per hour is attained 1 foot above the ground surface. Therefore, to prevent or control wind erosion, it is necessary to reduce the wind velocity to a non-erodible rate for the given soil, and/or attain a protective condition on the soil surface. Properly established windbreaks have proven to be successful in helping to overcome this problem.

Several woody species have been used and a few are recommended for windbreaks on inland sites. Many of these are deciduous and some are evergreen such as *Juniperus virginiana* (Eastern red cedar). This native species is also used by homeowners for screening purposes.

J. virginiana is partially salt tolerant and has been planted and successfully grown on secondary sand dunes. Since this species is adapted to a variety of soil and climatic conditions, it has a large range of adaptation.

This project was started by collecting seed from approximately 50 locations in several coastal states. The first planting was made in the fall of 1975. The seed of *J. virginiana* are slow to germinate and the first planting emerged poorly. In 1978, these (2-0) seedlings were lined out and evaluated for growth rate and the desired form. The following year, 122 plants were selected from this planting and replanted in a windbreak design for initial evaluation.

This species is variable in growth rate and form. Some plants in the windbreak have exhibited good growth while others increased very little in height. The growth form varies from columnar to almost oval. The objective of this project is to evaluate the species for a fast growing strain that has dense foliage and columnar form.

Table

Height and width for *Juniperus virginiana*, 1982[1/]

PI No.	Plant No.	Height (cm)			Width (cm)		
		1980	1981	1982	1980	1981	1982
T-02738	1	162	210	250	82	95	125
	2	137	190	225	65	95	110
	3	198	240	255	122	145	180
	4	220	260	285	70	90	110
T-02703	1	247	275	340	109	155	200
	2	210	270	295	91	130	140
	3	160	215	235	90	110	130
	4	197	250	300	91	135	150
	5	214	250	290	97	155	190
	6	200	250	300	77	115	150
	7	200	250	280	110	180	200
	8	233	290	350	84	135	145
	9	234	295	340	98	165	175
	10	180	235	265	107	155	180
	11	186	245	285	69	105	110
	12	210	255	300	104	145	165
	13	167	220	255	96	140	170
	14	213	275	320	100	150	165
	15	175	240	280	107	145	170
	16	133	165	200	74	105	125
	17	221	270	310	114	180	200
T-02708	1	213	255	290	108	160	170
	2	193	230	270	103	155	170
	3	162	215	240	70	110	110
	4	222	260	300	110	180	170
	5	196	250	285	86	115	130
	6	177	205	235	90	130	160
	7	192	255	285	83	130	145
	8	173	200	210	81	130	150
	9	194	215	245	82	110	130
	10	216	240	260	97	125	150
	11	200	230	245	100	130	150
	12	219	280	295	120	150	165
	13	218	230	270	106	165	170
	14	204	280	305	94	130	140
	15	167	220	265	90	125	145
	16	207	255	290	102	140	160

Table

Height and width for *Juniperus virginiana*, 1982

PI No.	Plant No.	Height (cm)			Width (cm)		
		1980	1981	1982	1980	1981	1982
T-02710	1	195	235	270	96	130	145
	2	193	245	275	110	165	180
	3	196	250	290	87	110	125
	4	184	235	265	73	105	115
	5	229	255	305	95	130	150
	6	214	245	285	93	130	155
	7	204	260	295	96	140	155
	8	176	225	260	113	160	195
	9	169	215	255	122	180	200
	10	206	230	255	103	150	170
	11	173	230	270	108	155	170
	12	182	225	265	96	130	160
	13	184	205	215	110	165	200
	14	198	250	290	72	110	120
	15	210	265	310	103	170	180
	16	200	260	280	105	170	190
T-02711	1	181	120	235	105	170	175
	2	224	250	305	115	170	200
	3	227	255	300	114	145	160
	4	200	265	295	94	125	150
	5	212	275	290	115	180	215
	6	217	270	310	93	155	175
	7	162	225	265	90	135	155
	8	230	255	290	103	140	160
	9	200	225	275	117	180	200
	10	175	205	235	129	180	200
T-02704	1	197	235	290	89	120	145
	2	183	245	260	90	115	140
	3	208	250	285	93	145	170
	4	182	270	300	98	140	160
	5	211	270	300	120	190	205
	6	207	270	285	82	115	120
	7	209	260	280	92	120	140
	8	194	250	285	85	125	135
	9	200	245	290	86	125	140
	10	179	225	260	96	130	150
	11	176	215	250	82	110	120
T-02705	1	192	235	270	92	140	155
	2	168	195	235	74	125	140
	3	200	245	285	79	125	140
	4	220	285	290	106	135	145
	5	192	270	275	95	130	145
	6	227	280	320	99	160	170
	7	206	280	340	121	185	195

Table

Height and width for *Juniperus virginiana*, 1982

PI No.	Plant No.	Height (cm)			Width (cm)		
		1980	1981	1982	1980	1981	1982
T-02707	1	195	270	275	61	105	120
	2	171	230	250	103	150	180
	3	218	265	290	110	150	150
	4	193	245	265	94	125	140
	5	200	235	260	105	150	165
	6	192	245	270	90	130	140
	7	145	200	215	81	135	155
	8	213	260	295	106	165	180
	9	179	250	275	102	150	155
	10	190	225	270	63	105	120
	11	152	195	220	97	150	170
T-02709	1	210	255	240	103	140	165
	2	216	275	310	125	190	210
	3	213	285	330	130	180	190
	42	215	275	310	88	140	150
	5	191	235	270	110	155	180
	6	217	275	310	103	140	170
	7	220	270	305	89	140	150
	8	210	270	300	68	110	135
	9	216	270	310	93	125	140
	10	200	245	300	112	145	170
	11	189	240	295	112	135	160
	12	210	255	300	120	180	215
	13	220	270	310	117	180	210
T-02738	1	200	255	290	100	130	140
	2	207	260	305	124	170	185
	3	179	230	285	82	120	140
	4	192	250	285	70	105	125
	5	156	190	225	100	120	145
	6	199	240	270	85	100	110
	7	200	245	280	84	105	140
	8	191	225	275	77	105	125
	9	171	235	275	66	95	120
	10	167	220	235	76	105	130
	11	170	230	225	85	120	150
	12	185	240	275	68	95	130
	13	182	235	280	63	90	115
	14	172	215	230	78	100	115
	15	171	230	270	71	105	115
	16	179	240	290	96	145	170
	17	189	245	280	82	100	120

Table

Height and width for *Juniperus virginiana*, 1982

PI No.	Plant No.	Height (cm) 1980	1981	1982	Width (cm) 1980	1981	1982
T-02721 2/	1			225			95
	2			180			95
	3			160			95
T-02696 2/	1			190			110
T-02714 2/	1			240			95
T-02715 2/	1			215			130
T-02716 2/	1			225			140
T-02728 2/	1			220			90
	2			235			110
T-02727 2/	1			215			110
T-02734 2/	1			170			95

1/(2-1) stock was planted in a windbreak design in March 1979.

2/Plants were transplanted to present location in March of 1981.

Woody Plants for Sand Dune Stabilization

341006C

There are many miles of unstabilized back dunes along the mid-Atlantic coast from North Carolina to Massachusetts. At one time, many of these dunes were vegetated with herbaceous and woody plants which have since disappeared because of changes in the environment, introduced pests and more intense use. Other dunes, which have not been vegetated before with herbaceous or woody plants, could be stabilized with adapted woody species. As a result of natural plant succession, some of these dunes will in time become vegetated with woody species, but this is a slow process. The areas that are partially stabilized with woody plants allow sand movement to occur. While this isn't bad in itself, drifting sand from large unstable areas on the back dunes can develop into a serious problem. Woody plants adapted to this environment are not readily available from commercial nurseries for the restoration and protection of coastal dunes.

The objective of this project is to select one or more superior woody cultivar which will be readily adapted to the back dune area in MLRA 149 and 153 of the mid-Atlantic coast.

In 1979, seed collections of four woody species were made from Georgia to Cape Cod, Massachusetts. The four collected species are Myrica cerifera (wax myrtle), M. pensylvanica (bayberry), Rosa spp. and Prunus spp.

A total of 191 accessions were planted in the fall of 1979 and emerged in the spring of 1980. Nearly all accessions exhibited fair to good vigor during the first year of growth.

In the spring of 1981, the Rosa species and Prunus species were transplanted to an initial observation site at the PMC. The Myrica species, which require two years to develop an adequate root system for satisfactory transplanting, were transplanted to the initial observation site in the spring of 1982, along with four late arriving Rosa accessions. Many of the M. cerifera accessions were collected south of Maryland and did not tolerate the cold winter temperatures at Cape May.

Shortly after planting, many of the Myrica accessions and the four new Rosa accessions were severely damaged by gypsy moth caterpillars. During the summer, many Myrica accessions again suffered leaf damage from an undetermined (possibly herbicidal) cause. However, in most accessions, an adequate number of plants survived and recovered. An aphid infestation caused slight to moderate damage to the established Prunus and Rosa accessions before the problem was controlled.

Table 1

Dimensions of woody plants for sand dune stabilization, 1982[1/]

Species/ PI No.	Height (cm)		Width (cm)		Diameter[2/] (mm)		Plant[3/] Nos.		Average Height (cm)	Average Width (cm)	Average Diameter (mm)
Prunus maritima											
T-13172	115	115	90	145	32	27			115	118	30
T-07614	135	125	165	125	34	26			130	145	30
T-07632	85	75	75	95	24	28			80	85	26
T-07634	80	85	85	65	24	28			82	75	26
T-09192	125	100	90	110	29	18			112	100	24
T-09193	120	110	95	80	33	21	2	7	115	88	27
T-09200	115	135	95	110	23	27			125	102	25
T-09204	145	120	135	135	29	30	2	7	132	135	30
T-11246	110	110	95	120	25	26			110	108	26
T-11248	80	55	110	145	30	34	1	3	68	128	32
T-11249	75	135	115	180	27	31	1	3	105	148	29
T-11250	95	125	105	165	19	28			110	135	24
T-11251	120	165	100	110	31	24			142	105	28
T-11252	140	105	145	85	32	24			122	115	28
T-11275	145	155	95	140	24	28			150	118	26
T-12013	115	135	170	145	36	28			125	158	32
P. serotina											
T-13173	120	105	75	75	18	22	2	7	112	75	20
T-13174	130	115	110	95	32	33			122	102	32
T-15504	50	70	30	60	12	18	3	11	60	45	15
T-13310	140	135	145	105	30	36	4	10	138	125	33
T-15505	120	130	145	115	38	29			125	130	34
P. virginiana											
T-15506	95	70	65	45	24	17			82	55	20
T-15507	125	140	75	65	24	27			132	70	26
Rosa sp.											
T-02786	60	40	140	100					50	120	
T-02787	35	25	105	95			4	7	30	100	
T-02788	45	50	90	95					48	92	
T-07078	35	45	125	90					40	108	
T-07640	45	45	115	115					45	115	
T-08303	35	40	70	100					38	85	
T-08304	50	45	125	110					48	118	
T-08305	40	30	100	90			2	7	30	95	
T-08306	45	40	115	110			3	4	42	112	
T-08307	35	45	90	120					40	105	

Table 1
(cont.)

Dimensions of woody plants for sand dune stabilization, 1982

Species/ PI No.	Height (cm)		Width (cm)		Diameter (mm)	Plant Nos.		Height (cm)	Width (cm)	Diameter (mm)
Rosa sp.										
T-08308	35	40	100	90				38	95	
T-08309	40	50	85	90				45	88	
T-08310	50	45	115	100				48	108	
T-08311	40	40	110	105				40	108	
T-09191	50	70	120	165				60	142	
T-11254	70	30	110	80		3	11	50	95	
T-11255	45	45	110	115				45	112	
T-11256	85	75	120	150				80	135	
T-11257	55	50	115	95				52	105	
T-11258	55	60	135	130				58	132	
T-11259	40	50	115	100				45	108	
T-11260	65	40	130	90				52	110	
T-11261	70	45	95	115				58	105	
T-11276	40	75	110	115				58	112	
T-11277	50	35	100	90				42	95	
T-11278	55	35	130	120				45	125	
T-11279	50	40	105	100				45	102	
T-11280	35	45	90	75				40	82	
T-11281	50	30	110	90				40	100	
T-12014	35	40	110	100				38	105	
T-12015	40	55	95	100				48	98	
T-12016	50	50	115	105				50	110	
T-12017	55	75	95	100				65	98	
T-12018	50	55	115	120				52	118	
T-15508	55	40	120	95				48	108	
T-15509	85	55	95	95				70	95	
T-15510	40	70	100	110				55	105	
T-15511	60	50	95	80				55	88	
CN00322	-	-	-	-				-	-	
CN00321	-	-	-	-				-	-	
CN00323	-	-	-	-				-	-	
CN00324	-	-	-	-				-	-	
T-11282	90	55	125	100				72	112	
T-15512	125	95	125	100				110	112	

1/Fifteen plants or less per accession were planted from April 16 to April 27, 1981. Height and width recorded May 4, diameter recorded May 27.

2/ Stem diameter measured 2 cm above sand line.

3/ Position of plants measured if other than number 4 and 11.

Table 2

Vigor, bloom and leaf expansion of woody plants for sand dune stabilization, 1982 [1/]

Species/ PI No.	Vigor	Bloom	Leaf Expansion
Prunus maritima	[2/]	[3/]	[4/]
T-13172	3	B	0
T-07614	4	N	0
T-07632	4	B	0
T-07634	3	B	0
T-09191	5	N	0
T-09193	6	B	I
T-09200	3	N	0
T-09204	3	N	0
T-11246	6	B	I
T-11248	4	N	0
T-11249	5	B	I
T-11250	3	N	0
T-11251	4	N	0
T-11252	4	N	0
T-11275	4	B	0
T-12013	3	N	0
P. serotina			
T-13173	4	N	0
T-13174	4	N	0
T-15504	5	N	0
T-13310	3	N	0
T-15505	3	N	0
P. virginiana			
T-15506	3	N	0
T-15507	3	N	0
Rosa sp.			
T-02786	3	N	0
T-02787	3	N	0
T-02788	3	N	0
T-07078	4	N	0
T-07640	3	N	0
T-08303	4	N	0
T-08304	3	N	0
Rosa sp.			
T-08305	3	N	0
T-08306	4	N	0
T-08307	4	N	0
T-08308	3	N	0
T-08309	3	N	0
T-08310	3	N	0
T-08311	3	N	0
T-09191	3	N	0
T-11254	3	N	0
T-11255	2	N	0
T-11256	2	N	0
T-11257	3	N	0
T-11258	3	N	0
T-11259	3	N	0
T-11260	3	N	0
T-11261	3	N	0
T-11276	2	N	0
T-11277	3	N	0
T-11278	3	N	0
T-11279	4	N	0
T-11280	3	N	0
T-11281	3	N	0
T-12014	3	N	0
T-12015	3	N	0
T-12016	4	N	0
T-12017	3	N	0
T-12018	3	N	0
T-15508	3	N	0
T-15509	3	N	0
T-15510	3	N	0
T-15511	3	N	0
T-11282	3	N	0
T-15512	3	N	0

1/Fifteen plants or less per accession planted from April 16-April 27, 1981; data recorded May 7.
2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.
3/Ratings are - B=Most in bloom; A=After bloom; N=Prebloom.
4/Ratings are - O=Out leaves expanded; I=In leaves not expanded.

Table 3

Survival, vigor and insect damage [1/] on woody plants for sand dune stabilization, 1982

Species/ PI No.	No. Planted	No. Survived	Percent Survival	Vigor	Insect Damage
Rosa rugosa				[2/]	[3/]
CN00322	15	15	100	8	9
CN00321	15	15	100	8	9
CN00323	15	14	93	8	8
CN00324	15	13	87	7	7
Myrica cerifera					
T-02741	15	10	67	5	3
T-02740	7	1	14	7	3
T-02742	6	0	0	10	1
T-02743	4	0	0	10	1
T-02745	5	0	0	10	1
T-02746	4	0	0	10	1
T-11271	4	2	50	7	1
T-02747	15	3	20	8	3
M. pensylvanica					
T-02749	15	14	93	6	5
T-02750	15	15	100	5	6
T-02751	15	15	100	5	5
T-02752	15	14	93	6	5
T-02753	15	11	73	5	5
T-02754	15	15	100	6	5
T-02755	15	15	100	6	6
T-02756	15	15	100	6	5
T-02757	15	13	87	6	6
T-02759	10	9	90	5	4
T-02760	15	15	100	5	5
T-02761	14	10	71	6	5
T-02762	15	11	73	8	8
T-02763	15	14	93	5	6
T-02764	15	14	93	6	5
T-02765	15	10	67	7	7
T-02766	15	14	93	6	6
T-02767	15	15	100	5	5
T-02768	15	15	100	6	6
T-02769	15	14	93	5	6
T-02770	15	15	100	7	7
T-07613	15	14	93	5	6
T-07638	15	11	73	5	6

Table 3
(cont.)

Survival, vigor and insect damage
on woody plants for sand dune stabilization, 1982

Species/ PI No.	No. Planted	No. Survived	Percent Survival	Vigor	Insect Damage
M. pensylvanica					
T-09194	15	11	73	7	5
T-09195	15	13	87	7	5
T-09196	15	10	67	7	4
T-09197	15	11	73	6	5
T-09198	15	13	87	6	5
T-07639	15	15	100	5	6
T-09201	15	13	87	6	5
T-09202	15	14	93	6	6
T-09203	15	14	93	7	8
T-08298	15	15	100	7	7
T-08299	15	12	80	7	5
T-08300	15	12	80	6	6
T-08301	15	15	100	7	7
T-08302	15	13	87	7	5
T-11232	15	12	80	6	6
T-11233	15	14	93	5	5
T-11234	15	14	93	6	7
T-11235	15	14	93	5	7
T-11236	15	14	93	5	7
T-11237	15	15	100	6	7
T-11238	15	12	80	5	6
T-11239	15	10	67	7	6
T-11240	7	3	43	6	5
T-11275	1	0	0	10	1
T-11231	15	5	33	8	4
T-11241	15	15	100	4	5
T-11242	15	15	100	4	3
T-11243	15	15	100	3	3
T-11244	15	15	100	4	4
T-11245	15	15	100	4	4
T-11260	15	15	100	3	5
T-11267	15	15	100	3	5
T-11272	15	15	100	3	3
T-11273	15	15	100	3	4
T-12007	15	15	100	4	3
T-12008	15	13	87	4	5
T-12009	15	15	100	4	6
T-12010	15	15	100	4	4
T-12011	15	15	100	4	5
T-14667	4	1	25	9	1
NJ-86	5	5	100	5	5

Table 3
(cont.)

Survival, vigor and insect damage
on woody plants for sand dune stabilization, 1982

Species/ PI No.	No. Planted	No. Survived	Percent Survival	Vigor	Insect Damage
M. pensylvanica					
T-12410	15	15	100	6	6
T-12411	15	15	100	6	6
T-12012	15	14	93	6	6
PI-434153	12	9	75	7	3
PI-434154	10	7	70	7	6
PI-434155	15	12	80	6	5
PI-434156	7	4	57	7	2
PI-434157	13	3	23	7	2
T-13170	13	6	46	7	5
T-13171	15	8	53	7	5
PI-434150	15	15	100	4	3
PI-434151	15	13	87	4	4
PI-434152	15	9	60	4	3
PI-434154	3	1	33	6	3
PI-434156	2	0	0	10	1
PI-434157	5	3	60	6	5
PI-434159	15	11	73	5	5

1/Fifteen or less plants per accession planted from March 26-April 16, 1981; data recorded June 8.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

3/Insect Damage (mostly by caterpillars) - 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very severe; 10=Complete defoliation.

Table 4

Dimensions of newly planted woody plants for sand dune stabilization, 1982 [1/]

Species/ PI No.	Plant Positions [2/]		Height (cm)		Width (cm)		Diameter (mm)		Average Ht. (cm)	Average Width (cm)	Average Diameter (mm)
Rosa rugosa											
CN00322	4	11	40	30	35	20	-	-	35	28	-
CN00321			30	35	50	30	-	-	32	40	-
CN00323			40	25	40	10	-	-	32	25	-
CN00324		10	30	30	40	30	-	-	30	35	-
Myrica cerifera											
T-02741	5		45	40	40	30	5	5	42	35	5
T-02740	2	-	15	-	15	-	4	-	15	15	4
T-02742	-	-	-	-	-	-	-	-	-	-	-
T-02743	-	-	-	-	-	-	-	-	-	-	-
T-02745	-	-	-	-	-	-	-	-	-	-	-
T-02746	-	-	-	-	-	-	-	-	-	-	-
T-11271	2	4	10	20	20	15	5	5	15	18	5
T-02747	2		20	10	25	5	10	5	15	15	8
M. pensylvanica											
T-02749	5		35	45	35	30	6	6	40	32	6
T-02750			40	35	35	25	7	8	38	30	8
T-02751			30	25	30	15	5	5	28	22	5
T-02752			35	25	30	25	6	4	30	28	5
T-02753	5		35	15	35	35	9	4	25	35	6
T-02754			35	20	25	25	6	3	28	25	4
T-02755			15	25	15	15	3	3	20	15	3
T-02756			25	10	20	25	3	2	18	22	2
T-02757			35	35	35	20	6	4	35	28	5
T-02759		8	20	30	20	45	5	5	25	32	5
T-02760			25	40	25	30	3	6	32	29	4
T-02761	5		30	20	35	15	4	5	25	25	4
T-02762			25	20	20	20	4	2	22	20	3
T-02763			35	50	20	35	6	8	42	28	7
T-02764			30	25	10	25	4	7	28	18	6
T-02765			35	30	25	30	5	6	32	28	6
T-02766			30	35	25	30	7	5	32	28	6
T-02767			20	40	15	20	4	6	30	18	5
T-02768			35	35	20	20	4	5	35	20	4
T-02769		10	35	40	30	30	5	5	38	30	5
T-02770			25	20	25	25	3	3	22	25	3
T-07613			30	20	30	15	5	3	25	22	4

Table 4
(cont.)

Dimensions of newly planted woody plants for sand dune stabilization, 1982

Species/ PI No.	Plant Positions		Height (cm)		Width (cm)		Diameter (mm)		Average Ht. (cm)	Average Width (cm)	Average Diameter (mm)
M. pensylvanica											
T-07638		10	30	20	30	25	7	5	25	28	6
T-09194			15	15	15	15	2	2	15	15	2
T-09195	5		10	10	20	10	2	3	10	15	2
T-09196			25	10	40	10	3	1	18	25	2
T-09197	5	12	15	20	20	30	3	4	18	25	4
T-09198			20	20	5	20	3	3	20	12	3
T-07639			20	45	20	35	4	9	32	28	6
T-09201			20	10	15	5	3	2	15	10	2
T-09202			35	20	35	15	6	3	28	25	4
T-09203		10	20	25	15	15	3	3	22	15	3
T-08398			20	10	15	15	3	2	15	15	2
T-08299			5	5	5	5	2	2	5	5	2
T-08300			15	10	15	20	3	3	12	18	3
T-08301			20	15	25	10	4	4	18	18	4
T-08302			10	20	20	10	8	4	15	15	6
T-11232			15	20	15	5	2	4	18	10	3
T-11233			30	15	20	30	3	3	22	25	3
T-11234			25	20	15	30	3	3	22	22	3
T-11235			40	30	15	25	3	6	25	20	4
T-11236			20	30	15	25	3	6	25	20	4
T-11237			25	15	20	20	4	4	20	20	4
T-11238	5	10	15	25	15	15	3	3	20	15	3
T-11239			20	20	25	10	6	3	20	18	4
T-11240	2	3	45	30	45	35	11	7	38	40	9
T-11275	-	-	-	-	-	-	-	-	-	-	-
T-11231	3	9	15	20	20	20	3	3	18	20	3
T-11241			45	30	30	20	7	6	38	25	6
T-11242			50	35	25	30	7	8	48	32	8
T-11243			45	50	35	30	7	8	48	28	8
T-11244	5		60	35	20	35	7	8	48	28	8
T-11245			55	45	20	30	9	6	50	25	8
T-11266			50	55	30	35	8	10	52	32	9
T-11267			45	25	25	15	7	5	35	20	6
T-11272			65	35	35	30	12	6	50	32	9
T-11273			50	40	30	30	6	7	45	30	6

Table 4
(cont.)

Dimensions of newly planted woody plants for sand dune stabilization, 1982

Species/ PI No.	Plant Positions		Height (cm)		Width (cm)		Diameter (mm)		Average Ht. (cm)	Average Width (cm)	Average Diameter (mm)
M. pensylvanica											
T-12007			40	45	40	45	11	7	42	42	9
T-12008			35	30	35	35	7	10	32	35	8
T-12009			30	40	20	30	7	7	35	25	7
T-12010			20	25	15	25	8	6	22	20	7
T-12011			20	35	25	15	3	5	28	20	4
T-14667	2	-	5	-	5	-	3	-	5	5	3
T-06412	2	4	20	20	20	30	2	5	20	25	4
T-12410			15	15	25	5	2	2	15	15	2
T-12411			10	15	10	20	2	3	12	15	2
T-12012			20	15	25	10	4	5	18	18	4
434153	2	9	15	20	15	10	3	3	18 4/	12 4/	4 4/
434154	3	6	30	10	20	15	4	3	23 4/	27 4/	4 4/
434155			25	20	20	5	6	3	22 4/	12 4/	4 4/
434156	3	5	10	10	10	10	3	3	18 4/	15 4/	6 4/
434157	3	9	10	10	20	15	2	2	22 4/	24 4/	5 4/
T-13170		8	20	10	20	10	5	2	15	15	4
T-13171		10	20	10	20	5	3	2	15	12	2
434150			50	45	25	45	11	9	48	35	10
434151	5		60	45	55	20	8	8	52	38	8
434152		10	55	40	40	40	10	7	48	40	8
434154	2	-	30	-	45	-	5	-	5/	5/	5/
434156	1	-	35	-	25	-	11	-	5/	5/	5/
434157	3	4	30	40	30	30	7	8	5/	5/	5/
434159		10	45	35	35	25	11	5	40	30	8

1/Fifteen or less plants per accession planted from March 26-April 16; data recorded from June 9 to June 28.
2/Except as noted, plant positions are numbers 4 and 11.
3/Stem diameter measured 2 cm above sand line.
4/Average of both rows of this accession.
5/See footnote 4/for average of these accessions.

Table 5

Evaluations of Prunus species for sand dune stabilization, 1982 [1/]

PI No./ Species	Height (cm)	Width (cm)	Stem Diameter (mm)	Vigor	Survival (%)	Insect Damage
Prunus maritima	[2/]	[2/]	[2/]	[3/]		[4/]
T13172	135	200	48	4	100	3
T07614	135	232	46	3	100	2
T07632	120	150	36	4	100	2
T07634	125	158	38	4	100	2
T09192	140	190	36	4	100	2
T09193	148	150	40	4	100	2
T09200	140	168	39	3	100	3
T09204	138	192	42	3	100	2
T11246	140	180	42	3	100	2
T11248	82	152	40	4	100	2
T11249	115	225	38	4	100	2
T11250	125	202	31	5	100	2
T11251	155	220	42	3	100	2
T11252	130	195	38	3	100	3
T11275	178	202	40	3	100	2
T12013	142	225	36	4	100	2
P. serotina						
T13173	180	158	32	4	100	2
T13174	228	215	50	3	87	2
T15504	140	115	27	5	67	2
T13310	225	208	51	3	87	2
T15505	192	205	48	3	100	2
P. virginiana						
T15506	175	105	28	4	100	4
T15507	192	110	36	4	92	5

1/Planted April 1, 1981 Field 5 & 6 Cape May PMC; Height, width, diameter survival and insect damage recorded October 27; Vigor recorded August 3.

2/Average of 2 plants.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

4/Ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very severe; 10=Complete defoliation.

Table 6

Evaluations of *Rosa* species for sand dune stabilization, 1982[1/]

PI No.	Height (cm)	Width (cm)	Vigor [2/]	Fruit Production [3/]	Survival (%)	Insect Damage [4/]
T02786	98	140	5	4	100	2
T02787	78	158	2	6	90	2
T20788	75	138	5	3	100	2
T07078	82	145	4	4	100	2
T07640	80	145	4	5	100	2
T08303	68	120	4	5	100	2
T08304	90	158	3	4	100	2
T08305	68	148	3	5	100	2
T08306	70	152	7	7	100	2
T08307	80	138	5	5	100	2
T08308	75	132	4	3	100	2
T08309	75	120	3	2	100	2
T08310	118	160	3	3	100	2
T08311	95	148	3	3	100	2
T09191	112	152	5	4	100	2
T11254	75	132	4	4	100	2
T11255	98	142	4	5	100	2
T11256	122	152	5	6	100	2
T11257	88	108	6	4	100	2
T11258	100	132	6	4	100	2
T11259	85	135	4	3	100	2
T11260	95	138	3	5	100	2
T11261	90	125	6	5	100	2
T11276	102	130	3	5	100	2
T11277	78	148	6	5	100	2
T11278	122	165	3	5	100	2
T11279	80	148	5	4	100	2
T11280	78	132	5	3	93	2
T11281	70	132	4	3	100	2
T12014	85	140	3	3	93	2
T12015	70	130	4	4	100	2
T12016	62	142	4	4	100	2
T12017	105	160	5	5	100	2
T12018	92	145	3	4	100	2
T15508	92	140	4	4	100	2

Table 6
(cont.)

Evaluations of Rosa species for sand dune stabilization, 1982

PI No.	Height (cm)	Width (cm)	Vigor	Fruit Production	Survival (%)	Insect Damage
T15509	125	160	3	4	93	2
T15510	100	155	2	5	100	2
T15511	92	110	5	2	100	2
T30187	45	55	5	10	13	2
T30188	28	62	4	10	13	2
T30189	25	5	9	10	7	3
T30190	20	38	5	10	40	3
T11282	105	120	8	3	100	2
T15512	105	132	8	3	100	2

1/Planted April 16-27, 1981; fields 5&6 Cape May PMC except T30187 to T30190 which were planted March 26, 1982; vigor recorded August 26; other data recorded October 27.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

3/Ratings are: 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very sparse; 10=None.

4/Ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very severe; 10=Complete defoliation.

Table 7

Evaluations of *Myrica* species for sand dune stabilization, 1982[1/]

Species/ PI No.	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (%)	Amount of Foliage	Insect Damage
Myrica cerifera	[2/]	[2/]	[2/]	[3/]		[4/]	[5/]
T02741	48	45	9	5	67	4	2
T02740	15	20	4	5	14	4	2
T02742	-	-	-	10	0	10	-
T02743	-	-	-	10	0	10	-
T02745	-	-	-	10	0	10	-
T02746	-	-	-	10	0	10	-
T11271	-	-	-	10	0	10	-
T02747	30	32	11	6	53	5	2
M. pensylvanica							
T02749	42	45	9	5	67	5	2
T02750	40	35	10	6	33	6	3
T02751	30	22	7	5	67	5	2
T02752	30	35	6	5	80	6	2
T02753	30	32	10	5	60	5	2
T02754	30	30	6	7	73	6	3
T02755	28	32	6	4	67	5	2
T02756	22	25	4	8	33	7	2
T02757	32	38	8	6	33	6	2
T02759	28	42	7	6	100	5	3
T02760	30	22	5	6	80	5	2
T02761	20	28	5	8	21	8	2
T02762	8	10	2	8	7	9	1
T02763	48	38	10	6	80	5	2
T02764	32	32	9	6	40	5	2
T02765	18	12	4	8	20	9	3
T02766	25	12	4	8	20	8	3
T02767	40	45	10	5	73	4	2
T02768	38	35	8	5	80	6	2
T02769	38	35	10	7	60	6	2
T02770	25	25	6	6	40	6	2
T07613	25	38	9	4	100	4	2
T07638	30	32	8	5	47	6	2
T09194	12	10	2	6	27	7	2
T09195	8	12	2	5	13	7	2

Table 7
(cont.)

Evaluations of *Myrica* species for sand dune stabilization, 1982

Species/ PI No.	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (%)	Amount of Foliage	Insect Damage
T09196	22	32	5	6	27	7	2
T09197	15	20	4	5	33	7	2
T09198	12	22	4	6	27	7	2
T07639	42	32	10	5	67	5	2
T09201	-	-	-	9	13	9	-
T09202	25	25	6	6	40	6	2
T09203	20	22	4	5	13	7	2
T08298	15	22	4	7	40	6	2
T08299	12	15	4	6	53	6	2
T08300	15	25	4	6	47	6	2
T08301	8	8	2	7	20	7	2
T08302	20	20	4	6	27	7	2
T11232	-	-	-	7	20	7	-
T11233	22	20	3	8	13	8	3
T11234	25	25	4	4	80	5	3
T11235	28	28	6	5	87	4	2
T11236	25	32	8	5	53	5	3
T11237	22	22	5	6	60	6	2
T11238	28	22	6	4	80	4	2
T11239	20	18	6	4	7	7	2
T11240	38	45	10	5	57	6	2
T11275	-	-	-	10	0	10	2
T11231	22	22	10	6	13	7	2
T11241	48	45	10	6	67	6	2
T11242	45	35	8	6	80	6	2
T11243	52	40	10	5	80	4	3
T11244	42	28	9	5	80	4	3
T11245	45	32	8	5	87	4	3
T11266	50	38	10	5	73	5	3
T11267	42	32	8	4	93	4	3
T11272	58	42	13	5	93	4	3
T11273	62	35	12	5	93	5	3
T12007	45	40	13	5	87	5	3
T12008	35	40	9	5	100	4	3
T12009	40	25	10	5	73	5	3

Table 7
(cont.)

Evaluations of *Myrica* species for sand dune stabilization, 1982

Species/ PI No.	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Survival (%)	Amount of Foliage	Insect Damage
T12010	28	28	6	6	73	6	2
T12011	30	28	6	6	40	6	3
T14667	-	-	-	10	0	10	-
T06412	18	30	4	7	60	7	2
T12410	15	20	4	5	33	6	2
T12411	18	25	7	5	53	5	2
T12012	22	28	6	6	47	6	2
434153	15	20	7	6	33	6	2
434154	18	27	6	5	38	5	2
434155	25	38	8	5	33	5	2
434156	-	-	-	10	0	10	-
434157	8	10	2	7	22	7	2
T13170	20	25	6	6	15	7	2
T13171	15	22	4	7	7	7	2
434150	62	62	18	2	93	2	2
434151	38	28	8	5	53	5	2
434152	50	50	12	4	53	5	2
434159	32	30	6	7	47	6	2

1/Planted April 5-16 Field 5&6 Cape May PMC. Vigor, survival and amount of foliage recorded August 3; Height, width, diameter and insect damage recorded November 1.

2/Average of two plants; dash (-) indicates no living plants to measure.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

4/Ratings are: 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very sparse; 10=None.

5/Ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very severe.

TIDAL BANK STABILIZATION

Spartina alterniflora on a Tidal Bank

34I018F

FINAL REPORT

During June of 1980, 40 selected accessions of Spartina alterniflora (smooth cordgrass) were established on a sandy beach on the Wye Plantation in Queen Annes County, Maryland. The two upper hills in each row were planted above the normal high tide elevation. Approximately, three meters of beach were left between the planting and the normal low water line. The salt concentration of the water was 8.8 PPT at planting time. A controlled release fertilizer was placed in the planting hole at establishment and a soluble fertilizer was broadcast in late summer.

Very little growth was observed during the first month. PI-421208 appeared to be the outstanding accession. Erosion in Rep I and II was almost nil while Rep III was subjected to severe damage from wave action. Excessive wave action undercut the bank, however, the plant damage seems to be entirely due to abrasion of sand and water.

Between August and mid-November of 1980, a storm occurred which caused moderate damage to Rep I and severe damage to Rep II and Rep III. In Rep I, the debris was deposited nearly 0.5 meter higher than normal. Severe destruction of Rep II was due to the poor stand of existing plants. About 0.5 meter of the semi-vertical bank was lost in Rep III and except for a few subplots, only scattered plants remained.

During June of 1981, 11 kilograms of 10-10-10 fertilizer were applied to each replication. The plots did not fully recover from the winter and regrowth was rated as poor. PI-421208 which was considered outstanding in performance for 1980 was extensively grazed by animals during 1981. T-02816 appeared to be the best accession for 1981.

In 1982, only Reps I and II were evaluated. There was some grazing damage, apparently by cattle, to the northern end of Rep II. The stand density appeared to improve in 1982. Although overall the planting was still sparse, several accessions were quite dense. Rhizomic spread from surviving plants is occurring and in many instances adjacent plots are spreading into each other making evaluation of individual accessions difficult.

Considering the condition of the planting, the difficulty in obtaining accurate data and the amount of data already collected, no more formal evaluations will be made on this planting.

Table 1

Regrowth, stand and protection for [1]
30 *Spartina alterniflora* accessions, 1982

PI No./ Rep	Regrowth	Stand	Beach Protection
T-2804	[2]	[2]	[2]
I	9	9	10
II	-	-	-
T-2808			
I	9	9	9
II	8	7	7
T-2816			
I	7	2	2
II	7	5	5
421140			
I	-	-	-
II	-	-	-
421144			
I	7	8	8
II	7	7	8
421146			
I	9	9	9
II	8	8	9
421153			
I	9	9	9
II	9	8	8
421159			
I	8	7	8
II	-	-	-
421162			
I	9	8	8
II	-	-	-
421163			
I	7	6	7
II	7	5	7

Table 1
(cont.)

Regrowth, stand and protection for
30 *Spartina alterniflora* accessions, 1982

PI No./ Rep	Regrowth	Stand	Beach Protection
421166			
I	7	5	6
II	7	6	8
421167			
I	-	-	-
II	9	9	10
421175			
I	8	9	10
II	8	8	9
421184			
I	-	-	-
II	7	7	6
421185			
I	-	-	-
II	-	-	-
421187			
I	8	8	8
II	-	-	-
421188			
I	-	-	-
II	9	7	9
421198			
I	-	-	-
II	-	-	-
421199			
I	-	-	-
II	-	-	-
421200			
I	-	9	9
II	7	6	8

Table 1
(cont.)

Regrowth, stand and protection for
30 *Spartina alterniflora* accessions, 1982

PI No./ Rep	Regrowth	Stand	Beach Protection
421202			
I	6	4	4
II	7	6	8
421203			
I	-	-	-
II	8	7	9
421208			
I	7	2	2
II	9	7	7
421210			
I	-	-	-
II	7	7	9
421219			
I	8	8	9
II	6	5	7
421221			
I	8	7	9
II	6	5	8
421224			
I	7	8	9
II	8	7	8
421228			
I	-	-	-
II	6	6	7
421230			
I	5	4	6
II	8	8	9
421231			
I	7	9	8
II	-	-	-

1/60 hills established/accession/replication in June 1980; data recorded April 22.
2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead or none.

Table 2

Stand and vigor for 30 *Spartina alterniflora* accessions, 1982[1/]

PI No./ Rep	Stand	Vigor	PI No./ Rep	Stand	Vigor
T-2804	[2/]	[2/]	421166		
I	8	5	I	4	2
II	8	4	II	2	4
T-2808			421167		
I	9	4	I	8	5
II	3	2	II	4	4
T-2816			421175		
I	3	3	I	8	5
II	6	4	II	5	5
421140			421184		
I	6	5	I	9	4
II	10	10	II	4	3
421144			421185		
I	5	5	I	10	10
II	8	5	II	9	5
421146			421187		
I	9	4	I	4	4
II	9	4	II	7	4
421153			421188		
I	5	4	I	9	4
II	6	4	II	7	4
421159			421198		
I	8	5	I	10	10
II	9	5	II	9	5
421162			421199		
I	5	4	I	9	5
II	7	5	II	10	10
421163			421200		
I	5	4	I	6	5
II	2	4	II	3	4

Table 2
(cont.)

Stand and vigor for 30 Spartina alterniflora accessions, 1982

PI No./ Rep	Stand	Vigor	PI No./ Rep	Stand	Vigor
421202			421221		
I	2	2	I	4	5
II	3	4	II	3	3
421203			421224		
I	6	4	I	7	5
II	5	5	II	6	5
421208			421228		
I	2	2	I	10	10
II	5	3	II	5	5
421210			421230		
I	9	5	I	3	3
II	8	4	II	4	4
421219			421231		
I	7	3	I	4	2
II	3	3	II	6	6

1/60 hills established/accession/replication in June 1980; data recorded June 17.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead or none.

Table 3

Best 5 *Spartina alterniflora* accessions 1/
out of 30 growing on a tidal river bank, 1982

	Rep I	Rep II
Best 2/	421208	421166
2nd Best	T-2816	421163
3rd Best	421202	421203
4th Best	421231	421221
5th Best	421230	421202

1/60 hills established/accession/replication in June 1980 at the Wye Plantation in Maryland; data recorded August 11.

2/Rating based on stand, vigor and erosion control.

Table 4

Vigor, erosion control, damage and seedhead stage [1/] for 30 *Spartina alterniflora* accessions on a tidal river bank, 1982

PI No./ Rep	Vigor	Erosion Control	Damage		Seedhead Stage
			Insect	Disease	
T-2804	[2/]	[2/]	[3/]	[3/]	[4/]
I	3	5	1	1	M
II	5	6	1	1	M
T-2808					
I	5	8	1	1	M
II	3	4	1	1	D
T-2816					
I	3	3	1	1	D
II	4	6	1	1	D
421140					
I	4	6	1	2	D
II	10	10	-	-	-
421144					
I	3	4	1	2	D
II	3	7	1	1	D
421146					
I	3	8	1	1	D
II	4	8	1	1	D
421153					
I	4	4	1	1	D
II	4	5	1	1	D
421159					
I	5	5	1	1	D
II	4	5	1	1	D
421162					
I	4	4	1	1	M
II	5	4	1	1	D
421163					
I	4	4	1	1	M
II	2	2	1	1	D
421166					
I	5	6	1	1	D
II	3	2	1	2	D

Table 4
(cont.)

Vigor, erosion control, damage and seedhead stage for 30 *Spartina alterniflora* accessions on a tidal river bank, 1982

PI No./ Rep	Vigor	Erosion Control	Damage		Seedhead Stage
			Insect	Disease	
421167					
I	4	7	1	1	D
II	4	4	1	2	D
421175					
I	4	5	1	1	M
II	4	6	1	1	M
421184					
I	4	8	1	1	M
II	4	6	1	1	D
421185					
I	10	10	-	-	-
II	5	9	1	1	M
421187					
I	5	6	1	1	M
II	3	7	1	1	D
421188					
I	5	7	1	1	M
II	4	6	1	1	M
421198					
I	3	7	1	1	D
II	3	8	1	1	D
421199					
I	3	7	1	1	D
II	10	10	-	-	-
421200					
I	4	5	1	1	M
II	5	4	1	2	D
421202					
I	5	4	1	1	M
II	5	4	1	2	M
421203					
I	4	5	1	2	D
II	5	5	1	2	M

Table 4
(cont.)

Vigor, erosion control, damage and seedhead stage for 30 Spartina alterniflora accessions on a tidal river bank, 1982

PI No./ Rep	Vigor	Erosion Control	Damage		Seedhead Stage
			Insect	Disease	
421208					
I	4	2	1	1	D
II	3	5	1	1	D
421210					
I	3	9	1	1	D
II	3	5	1	1	D
421219					
I	4	7	1	1	M
II	4	4	1	1	D
421221					
I	4	5	1	1	M
II	4	3	1	1	D
421224					
I	4	6	1	2	D
II	5	6	1	1	M
421228					
I	10	10	-	-	-
II	4	6	1	1	M
421230					
I	4	4	5	1	M
II	6	5	1	2	D
421231					
I	5	3	1	1	D
II	5	7	1	1	M

1/60 hills established/accession/replication in June 1980 at the Wye Plantation, Maryland; data recorded September 23.
2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None or Dead.
3/Ratings are - 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.
4/M=Mature seed; D=Dough Stage.

Initial Evaluation of *Solidago sempervirens*

34I023C

The vegetation behind the frontal dune along the mid-Atlantic coast is subject to pest damage. Once a dune becomes stable, *Ammophila breviligulata* (American beachgrass), either planted or volunteer, is the main species on these sites. After a period of time, disease and/or insects tend to inhibit plant vigor and eventually kill entire stands. The lack of adequate cover may cause large "blow outs" and undesirable changes in the dune pattern. While deterioration of *A. breviligulata* is a natural phenomenon, the invasion of long-lived native perennials into the weakened stand of beachgrass is a slow process. Present management techniques do not insure adequate dune cover.

Solidago sempervirens (Seaside goldenrod) is a salt tolerant perennial forb that is often found growing in association with *A. breviligulata*. It is well adapted to the entire dune area along the Atlantic coast growing from the crest of the foredune back through the woody climax vegetation in the back dune area. Plants produce several unbranched stems up to one meter high from short rhizomes and sometimes form open stands in the interdunal area. *S. sempervirens* can be used as a complimentary plant to *A. breviligulata* and other dune species for sand dune stabilization.

An assembly of *S. sempervirens* was made in 1981. Sixty-six accessions were collected as seed and thirty-three as vegetative material from North Carolina to Massachusetts. These were propagated at the National PMC. Failure of some accessions to germinate (due in part to immature seed) reduced this number to seventy-nine accessions which were planted in an observation plot at the Cape May PMC in late spring 1982. Attrition further reduced this number to fifty-six accessions.

Table 1

Survival and vigor for *Solidago sempervirens*, 1982[1/]

PI No. (T-No.)	Number Planted	Number Survived	Vigor	PI No. (T-No.)	Number Planted	Number Surv.	Vigor
30157	20	17	7	27021	4	4	4
27713	12	10	5	27688	15	10	7
27698	6	3	6	27687	7	0	10
30163	20	18	5	27709	4	0	10
27701	10	3	6	2796	8	8	5
30150	11	11	5	27692	11	3	8
27715	11	3	6	27029	20	20	5
27048	20	17	4	27049	20	16	7
27028	20	18	5	27689	2	1	8
2802	12	12	4	27702	3	0	10
30146	7	2	9	27020	6	3	5
27703	5	1	8	30147	20	19	4
27022	15	15	4	27695	8	1	9
27700	6	1	9	30158	20	20	4
27686	15	5	8	27710	3	1	9
27030	20	20	4	30149	20	19	4
27032	20	19	4	27683	19	1	9
30148	7	6	6	27712	8	3	8
27684	11	7	8	27706	6	0	10
27008	3	3	4	27046	4	4	4
30163	5	4	4	30160	20	19	5
27052	20	20	4	27025	20	20	6
30159	20	20	4	27026	20	20	6
30156	20	20	4	27050	8	8	7
27039	20	20	4	27027	7	7	6
27696	9	0	10	27694	5	1	9
27693	8	0	10	27699	3	0	10
27707	5	0	10	30162	20	20	5
27685	10	10	3	27042	20	20	4
27045	20	20	5	27053	20	20	4
27714	11	1	6	2798	4	4	6
27705	8	0	10	30161	20	20	6
27038	20	19	6	27704	12	0	10
27711	3	0	10	30155	16	14	7
27051	8	8	4	27697	10	1	9
2800	3	0	10	27690	11	6	6
27017	13	13	4	27047	20	20	6
27708	9	1	9	27024	20	20	6
2799	4	4	6	27019	2	12	6
27044	20	20	6	30154	20	20	6

Table 1
(cont.)

Survival and vigor for Solidago sempervirens, 1982

1/20 plants or less/accession planted May 28-June 10 in Field 3, Cape May PMC; data recorded July 14.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

Table 2
(cont.)

Evaluations for *Solidago sempervirens*, 1982

PI No.	Vigor 8/17	Vigor 10/21	Foliage Abundance	Leaf Characteristics	Uniformity	Disease Damage	Survival No.
T27021	5	6	4	W	U	3	4
T27688	8	5	-	N	-	-	2
T27687	-	-	-	-	-	-	0
T27709	-	-	-	-	-	-	0
T02796	4	4	3	M	Nu	3	7
T27692	-	-	-	-	-	-	0
T27029	3	2	2	M	Nu	3	20
T27049	4	4	4	W	U	4	10
T27689	6	5	-	W	-	-	1
T27702	-	-	-	-	-	-	0
T27020	5	7	4	W	Nu	2	2
T30147	4	4	2	W	U	2	16
T27695	-	-	-	-	-	-	0
T30158	3	5	3	W	U	4	20
T27710	-	-	-	-	-	-	0
T30149	4	3	4	W	Nu	2	5
T27683	-	-	-	-	-	-	0
T27712	5	3	-	N	-	-	1
T27706	-	-	-	-	-	-	0
T27046	4	4	4	W	U	3	4
T30160	4	4	3	W	U	3	13
T27025	7	8	6	N	H	1	13
T27026	5	6	4	N	Nu	2	18
T27050	5	4	4	W	Nu	2	5
T27027	4	3	4	W	U	2	6
T27694	-	-	-	-	-	-	0
T27699	-	-	-	-	-	-	0
T30162	5	7	5	N	Nu	2	11
T27042	3	5	3	W	U	4	15
T27053	4	5	3	W	U	3	19
T02798	5	3	-	W	-	-	1
T30161	4	4	3	W	U	4	16
T27704	-	-	-	-	-	-	0
T30155	6	4	5	W	Nu	1	5
T27697	-	-	-	-	-	-	0

Table 2

Evaluations for Solidago sempervirens, 1982[1/]

PI No.	Vigor 8/17 [2/]	Vigor 10/21 [2/]	Foliage Abundance [3/]	Leaf Characteristics [4/]	Uniformity [5/]	Disease Damage [6/]	Survival No. [7/]
T30157	6	6	-	W	-	-	1
T27713	5	3	5	N	Nu	1	10
T27698	5	3	7	W	Nu	3	2
T30163	4	5	5	W	Nu	3	17
T27701	4	6	4	W	U	2	2
T30150	4	5	5	W	Nu	3	11
T27715	6	6	-	N	H	-	1
T27048	4	4	3	W	U	4	16
T27028	6	6	5	M	Nu	3	12
T02802	3	6	3	W	U	4	11
T30146	-	-	-	-	-	-	0
T27703	5	6	-	N	-	-	1
T27022	2	5	3	W	U	5	14
T27700	-	-	-	-	-	-	0
T27686	-	-	-	-	-	-	0
T27030	3	6	3	M	U	2	19
T27032	3	4	3	W	U	4	18
T30148	5	4	4	W	U	2	4
T27684	6	7	-	W	-	-	1
T27008	5	7	3	W	U	3	3
T30163	4	3	3	W	U	3	2
T27052	4	5	2	W	U	3	20
T30159	3	5	2	W	U	4	20
T30156	5	5	4	W	U	3	19
T27039	3	5	2	W	U	2	18
T27696	-	-	-	-	-	-	0
T27693	-	-	-	-	-	-	0
T27707	-	-	-	-	-	-	0
T27865	2	3	2	W	U	1	10
T27045	4	4	3	W	U	2	19
T27714	5	4	-	N	-	-	1
T27705	-	-	-	-	-	-	0
T27038	4	4	3	W	Nu	2	18
T27711	-	-	-	-	-	-	0
T27051	3	5	3	M	U	2	8

Table 2
(cont.)

Evaluations for *Solidago sempervirens*, 1982

PI No.	Vigor 8/17	Vigor 10/21	Foliage Abundance	Leaf Characteristics	Uniformity	Disease Damage	Survival No.
T02800	-	-	-	-	-	-	0
T27017	4	5	4	W	Nu	3	11
T27708	-	-	-	-	-	-	0
T02799	7	3	4	W	U	1	2
T27044	5	4	4	W	Nu	1	15
T27690	4	5	4	N	Nu	1	4
T27047	5	5	3	W	U	3	15
T27024	6	5	4	W	U	1	12
T27019	4	6	4	W	Nu	4	7
T30154	4	3	3	W	U	2	19

1/Planted May 28-June 10 in Field 3, Cape May PMC. Leaf characteristics recorded Aug. 17; Foliage abundance, uniformity and disease damage recorded Aug. 31; Survival recorded Oct. 21.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; Dash (-) = Dead.

3/Ratings are: 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very sparse; - = Too few plants to evaluate.

4/Ratings are: W=Wide leaves; N=Narrow leaves; M=Mixture.

5/Ratings are: U=Uniform; Nu=Non-uniform; H=Hybrid.

6/Ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe; - = Too few plants to evaluate.

7/Number of surviving plants, see Table 1 for number planted.

Table 3

Dimensions and development dates for *Solidago sempervirens*, 1982[1/]

PI No.	Height (cm)[2/]	Width (cm)[2/]	Bloom Date[3/]	Maturity Date[3/]	Dormancy Date[4/]
T30157	55	30	10/4	11/2	11/23
T27713	55	70	10/13	12/1	1/11
T27698	35	45	10/13	12/1	1/11
T30163	50	65	9/22	11/2	12/17
T27701	60	40	10/4	11/16	12/7
T30150	45	50	10/13	11/23	12/17
T27715	60	50	10/4	11/9	12/17
T27048	75	60	10/4	11/16	12/17
T27028	75	40	9/22	10/27	12/17
T02802	105	40	9/22	10/27	12/7
T30146	-	-	-	-	-
T27703	65	35	10/4	11/2	11/23
T27022	65	80	9/22	11/2	12/7
T27700	-	-	-	-	-
T27686	-	-	-	-	-
T27030	65	75	10/4	11/9	12/7
T27032	80	60	10/4	11/9	12/17
T30148	60	40	10/4	11/9	12/21
T27684	35	25	10/4	11/9	11/9
T27008	55	60	9/15	10/21	11/23
T30163	70	65	10/4	11/23	12/17
T27052	70	50	10/4	11/9	12/7
T30159	70	65	10/13	11/16	12/17
T30156	60	50	10/13	11/16	12/17
T27039	60	60	9/22	10/27	12/7
T27696	-	-	-	-	-
T27693	-	-	-	-	-
T27707	-	-	-	-	-
T27685	80	50	9/22	11/2	12/17
T27045	60	55	10/4	11/16	12/17
T27714	55	70	10/4	11/9	12/17
T27705	-	-	-	-	-
T27038	55	45	10/4	11/16	12/17
T27711	-	-	-	-	-
T27051	80	60	10/4	11/16	12/17

Table 3
(cont.)

Dimensions and development dates for *Solidago sempervirens*, 1982

PI No.	Height (cm)	Width (cm)	Bloom Date	Maturity Date	Dormancy Date
T27021	20	50	10/17	11/23	12/21
T27688	40	30	10/4	11/16	12/07
T27687	-	-	-	-	-
T27709	-	-	-	-	-
T02796	55	45	10/4	11/9	1/11
T27692	-	-	-	-	-
T27029	55	55	10/13	12/1	1/11
T27049	55	50	10/4	11/9	12/17
T27689	25	40	10/4	11/16	12/17
T27702	-	-	-	-	-
T27020	45	65	9/22	10/21	11/23
T30147	65	55	10/4	11/16	12/17
T27695	-	-	-	-	-
T30158	65	80	10/4	11/16	12/7
T27710	-	-	-	-	-
T30149	50	45	10/13	12/1	12/21
T27683	-	-	-	-	-
T27712	45	65	10/4	11/9	1/11
T27706	-	-	-	-	-
T27046	55	55	10/4	11/9	12/17
T30160	65	50	10/4	11/9	12/17
T27025	50	25	10/4	11/2	12/7
T27026	70	40	9/22	10/27	12/7
T27050	25	40	10/13	12/1	12/21
T27027	45	45	10/13	12/1	1/11
T27694	-	-	-	-	-
T27699	-	-	-	-	-
T30162	60	60	10/4	11/9	12/17
T27042	65	55	10/4	11/9	12/17
T27053	40	50	10/4	11/16	12/7
T02798	45	40	10/4	12/1	12/21
T30161	55	45	10/4	11/9	12/17
T27704	-	-	-	-	-
T30155	30	45	10/21	12/7	1/11
T27697	-	-	-	-	-

Table 3
(cont.)

Dimensions and development dates for Solidago sempervirens, 1982

PI No.	Height (cm)	Width (cm)	Bloom Date	Maturity Date	Dormancy Date
T02800	-	-	-	-	-
T27017	55	60	10/4	11/16	1/11
T27708	-	-	-	-	-
T02799	25	40	11/2	12/21	1/11
T27044	40	55	10/4	11/16	12/17
T27690	60	50	10/13	12/1	12/17
T27047	55	50	10/4	11/16	12/7
T27024	55	35	10/4	11/16	12/17
T27019	45	75	9/22	11/9	12/17
T30154	65	40	10/4	11/23	1/11

1/Planted May 28-June 10 in Field 3, Cape May PMC; Height and width data recorded September 10.

2/Average height and width for the row.

3/Date 50% or more plants are in bloom or have matured fruit.

4/Date 95% dormant, not including winter rosette.

INITIAL EVALUATIONS

Spartina alterniflora for Tidal Bank Stabilization

34I025F, 34I026F, 34I033F

Coastal sound banks and river estuaries which are exposed to storms and tidal action are a severe erosion problem along the mid-Atlantic coast. The problem is acute in the states of Virginia, North Carolina and Maryland and to a lesser extent in Delaware and New Jersey. The Soil Conservation Service has recognized shore erosion as a critical problem for many years. Previous efforts were mainly directed towards engineering structures and transplanting native cordgrasses from nearby marshes along eroding tidal areas.

In 1975, the shore erosion problem was designated as a high priority item for the Cape May PMC service area. The planned action was to be limited to saline waters and was divided into two phases; these being the stabilization of the intertidal zone and vegetation of the beach area above the tidal zone.

S. alterniflora (smooth cordgrass) is the only grass that has potential for stabilizing the intertidal zone of saline waters along the mid-Atlantic coast. In 1977, an assembly of 111 accessions was planted on the PMC. This was planted in a simulated tidal basin excavated in a permeable soil. The plants were flooded twice each week during the summer. The plant growth was rated fair to good in the shallow basin despite the lack of normal tidal cycles of saline water.

Normally, *S. alterniflora* grows in the intertidal zone of saline waters where the grass is subjected to two tidal cycles each day. The conditions are difficult to simulate on an inland site. The available natural sites were either covered with native plants or lacked the security offered at a PMC site.

In the spring of 1982, the 1980 Planting was plowed and disked frequently to kill the rhizomes. The pit was then replanted to the 30 selected accessions. One additional accession, from a site nearby the 1982 Off-center Planting, was added bringing the total to 31. For identification, these yearly plantings in the on-center pits were given project numbers. The 1980 Planting is 34I025F, the 1981 Planting is 34I026F and the 1982 Planting is 34I033F.

Twenty-six (26) accessions were selected for evaluation in 1983. It is planned to add one accession from the 1983 Off-center Planting bringing the total to 27. The 1981 pit will be plowed and replanted to these 27 accessions in 1983.

The objective of this project is to select a vigorous, hardy strain of *S. alterniflora* to plant on the tidal banks of saline streams.

Table 1

Plant residue for Spartina alterniflora after the second winter, 1982[1]

PI Number	Type[2]	Amount[3]	Amount[4]	PI Number	Type	Amount[3]	Amount[4]
421162	U/P	3	4	421185	P	7	5
421184	U/P	4	4	421187	U/P	7	7
421166	U/P	2	4	421224	U	6	4
421163	U/P	2	4	421172	U/P	6	-
421195	U/P	4	-	421230	U/P	4	2
421144	U	6	4	421169	U	4	-
421120	U/P	7	-	421232	U	5	-
421221	U	3	2	421208	U	5	5
421190	U	5	-	421175	U/P	7	8
T-2804	U	4	3	421145	U	7	-
421146	-	10	10	421198	U	5	2
421228	U/P	3	4	421203	U/P	6	5
421210	U/P	4	3	421154	-	10	-
421153	U/P	4	2	421192	P	9	-
T-2808	U/P	3	2	421188	P	8	7
421167	U/P	5	4	421231	U	9	9
421159	P	8	9	421202	-	10	10
421140	U/P	7	6	T-2809	U	9	-
421199	U	6	6	421219	U	8	6
421200	U/P	5	5	T-2816	U	3	2

1/Planted June 3, 1980; data recorded March 12.

2/Ratings are - U=Mostly upright; P=Mostly prone; U/P=About half and half.

3/Ratings are - 1=Excellent; 3=Good; 5=Moderate; 7=Poor; 9=Very Poor; 10=None.

4/Data recorded April 29.

Table 2

Relative amount of regrowth for *Spartina alterniflora* following the second winter, 1982[1/]

PI Number	Date Evaluated					
	3/26[2/]	4/2	4/9	4/20	4/29	5/6
421162	7	5	4	5	3	4
421184	5	4	3	4	2	4
421166	5	3	3	3	2	3
421163	6	5	4	4	1	4
421195	6	6	5	7	-	6
421144	7	7	6	7	3	5
421220	7	8	6	7	-	7
421221	8	6	5	4	3	5
421190	8	7	6	7	-	6
T-2804	4	8	6	6	3	6
421146	10	10	10	10	10	10
421228	3	5	2	3	1	3
421210	2	1	3	2	1	3
421153	5	6	5	7	2	6
T-2808	6	5	6	7	2	5
421167	4	6	7	4	2	4
421159	8	9	9	8	5	7
421140	9	10	10	9	7	9
421199	7	7	7	7	3	7
421200	5	7	8	6	4	5
421185	9	9	5	7	4	6
421187	5	9	7	8	6	5
421224	6	8	8	7	3	6
421172	5	9	7	8	-	8
421230	4	7	6	6	4	6
421169	1	2	2	3	-	3
421232	4	6	6	7	-	5
421208	6	9	9	8	6	8
421175	3	5	4	6	4	6
421145	10	9	9	8	-	7

Table 2
(cont.)
Relative amount of regrowth for
Spartina alterniflora following the second winter, 1982

PI Number	Date Evaluated					
	3/26	4/2	4/9	4/20	4/29	5/6
421198	2	4	3	3	3	4
421203	3	5	6	7	3	5
421154	10	10	10	10	-	10
421192	10	10	10	10	-	10
421188	9	9	9	9	7	8
421231	7	8	9	9	5	9
421202	10	10	10	10	10	10
T-2809	9	10	10	10	-	8
421219	7	8	9	9	4	8
T-2816	7	9	9	8	9	7

1/Planted June 3, 1980.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 3

Evaluations for *Spartina alterniflora* following the second winter, 1982[1]

PI No.	Relative Density	Rhizome Spread[2] (cm)	Row Width[3] (cm)	Residue	Amount of Foliage	Vigor	Stand
	[4]			[5]	[6]	[4]	[4]
421162	2	265	165	1	3	2	1
421184	3	220	145	1	4	2	2
421166	2	310	170	3	5	3	2
421163	3	315	200	1	4	2	2
421144	6	170	110	1	2	2	4
421221	3	320	210	1	2	2	3
T-2804	5	130	85	1	3	2	2
421146	10	0	0	4	10	10	10
421228	2	290	190	1	3	2	1
421210	2	340	190	1	3	2	2
421153	4	220	130	3	3	3	3
T-2808	3	340	160	1	2	2	2
421167	2	230	120	1	2	2	2
421159	6	160	40	2	6	4	5
421140	9	120	50	2	9	6	6
421199	7	140	90	3	5	3	4
421200	4	270	140	3	3	3	2
421185	5	290	140	2	4	3	2
421187	4	210	120	2	4	2	3
421224	5	190	90	1	3	2	4
421230	3	210	95	1	3	3	2
421208	8	80	15	1	7	5	6
421175	6	190	90	2	5	4	4
421198	6	210	130	1	2	2	2
421203	6	160	110	2	2	2	3
421188	7	140	60	2	5	4	7
421231	9	80	10	2	6	5	9
421202	10	0	0	4	10	10	10
421219	9	100	60	3	4	4	7
T-2816	5	180	90	1	3	6	5

1/Planted June 3, 1980; density, spread and width recorded May 18, other data recorded May 13.
2/Maximum rhizome spread from edge to edge in centimeters.
3/Average row width in centimeters.
4/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.
5/Ratings are: 1=Upright; 2=Prostrate and partially decayed; 3=Combination 4=None.
6/Ratings are: 1=Very large amount; 3=Large; 5=Moderate; 7=Little; 9=Very Little; 10=None.

Table 4

Plant residue for Spartina alterniflora after the first winter, 1982[1]

PI Number	Type[2]	Amount[3]	Amount[4]	PI Number	Type	Amount	Amount
421219	U	4	6	421190	U/P	4	-
421162	U/P	6	7	421192	P	8	-
421163	U/P	5	5	421166	U/P	5	7
421220	U/P	3	-	421167	U	5	6
421202	P	3	6	421159	U/P	6	8
421145	U/P	9	-	421175	P	5	7
421154	U	9	-	421185	P	5	6
421195	U	6	-	421228	U	5	3
T-2809	U/P	7	-	T-2804	U	6	5
421184	U/P	3	6	421231	U/P	6	6
421200	U/P	5	4	421208	U	3	1
421187	U/P	6	6	421199	U	4	6
T-2816	U	4	3	421172	U/P	5	-
421230	U	7	6	421144	U	3	2
421232	U/P	6	-	421169	U	5	-
421188	P	5	6	421210	P	4	7
421140	U/P	4	3	T-2808	U/P	4	3
421153	U/P	4	4	421224	U/P	4	4
421146	U	7	5	421198	U	4	4
421203	P	6	2	421221	U	3	2

1/Planted May 27-June 12, 1981; data recorded March 12.

2/Ratings are - U=Mostly upright; P=Mostly prone; U/P=About half and half.

3/Ratings are - 1=Excellent; 3=Good; 5=Moderate; 7=Poor; 9=Very Poor; 10=None.

4/Data recorded April 29.

Table 5

Relative amount of regrowth for *Spartina alterniflora* following the first winter, 1982[1/]

PI Number	Date Evaluated					
	3/26[2/]	4/2	4/9	4/20	4/29	5/6
421219	3	4	4	4	2	4
421162	5	6	5	5	4	5
421163	3	6	4	5	3	5
421220	3	6	4	5	-	4
421202	4	7	5	6	2	4
421145	10	10	10	10	-	10
421154	10	10	10	10	-	10
421195	3	5	4	6	-	5
T-2809	8	10	9	9	-	9
421184	4	5	4	5	2	4
421200	5	5	4	6	3	4
421187	5	8	5	7	5	5
T-2816	8	10	10	9	6	9
421230	7	7	6	8	5	6
421232	6	7	5	7	-	5
421188	5	5	5	6	3	4
421140	4	7	6	5	2	4
421153	6	7	6	6	2	4
421146	9	9	7	7	3	6
421203	5	5	6	6	7	5
421190	10	9	7	9	-	5
421192	10	10	9	10	-	9
421166	7	9	7	7	3	4
421167	9	8	7	8	4	5
421159	5	5	5	5	3	4
421175	2	2	2	3	2	3
421185	10	6	5	5	3	4
421228	7	4	3	5	3	4
T-2804	7	6	5	8	4	4
421231	7	6	6	8	5	5

Table 5
(cont.)

Relative amount of regrowth
for Spartina alterniflora following the first winter, 1982

PI Number	Date Evaluated					
	3/26	4/2	4/9	4/20	4/29	5/6
421208	10	10	8	9	4	8
421199	4	3	3	4	2	3
421172	9	8	6	8	-	5
421144	5	5	4	6	2	4
421169	6	4	3	3	-	3
421210	4	4	3	4	2	4
T-2808	9	9	9	10	9	9
421224	9	9	8	9	5	7
421198	3	3	3	3	2	3
421221	5	3	3	5	3	5

1/Planted May 27-June 12, 1981.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None

Table 6

Measurements of *Spartina alterniflora*, 1982[1/]

PI No.	Leaf Height[2/] (cm)	Row Width[2/] (cm)	Head Height[2/] (cm)	Rhizome Spread[3/] (cm)	Stem Density[4/] (No.)
421219	100	65	160	120	37
421162	65	110	100	185	22
421163	75	160	140	275	30
421202	95	70	130	135	56
421184	120	150	150	355	48
421200	100	120	150	210	47
421187	100	85	145	250	66
T-2816	95	100	175	215	28
421230	90	80	130	160	36
421188	85	95	125	185	34
421140	95	110	130	195	32
421153[5/]	95	120	145	220	31
421146[5/]	65	30	120	90	8
421203	95	100	135	135	37
421166	70	130	115	190	52
421167	80	85	135	115	94
421159	80	90	135	180	66
421175	60	120	80	200	114
421185	75	100	125	160	48
421228	100	135	130	230	72
T-2804	110	125	140	130	70
421231[6/]	70	90	130	180	54
421208[6/]	50	15	100	100	16
421199	65	105	145	170	66
421144	105	125	160	205	46
421210	60	130	80	265	45
T-2808	95	50	150	95	13
421224	110	80	155	145	60
421198	90	130	155	200	56
421221	90	150	150	305	26

1/Planted May 27-June 12, 1981; Leaf height and row width recorded July 20; Head height-Sept. 9-24; Stem density-Sept. 9; Rhizomes spread Nov. 3.
2/Measurement of average area as determined by occular estimate.
3/Maximum spread from edge to edge.
4/Average count of two 30 cm x 30 cm squares.
5/Replanted Spring 1982.
6/Majority of plants removed for other plantings spring 1982.

Table 7

Bloom, dormancy, vigor, amount of foliage and injury for *Spartina alterniflora*, 1982 [1]

PI No.	Bloom Date [2]	Dormancy Date [3]	Vigor May 14 [4]	Vigor July 20	Amount of Foliage [5]	Insect Injury [6]	Disease Injury [6]
421219	8/3	12/14	2	3	4	1	1
421162	8/31	11/23	4	5	4	1	2
421163	8/24	11/23	3	3	3	1	3
421202	8/3	11/30	2	3	4	1	3
421184	7/20	11/23	2	2	3	1	4
421200	7/20	11/23	3	2	4	1	4
421187	7/20	11/23	2	2	5	1	5
T-2816	9/7	11/30	2	4	3	1	3
421230	8/3	11/23	5	4	4	1	3
421188	7/20	11/30	2	3	3	1	5
421140	9/22	11/30	2	5	3	1	2
421153	9/7	11/23	2	5	3	1	3
421146	8/31	12/21	2	5	4	1	5
421203	8/30	11/30	3	3	4	1	4
421166	8/10	11/23	3	4	4	1	3
421167	8/10	12/14	2	4	3	1	2
421159	8/10	12/7	3	3	3	1	3
421175	7/9	11/23	3	5	5	1	5
421185	8/3	11/3	2	5	4	1	4
421228	7/20	11/30	3	3	3	1	2
T-2804	8/3	11/30	2	3	3	1	2
421231	8/10	11/23	4	5	4	1	3
421208	9/14	11/30	4	4	4	1	3
421199	8/10	12/21	3	2	3	1	2
421144	8/31	12/14	3	3	2	1	4
421210	9/14	12/7	3	3	4	2	2
T-2808	8/18	11/30	5	3	3	1	6
421224	8/3	11/30	5	4	3	1	4
421198	8/3	12/14	2	2	2	1	3
421221	8/31	11/30	2	3	3	1	2

1/Planted May 27-June 12, 1981; Foliage and injury data recorded Aug. 31.
2/Date that two or more plants were actively flowering.
3/Date 95% dormant.
4/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.
5/Ratings are: 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very Sparse.
6/Ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Table 8

First year measurements of *Spartina alterniflora*, 1982[1/]

PI No.	Height 7/22 (cm)	Height 9/9	Width 7/22 (cm)	Width 9/9	Head Height (cm)	Stem Density (No.)	Rhizome Spread (cm)
421208	45[2/]	110	30[2/]	75	115[2/]	10[3/]	120[4/]
421144	55	85	15	35	95	6	65
421175	45	55	15	35	60	14	70
421221	50	90	30	60	105	12	125
421228	60	80	25	40	100	19	70
T30166	65	90	30	55	110	13	55
421224	60	85	15	35	110	8	65
421140	45	90	25	50	90	10	75
421184	45	90	20	30	100	12	80
421231	60	70	20	40	90	14	50
421188	40	75	20	50	85	4	30
421203	65	90	25	50	100	15	90
421166	45	85	20	55	85	11	95
T2804	50	75	20	45	90	12	35
421200	45	90	25	50	105	10	70
421185	55	80	20	50	105	14	90
421167	55	80	25	40	95	17	65
421210	40	60	20	40	65	12	90
T2808	40	80	15	40	95	8	80
421163	45	75	20	40	80	8	65
421198	45	80	25	50	90	12	105
421219	65	35	25	30	0	6	35
421153	50	85	25	60	95	14	65
421202	50	70	25	45	90	14	45
421159	40	75	20	50	100	12	80
421162	50	95	20	60	115	20	70
421146	50	80	20	40	100	6	90
421199	40	75	20	40	90	13	65
T2816	45	90	30	50	105	9	45
421187	70	90	30	40	115	10	40
421230	40	75	20	40	85	18	60

1/Planted Cape May PMC June, 1982; Head height recorded September 9-24; stem density recorded September 9; rhizome spread recorded November 4.
2/Measurement of average size as determined by occular estimate.
3/Average count of 2 30 cm x 30 cm squares.
4/Maximum spread from edge to edge.

Table 9

First year evaluations of *Spartina alterniflora*, 1982[1/]

PI No.	Bloom Date [2/]	Dormancy Date [3/]	Vigor 7/22 [4/]	Vigor 11/4 [4/]	Amount of Foliage [5/]	Insect Injury [6/]	Disease Injury [6/]
421208	9-14	12-7	4	4	4	1	2
421144	9-14	12-21	4	3	3	1	2
421175	7-22	12-1	5	5	5	1	2
421221	9-7	12-14	3	3	3	1	2
421228	8-18	12-14	4	4	5	1	2
T30166	8-18	12-14	5	5	4	1	2
421224	8-10	12-1	3	5	4	1	2
421140	9-22	12-14	5	5	4	2	2
421184	8-18	12-1	4	5	3	1	2
421231	7-22	12-7	5	5	5	2	3
421188	8-10	12-14	6	5	5	1	2
421203	8-10	12-1	4	5	4	1	2
421166	8-24	11-17	5	5	3	1	2
T02804	8-10	11-23	4	5	6	1	3
421200	8-10	12-1	4	5	3	1	2
421185	8-18	11-23	4	5	4	1	2
421167	8-18	12-14	4	5	3	1	2
421210	9-14	12-1	5	5	3	1	2
T02808	8-24	12-14	4	5	4	1	2
421163	9-7	12-1	3	5	3	1	3
421198 [7/]	8-18	12-21	4	3	3	1	2
421219 [7/]	None	12-21	4	4	6	1	1
421153	9-7	12-7	4	5	4	1	2
421202	8-3	12-7	3	5	3	1	3
421159	8-10	12-14	4	4	2	1	2
421162	9-7	12-7	4	4	3	1	2
421146	9-14	12-14	5	4	5	1	3
421199	8-18	12-21	4	3	4	1	2
T02816	8-31	12-21	4	4	5	1	2
421187	7-22	12-1	4	5	5	1	3
421230	8-24	11-23	4	5	5	1	2

1/Planted Cape May PMC June 1982. Insect injury recorded July 22; disease injury and amount of foliage recorded September 14.
2/Date 2 or more plants actively flowering.
3/Date 95% dormant.
4/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.
5/Ratings are: 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very sparse.
6/Ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very severe; 10=Complete defoliation.
7/Suffered severe grazing damage and did not produce a seedhead.

SOIL CONSERVATION SERVICE
PLANT MATERIALS CENTER
CAPE MAY COURT HOUSE, NJ

PMC PROJECT PLAN

I. Project Title: Assembly and evaluation of sea oats Uniola paniculata L.

Project No: 34I029C

Sea oats is a perennial, long-lived sand stabilizing grass that is found along the Atlantic and Gulf coasts south of Virginia Beach, Virginia. This grass is slow to establish but is persistent following establishment. It has a dense fibrous root system which makes it an excellent sand binding plant. The abundant foliage on the individual plants make it an important part of the foredune flora within its area of adaptation.

II. Problem:

American beachgrass is the primary grass that is planted for stabilization of sand dunes along the mid-Atlantic coast. Diseases and insects have threatened the effectiveness of this species. Within its area of adaptation, sea oats is a valuable component of the plant community along the foredunes. Poor seedling vigor, slow rate of establishment, slow spreading, poor survival of native transplants and low germination rates have discouraged scientific work with the species. The need exists for an adapted variety of sea oats for use in MLRA 153.

III. Objective:

The objective of this project is to develop and cooperatively release a variety of sea oats for use in Maryland, Virginia and North Carolina within MLRA 153.

This project will be conducted in phases. The first two will involve screening for winter hardy plants in the northern range of the area of adaptation. This is the area where the species is needed most. The final phase will encompass a full assembly and comprehensive evaluation.

IV. Literature Review: Attachment 1.

V. Procedure:

A. Phase I - Use existing plants of 3 accessions collected in Virginia now in F-1. 1982-85.

1. Start 35 plants of each accession in 1 quart pots.

a. Date - December (after killing frost but prior to 28°F soil temperature).

b. Maintain potted plants in greenhouse during winter.

c. Keep temperatures depressed to 40-45°F for 2 months.

2. Leave remaining plants in F-1 to overwinter.

a. Check for spring regrowth.

b. Evaluate winter survival - May.

c. Maintain any surviving plants.

3. Establish new plantings with greenhouse material:

a. Sites
   (1) PMC - F-1
   (2) Wildwood, NJ
   (3) Ft. Miles, DE

b. Date - May, 1983

c. Spacing - Single row - 3.5 feet between rows; 2 feet within row.

d. No. - 10 plants/accession/site.

e. Accessions - 3

4. Evaluations - All living plants from Nos. 2 and 3 above:

a. 1983
   (1) Survival - No.
      (a) June
      (b) Aug.

   (2) Vigor (1-10)
      (a) June
      (b) Aug.

   (3) Plant dimensions
      (a) H x W (cm)
      (b) Sept.

   (4) Culm production (No.)

   (5) Amount of foliage (1-10)

b. 1984
   (1) Survival - No.
      (a) May
      (b) July
      (c) Sept.

(2) Regrowth
(a) Amount (1-10)
(b) May

(3) Vigor (1-10)
(a) June
(b) Aug.

(4) Flowering date

(5) Plant dimensions
(a) H x W (cm)
(b) Sept.

(6) Culm production (No.)

(7) Amount of foliage (1-10)

5. Initial Selection

Use winter hardy plants for phase II.

B. Phase II - 1982-86

1. Collect seed from Virginia Beach and Delmarva peninsula.

a. Split seed lots into two equal parts.

b. Germinate seed in greenhouse.
(1) Jan. 1983 - Lot 1
(2) Jan. 1984 - Lot 2

c. Grow plants in $2\frac{1}{2}$ inch peat pots filled with sand.

2. Recollect seed during second year.

3. Planting Plan

a. Sites - Adjacent to phase I.
(1) PMC
(2) Wildwood, NJ
(3) Ft. Miles, DE

b. Accessions - As many as possible.

c. No. of plants
(1) Wildwood, Ft. Miles - 25
(2) PMC - Remainder of plants.

d. How: Potted ($2\frac{1}{4}$X)

e. Spacing
(1) Single row/accession
(2) 2 feet between plants
(3) 3.5 feet between rows

f. Planting Dates
   (1) May 83
   (2) May 84

4. Evaluations

   a. As in A-4 above.

   b. 1983

   c. 1984

   d. Use PM Form 60.

5. Management

   a. Fertilizer
      (1) On Center - 500 lb. 10-10-10/A plus 30# N/A.
      (2) Off-center - 30 grams of slow release fertilizer/hill at planting time.

   b. Irrigation - on center; Use supplemental water as needed for sustained growth.

   c. Pest Control - Use chemical and mechanical means to control weeds, disease and insects.

   d. Move plants from PMC field to greenhouse.
      (1) Accessions - all (from PMC only)
      (2) No. - 85 plants/accession
      (3) Method - Randomly select plants from plots; may subdivide hills.
      (4) How - Pot into 1 quart containers.
      (5) When:
         (a) Dec. 1983
         (b) Dec. 1984
      (6) Maintain as in Phase I.
      (7) Replant greenhouse overwintered plants.
         (a) Sites
            i. Ft. Miles, DE
            ii. Assateague Island, MD
            iii. Accomack Co, VA

         (b) No. of plants:
            25/accession/site

         (c) When:
            i. May 84
            ii. May 85

C. Phase III - Full scale evaluation 1983-88

1. Assembly - 1983 & 1984
   a. Number - 90
      (1) Maryland - 5
      (2) Virginia - 25
      (3) North Carolina - 30
      (4) South Carolina - 20
      (5) Georgia - 10

   b. Sites - Sand dunes.

   c. Type
      (1) Seed
         (a) Preferred
         (b) Several seedheads/site

      (2) Vegetative - Collect 25 culms per site if seed not ripe.

2. Planting Plan
   a. Locations
      (1) Virginia Beach, VA
      (2) Accomack Co., VA

   b. Plot layout - Single row, non-replicated design.

   c. Row size - 50 feet

   d. Row spacing - 3.5 feet

   e. Plant spacing - 1 foot

   f. Planting stock - Potted plants (3 months old) - started in greenhouse.

   g. Planting date - May 15, 1984

3. Management
   a. Site - Select stable sandy area with minimum amount of vegetation.

   b. Fertilizer
      (1) Initial
         i. 30 grams slow release/hill at planting time.
         ii. 500 lbs/A of 10-10-10 broadcast in July.

      (2) Maintenance
         i. 750 lbs/A 10-10-10 - May 1.
         ii. 500 lbs/A 10-10-10 - July 1.

   c. Pest Control
      (1) Weeds - Hand weed as necessary.
      (2) Insects - Use chemical control to prevent seedhead damage.

4. Evaluations:

   a. Use PM-60 (Attachment 2).

   b. Additional factors as appropriate.

5. Selections:

   Select superior strains based on winter hardiness, seed production, sand cover, insect and disease resistance and spreading ability.

6. Initial Increase:

   Those accessions selected for advanced evaluations will be increased from material on initial evaluation site.

7. Advanced Evaluation:

   a. This plan will be amended to reflect updated knowledge and use of the species before making advanced plantings.

   b. Sites
      1 north and 1 south of initial evaluation site.

   c. Replications - 2

   d. Evaluations - More detailed.

8. Release:

   The superior hardy strain adapted to mid-Atlantic coastal dunes will be cooperatively released by SCS and other interested agency(ies).

Spartina alterniflora - Reed Property

34I031F

On June 2 and 3, 1982, this Spartina alterniflora (smooth cordgrass) planting was installed at Wilmers Point, Maryland, Queen Anne County on the Adrian Reed Property. This planting consists of two replications; Rep I is on a western exposure and Rep II on a northern exposure. Rep II has less beach than Rep I and is the harsher site. Thirty selected accessions, plus one native accession (T-30166) selected near the site, were planted on the sandy and gravelly beach. A controlled release fertilizer was placed in the planting holes at establishment. At high tide, all of the plants are in the water.

Early evaluations were hampered by very high tides but it was evident that the plants in Rep I were doing better than those in Rep II. In September, the planting suffered grazing damage, probably by geese. This varied from slight to severe depending on the plot location, but Rep II was the more severely damaged. There was a significant amount of sand and gravel accumulation on most plots. By mid-November, at least one-half of Rep II was washed out. Rep I, however, was in very good shape. The best accessions vary with evaluation date, but PI-421228 and PI-421203 have exhibited excellent performance.

Table 1

Plant height, width, survival, vigor and erosion control for 31 *Spartina alterniflora* accessions, 1982[1/]

PI No./ Rep	Leaf Height (cm)		Plant Width (cm)		Survival Number	Survival Percent	Vigor	Erosion Control
T-2804							4[2/]	4[2/]
I	40	60	35	50	29	72		
II	50	40	45	35	24	60	5	5
Ave.	48		41					
T-2808								
I	60	45	30	45	23	58	3	7
II	60	70	30	35	23	58	5	4
Ave.	59		35					
T-2816								
I	30	60	25	35	25	62	5	7
II	80	70	50	50	24	60	3	3
Ave.	60		40					
T-30166								
I	60	40	50	30	35	88	4	5
II	50	50	35	40	25	62	3	3
Ave.	50		39					
421140								
I	60	40	70	45	26	65	4	5
II	70	40	40	50	23	58	4	4
Ave.	52		51					
421144								
I	50	40	40	25	19	48	4	7
II	55	50	30	25	17	42	5	7
Ave.	49		30					
421146								
I	40	55	25	40	25	62	3	7
II	50	35	35	35	17	68	4	5
Ave.	45		34					
421153								
I	55	50	35	50	13	32	4	7
II	30	40	35	25	9	22	5	8
Ave.	44		36					
421159								
I	45	35	50	40	28	70	3	5
II	40	20	35	25	14	35	6	5
Ave.	35		38					

Table 1
(cont.)

Plant height, width, survival, vigor
and erosion control for 31 *Spartina alterniflora* accessions, 1982

PI No./ Rep	Leaf Height (cm)		Plant Width (cm)		Survival Number	Survival Percent	Vigor	Erosion Control
421162								
I	60	55	50	50	38	95	3	5
II	40	70	35	45	16	40	5	5
Ave.	56		45					
421163								
I	50	60	40	45	15	38	3	4
II	60	70	40	45	33	82	4	3
Ave.	60		42					
421166								
I	50	60	40	40	29	72	3	4
II	55	60	55	60	35	88	3	2
Ave.	56		49					
421167								
I	40	60	30	45	33	82	4	4
II	35	35	30	25	12	30	4	6
Ave.	42		32					
421175								
I	60	30	40	25	22	55	3	6
II	20	25	20	25	19	48	5	6
Ave.	34		28					
421184								
I	60	70	40	50	25	62	4	5
II	40	90	35	40	14	35	5	7
Ave.	65		41					
421185								
I	55	60	30	40	27	68	3	5
II	80	60	60	45	22	55	5	5
Ave.	64		44					
421187								
I	70	40	40	20	29	72	3	6
II	80	75	30	50	22	55	4	5
Ave.	66		35					
421188								
I	60	60	45	50	23	58	2	3
II	30	40	30	20	7	18	6	7
Ave.	48		36					

Table 1
(cont.)

Plant height, width, survival, vigor
and erosion control for 31 *Spartina alterniflora* accessions, 1982

PI No./ Rep	Leaf Height (cm)		Plant Width (cm)		Survival Number	Survival Percent	Vigor	Erosion Control
421198								
I	35	30	40	40	6	15	4	8
II	30	40	30	30	10	25	6	8
Ave.	34		35					
421199								
I	50	35	35	30	27	68	3	5
II	40	40	25	35	25	62	5	4
Ave.	41		34					
421200								
I	65	65	40	60	31	78	3	4
II	90	80	40	40	29	72	4	3
Ave.	75		45					
421202								
I	80	90	50	55	28	70	3	4
II	50	40	30	30	15	38	5	6
Ave.	65		41					
421203								
I	45	60	45	65	37	92	3	4
II	55	50	55	45	37	92	3	2
Ave.	52		52					
421208								
I	50	60	40	45	37	92	3	5
II	45	50	35	40	14	35	4	6
Ave.	51		40					
421210								
I	35	25	35	20	25	62	5	6
II	10	30	15	30	12	30	7	8
Ave.	25		25					
421219								
I	60	60	30	40	29	72	4	5
II	45	30	35	30	17	42	5	6
Ave.	49		34					
421221								
I	35	40	40	50	25	62	4	4
II	40	50	40	30	15	30	5	5
Ave.	41		40					

Table 1
(cont.)

Plant height, width, survival, vigor
and erosion control for 31 *Spartina alterniflora* accessions, 1982

PI No./ Rep	Leaf Height (cm)		Plant Width (cm)		Survival Number	Survival Percent	Vigor	Erosion Control
421224								
I	100	60	30	50	35	88	3	5
II	50	40	40	40	32	80	4	4
Ave.	62		40					
421228								
I	65	95	60	45	30	75	2	2
II	60	50	40	20	13	32	5	7
Ave.	68		41					
421230								
I	80	40	40	30	21	52	3	6
II	65	60	30	30	20	50	4	5
Ave.	61		32					
421231								
I	45	35	50	30	26	65	4	5
II	25	25	30	25	14	35	6	8
Ave.	32		34					

1/40 hills/accession/replication (except 421146 in Rep-II has 25) planted June 3 at Wilmers Point, Maryland; data recorded August 12.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 2

Best five out of thirty-one *Spartina alterniflora* accessions planted on a tidal river bank, 1982[1/]

	R-I	R-II
Best	421228	421166
2nd Best	421188	421203
3rd Best	421200	T-2816
4th Best	421162	T-30166
5th Best	421199	421163

1/40 hills/accession/replication (except 421146 in Rep II has 25) planted June 3 at Wilmers Point, Maryland; data recorded August 12.

2/Ratings based on number of plants, amount of foliage, vigor and erosion control.

Table 3

Culms per hill for 31 *Spartina alterniflora* accessions, 1982[1/]

PI No./ Rep	Culms/Hill (No.)			Average/ Rep.	Average/ Accession
T-2804	[2/]				
I	30	13	45	29	
II	36	25	22	28	28
T-2808					
I	9	21	13	14	
II	20	21	31	24	19
T-2816					
I	7	6	11	8	
II	19	14	7	13	11
T-30166					
I	17	16	22	18	
II	30	31	3	21	20
421140					
I	13	9	16	13	
II	18	13	38	23	18
421144					
I	12	13	28	18	
II	4	14	8	9	13
421146					
I	11	9	15	12	
II	29	10	35	25	18
421153					
I	14	31	5	17	
II	8	7	11	9	13
421159					
I	2	11	9	7	
II	10	16	3	10	8
421162					
I	18	23	7	16	
II	19	8	2	10	13
421163					
I	66	37	43	49	
II	18	15	14	16	32

Table 3
(cont.)

Culms per hill for 31 Spartina alterniflora accessions, 1982

PI No./ Rep	Culms/Hill (No.)			Average/ Rep.	Average/ Accession
421166					
I	27	26	23	25	
II	24	16	21	20	23
421167					
I	13	10	17	13	
II	5	2	6	5	9
421175					
I	22	21	11	18	
II	8	6	4	6	12
421184					
I	16	28	25	23	
II	18	6	29	18	20
421185					
I	16	19	12	16	
II	23	8	9	13	14
421187					
I	24	42	26	31	
II	28	15	18	20	26
421188					
I	32	24	20	25	
II	4	7	4	5	15
421198					
I	15	20	117	51	
II	9	7	1	6	28
421199					
I	13	17	29	20	
II	7	14	15	12	16
421200					
I	31	23	30	28	
II	24	17	34	25	26
421202					
I	32	26	19	26	
II	15	12	14	14	20

Table 3
(cont.)

Culms per hill for 31 Spartina alterniflora accessions, 1982

PI No./ Rep	Culms/Hill (No.)			Average/ Rep.	Average/ Accession
421203					
I	16	32	16	21	
II	16	14	9	13	17
421208					
I	16	7	7	10	
II	24	16	12	17	14
421210					
I	19	7	15	14	
II	3	4	1	3	8
421219					
I	15	5	12	11	
II	5	3	5	4	8
421221					
I	13	10	17	13	
II	14	14	31	20	16
421224					
I	24	20	20	21	
II	15	11	15	14	18
421228					
I	59	29	67	52	
II	3	7	7	6	29
421230					
I	31	17	43	30	
II	12	22	7	14	22
421231					
I	20	21	17	19	
II	2	5	3	3	11

1/Planted June 3 at Wilmers Point, Maryland; data recorded September 23.

2/The 3rd hill from the top in rows 1, 3 and 5 were counted, or if missing, the nearest hill to this location.

Table 4

Vigor, foliage, injury and erosion control for 1/ thirty-one *Spartina alterniflora* accessions, 1982

PI NO./ Rep	Vigor	Amount of Foliage	Animal Injury	Erosion Control
	2/	3/	4/	2/
T-2804				
I	5	3	2	3
II	4	6	7	5
T-2808				
I	4	5	3	5
II	4	4	3	3
T-2816				
I	3	6	3	6
II	4	6	7	5
T-30166				
I	3	4	2	4
II	3	6	8	6
421140				
I	3	5	2	4
II	4	4	4	3
421144				
I	3	6	3	6
II	4	7	6	7
421146				
I	4	5	3	5
II	4	6	7	5
421153				
I	3	5	2	4
II	4	7	6	6
421159				
I	4	4	2	4
II	4	7	6	6
421162				
I	4	4	2	3
II	4	6	7	5
421163				
I	4	3	4	3
II	4	3	5	3

Table 4
(cont.)

Vigor, foliage, injury and erosion control for 1/ thirty-one *Spartina alterniflora* accessions, 1982

PI No./ Rep	Vigor	Amount of Foliage	Animal Injury	Erosion Control
421166				
I	4	3	4	2
II	5	6	8	4
421167				
I	3	4	4	3
II	4	7	6	7
421175				
I	3	5	2	5
II	7	9	3	9
421184				
I	4	4	2	4
II	4	7	7	7
421185				
I	4	5	3	4
II	4	5	3	4
421187				
I	4	4	2	4
II	4	4	3	4
421188				
I	4	3	4	2
II	4	9	5	9
421198				
I	3	6	5	6
II	4	8	8	9
421199				
I	3	4	2	4
II	4	6	7	6
421200				
I	3	3	2	3
II	4	4	6	3
421202				
I	4	4	3	4
II	4	7	8	6

Table 4
(cont.)

Vigor, foliage, injury and erosion control for thirty-one Spartina alterniflora accessions, 1982

PI No./ Rep	Vigor	Amount of Foliage	Animal Injury	Erosion Control
421203				
I	4	3	2	3
II	4	4	6	3
421208				
I	3	4	2	4
II	4	7	8	7
421210				
I	3	6	3	6
II	4	8	5	7
421219				
I	3	5	5	4
II	4	7	6	7
421221				
I	3	4	5	4
II	4	4	5	4
421224				
I	3	4	3	4
II	4	5	7	4
421228				
I	3	1	3	2
II	5	7	6	7
421230				
I	4	5	4	4
II	4	6	7	5
421231				
I	4	5	6	4
II	7	9	3	9

1/Planted June 3 at Wilmers Point, Maryland; data recorded September 23.
2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.
3/Ratings are - 1=Very Large; 3=Large; 5=Moderate; 7=Little; 9=Very Little.
4/Ratings are - 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very severe.

Table 5

Characteristics of 31 Spartina alterniflora accessions growing on a tidal bank, 1982[1/]

PI No./ Rep	Survival	Vigor	Percent Dormancy	Seed Production	Erosion Control
	[2/]	[3/]		[4/]	[3/]
T-2804					
I	28	5	45	2	3
II	13	7	95	9	7
T-2808					
I	18	5	15	9	5
II	16	6	40	8	6
T-2816					
I	10	5	15	7	6
II	13	7	100	10	7
T-30166					
I	24	5	15	5	5
II	17	6	60	10	8
421140					
I	17	5	20	7	5
II	16	5	55	8	5
421144					
I	11	3	5	10	8
II	12	7	95	10	8
421146					
I	18	4	10	9	6
II	0	10	-	-	-
421153					
I	14	5	15	8	7
II	0	10	-	-	-
421159					
I	20	4	10	5	5
II	0	10	-	-	-
421162					
I	27	5	30	5	4
II	0	10	-	-	-
421163					
I	17	6	50	6	3
II	24	5	50	8	4

Table 5
(cont.)

Characteristics of 31 *Spartina alterniflora* accessions growing on a tidal bank, 1982

PI No./ Rep	Survival	Vigor	Percent Dormancy	Seed Production	Erosion Control
421166					
I	26	5	30	4	5
II	28	7	90	8	6
421167					
I	24	4	10	6	5
II	0	10	-	-	-
421175					
I	21	5	15	6	6
II	0	10	-	-	-
421184					
I	22	5	30	4	4
II	0	10	-	-	-
421185					
I	19	5	35	8	6
II	8	7	75	9	9
421187					
I	21	4	20	4	5
II	12	7	85	10	7
421188					
I	23	5	30	5	4
II	0	10	-	-	-
421198					
I	8	7	30	10	9
II	0	10	-	-	-
421199					
I	24	4	15	5	4
II	0	10	-	-	-
421200					
I	29	4	30	5	3
II	19	5	65	7	6
421202					
I	26	5	30	6	4
II	0	10	-	-	-

Table 5
(cont.)

Characteristics of 31 *Spartina alterniflora* accessions growing on a tidal bank, 1982

PI No./ Rep	Survival	Vigor	Percent Dormancy	Seed Production	Erosion Control
421203					
I	37	5	40	3	2
II	28	6	75	9	5
421208					
I	30	5	25	8	5
II	9	8	80	10	9
421210					
I	9	4	10	9	7
II	0	10	-	-	-
421219					
I	20	6	10	10	6
II	0	10	-	-	-
421221					
I	19	4	10	10	5
II	11	7	50	10	8
421224					
I	27	4	15	9	6
II	19	8	95	10	9
421228					
I	28	5	40	3	2
II	0	10	-	-	-
421230					
I	16	6	25	9	8
II	0	10	-	-	-
421231					
I	16	5	30	5	5
II	0	10	-	-	-

1/Planted June 3 at Wilmers Point, Maryland; data recorded November 18.
2/Number of surviving hills out of 40 planted.
3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 10=Dead or None.
4/Ratings are - 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 10=None.

Table 6

Rhizome spread for 31 *Spartina alterniflora* accessions, 1982[1/]

PI No./ Rep	Rhizome Spread 1 (cm)	2 (cm)	3 (cm)	Ave. (cm)
T-2804				
I	30[2/]	15	20	22
II	10	10	15	12
T-2808				
I	10	15	15	13
II	20	10	20	17
T-2816				
I	15	10	10	12
II	10	15	30	18
T-30166				
I	15	20	15	17
II	15	10	20	15
421140				
I	15	10	15	13
II	25	15	25	22
421144				
I	10	15	25	17
II	20	25	20	22
421146				
I	20	15	25	20
II	0	0	0	0
421153				
I	20	25	10	18
II	0	0	0	0
421159				
I	20	35	5	20
II	0	0	0	0
421162				
I	15	20	15	17
II	0	0	0	0
421163				
I	35	30	20	28
II	10	10	30	17

Table 6
(cont.)

Rhizome spread for 31 Spartina alterniflora accessions, 1982

PI No./ Rep	Rhizome Spread 1 (cm)	2 (cm)	3 (cm)	Ave. (cm)
421166				
I	20	25	30	25
II	25	20	10	18
421167				
I	20	15	15	17
II	0	0	0	0
421175				
I	35	25	20	27
II	0	0	0	0
421184				
I	45	30	20	32
II	0	0	0	0
421185				
I	15	25	10	17
II	10	15	15	13
421187				
I	35	20	20	25
II	20	5	20	15
421188				
I	30	25	20	25
II	0	0	0	0
421198				
I	10	15	20	15
II	0	0	0	0
421199				
I	30	20	35	28
II	0	0	0	0
421200				
I	25	30	35	30
II	30	25	30	28
421202				
I	20	25	15	20
II	0	0	0	0

Table 6
(cont.)

Rhizome spread for 31 Spartina alterniflora accessions, 1982

PI No./ Rep	Rhizome Spread 1 (cm)	2 (cm)	3 (cm)	Ave. (cm)
421203				
I	20	25	20	22
II	20	25	10	18
421208				
I	15	10	10	12
II	10	10	20	13
421210				
I	10	10	15	12
II	0	0	0	0
421219				
I	15	10	15	13
II	0	0	0	0
421221				
I	15	15	20	17
II	5	15	20	13
421224				
I	25	25	35	28
II	25	5	10	13
421228				
I	35	30	25	30
II	0	0	0	0
421230				
I	15	10	45	20
II	0	0	0	0
421231				
I	20	25	20	22
II	0	0	0	0

1/Planted June 3 at Wilmers Point, Maryland; data recorded November 18.
2/The 3rd hill from the top in rows 1, 3 and 5 was measured or if missing, the nearest hill to this location.

Table 7

Best five out of thirty-one *Spartina alterniflora* accessions growing on a tidal bank, 1982[1/]

	Rep I	Rep II
Best	421203	421163
2nd Best	421228	421203
3rd Best	421200	421200
4th Best	421166	421166
5th Best	T-02804	421140

1/Planted June 3 at Wilmers Point, Maryland; rated November 18.

Pine Crosses USDA-NJ-SCS

34I035W

Pinus rigida (pitch pine) is a hardy yellow pine that grows as far north as Maine. However, its rate of growth and form are poorer than P. taeda L. (loblolly pine). Foresters have been interested in the possibility of combining P. taeda's rate of growth and form with P. rigida's winter hardiness. The study started in 1963 by the Northeastern Forest Experiment Station and WESTVACO assisted by other interested agencies.

Test plantings of hybrids between selected clones of P. rigida and P. taeda have been made. Not only do certain hybrids combine P. taeda's rate of growth and form with P. rigida's winter hardiness, but their fibrous root system apparently permits rapid growth on droughty sites or strip-mined areas.

The Cape May PMC became involved in 1982 with the establishment of a test plot of the P. rigida P. taeda hybrid as a demonstration project at the center. The greenhouse grown crosses were planted on the center during April. Within two weeks, many of the needles had turned brown, particularly near the bottom of each plant. It is suspected that the plants were not properly hardened off after removal from the greenhouse. Survival, vigor, growth rate and winter hardiness are the factors being evaluated.

Table 1.--Survival, average and maximum heights of surviving trees 4 growing seasons after 1972 planting in Greenbrier County, West Virginia[1/]

Stock	Geographic source	Survival	Average height	Maximum height
		Percent	Feet (Meters)	Feet (Meters)
Maryland loblolly	Maryland	38	2.5 (0.76)	4.7 (1.43)
New Lisbon pitch	Mixed orchard clones	95	3.1 (0.94)	6.6 (2.01)
63 X 23	N. J. X Md.	88	3.1 (0.94)	5.7 (1.74)
65 X 11-20	N. J. X S. C.	62	3.2 (0.98)	5.6 (1.71)
65 X 11-10	N. J. X S. C.	87	3.4 (1.04)	6.0 (1.83)
64 X 11-10	N. J. X S. C.	77	3.5 (1.07)	7.0 (2.13)
54 X 11-20	Va. X S. C.	78	3.6 (1.10)	5.7 (1.74)
58 X 11-20	W. Va. X S. C.	90	3.6 (1.10)	5.4 (1.65)
	(etc. through 24 clonal crosses)			
75 X 23	N. H. X Md.	97	4.8 (1.46)	6.5 (1.98)
60 X 7-56	Pa. X S. C.	83	4.9 (1.49)	7.0 (2.13)
71 X 15A	Mass. X Md.	98	5.0 (1.52)	7.5 (2.29)
70 X 23	Pa. X Md.	100	5.0 (1.52)	6.8 (2.07)
62 X 11-9	N. Y. X S. C.	98	5.0 (1.52)	6.6 (2.01)
77 X 22	N. H. X Md.	98	5.2 (1.58)	7.7 (2.35)
62 X 7-56	N. Y. X S. C.	97	5.4 (1.65)	7.6 (2.32)
77 X 4-32	N. H. X Md.	97	5.8 (1.77)	9.4 (2.86)

1/Information compiled and published by S. Little and I.F. Trew

Table 2.--Survival, average and maximum heights of surviving trees 3 growing seasons after 1973 planting in Ocean County, New Jersey[1/]

Stock	Geographic source	Survival	Average height	Maximum height
		Percent	Feet (Meters)	Feet (Meters)
54 X 7-56	Va. X S. C.	52	2.68 (0.82)	5.0 (1.52)
New Lisbon pitch	Mixed orchard clones	100	2.87 (0.87)	4.7 (1.43)
56 + 57 OP[2/]	W. Va. X ?	100	2.90 (0.88)	4.1 (1.25)
Korean pitch X loblolly	Unknown	95	3.07 (0.94)	5.9 (1.80)
76 X 23	N. H. X Md.	100	3.25 (0.99)	5.4 (1.65)
54 X 11-9	Va. X S. C.	98	3.26 (0.99)	5.1 (1.55)
(etc. through 14 more clonal crosses and loblolly 24 OP)				
78 X 15A	Maine X Md.	100	4.35 (1.33)	6.5 (1.98)
65 X 23	N. J. X Md.	92	4.43 (1.35)	6.2 (1.89)
62 X 11-10	N. Y. X S. C.	96	4.50 (1.37)	6.1 (1.86)
VDF loblolly	Virginia	95	4.53 (1.38)	7.0 (2.13)
62 X 7-56	N.Y. X S. C.	97	4.66 (1.42)	7.3 (2.22)
Loblolly	Maryland	100	4.72 (1.44)	6.9 (2.10)

1/Information compiled and published by S. Little and I.F. Trew
2/Open-or wind-pollinated pitch clones in orchard.

Table 3--Survival, average and maximum heights of surviving trees 3 growing seasons after 1973 planting in Cecil County, Maryland[1/]

Stock	Geographic source	Survival	Average height	Maximum height
		Percent	Feet (Meters)	Feet (Meters)
68 X 23	Pa. X Md.	100	1.94 (0.59)	5.8 (1.77)
58 X 4-32	W. Va. X Md.	100	2.17 (0.66)	4.5 (1.37)
54 X 11-10	Va. X S. C.	70	2.53 (0.77)	5.1 (1.55)
VDF[2/] pitch	Virginia	98	2.59 (0.79)	4.5 (1.37)
58 X 11-20	W. Va. X S. C.	100	2.85 (0.87)	6.6 (2.01)
New Lisbon pitch	Mixed orchard clones	97	2.86 (0.87)	5.3 (1.62)
56 + 57 OP	W. Va. X ?	95	3.34 (1.02)	4.8 (1.46)
78 X 22	Maine X Md.	93	3.37 (1.03)	5.7 (1.74)
Korean pitch X loblolly	Unknown	100	3.43 (1.05)	5.9 (1.80)
(etc. through 28 more clonal crosses[3/]				
62 X 7-56	N. Y. X S. C.	100	4.81 (1.47)	8.0 (2.44)
76 X 4-32	N. H. X Md.	100	4.82 (1.47)	8.0 (2.44)
78 X 19	Maine X Md.	100	4.86 (1.48)	6.9 (2.10)
VDF[2/] loblolly	Virginia	100	4.88 (1.49)	7.1 (2.16)
65 X 22	N. J. X Md.	100	5.05 (1.54)	7.6 (2.32)
76 X 22	N. H. X Md.	100	5.07 (1.55)	7.2 (2.19)
54 X 7-56	Va. X S. C.	97	5.14 (1.57)	8.6 (2.62)
Loblolly 24 OP	Md. X ?	100	5.30 (1.62)	7.3 (2.22)

1/Information compiled and published by S. Little and I.F. Trew
2/Seed supplied by Virginia Division of Forestry.
3/And Maryland loblolly, last had average height of 4.28 ft.--25th from the tallest stock.

Table 4--Survival, average and maximum heights of surviving trees 3 growing seasons after 1973 planting in Ritchie County, West Virginia[1/]

Stock	Geographic source	Survival	Average height	Maximum height
		Percent	Feet (Meters)	Feet (Meters)
New Lisbon pitch	Mixed orchard clones	72	2.2 (0.67)	3.7 (1.13)
VDF Pitch	Virginia	78	2.5 (0.76)	4.4 (1.34)
67 X 23	N. J. X Md.	70	2.5 (0.76)	3.9 (1.19)
76 X 23	N. H. X Md.	77	2.6 (0.79)	3.9 (1.19)
65 X 23	N. J. X Md.	78	2.6 (0.79)	4.4 (1.34)
Korean pitch X loblolly	Unknown	80	2.6 (0.79)	4.3 (1.31)
(etc. through 30 more clonal crosses and 4 checks[2/])				
62 X 15A	N.Y. X Md.	83	3.2 (0.98)	5.0 (1.52)
78 X 15A	Maine X Md.	78	3.2 (0.98)	5.1 (1.55)
62 X 19	N. Y. X Md.	90	3.3 (1.01)	4.7 (1.43)
77 X 4-32	N. H. X Md.	73	3.4 (1.04)	5.8 (1.77)
54 X 7-56	Va. X S. C.	77	3.4 (1.04)	6.3 (1.92)
62 X 22	N. Y. X Md.	77	3.4 (1:04)	5.7 (1.74)
77 X 15A	N. H. X Md.	82	3.4 (1.04)	5.1 (1.55)
62 X 11-20	N. Y. X S. C.	67	3.5 (1.07)	6.0 (1.83)
76 X 22	N. H. X Md.	77	3.5 (1.07)	6.0 (1.83)
65 X 15A	N. J. X Md.	75	3.6 (1.10)	6.3 (1.92)

1/Information compiled and published by S. Little and I.F. Trew.
2/Best pitch check (56+57 OP) had an average height of 2.9 ft; best loblolly check (VDF) had an average of 3.0 ft.

Table 5

Survival of *Pinus* spp. planted on a sassafras soil, 1982[1/]

Stock	Rep	Row	Position	Date	
				May 18[2/]	Sept. 8
62x4-32	I	1	1	6	4
47x62			2	6	6
AxD			3	4	2
AxD			4	5	4
AxD			5	4	3
4756			6	6	6
Pitch plains			7	6	1
Loblolly			8	6	5
75x22			9	6	3
AxD			10	3	4
62x23			11	6	5
AxD		2	1	5	2
62x22			2	6	4
67x22			3	6	4
77x23			4	5	5
77x4-32			5	6	6
65x15A			6	6	6
65x23			7	5	6
65x4-32			8	6	5
80x6-22			9	6	5
AxD			10	5	2
80x11-9	II	2	11	6	3
77x4-32			12	6	5
77x23		3	1	4	0
4759			2	6	4
71x4-32			3	6	4
76x15A(2)			4a	2	2
SOP(4)			4b	4	0
AxD			5	2	4
Loblolly			6	5	4
AxD			7	0	1
AxD			8	2	0
AxD			9	1	0
65x15A			10	2	0
62x23			11	6	2
AxD			12	6	5

Table 5
(cont.)

Survival of *Pinus* spp. planted on a sassafras soil, 1982

Stock	Rep	Row	Position	Date	
				May 18	Sept. 8
4769	II	4	1	6	5
78x6-42			2	6	3
65x4-32			3		5
65x23			4	6	5
62x4-32			5	6	2
78x23			6	6	4
AxD			7	6	6
AxD	III		8	6	5
AxD			9	6	4
71x11-20			10	6	5
65x11-20			11	6	5
Pitch plains			12	6	3
65x23			13	6	4
65x15A			14	6	2
62x4-32			15	6	4
78x4-32		5	1	6	4
65x4-32			2	6	4
Loblolly			3	6	6
AxD			4	5	4
4769			5	6	6
62x11-10			6	5	4
AxD			7	6	5
AxD			8	6	5
AxD			9	6	5
78x23			10	6	4
4756			11	6	5
77x4-32			12	6	5
79x7-56			13	6	6

1/6 plants/accession/position except as noted planted April 20-May 13 at the Cape May PMC. All plants containerized.

2/No. of plants with green needles; others assumed dead.

Table 6

Vigor ratings and dimensions of *Pinus* species planted at the Cape May PMC, 1982 [1/]

Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor R-I [2/]	Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor
62x4-32	1	13	16	3	Pitch	1	21	19	2
	2	11	10	2	Plains	2	10	6	-
	3	19	13	2		3	9	6	-
	4	17	12	2		4	11	6	9
	5	14	5	-		5	14	7	9
	6	16	10	1		6	16	10	9
4762	1	7	6	3	Loblolly	1	29	17	1
	2	9	5	2		2	22	19	9
	3	8	6	3		3	24	19	1
	4	10	7	3		4	21	16	2
	5	8	6	3		5	25	14	5
	6	7	6	3		6	20	13	3
AxD	1	18	17	2	75x22	1	11	9	5
	2	17	20	2		2	8	6	3
	3	16	7	7		3	12	11	2
	4	11	12	5		4	9	6	6
	5	- [3/]	-	-		5	12	9	-
	6	7	4	8		6	15	10	2
AxD	1	12	7	9	AxD	1	11	6	2
	2	11	17	2		2	11	3	7
	3	15	12	2		3	5	3	-
	4	15	10	4		4	10	6	7
	5	11	10	1		5	12	3	5
	6	11	3	9		6	12	2	-
AxD	1	9	20	2	62x23	1	19	12	2
	2	8	4	-		2	14	10	3
	3	9	16	1		3	19	16	1
	4	11	11	3		4	16	10	3
	5	9	7	8		5	15	14	2
	6	5	3	-		6	15	12	2
4756	1	6	7	2	AxD	1	6	2	-
	2	6	6	4		2	6	8	-
	3	6	6	3		3	13	9	9
	4	7	12	2		4	12	3	9
	5	7	12	2		5	6	7	1
	6	10	8	1		6	7	2	9

Table 6
(cont.)

Vigor ratings and dimensions of
Pinus species planted at the Cape May PMC, 1982

Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor
		R-I		
62x22	1	7	10	1
	2	12	7	3
	3	7	7	1
	4	15	10	1
	5	14	8	9
	6	9	7	9
67x22	1	14	7	5
	2	15	6	4
	3	8	4	3
	4	10	8	2
	5	8	5	2
	6	14	6	-
77x23	1	12	6	2
	2	9	7	1
	3	19	10	3
	4	15	9	1
	5	-	-	-
	6	15	6	3
77x4-32	1	10	7	3
	2	11	5	2
	3	9	6	3
	4	8	5	2
	5	15	11	1
	6	14	12	1
65x15A	1	9	7	2
	2	11	6	1
	3	7	6	2
	4	13	11	2
	5	13	9	2
	6	15	11	1
		R-II		
80x11-9	1	15	15	1
	2	24	4	9
	3	21	6	4
	4	20	9	4
	5	17	6	8
	6	9	7	-
65x23	1	9	5	4
	2	10	4	5
	3	11	7	2
	4	14	10	1
	5	18	7	4
	6	15	11	1
65x4-32	1	18	8	2
	2	18	7	4
	3	17	6	4
	4	8	7	1
	5	10	7	-
	6	14	3	3
80x6-22	1	15	14	2
	2	19	15	2
	3	14	10	3
	4	17	14	1
	5	19	15	1
	6	15	11	-
AxD	1	6	7	2
	2	6	2	9
	3	7	6	-
	4	7	3	4
	5	10	2	-
	6	-	-	-
77x4-32	1	14	3	9
	2	14	11	3
	3	13	7	8
	4	10	11	1
	5	11	11	4
	6	9	9	2

Table 6
(cont.)

Vigor ratings and dimensions for
Pinus species planted at the Cape May PMC, 1982

R-II

Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor	Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor
77x23	1	14	5	9	AxD	1	10	2	9
	2	-	-	-		2	-	-	-
	3	14	10	9		3	-	-	-
	4	13	3	-		4	4	2	9
	5	-	-	-		5	-	-	-
	6	20	12	3		6	-	-	-
4759	1	8	7	5	AxD	1	7	4	9
	2	6	6	7		2	5	5	-
	3	6	4	-		3	2	1	-
	4	5	6	3		4	-	-	-
	5	7	6	4		5	-	-	-
	6	5	7	5		6	-	-	-
71x4-32	1	12	9	1	AxD	1	4	2	9
	2	12	6	9		2	-	-	-
	3	10	5	3		3	6	3	-
	4	13	7	-		4	6	1	-
	5	11	11	2		5	-	-	-
	6	11	4	3		6	-	-	-
76x15A-2	1	18	15	2	65x15A	1	17	15	9
S.O.P.-4	2	17	12	2		2	2	2	-
	3	7	4	-		3	3	3	-
	4	7	4	2		4	5	2	-
	5	8	13	9		5	13	7	-
	6	8	6	-		6	-	-	-
AxD	1	7	10	2	62x23	1	19	6	-
	2	5	3	9		2	19	4	-
	3	5	2	9		3	14	11	9
	4	11	12	1		4	13	15	2
	5	2	2	-		5	13	15	1
	6	6	1	8		6	13	14	-
Loblolly	1	19	7	-	AxD	1	13	11	2
	2	22	11	2		2	10	10	2
	3	-	-	-		3	8	8	2
	4	17	13	2		4	7	6	3
	5	25	17	1		5	6	3	9
	6	22	11	1		6	8	9	9

Table 6
(cont.)

Vigor ratings and dimensions for
Pinus species planted at the Cape May PMC, 1982

Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor	Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor
				R-II					
4769	1	7	6	4	62x4-32	1	9	5	1
	2	10	8	2		2	7	2	3
	3	8	5	2		3	9	5	-
	4	14	9	1		4	9	7	2
	5	13	8	1		5	8	6	3
	6	12	8	9		6	12	7	1
78x6-42	1	21	15	3	78x23	1	11	7	1
	2	15	14	2		2	8	6	2
	3	16	13	8		3	8	4	3
	4	20	14	9		4	12	7	4
	5	21	18	9		5	7	5	2
	6	16	13	2		6	8	7	2
65x4-32	1	21	13	2	AxD	1	13	18	1
	2	15	7	2		2	8	6	2
	3	13	6	9		3	9	7	2
	4	14	15	4		4	11	10	2
	5	15	13	1		5	11	8	2
	6	11	6	1		6	11	15	2
65x23	1	5	4	4					
	2	13	8	3					
	3	12	11	2					
	4	13	4	2					
	5	14	9	-					
	6	9	6	2					
				R-III					
AxD	1	13	11	1	71x11-20	1	13	13	7
	2	11	10	2		2	15	13	4
	3	7	6	-		3	18	11	3
	4	14	11	2		4	17	7	4
	5	12	8	2		5	18	13	3
	6	18	13	1		6	18	9	2
AxD	1	7	15	1	65x11-20	1	11	8	-
	2	15	19	1		2	13	5	1
	3	9	11	2		3	13	5	1
	4	-	-	-		4	14	6	1
	5	11	7	2		5	19	13	2
	6	11	6	3		6	18	13	2

Table 6
(cont.)

Vigor ratings and dimensions of
Pinus species planted at the Cape May PMC, 1982

Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor	Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor
				R-III					
Pitch Plains	1	12	7	4	Loblolly	1	29	8	2
	2	13	5	1		2	27	15	2
	3	10	7	-		3	16	12	2
	4	11	5	-		4	30	11	1
	5	13	7	1		5	26	14	1
	6	14	8	7		6	31	13	1
65x23	1	19	6	9	AxD	1	15	16	1
	2	11	5	2		2	-	-	-
	3	13	3	4		3	14	15	1
	4	13	5	2		4	7	8	-
	5	15	13	9		5	4	8	2
	6	14	8	1		6	7	6	4
65x15A	1	14	12	2	4769	1	6	5	2
	2	6	6	-		2	5	5	2
	3	5	4	-		3	9	5	2
	4	8	6	5		4	9	8	2
	5	18	19	3		5	6	5	2
	6	13	4	7		6	10	7	3
62x4-32	1	14	11	2	62x11-10	1	9	6	1
	2	9	7	1		2	14	13	3
	3	9	3	9		3	-	-	-
	4	10	7	1		4	16	14	7
	5	16	7	1		5	20	15	3
	6	9	7	4		6	19	16	2
78x4-32	1	-	-	-	AxD	1	5	3	2
	2	17	10	2		2	10	14	1
	3	16	7	1		3	10	8	1
	4	10	5	1		4	14	12	1
	5	12	5	1		5	8	8	1
	6	11	4	2		6	11	14	2
65x4-32	1	15	16	3	AxD	1	10	16	2
	2	4	4	-		2	8	16	1
	3	15	5	2		3	8	12	1
	4	13	4	2		4	8	6	1
	5	9	4	-		5	7	7	2
	6	11	4	1		6	7	5	-

Table 6
(cont.)

Vigor ratings and dimensions of
Pinus species planted at the Cape May PMC, 1982

Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor	Stock No.	Plant No.	Height (cm)	Width (cm)	Vigor
					R-III				
AxD	1	8	7	-	77x4-32	1	12	8	1
	2	8	7	1		2	8	6	2
	3	6	55	2		3	10	4	1
	4	6	5	3		4	10	5	3
	5	5	7	2		5	8	8	1
	6	7	6	3		6	12	2	3
78x23	1	13	5	1	79x7-56	1	17	13	1
	2	12	6	1		2	20	13	2
	3	8	3	-		3	13	14	1
	4	13	5	8		4	20	14	2
	5	12	8	3		5	16	15	1
	6	6	4	2		6	15	13	1
4756	1	11	9	-					
	2	6	8	2					
	3	7	14	7					
	4	7	11	2					
	5	9	15	2					
	6	8	11	1					

1/Plants established April 20-May 13 at the Cape May PMC; Data recorded June 21.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Dash (-) indicates no data taken.

Table 7

Fall vigor ratings for Pinus species planted at the Cape May PMC, 1982[1/]

Stock No.	Row/ Position	Vigor	Stock No.	Row/ Spacing	Vigor
		R-I			
62x4-32	1-1	6[2/]	62x23	1-11	4
4762	1-2	5	AxD	2-1	5
AxD	1-3	4	62x22	2-2	5
AxD	1-4	4	67x22	2-3	6
AxD	1-5	5	77x23	2-4	4
4756	1-6	6	77x4-32	2-5	4
Pitch Plains	1-7	5	65x15A	2-6	5
Loblolly	1-8	3	65x23	2-7	4
75x22	1-9	6	65x4-32	2-8	6
AxD	1-10	7	80x6-22	2-9	4
			AxD	2-10	6
		R-II			
80x11-9	2-11	5	AxD	3-8	10
77x4-32	2-12	8	AxD	3-9	10
77x23	3-1	10	65x15A	3-10	10
4759	3-2	6	62x23	3-11	4
71x4-32	3-3	6	AxD	3-12	7
76x15A	3-4A	5	4769	4-1	5
S.O.P.	3-4B	10	78x6-42	4-2	6
AxD	3-5	5	65x4-32	4-3	6
Loblolly	3-6	3	65x23	4-4	7
AxD	3-7	9	62x4-32	4-5	5
			78x23	4-6	7
			AxD	4-7	5
		R-III			
AxD	4-8	5	Loblolly	5-3	2
AxD	4-9	6	AxD	5-4	4
71x11-20	4-10	7	4769	5-5	5
65x11-20	4-11	6	62x11-10	5-6	6
Pitch Plains	4-12	6	AxD	5-7	4
65x23	4-13	7	AxD	5-8	5
65x15A	4-14	5	AxD	5-9	5
62x4-32	4-15	6	78x23	5-10	5
78x4-32	5-1	4	4756	5-11	5
65x4-32	5-2	7	77x4-32	5-12	7

Table 7.
(cont.)

Fall vigor ratings for *Pinus* species planted at the Cape May PMC, 1982

Stock No.	Row/ Position	Vigor
		R-III
79x7-56	5-13	5

1/Plants established April 20-May 13 at the Cape May PMC; Data recorded September 8.

2/Ratings are: 1-Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

SAND DUNE STABILIZATION

Ammophila arenaria for Sand Dunes

34A007C

FINAL REPORT

Ammophila arenaria (European beachgrass) has been evaluated by the Cape May PMC for several years. While this species is not well adapted to the mid-Atlantic coast foredunes, its potential to become adapted behind the foredunes where *A. breviligulata* (American beachgrass) deteriorates was considered good. Approximately, 11 accessions have been evaluated. In 1972, T-02675 was selected for further evaluation. Between 1972 and 1978, seven more accessions were evaluated. Three of these and T-02675 were selected for further testing. During this time, T-02675 was used as the standard. In 1979, PI-319816 became the standard. Because of the variation in the seedling plants of PI-319816, the superior ones were selected and assigned a new number, T-14666. In 1980, two new accessions, T-06650 and T-06651, were moved to advanced evaluation along with T-14666 and T-13176. The results show that T-14666 is superior to the remaining three accessions in vigor, stand, spreading ability and tolerance to winter injury. T-06650 was second best followed by T-06651. T-01176 was discarded due to poor longevity and severe winter injury. Vegetative material of T-14666 will be maintained at the Cape May PMC.

WILDLIFE FOOD AND COVER

Elaeagnus umbellata PI-421132 for Wildlife Food and Cover

34A009J

FINAL REPORT

The results of previous evaluations for *Elaeagnus umbellata* (autumn olive) PI-421132 have confirmed its desirability for wildlife food and cover. Like other *Elaeagnus* strains, it is an excellent conservation plant. Its prolific fruit production is only transmitted by vegetative propagation. It differs from 'Cardinal' (PI-421800) by having a later fruit maturity date and better leaf retention during the early winter.

Cardinal and PI-421132 were established in the spring of 1976 at fourteen planting sites. Several other plantings of these two accessions were established at various locations in later years. The locations are in Plant Hardiness Zones 5b to 9b. The plantings extend westward from New Hampshire to Oregon and from Michigan to Florida.

Survival of PI-421132 has been good with only a few locations losing plants. Winter injury to PI-421132 has been severe in Michigan and New York (zone 5b). In Michigan, the topgrowth was killed back to the soil each year and all new growth has been from basal sprouts. A record cold temperature (-32°C) observed at Big Flats, New York killed the plants back to the soil line during the 1978-79 winter.

A 1979 planting in New Hampshire suffered light winter damage to both PI-421132 and Cardinal. However, the fruit produced by PI-421132 never ripened. It remained green and later shriveled up on the branches. Therefore, PI-421132 is only adapted through Plant Hardiness Zone 5a.

In general, very little insect or disease damage has been observed on either accession. The amount of damage was equally distributed between PI-421132 and Cardinal. In 1981, disease damage was reported only by Florida and this was reported as light.

Fruit production on PI-421132 was recorded at 9 locations. In general, PI-421132 matures later and produces a greater quantity of larger fruit than Cardinal. Birds have been observed eating the fruit at several locations. They seem to prefer Cardinal to PI-421132.

Summary

The original objective of this project was to determine the range of adaptation for PI-421132 and compare the performance between Cardinal and PI-421132. It has been determined that PI-421132 is not adapted in Plant Hardiness Zone 5b, but it appears to be adapted in 5a and southward. Therefore, this late maturing *E. umbellata* would have wider use in the south than in the northeast.

In locations where PI-421132 is considered adapted, it has been consistently reported as producing larger size and a greater abundance of fruit than the Cardinal variety of the same age. The results also support the fact that the fruit of PI-421132 matures 6-10 weeks later, depending upon location, than Cardinal and possesses significantly better leaf retention during the winter.

These unique characteristics allow available food and cover to be present for certain wildlife during critical periods when lack of protective cover and starvation is a threat.

Numerous field plantings have been established in several Major Land Resource Areas. The results of these plantings will be used in conjunction with the results from this project to document the performance of PI-421132.

Table 1

Three characteristics for two strains of Elaeagnus umbellata, 1982

Location	Year Estab.	Zone 1/	PI-421132			'Cardinal'		
			Sur. (%) 2/	Vigor 3/	HxW 4/	Sur. (%)	Vigor	HxW
Missouri	1976	6a	100	E	4.5 x 4.8	40	G	4.0 x 3.9
New Jersey	1976	6b	100	G-E	3.4 x 5.2	100	F-G	3.1 x 4.0
Virginia	1976	7a	100	G 5/	4.0 x 3.0	100	F	3.0 x 2.0
Cape May PMC	1976	7b	100	-	3.8 x 5.7	100	-	3.1 x 4.0
Tennessee	1976	7b	100	-	4.3 x 5.1	100	-	3.3 x 3.3
Mississippi	1976	8a	80	-	5.5 x 5.0	60	-	3.0 x 3.0
Georgia	1976	8b	100	-	-	100	-	-
West Virginia	1977	6b	100	-	3.7 x -	100	-	2.7 x -
Oregon	1977	8b	100	-	2.4 x -	100	-	2.7 x -
New Hampshire	1979	5b	71	-	-	-	-	-
Pennsylvania	1979	6a	100	-	2.7 x -	100	-	2.4 x -

1/Zone = Plant Hardiness Zone.
2/Survival - Percent of living plants fall 1982; 5 plants established/accession/location.
3/Vigor - E=Excellent; G=Good; F=Fair; P=Poor.
4/Dimensions - Height x width; expressed in meters.
5/Information not available.

Table 2

Four characteristics for PI-421132 and 'Cardinal' Elaeagnus umbellata, 1982

Location	Zone [1]	PI-421132 Fruiting Dates Maturity [2]	PI-421132 Fruiting Dates Prod. [4]	PI-421132 Fruit Leaf Ret. [4]	PI-421132 Fruit Fruit Ret. [4]	'Cardinal' Fruiting Dates Maturity	'Cardinal' Fruiting Dates Prod.	'Cardinal' Fruit Leaf Ret.	'Cardinal' Fruit Fruit Ret.
Missouri	6a	- [3]	0	-	-	-	-	-	-
New Jersey	6b	12-1	5	-	-	9-1	4	-	-
Virginia	7a	-	-	3	-	-	-	-	-
Cape May PMC	7b	-	4	4	4	-	2	2	2
Tennessee	7b	-	5	5	5	-	5	2	1
Mississippi	8a	10-6	4	4	5	7-15	2	2	-
Georgia	8b	-	5	5	5	-	3	3	1
West Virginia	6b	-	0	5	-	-	0	2	-
Oregon	8b	-	5	5	5	-	3	1	1
New Hampshire	5b	-	-	5	-	-	-	-	-
Pennsylvania	6a	-	5	5	-	-	2	3	-

1/Zone = Plant Hardiness Zone.
2/Maturity - Date that a majority of the fruit was ripe.
3/Information not available.
4/Ratings are: 1-5; 5=Best, 0=No fruit observed.

Pest-resistant Plants for Secondary Dune Stabilization

34A012C

Ammophila breviligulata (American beachgrass) is well adapted to the foredunes and beach areas in front of the foredunes. A superior cultivar of A. breviligulata 'Cape' was introduced in 1972 and since that time has been used extensively for dune stabilization from Massachusetts to Virginia. However, plantings of Cape and native strains of A. breviligulata behind the foredune and sometimes on the foredune tend to deteriorate after accumulation of sand ceases or in the absence of fertilizer applications.

Large vegetated areas behind the foredune along the Atlantic Coast are subjected to disease and/or insect damage. Prior to infestation, these sites are usually planted to or volunteer into A. breviligulata. After a period of time, the plants exhibit poor vigor and the stand is reduced considerably resulting in little or no cover. While the deterioration of the beachgrass is a natural phenomenon, the invasion of long-lived perennial grasses into the weakened stands of beachgrass is a slow process. Proper management does not necessarily prevent stand deterioration. No recommended adapted disease resistant grass is commercially available for planting on these sites.

The objective is to test several long-lived salt tolerant species for persistence behind the foredune where A. breviligulata stands have deteriorated due to disease or other problems. Since long-lived species generally develop slowly, as compared to A. breviligulata, considerable time will be required to evaluate the benefit of the long-lived species.

The first planting was installed at Island Beach State Park, New Jersey in 1978. None of the species produced the amount of foliage that is usually observed for that species when planted on a recently formed sand dune. Even Cape failed to respond with vigorous growth on this apparently diseased site. While Elymus arenarius (European wildrye) was the best test species on this diseased site in 1978, the amount of foliage and vigor was not outstanding. During the year of establishment, Cape performed better than all of the other species. Since Cape is not well adapted to these back dune areas, this really is not significant.

In 1980 and 1981, expanded plantings were established in Delaware and North Carolina at which time Spartina patens (saltmeadow cordgrass) and Carex arenaria (European sedge) were added to the plan. In the North Carolina planting established in 1980, Cape was definitely superior during the first year. However, Cape began to lose its superiority by the fall of 1981 and is now rated less vigorous than S. patens PI-421239 and equal to C. kobomugi.

Table 1

Vigor, stand, cover and stem density for nine pest resistant plants growing on a sand dune, 1982 [1/]

PI No./ Species/Rep	Vigor	Stand	Cover	Stem Density 1	2	Ave.
T-02675						
Ammophila arenaria	[2/]	[2/]	[2/]	[3/]		
I	10	10	10	0	0	0
II	10	10	10	0	0	0
III	10	10	10	0	0	0
'Cape'						
A. breviligulata						
I	3	5	6	7	29	18
II	4	4	2	4	7	6
III	4	3	4	14	28	21
T-02688						
Carex arenaria						
I	3	7	8	15	7	11
II	4	7	7	32	26	29
III	10	10	10	0	0	0
PI-433953						
C. kobomugi						
I	3	4	4	7	8	8
II	4	4	4	12	7	10
III	4	6	6	9	6	8
PI-348865						
Elymus arenarius						
I	10	10	10	0	0	0
II	10	10	10	0	0	0
III	10	10	10	0	0	0
PI-421134						
E. vancouverensis						
I	4	8	9	4	1	2
II	5	8	9	1	2	2
PI-421238						
Spartina patens						
I	5	4	5	38	23	30
II	5	4	4	42	68	55
III	5	4	4	37	38	38
III-9	5	6	6	29	62	46

Table 1
(cont.)

Vigor, stand, cover and stem density for
nine pest resistant plants growing on a sand dune, 1982

PI No./ Species/Rep	Vigor	Stand	Cover	Stem Density 1	2	Ave.
PI-421239						
S. patens						
I	5	5	5	41	25	33
II	5	4	3	33	21	27
III	5	2	2	53	70	62
PI-421250						
S. patens						
I	5	6	6	11	29	20
II	5	5	4	22	26	24
III	5	3	3	20	14	17

1/114 hills/accession/replication planted near Duck, North Carolina on April 2, 1980; data recorded September 29.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None or Dead.

3/Number of stems in a randomly determined 30 x 30 cm area.

Table 2

Best three of nine pest resistant plants growing on a sand dune, 1982[1/]

	R-I	R-II	R-III
Best[2/]	Carex kobomugi	Spartina patens (PI-421239)	Spartina patens (PI-421239)
2nd Best	'Cape'	Carex kobomugi	Spartina patens (PI-421250)
3rd Best	Spartina patens (PI-421238)	Spartina patens (PI-421238)	'Cape'

1/114 hills/accession/replication planted near Duck, North Carolina on April 2, 1980; data recorded September 29.

2/Ratings based on stand, vigor and ability to trap blowing sand.

Table 3

Third Year Evaluations for
Pest-Resistant Plants Growing on a Sand Dune, 1982[1/]

Species/ Rep	Stem Count[2/]	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Ammophila arenaria						
I	0	0	0	9[3/]	-[4/]	-[4/]
II	0	0	0	9	-	-
III	4	12	28	9	9	9
Elymus arenarius						
I	0	0	0	9	-	-
II	0	0	0	9	-	-
III	0	0	0	9	-	-
E. vancouverensis						
I	3	5	18	7	6	6
II	3	4	18	7	6	6
III	3	4	16	7	6	6
Panicum amarum						
I	2	10	25	6	4	4
II	13	25	28	4	3	3
III	2	12	22	5	4	4
Carex kobomugi						
I	10	27	18	4	3	3
II	6	16	10	5	4	4
III	18	45	20	4	3	3
A. breviligulata						
I	45	25	60	4	3	3
II	35	25	60	4	3	3
III	32	24	50	5	4	4
Spartina patens (421250)						
I	10	12	35	6	4	4
II	20	18	40	5	3	3
III	23	22	42	4	3	3
S. patens (421239)						
I	18	16	45	4	3	3
II	15	12	28	6	4	4
III	15	13	28	6	4	4

Table 3
(cont.)

Third Year Evaluations for
Pest-Resistant Plants Growing on a Sand Dune, 1982

S. patens	(421238)					
I	20	18	45	5	4	4
II	25	16	42	5	4	4
III	25	16	44	5	4	4

1/ 108 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on March 25, 1980; some accessions in R-III had less than 108 plants; data recorded November 16.

2/ Number of stems growing in a 0.25 M^2 area.

3/ Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/ Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Table 4

Second Year Evaluations for
Pest-Resistant Plants Growing on a Sand Dune, 1982[1/]

Species/ Rep	Stem Count[2/]	Foliage Spread (cm)	Height (cm)	Vigor	Insect Damage	Disease Damage
Ammophila arenaria						
I	50	26	46	5[3/]	3[4/]	2[4/]
II	55	30	50	4	2	2
III	62	28	50	4	2	2
Elymus arenarius						
I	0	0	0	9	-	-
II	3	7	30	8	5	5
III	3	6	28	8	5	5
E. vancouverensis						
I	6	8	23	8	5	5
II	9	10	25	8	5	5
III	12	18	30	6	3	3
Panicum amarum						
I	3	20	25	6	4	4
II	8	32	30	4	3	3
III	20	33	34	4	3	3
Carex kobomugi						
I	10	22	18	4	3	3
II	12	25	17	4	3	3
III	10	25	18	5	4	3
A. breviligulata						
I	33	28	48	4	2	2
II	38	30	50	4	2	2
III	42	35	62	3	2	2
Spartina (421250) *patens*						
I	16	12	26	6	2	2
II	20	13	30	5	2	2
III	22	15	34	5	2	2
S. (421239) *patens*						
I	10	7	15	8	3	3
II	16	10	22	7	2	2
III	10	10	18	7	3	3

Table 4
(cont.)

Second Year Evaluations for
Pest-Resistant Plants Growing on a Sand Dune, 1982

S. patens (421238)						
I	14	9	22	7	3	3
II	18	10	25	6	2	2
III	20	14	25	6	2	2

1/ 108 vegetative plants established/accession/replication at Fenwick Island State Park, Delaware on March 31, 1981; some accessions in R-III had less than 108 plants; data recorded November 16.

2/ Number of stems growing in a 0.25 M^2 area.

3/ Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/ Ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Herbaceous Plants for Wildlife Food and Cover

34A014J

Several herbaceous species are available for the establishment of vegetative cover on critical areas. While these species provide good erosion control, their wildlife value is limited.

Solid stands of erosion control species often tend to discourage rather than encourage the use of these areas by small game and birds. Wildlife need plants for food, escape and nesting cover and travel lanes. A solid stand of one species will not provide all four elements for most wildlife.

Eight species of herbaceous conservation plants, with some potential for wildlife food and cover, were used to establish a wildlife planting in 1979. Each plot was 7 x 16.5 meters and replicated three times in a randomized plot design. Single species of legumes or grasses were used in each plot. No maintenance of any type was performed beyond the establishment period.

Lespedeza thunbergii 'VA-70' (shrub lespedeza), Eragrostis curvula (weeping lovegrass) and Festuca arundinacea (tall fescue) exhibited good stands 90 days after seeding while stand ratings for all other involved species were considered as fair.

In 1980, second year evaluations showed F. arundinacea, E. curvula and L. sylvestris as the best three for stand performance. Spring regrowth was also better for F. arundinacea and L. sylvestris.

Winter food for birds was rated best for P. virgatum and L. cuneata 'Interstate' due to the abundance of available seed both on the plants and ground. L. thunbergii provided the best fall cover for small mammals while E. curvula provided the best winter cover.

During the spring of 1981 and 1982, one-half of each plot was mowed to a height of 4 inches. Regrowth was good for all species, however, L. cuneata and P. virgatum exhibited considerably better vigor during the summer and fall in the mowed area than in the non-mowed area. Seed production was also greater for these two species in the non-mowed area. E. curvula, L. thunbergii and P. virgatum continue to provide the best wildlife cover for all seasons. Winter food for wildlife is rated best for P. virgatum and L. cuneata Interstate.

An additional wildlife planting was established at the PMC in the spring of 1981. Plots were seeded to mixtures of various grasses and legumes to determine the compatibility of seeded wildlife species with erosion control plants. Despite the strong competition from annual weeds, the planting was successful in becoming established, however, vigor was reduced considerably. The plots which were seeded to a mixture of P. virgatum, E. curvula, and L. thunbergii exhibited the best stand and vigor during the establishment period and was also rated best in two out of three replications for the 1982 evaluations. L. sylvestris, Lolium perenne (perennial

ryegrass), L. thunbergii and L. cuneata 'Appalow' were rated consistently poor for stand and vigor in all three replications.

The objective of this project is to select conservation plants to improve the wildlife food and cover on critical areas which are seeded primarily for stabilization.

Fourth Year Wildlife Food & Cover Plots for Birds & Small Mammals
(Strip Planting)

Notes

August 18, 1982:

Lespedeza cuneata (Appalow) - Excessive competition from annual lespedeza and other weed species. Not providing much wildlife food or cover at this time. Fair stand and vigor.

Panicum clandestinum - Moderate amount of mature seed on plants. Leaves are browning on edges. Good source of wildlife food and cover. Excellent stand with good vigor.

Festuca arundinacea - Providing poor cover and very little seed for wildlife use. Suffering extensively from drought. Plot is almost entirely brown. Good stand with poor vigor.

Eragrostis curvula - Exhibiting good cover and moderate amount of mature seedheads. Plants are being affected by drought but not nearly as much as the fescue. Good stand with fair vigor.

Lespedeza thunbergii (VA-70) - Plants are providing excellent cover with little food value at this time. Lower leaves are beginning to brown and curl due to drought. Excellent stand with good vigor.

Lespedeza cuneanta (Interstate) - Plants are exhibiting good cover potential with very little wildlife food value. Plants appear to be fairly drought tolerant. Excellent stand with good vigor.

Panicum virgatum - Plants are providing excellent wildlife cover. Some immature seed available. Drought has little effect on plants. Excellent stand and vigor.

Lathyrus sylvestris (Lathco) - Good seed supply for wildlife food. Plants are providing good cover. Some discoloration of leaves (yellowing). Excellent stand with good vigor.

Note: Plots are extremely dry. No irrigation is being applied and precipitation has averaged approximately 1 inch per month for July and August.

Table 1

Availability of winter food and cover [1] for eight herbaceous wildlife species, 1982

Species	Food		Cover	
	Birds [2]	Mammals [2]	Birds [2]	Mammals [2]
Lespedeza cuneata ('Appalow')	9	9	8	9
Panicum clandestinum	9	9	9	9
Festuca arundinacea	9	7	9	9
Eragrostis curvula	9	8	3	3
L. thunbergii ('VA-70')	9	9	7	8
L. cuneata ('Interstate')	7	9	5	5
P. virgatum	8	9	1	2
Lathyrus sylvestris ('Lathco')	9	8	9	9

1/Plots were established on May 8, 1979; data recorded Feb. 27.

2/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 2

Evaluation for eight herbaceous wildlife plant species, 1982[1/].

Species	Stand	Vigor	Food		Spring Cover Regrowth[2/]			
			Birds	Mammals	Birds	Mammals	M	NM
			R-I					
Lespedeza cuneata(Appalow)	7[3/]	6[3/]	9[3/]	8[3/]	9[3/]	9[3/]	5[3/]	6[3/]
Panicum clandestinum	4	3	8	4	8	8	3	3
Festuca arundinacea	3	4	8	8	7	7	4	3
Eragrostis curvula	4	5	8	8	4	4	3	6
L. (VA-70) thunbergii	3	3	7	7	1	1	5	3
L. cuneata (Interstate)	3	3	3	7	2	2	5	3
P. virgatum	4	3	7	7	2	2	2	5
Lathyrus(Lathco) sylvestris	3	2	7	5	6	6	3	2
			R-II					
L. thunbergii(VA-70)	3	3	7	7	1	1	4	3
L. cuneata (Interstate)	3	3	3	7	2	2	5	3
P. virgatum	4	4	7	7	2	2	5	3
P. clandestinum	4	3	8	4	8	8	4	3
E. curvula	5	7	8	8	4	4	4	6
L. sylvestris (Lathco)	4	2	7	5	6	6	2	2
L. cuneata(Appalow)	7	5	9	8	9	9	5	6
F. arundinacea	2	3	8	8	4	4	3	3

Table 2
(cont.)

Evaluation for eight herbaceous wildlife plant species, 1982

Species	Stand	Vigor	Food		Spring Cover		Regrowth	
			Birds	Mammals	Birds	Mammals	M	NM
			R-III					
L. sylvestris (Lathco)	5	2	7	5	6	6	2	2
P. virgatum	5	4	7	7	2	2	5	3
F. arundinacea	3	3	8	8	7	7	3	3
L. cuneata (Appalow)	7	5	9	8	9	9	5	5
L. cuneata (Interstate)	4	3	3	7	2	2	5	3
L. thunbergii (VA-70)	3	3	7	7	1	1	4	3
P. clandestinum	4	4	8	4	8	8	3	3
E. curvula	5	6	8	8	4	4	5	7

1/Plots were seeded on May 8, 1979; data recorded May 17.

2/M=Mowed; NM=Non-mowed; the west half of plots were mowed to a height of 4 inches on March 30.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Note - Songbirds were flushed from VA-70 lespedeza plots.

Table 3

Relative rating for eight herbaceous wildlife plants, 1982[1/]

Best[2/]	Lespedeza thunbergii (VA-70)
2nd Best	Panicum virgatum
3rd Best	L. cuneata (Interstate)
4th Best	Lathyrus sylvestris (Lathco)
5th Best	P. clandestinum
6th Best	Eragrostis curvula
7th Best	Festuca arundinacea
8th Best	L. cuneata (Appalow)

1/Plants seeded on May 8, 1979; data recorded August 18.

2/Ratings based on plant's vigor and its ability to provide effective wildlife food and cover at the time of this evaluation.

Table 4

Evaluations for nine herbaceous wildlife species, 1982[1/]
Compatibility Planting

Species	Wildlife Food		Wildlife Cover		Stand	Vigor
	Birds	Mammal	Birds	Mammal		
	R-I					
Festuca arundinacea Lathyrus sylvestris (Lathco)	4[2/]	6[2/]	6[2/]	7[2/]	5[2/]	5[2/]
Eragrostis curvula Panicum clandestinum Lespedeza cuneata (Appalow)	7	6	6	7	6	6
F. arundinacea L. cuneata (Appalow)	4	6	6	7	7	7
L. cuneata (Interstate) E. curvula L. thunbergii (VA-70)	7	6	5	5	5	5
Lolium perenne L. sylvestris (Lathco) P. virgatum	6	6	3	3	5	3
F. arundinacea L. cuneata (Interstate) P. virgatum	5	6	3	3	5	3
F. arundinacea L. thunbergii (VA-70)	3	5	5	6	6	5
P. virgatum E. curvula L. thunbergii (VA-70)	5	5	1	1	1	1
L. perenne P. clandestinum L. thunbergii (VA-70)	3	3	6	6	7	5
F. arundinacea	3	6	4	4	5	5
L. perenne L. thunbergii (VA-70)	6	7	8	9	8	7
Eragrostis curvula P. clandestinum L. cuneata (Interstate)	5	5	3	3	4	3

Table 4
(cont.)

Evaluations for nine herbaceous wildlife species, 1982
Compatibility Planting

Species	Wildlife Food		Wildlife Cover		Stand	Vigor
	Birds	Mammal	Birds	Mammal		
	R-II					
L. perenne L. sylvestris (Lathco) P. virgatum	5	7	2	2	3	2
F. arundinacea L. cuneata (Interstate) P. virgatum	5	7	2	2	2	1
F. arundinacea	3	6	6	6	5	5
F. arundinacea L. thunbergii (VA-70)	4	6	6	6	6	5
F. arundinacea L. sylvestris (Lathco)	5	7	5	5	6	6
F. arundinacea L. cuneata (Appalow)	5	7	5	5	6	6
L. cuneata (Interstate) E. curvula L. thunbergii (VA-70)	6	6	6	6	7	5
E. curvula P. clandestinum L. cuneata (Appalow)	6	5	4	4	4	4
P. virgatum E. curvula L. thunbergii (VA-70)	6	5	3	3	3	4
L. perenne P. clandestinum L. thunbergii (VA-70)	3	3	6	6	6	5
E. curvula P. clandestinum L. cuneata (Interstate)	6	5	5	5	4	4
L. perenne L. thunbergii (VA-70)	3	4	6	6	4	5

Table 4
(cont.)

Evaluations for nine herbaceous wildlife species, 1982
Compatibility Planting

Species	Wildlife Food		Wildlife Cover		Stand	Vigor
	Birds	Mammal	Birds	Mammal		
	R-III					
P. virgatum E. curvula L. thunbergii (VA-70)	4	5	1	1	2	3
F. arundinacea L. thunbergii (VA-70)	3	6	5	5	3	6
L. cuneata (Interstate) E. curvula L. thunbergii (VA-70)	7	6	4	5	4	5
F. arundinacea L. cuneata (Appalow)	3	5	5	5	3	4
L. perenne L. sylvestris (Lathco) P. virgatum	5	5	4	4	2	3
E. curvula P. clandestinum L. cuneata (Appalow)	5	4	3	3	4	3
F. arundinacea L. cuneata (Interstate) P. virgatum	5	5	5	5	5	4
F. arundinacea L. sylvestris (Lathco)	5	6	7	7	5	6
F. arundinacea	5	7	7	7	6	6
L. perenne L. thunbergii (VA-70)	6	7	8	8	7	7
E. curvula P. clandestinum L. cuneata (Interstate)	5	4	3	3	3	3
L. perenne P. clandestinum L. thunbergii (VA-70)	4	3	6	6	6	5

1/Rep I and II were seeded on June 5, 1981; Rep III was seeded on June 8, 1981; data recorded July 2.
2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 5

Evaluations for nine herbaceous wildlife species, 1982

1981 Compatibility Planting

Species	Percent Stand [2]	Vigor R-I [4]	Competitive Performance [4]	Relative Rating [3]
Festuca arundinacea	75	4	3	
Lathyrus sylvestris(Lathco)	25	5	7	
Eragrostis curvula	50	3	3	
Panicum clandestinum	40	4	4	
Lespedeza cuneata(Appalow)	10	6	8	
F. arundinacea	60	3	3	
L. cuneata(Appalow)	40	4	5	
L. cuneata(Interstate)	30	5	6	
E. curvula	50	3	3	
L. thunbergii(VA-70)	20	5	6	
Lolium perenne	5	8	8	
L. sylvestris(Lathco)	10	5	8	3rd Best
P. virgatum	85	2	2	
F. arundinacea	10	6	8	
L. cuneata(Interstate)	15	4	8	2nd Best
P. virgatum	75	2	2	
F. arundinacea	70	3	3	
L. thunbergii(VA-70)	30	3	5	
P. virgatum	70	2	2	Best
E. curvula	25	3	4	
L. thunbergii(VA-70)	5	6	8	
L. perenne	15	5	7	
P. clandestinum	60	3	3	
L. thunbergii(VA-70)	25	3	4	
F. arundinacea	100	2	1	
L. perenne	50	5	4	
L. thunbergii(VA-70)	50	3	3	
E. curvula	75	2	2	
P. clandestinum	15	3	6	
L. cuneata(Interstate)	10	3	6	

Table 5
(cont.)

Evaluations for nine herbaceous wildlife species, 1982

1981 Compatibility Planting

Species	Percent Stand	Vigor	Competitive Performance	Relative Rating
		R-II		
Lolium perenne	5	7	8	
L. sylvestris(Lathco)	5	5	8	2nd Best
P. virgatum	90	2	1	
F. arundinacea	10	6	7	
L. cuneata(Interstate)	10	4	6	
P. virgatum	80	1	2	Best
F. arundinacea	100	2	1	
F. arundinacea	70	2	2	
L. thunbergii(VA-70)	30	3	5	
F. arundinacea	95	2	1	
L. sylvestris(Lathco)	5	5	6	
F. arundinacea	70	3	3	
L. cuneata(Appalow)	30	4	5	
L. cuneata(Interstate)	20	3	4	
E. curvula	60	2	2	
L. thunbergii(VA-70)	20	3	4	
E. curvula	60	2	2	
P. clandestinum	25	3	4	
L. cuneata(Appalow)	15	4	5	
P. virgatum	50	3	3	
E. curvula	40	3	4	
L. thunbergii(VA-70)	10	3	6	
L. perenne	30	6	5	
P. clandestinum	30	4	4	
L. thunbergii(VA-70)	40	4	3	
E. curvula	50	2	2	
P. clandestinum	10	4	6	3rd Best
L. cuneata(Interstate)	40	3	3	
L. perenne	55	4	3	
L. thunbergii(VA-70)	45	3	3	

Table 5
(cont.)

Evaluations for nine herbaceous wildlife species, 1982

1981 Compatibility Planting

Species	Percent Stand	Vigor	Competitive Performance	Relative Rating
		R-III		
P. virgatum	50	3	2	
E. curvula	45	3	2	Best
L. thunbergii(VA-70)	5	5	7	
F. arundinacea	95	2	1	
L. thunbergii(VA-70)	5	6	8	
L. cuneata(Interstate)	15	3	6	
E. curvula	80	3	1	
L. thunbergii(VA-70)	5	5	7	
F. arundinacea	90	2	1	
L. cuneata(Appalow)	10	3	6	
Lolium perenne	40	4	5	
L. sylvestris(Lathco)	5	6	8	
P. virgatum	55	3	3	
E. curvula	40	4	3	2nd Best
P. clandestinum	55	3	3	
L. cuneata(Appalow)	5	7	7	
F. arundinacea	30	3	4	
L. cuneata(Interstate)	15	3	5	3rd Best
P. virgatum	55	3	1	
F. arundinacea	90	2	1	
L. sylvestris(Lathco)	10	4	8	
F. arundinacea	100	3	1	
L. perenne	65	3	3	
L. thunbergii(VA-70)	35	3	4	
E. curvula	45	2	3	
P. clandestinum	30	3	4	
L. cuneata(Interstate)	25	3	4	
L. perenne	10	3	8	
P. clandestinum	40	3	3	
L. thunbergii(VA-70)	50	2	3	

1/Plots were seeded in June of 1981; data recorded Sept. 14.
2/Percent of stand represented by individual species within the seeded plot.
3/Rating is for all seeded species within the plot. Rating based on the plants vigor and their wildlife food and cover value.
4/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 6

Stand, vigor and wildlife food and cover for eight conservation plants, 1982 [1/]

Maryland Planting

Species Replication	Stand	Cover [2/] (%)	Wildlife Food [3/]	Wildlife Cover [4/]
Eragrostis curvula				
PI-13311	[5/]		[5/]	[5/]
I	1	98	7	1
II	1	95	7	1
III	6	40	8	3
Avg.	2.6	78	7.3	1.7
Festuca arundinacea				
'KY-31'				
I	4	55	7	9
II	4	60	7	9
III	4	50	7	9
Avg.	4.0	55	7.0	9.0
Panicum clandestinum				
'Tioga'				
I	1	100	2	1
II	1	92	2	1
III	2	90	2	1
Avg.	1.3	94	2.0	1.0
P. virgatum				
PI-421138				
I	3	75	3	3
II	2	85	2	2
III	4	70	3	4
Avg.	3.0	77	2.7	3.0
Lathyrus sylvestris				
'Lathco'				
I	6	10	5	7
II	9	1	8	9
III	5	35	3	6
Avg.	6.6	15	5.3	7.3
Lespedeza cuneata				
'Appalow'				
I	2	80	3	4
II	2	85	3	4
III	5	25	5	5
Avg.	3.0	63	3.7	4.3

Table 6
(cont.)
Maryland Planting (continued)

Species/ Replication	Stand	Cover (%)	Wildlife Food	Wildlife Cover
Lespedeza cuneata 'Interstate'				
I	2	70	3	5
II	1	85	2	2
III	3	70	3	4
Avg.	2.0	75	2.7	3.7
L. thunbergii 'VA-70'				
I	3	60	3	4
II	2	85	2	2
III	5	40	4	6
Avg.	3.3	62	3.0	4.0

1/Plants established near Massey, MD in May 1980; Data recorded August 24.

2/Cover - Effective soil cover provided by planted species, expressed as percentage.

3/Capability of planted species to provide wildlife food.

4/Capability of planted species to provide wildlife cover.

5/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Advanced Evaluation of *Spartina patens*

34F015F

In 1976, the Cape May PM Team collected 78 accessions of *Spartina patens* (saltmeadow cordgrass) along the coastal areas from Massachusetts to Georgia. The 15 best accessions were selected for detailed evaluation. These were established on the center and on an exposed tidal bank along the Choptank River near Trappe, Maryland. Based on the 1978 data taken from the Trappe, Maryland planting and the on-center plots, ten of the best accessions were selected for additional testing. The ten selections were used to establish two new plantings in 1979. During 1980, five of the ten accessions were selected for advanced testing. A fine-stemmed prostrate strain from the Americus PMC (source NC) was added to the project. Three new tidal sites were planted near Wareham, Massachusetts; Nags Head, North Carolina; and Virginia Beach, Virginia.

The planting located near Wareham, Massachusetts exhibited very poor survival and growth. This poor performance is partially attributed to the extremely high salt content noted for this planting site. The Virginia Beach Planting was very successful. It is the best of all the plantings and continues to provide high quality data. One replication of the Nags Head, North Carolina Planting was destroyed by severe wave action.

During mid-summer or early fall of 1982, the entire North Carolina Planting was destroyed by construction equipment, apparently to be used as a building site.

Three additional plantings of *S. patens* were made in 1981. One is located near Warsaw, Virginia; another at Suffolk County Park in Long Island, New York. The third planting was established on the Chesapeake Bay in Kent County, Maryland. Potted plants were used.

The Long Island Planting suffered severe pedestrian damage early in the season and, consequently, never became established. During the establishment year, the Warsaw, Virginia Planting was severely damaged by a storm. The entire lower portion was washed away by high energy waves. The storm also deposited volumes of sand, gravel and organic matter on the upper portion of the planting. Another storm occurred during the spring of 1982 which was more intense than the first. While most of the planting was destroyed, a number of plants were still intact by late fall.

As with the Virginia Beach Planting, the planting in Kent County, Maryland was also successful. Some debris is occasionally washed onto the planting but appears to have little detrimental effect. Accession numbers PI-421237 and PI-421262 are consistently the best at this location for all three replications. The performance of these two accessions is nearly equal.

In the spring of 1982, another planting was made using three selections. The planting was established in Northumberland County, Virginia. Three replications were made using 128 potted plants per accessions for each replication. Some of the plants which were at the extreme forward and rear position of this planting were lost during the summer. These losses were primarily due to position and not accession performance. PI-421237 which is usually rated extremely high in most plantings was not considered the best accession for any factor at any time during the establishment year for this planting. PI-421262 was rated superior to the other accessions for stand, cover, foliage, uniformity of stand and potential ability to provide beach protection.

Table 1

Evaluations for four accessions of Spartina patens on a tidal area, 1982[1/]

Accession	Replication	Cover (%)	Dormancy (%)	Value for Intended Use[2/]	Rank
PI-421237	I	35	95	4	1
	II	60	95	1	1
	III	25	95	5	2
	Average	40	95	3.3	1.3
PI-421238	I	20	80	6	4
	II	50	80	3	3
	III	15	95	6	4
	Average	28	85	5.0	3.7
PI-421262	I	40	95	4	2
	II	40	95	5	4
	III	20	90	6	3
	Average	33	93	5.0	3.0
PI-434390	I	30	85	5	3
	II	55	85	2	2
	III	35	90	3	1
	Average	40	87	3.3	2.0

1/Planting established June 1981 at Echo Hill Camp, Chestertown, Maryland; Evaluated March 15.
2/Ratings: 1-10; 1=Excellent, 10=Poor.

Table 2

Evaluations for four accessions of *Spartina patens* on a tidal area, 1982[1/]

PI No. (Acc.)	Stand	Vigor	Regrowth	Percent Cover (%)	Value For Intended Purpose
			R-I		
421237	3[2/]	3[2/]	2[2/]	70[3/]	3[2/]
421238	5	7	6	35	6
421262	3	2	2	80	2
434390	4	5	5	45	5
			R-II		
421237	2	1	2	90	2
421238	5	5	4	55	4
421262	3	3	3	70	3
434390	4	4	4	75	3
			R-III		
421237	3	3	2	70	3
421238	6	6	5	35	5
421262	4	4	3	60	4
434390	4	4	4	60	4

1/96 hills/accession/replication were established at Echo Hill Camp, Chestertown, Maryland on June 3, 1981; data recorded May 18.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Percent cover represents the percent of total ground cover afforded by plant vegetation.

Table 3

Relative rating for four accessions 1/ of *Spartina patens* on a tidal bank, 1982

	R-I	R-II	R-III
Best 2/	421237	421237	421262
2nd Best	421262	421262	421237
3rd Best	421238	421238	434390
Last	434390	434390	421238

1/Planting was established on May 18, 1981 at Echo Hill Camp, Chestertown, Maryland; data recorded August 19.

2/Ratings based on the amount of growth, vigor and ground cover.

Table 4

Evaluations for four accessions [1] of *Spartina patens* on a tidal area, 1982

PI No.	Vigor [3]	Cover [2] (%)	Disease [4]	Seedheads
		R-I		
421237	1	100	2	Few
421238	5	45	4	Few
421262	1	100	2	Few
434390	6	25	3	Few
		R-II		
421237	1	100	2	Few
421238	6	40	2	Few-Mod.
421262	2	100	2	Few
434390	7	45	4	Few
		R-III		
421237	2	95	2	Few
421238	7	35	3	Few-Mod.
421262	3	95	3	Few
434390	5	45	3	Few

1/96 hills/accession/replication were established at Echo Hill Camp, Chestertown, Maryland on June 3, 1981; data recorded Aug. 19.
2/Percent cover represents the percent of total ground cover afforded by plant vegetation.
3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.
4/Ratings are - 1=None; 2=Slight; 4=Moderate; 6=Severe.

Table 5

Evaluations for four *Spartina patens* accessions on a tidal area, 1982[1/]

Accession	Replication	Stand [2/]	Dormancy [3/]	Cover (%) Above MHW	Cover (%) Below MHW
PI-421237	I	3	95	100	90
	II	4	95	85	65
	III	4	95	95	60
	Average	3.7	95	93	72
PI-421238	I	2	75	95	75
	II	1	60	100	80
	III	3	85	85	85
	Average	2.0	73	93	80
PI-421262	I	4	100	95	75
	II	5	90	80	50
	III	3	100	95	70
	Average	4.0	97	87	65
PI-434390	I	3	80	90	70
	II	3	95	95	70
	III	4	90	100	65
	Average	3.3	88	95	68

1/Planting established in Spring 1980 at Seashore State Park, Virginia Beach, Virginia; evaluated March 1.

2/Ratings are - 1=Excellent; 10=Poor.

3/Percent of foliage which is dormant (i.e. amount of foliage that is not green).

Table 6

Cover and storm protection of *Spartina patens*, 1982[1/]

PI No.	Rep I[2/]	II	III
421237	1	3	3
421238	3	1	5
421262	5	5	5
434390	5	5	5

1/Planting established in the spring of 1980 at Seashore State Park, Virginia Beach, Virginia; Data recorded July 20.

2/Ratings are for cover and protection from a storm - 1=Excellent; 3=Good; 5=Fair.

Table 7

Evaluations for four accessions of *Spartina patens* growing on a tidal bank, 1982[1/]

PI No.	Vigor	Percent Cover	Stem Density 1	2	3	Relative Rating
			R-I			
421237	4[2/]	70[3/]	82[4/]	133[4/]	246[4/]	2nd Best[5/]
421262	5	65	61	112	82	4th Best
434390	3	80	182	161	167	3rd Best
421238	3	80	148	101	146	Best
			R-II			
421238	2	85	148	114	167	Best
421262	6	50	87	59	72	4th Best
434390	4	70	116	152	90	3rd Best
421237	5	70	143	192	161	2nd Best
			R-III			
421237	4	65	163	92	162	3rd Best
434390	4	60	90	43	58	2nd Best
421262	5	55	48	58	20	4th Best
421238	4	65	66	112	238	Best

1/108 hills/accession/replication established May 22, 1980 at Virginia Beach, Virginia; data recorded October 19.
2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.
3/Number represents the percent of the ground within the total plot which is covered by live vegetative growth.
4/Number of live stems counted in 3 individual 30 cm square areas. Stems that were 3 cm or longer were counted.
5/Ratings based on vigor, growth, and ability to provide bank protection.

Table 8

Evaluations for four accessions of [1] *Spartina patens* on a tidal area, 1982

Accession	Replication	Stand [2]	Cover (%) [3]	Dormancy (%) [4]
PI-421237	I	5	50 [5]	95
	II	7	10 [5]	95
	III	4	75	95
	Average	5.3	45	95
PI-421238	I	7	15	95
	II	9	5	95
	III	10	5	95
	Average	8.7	8	95
PI-421262	I	9	5 [5]	100
	II	8 [5]	20 [5]	95
	III	5 [5]	85	90
	Average	7.3	37	95
PI-434390	I	6	40	80
	II	6	45	90
	III	9	5	95
	Average	7.0	30	89

1/Planting established in May 1981 at Carter Wellford Property on Rappahannock River in Warsaw, Virginia; Data recorded March 9.

2/Ratings are - 1=Excellent, 10=Poor.

3/Percent cover represents the percent of total ground cover afforded by plant vegetation.

4/Percent of foliage which is dormant (i.e. amount of foliage that is not green).

5/Treatment buried under sand, gravel and organic matter; poor performance due to burial.

Table 9

Plot depth, amount of cover and vigor for four *Spartina patens* accessions growing on a tidal bank, 1982[1/]

PI No/Rep	Depth (Feet)	Cover (%)	Vigor
PI-421237	[2/]		[3/]
I	20	90	4
II	23	80	8
Ave.	22	85	6
PI-421238			
I	27	90	2
II	22	80	3
Ave.	24	85	3
PI-421262			
I	24	70	5
II	25	90	1
Ave.	24	80	3
PI-434390			
I	25	85	3
II	25	90	2
Ave.	25	88	3

1/108 hills/replication/accession established near Nags Head, NC May 1980; Data recorded May 4.

2/Depth of planting plot from front to rear; planted plot depth was 27 feet.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 10

Relative rating for four Spartina patens accessions, 1982[1/]

	R-I	R-II
Best[2/]	PI-421262	PI-421238
2nd Best	PI-434390	PI-434390
3rd Best	PI-421238	PI-421262

1/108 hills/accession/replication established May 14 at Nags Head, NC; Data recorded May 4.

2/Best accession selected on general appearance for cover, amount of growth and intended use.

Table 11

Characteristics for four accessions of *Spartina patens* growing on a tidal bank, 1982 [1]

Accession/ Replication	Hills (No.)	Culms [2] (No.)	Spread [3] (cm)	Vigor [4]	Cover [4]
PI-421237					
I	45	195-60	30-18	2	3
II	32	164-104	26-30	3	4
III	82	86-43	22-18	2	3
Ave.	53	109	24	2.3	3.3
PI-421238					
I	49	96-53	26-25	3	4
II	56	87-51	15-18	3	4
III	84	90-35	18-22	3	4
Ave.	63	69	21	3	4
PI-421262					
I	72	116-89	24-28	2	2
II	-	0-0	0-0	-	-
III	101	74-50	26-23	2	3
Ave.	86(58)	110(55)	25	2	2.5
PI-434390					
I	65	73-78	23-28	2	3
II	30	91-44	28-24	3	4
III	74	119-71	26-24	3	4
Ave.	56	79	26	2.3	3.7

1/128 hills of potted plants/accession/replication established on May 26 in Northumberland County, Virginia; data recorded Aug. 17.

2/Number of culms in two hills; selection basis - random hill representing best plants and random hill representing average.

3/Maximum spread of culms emerging from sand in hills where culm counts were made.

4/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor.

Table 12

Characteristics for four *Spartina patens* accessions, 1982[1/]

Accession/ Replication	Disease Injury	Value[2/]	Hills/row
	[3/]	[3/]	[4/]
PI-421237			
I	2	4	7
II	2	5	9
III	5	3	14
PI-421238			
I	2	4	9
II	1	5	11
III	6	4	13
PI-421262			
I	3	2	10
II	-	-	0
III	6	4	16
PI-434390			
I	3	3	11
II	1	6	9
III	3	4	16

1/8 rows of 16 hills/accession/replication established on May 26 in Northumberland County, Virginia; data recorded August 17.

2/Conservation value of plants to protect and build up beach.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Number of living hills in longest row.

Table 13

Characteristics for four Spartina patens accessions, 1982[1/]

Accession/ Replication	Stand	Dormancy[2/]	Sand Cover	Value[3/]
	[4/]	[4/]	[4/]	[4/]
PI-421237				
I	5	4	5	5
II	5	4	5	4
III	3	3	4	3
PI-421238				
I	4	3	5	4
II	4	3	4	4
III	2	2	4	3
PI-421262				
I	3	4	4	2
II	10	-	-	-
III	3	3	4	2
PI-434390				
I	3	2	3	2
II	6	3	6	4
III	4	3	5	4

1/8 rows of 16 hills/accession/replication established on May 26 in Northumberland County, Virginia; Data recorded November 16.

2/Dormancy - Capability of foliage to remain green into the dormant season.

3/Conservation value of plants to protect and build up beach.

4/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None; - = No rating.

Table 14

Relative rating for *Spartina patens* for tidal bank stabilization, 1982[1/]

Order	Replication I	II	III
Best[2/]	PI-421262	PI-421238	PI-421262
2nd Best	PI-434390	PI-434390	PI-421237
3rd Best	PI-421238	PI-421237	PI-421238
Last	PI-421237	-	PI-434390

1/128 hills of potted plants/accession/replication established on May 26 in Northumberland County, Virginia; data recorded August 17.

2/Ratings based on visual observation of stand, cover, foliage, uniformity of stand and potential to protect beach.

Myrica Species Planting Technique

34C005C

Myrica spp. are native shrubs that are well adapted to sand dunes along the mid-Atlantic coast. These species are among the dominant woody plants immediately behind the foredune on many natural sites. *M. pensylvanica* (bayberry) occurs chiefly along the U.S. coast from Maine to Maryland. *M. cerifera* (wax myrtle) is adapted to sandy conditions but will grow in heavier soils. They are excellent sand stabilizers and are vital to the environment of natural dunes.

While *Myrica* spp. are well adapted to sand dunes along the east coast, the survival rate of bare-root planting stock has been relatively poor. Two-year-old *M. pensylvanica* seedlings are difficult to plant due to their huge top and root growth. Yet, one-year-old seedlings are generally small and have an inadequate root system. Two-year-old seedlings of *M. cerifera* are somewhat smaller than the same age *M. pensylvanica* plants. When 2-0 stock of *M. cerifera* have been planted on the dune area, the survival rates have varied from very poor to excellent. A technique which would result in consistently high survival rates for bare-root *M. pensylvanica* and *M. cerifera* seedlings on sand dunes is needed.

This project began in the spring of 1980 by planting 1-0 and 2-0 seedlings of the two *Myrica* species on a sand dune. In 1981, another planting was made on a man-made, inland sand dune in Ocean County, New Jersey and repeated at a nearby site in 1982. Only 1-0 and 2-0 seedlings of *M. pensylvanica* and 2-0 *M. cerifera* were used in the 1982 Planting. The root treatments were: (1) clay slurry applied to roots, (2) organic matter (peatmoss) incorporated with soil in the planting hole, (3) super slurper incorporated with soil in the planting hole, (4) peatmoss plus super slurper incorporated in the planting hole, and (5) control (no treatment).

Other than the unsuitability of 1-0 *M. cerifera*, the results have been too variable to draw any conclusions. Evaluations of the 1981 and 1982 Plantings will continue in 1983.

Table 1

Vigor and survival for two woody species, 1982[1/]

Treatment Species/age	Vigor Replication I	Vigor Replication II	Vigor Replication III	No. Living Replication I	No. Living Replication II	No. Living Replication III
Super slurper						
Bayberry (1-0)	6[2/]	4	5	7[3/]	9	7
Bayberry (2-0)	3	3	3	10	7	6
Wax myrtle (1-0)	-	4	-	0	1	1
Wax myrtle (2-0)	4	5	6	5	5	4
Super slurper + Peatmoss						
Bayberry (1-0)	4	3	4	8	9	6
Bayberry (2-0)	3	2	3	6	10	8
Wax myrtle (1-0)	-	-	-	0	0	1
Wax myrtle (2-0)	4	4	6	8	5	4
Peatmoss						
Bayberry (1-0)	5	3	4	8	10	8
Bayberry (2-0)	3	2	2	10	10	7
Wax myrtle (1-0)	9	-	-	1	0	0
Wax myrtle (2-0)	2	6	4	10	5	3
Clay						
Bayberry (1-0)	5	3	5	8	9	4
Bayberry (2-0)	3	3	2	10	8	10
Wax myrtle (1-0)	-	-	-	0	1	0
Wax myrtle (2-0)	3	5	7	9	4	2

Table 1
(cont.)

Vigor and survival for two woody species, 1982

Treatment Species/age	Vigor Replication I	Vigor Replication II	Vigor Replication III	No. Living Replication I	No. Living Replication II	No. Living Replication III
Control						
Bayberry (1-0)	5	5	5	8	8	6
Bayberry (2-0)	3	3	2	9	10	8
Wax myrtle (1-0)	9	-	-	1	1	1
Wax myrtle (2-0)	4	6	-	10	3	1

1/10 seedlings planted March 18, 1981; data recorded May 17. Treatments are: Super slurper - 20 gms SGP-200 mixed in planting hole; Peatmoss - 1 liter of peatmoss mixed in planting hole; Super slurper + Peatmoss - both at 20 + 1 mixed in planting hole; Clay - Roots dipped in thick clay slurry; Control - Roots dipped in water. Planting at the ASARCO mine near Lakehurst, New Jersey.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; - = No Rating.

3/Ten planted - number surviving.

Table 2

Dimensions, vigor and seed production for two woody species, 1982[1/]

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Control					
Wax Myrtle (1-0)			[2/]	[3/]	[4/]
I	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
II	25	20	6	4	10
	-	-	-		
	-	-	-		
Ave.	8.3	6.7	2		
III	35	45	12	5	10
	-	-	-		
	-	-	-		
Ave.	11.7	15	4		
Wax Myrtle (2-0)					
I	60	20	11	6	10
	50	65	15		
	65	40	15		
Ave.	58.3	41.7	13.7		
II	15	10	6	7	10
	30	25	8		
	-	-	-		
Ave.	15	11.7	4.7		
III	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
Bayberry (1-0)					
I	30	25	7	6	10
	20	45	8		
	30	35	10		
Ave.	26.6	35	8.3		
II	30	50	13	5	10
	20	45	10		
	40	70	23		
Ave.	30	55	15.3		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Control					
Bayberry (1-0)					
III	50	55	11	5	10
	40	65	12		
	45	70	19		
Ave.	45	63.3	10.7		
Bayberry (2-0)					
I	50	45	16	5	10
	40	40	14		
	50	35	15		
Ave.	46.7	40	15		
II	55	45	11	4	7
	55	40	15		
	70	65	19		
Ave.	60	50	15		
III	105	75	23	4	4
	75	75	22		
	70	75	21		
Ave.	83.3	75	22		
Super slurper					
Wax Myrtle					
I	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
II	30	35	16	7	10
	-	-	-		
	-	-	-		
Ave.	10	11.7	5.3		
III	30	20	7	6	10
	-	-	--		
	-	-	-		
Ave.	10	6.7	2.3		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Super slurper					
Wax myrtle (2-0)					
I	45	20	6	5	10
	45	60	24		
	45	30	11		
Ave.	45	36.7	13.7		
II	30	25	9	7	10
	45	25	12		
	55	35	13		
Ave.	43.3	28.3	11.3		
III	35	35	11	4	10
	55	50	15		
	35	35	9		
Ave.	41.7	40	11.7		
Bayberry (1-0)					
I	25	20	6	7	9
	30	50	8		
	20	15	5		
Ave.	25	28.3	6.3		
II	20	25	5	6	10
	40	45	11		
	35	35	8		
Ave.	31.7	35	8		
III	40	60	16	4	10
	35	35	8		
	35	40	9		
Ave.	36.7	45	11		
Bayberry (2-0)					
I	45	50	14	5	7
	40	40	8		
	50	50	15		
Ave.	45	46.7	12.3		
II	50	30	7	5	6
	55	35	12		
	60	60	22		
Ave.	55	41.7	13.7		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Super slurper					
Bayberry (2-0)					
III	50	40	11	5	6
	60	60	19		
	70	60	18		
Ave.	60	53.3	16		
Super slurper + Peatmoss					
Wax Myrtle (1-0)					
I	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
II	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
III	40	40	11	5	10
	-	-	-		
	-	-	-		
Ave.	13.3	13.3	3.7		
Wax Myrtle (2-0)					
I	50	35	12	5	10
	40	60	13		
	35	25	10		
Ave.	41.7	40	11.7		
II	40	25	9	5	10
	50	40	15		
	65	70	18		
Ave.	51.7	45	14		
III	35	35	7	5	10
	30	25	7		
	55	25	13		
Ave.	40	28.3	9		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Super slurper + Peatmoss					
Bayberry (1-0)					
I	45	60	12	5	10
	40	50	14		
	30	45	11		
Ave.	38.3	51.7	12.3		
II	45	40	13	5	8
	50	65	26		
	50	70	14		
Ave.	48.3	58.3	17.7		
III	45	80	10	4	10
	40	35	10		
	35	40	10		
Ave.	40	51.7	10		
Bayberry (2-0)					
I	55	45	11	6	10
	55	45	12		
	50	50	19		
Ave.	53.3	46.7	14		
II	50	25	10	4	7
	65	60	18		
	50	40	9		
Ave.	55	41.7	12.3		
III	80	85	25	4	4
	95	90	23		
	65	95	19		
Ave.	80	90	22.3		
Peatmoss					
Wax Myrtle (1-0)					
I	25	15	5	7	10
	-	-	-		
	-	-	-		
Ave.	8.3	5	1.7		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Peatmoss					
Wax Myrtle (1-0)					
II	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
III	40	15	7	6	10
	-	-	-		
	-	-	-		
Ave.	13.3	5	2.3		
Wax Myrtle (2-0)					
I	50	55	20	4	10
	40	45	12		
	60	40	11		
Ave.	50	46.7	14.3		
II	30	15	7	6	10
	40	30	8		
	-	-	-		
Ave.	23.3	15	5		
III	50	30	8	6	10
	25	25	8		
	45	35	12		
Ave.	40	30	9.3		
Bayberry (1-0)					
I	30	30	7	5	10
	50	80	15		
	35	50	11		
Ave.	38.3	53.3	11		
II	25	45	11	5	10
	25	45	14		
	25	35	8		
Ave.	25	41.7	11		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Peatmoss					
Bayberry (1-0)					
I	60	80	20	4	10
	40	45	12		
	40	50	18		
Ave.	46.7	58.3	16.7		
Bayberry (2-0)					
I	50	50	14	6	7
	60	35	13		
	50	70	15		
Ave.	53.3	51.7	14		
II	70	30	14	4	7
	70	60	18		
	55	65	17		
Ave.	65	51.7	16.3		
III	70	65	20	5	5
	60	50	19		
	65	60	20		
Ave.	65	58.3	19.7		
Clay					
Wax Myrtle (1-0)					
I	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		
II	20	10	5	7	10
	-	-	-		
	-	-	-		
Ave.	6.7	3.3	1.7		
III	-	-	-	10	10
	-	-	-		
	-	-	-		
Ave.	-	-	-		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Clay					
Wax Myrtle (2-0)					
I	45	35	9	6	10
	60	45	14		
	60	65	20		
Ave.	55	48.3	14.3		
II	35	15	6	5	10
	25	20	6		
	35	35	13		
Ave.	31.7	23.3	8.3		
III	35	35	11	6	10
	-	-	-		
	-	-	-		
Ave.	11.7	11.7	3.7		
Bayberry (1-0)					
I	35	55	12	5	10
	45	60	12		
	35	55	11		
Ave.	38.3	56.7	11.7		
II	55	55	18	5	9
	50	50	10		
	50	35	18		
Ave.	51.7	46.7	15.3		
III	50	60	17	5	8
	65	65	18		
	40	45	12		
Ave.	51.7	56.7	15.7		
Bayberry (2-0)					
I	35	35	9	6	10
	55	60	14		
	50	35	9		
Ave.	46.7	43.3	10.7		
II	60	60	18	5	7
	55	60	16		
	40	35	11		
Ave.	51.7	51.7	15		

Table 2
(cont.)

Dimensions, vigor and seed production for two woody species, 1982

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production
Clay					
Bayberry (2-0)					
III	90	70	19	4	5
	55	70	16		
	80	90	20		
Ave.	75	76.7	18.3		

1/Ten seedlings per treatment planted March 18, 1981 at the ASARCO Mine near Lakehurst, New Jersey; data recorded November 15.

2/Thickness of main stem or largest stem on multi-stemmed plants at soil line. Dash indicates no living plants at that location.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead or none.

4/Ratings are - 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very Sparse; 10=None.

Table 3

Survival, vigor and insect damage for woody plants growing on an inland sand dune, 1982 [1/]

Treatment/ Species/Rep	Survival (No.)	Vigor	Insect Damage
Super slurper		[2/]	[3/]
Bayberry(1-0)			
I	6	6	6
II	6	6	7
III	8	7	8
Bayberry(2-0)			
I	6	7	8
II	6	6	7
III	10	5	6
Wax Myrtle(2-0)			
I	1	9	1
II	7	7	3
III	2	8	1
Super slurper + Peat			
Bayberry(1-0)			
I	6	5	5
II	4	7	3
III	8	6	5
Bayberry(2-0)			
I	6	6	4
II	5	6	7
III	8	5	5
Wax myrtle(2-0)			
I	2	7	2
II	3	9	3
III	5	8	1
Peat			
Bayberry(1-0)			
I	10	7	8
II	4	8	5
III	9	5	6
Bayberry(2-0)			
I	8	6	4
II	9	6	8
III	6	6	6
Wax Myrtle(2-0)			
I	4	5	3
II	5	6	3
III	4	8	1
Clay			
Bayberry(1-0)			
I	8	7	8
II	7	7	9
III	8	7	8
Bayberry(2-0)			
I	6	6	6
II	9	5	6
III	6	6	6
Wax Myrtle(2-0)			
I	5	8	4
II	2	7	1
III	4	9	1

Table 3
(cont.)

Survival, vigor and insect damage
for woody plants growing on an inland sand dune, 1982

Treatment/ Species/Rep	Survival (No.)	Vigor	Insect Damage
Control			
Bayberry(1-0)			
I	7	5	6
II	9	6	7
III	10	6	5
Bayberry(2-0)			
I	6	7	7
II	9	7	8
III	9	5	6
Wax Myrtle(2-0)			
I	2	7	1
II	4	9	1
III	4	7	2

1/10 plants/species/treatment/age/replication planted in Ocean County, New Jersey March 25,; data recorded June 30.(Clayton Site)

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Ratings are - 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe; 10=Completely defoliated.

Table 4

Dimensions of woody species growing on a sandy site, 1982[1/]

Treatment/ Species/Rep	Plant Positions		Height (cm)		Width (cm)		Diameter (mm)	
Super slurper								
Wax myrtle (2-0)	[2/]						[3/]	
I	4	7	15	15	5	10	5	9
II	3	6	30	10	15	10	6	2
III	2	9	10	15	10	10	2	8
Ave.			15.8		10		5.3	
Bayberry (1-0)								
I	1	10	15	5	5	10	2	3
II	5	8	15	20	15	10	3	5
III	4	7	20	20	15	5	5	3
Ave.			15.8		10		3.5	
Bayberry (2-0)								
I	4	8	5	20	5	5	3	4
II	5	-	20	-	20	-	7	-
III	3	9	20	15	30	30	5	3
Ave.			13.3		15		3.7	
Super slurper + peatmoss								
Wax myrtle (2-0)								
I	6	9	30	25	15	20	4	6
II	4	6	5	10	5	10	5	4
III	6	7	15	20	20	10	8	5
Ave.			17.5		13.3		5.3	
Bayberry (1-0)								
I	3	9	20	20	20	20	3	5
II	5	-	25	-	15	-	5	-
III	2	7	5	30	10	20	3	5
Ave.			16.7		14.2		3.5	
Bayberry (2-0)								
I	4	7	20	10	20	10	5	5
II	-	8	-	15	-	25	-	5
III	3	7	20	20	20	15	3	6
Ave.			14.2		15		4	

Table 4
(cont.)

Dimensions of woody species growing on a sandy site, 1982

Treatment/ Species/Rep	Plant Positions	Height (cm)	Width (cm)	Diameter (mm)
Peatmoss				
Wax myrtle (2-0)				
I	5 8	20 30	15 10	10 7
II	4 7	25 5	20 5	10 3
III	7 8	20 20	15 10	4 4
Ave.		20	12.5	6.3
Bayberry (1-0)				
I	3 7	10 20	10 15	3 5
II	2 -	30 -	15 -	5 -
III	4 7	15 15	10 20	4 4
Ave.		15	11.7	3.5
Bayberry (2-0)				
I	- 10	- 25	- 10	- 5
II	1 8	15 25	25 25	5 5
III	4 6	20 20	30 15	4 6
Ave.		17.5	17.5	4.2
Clay				
Wax myrtle (2-0)				
I	6 7	20 15	5 10	3 5
II	3 4	25 20	10 5	7 7
III	- 8	- 10	- 15	- 8
Ave.		15	7.5	5
Bayberry (1-0)				
I	- 10	- 10	- 5	- 2
II	1 3	15 15	5 5	3 4
III	4 9	20 15	10 10	4 3
Ave.		12.5	5.8	2.6
Bayberry (2-0)				
I	4 7	20 40	5 25	3 6
II	5 7	20 25	15 20	6 4
III	4 8	10 15	15 35	3 6
Ave.		21.7	19.2	4.7

Table 4
(cont.)

Dimensions of woody species growing on a sandy site, 1982

Treatment/ Species/Rep	Plant Positions		Height (cm)		Width (cm)		Diameter (mm)	
Control								
Wax myrtle (2-0)								
I	7	10	10	15	15	5	4	2
II	3	9	20	15	5	5	7	5
III	3	-	15	-	15	-	4	-
Ave.			14.2		7.5		3.7	
Bayberry (1-0)								
I	4	7	20	20	10	10	4	4
II	4	5	35	25	10	15	4	3
III	4	7	5	10	10	5	4	3
Ave.			19.2		10		3.7	
Bayberry (2-0)								
I	2	8	20	15	15	20	4	9
II	4	8	15	45	15	20	4	6
III	6	8	20	15	15	10	5	3
Ave.			21.7		15.8		5.2	

1/10 plants/species/treatment/age/replication planted in Ocean County, New Jersey March 25; data recorded November 17. (Clayton Site)

2/Position of plant measured within the row.

3/Thickness at the base of the stem or thickest stem on multistemmed plants.

Table 5

Vigor and survival for woody species growing on an inland sand dune, 1982[1]

Treatment/ Species	Vigor			Survival			
	R-I	R-II	R-III	R-I	R-II	R-III	Total
Super slurper	[2]			[3]			
Wax myrtle (2-0)	4	5	4	5	4	6	15
Bayberry (1-0)	8	7	7	3	3	6	12
Bayberry (2-0)	7	5	5	3	1	4	8
Super slurper + Peatmoss							
Wax myrtle (2-0)	4	5	4	3	2	4	9
Bayberry (1-0)	5	6	5	5	1	4	10
Bayberry (2-0)	5	5	5	3	1	4	8
Peatmoss							
Wax myrtle (2-0)	4	4	5	3	3	3	9
Bayberry (1-0)	5	5	5	4	1	7	12
Bayberry (2-0)	8	4	4	1	2	6	9
Clay							
Wax myrtle (2-0)	5	5	4	3	2	1	6
Bayberry (1-0)	9	9	6	1	2	3	6
Bayberry (2-0)	5	4	4	6	7	4	17
Control							
Wax myrtle (2-0)	6	5	6	3	4	1	8
Bayberry (1-0)	6	5	6	7	4	5	16
Bayberry (2-0)	6	4	5	3	4	3	10

1/10 plants/species/treatment/age/replication planted in Ocean County, New Jersey March 25; data recorded November 17. (Clayton Site)

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

3/Number of surviving plants within row.

Cordgrass Planting Technique

34C022F

Several methods have been used to establish cordgrass on tidal streambanks. Fertilizer is essential when planting in a sterile sand and is desirable even on clay sites. Controlled release and soluble fertilizers applied at the time of establishment have produced conflicting results. Despite the cost, the controlled release material (3-4 months) is the preferred fertilizer especially when planting below the high water elevation. The cordgrasses will not tolerate constant shade. It is important to have full sun for at least one half of the day. Spartina alterniflora (smooth cordgrass) plants that are not grown in a saline medium, must be acclimated to salt well in advance to planting into the tidal zone.

Several plantings have been made by the Cape May PMC using both S. patens (saltmeadow cordgrass) and S. alterniflora. These results are published in the previous annual reports.

The most current planting was established in Northumberland County, Virginia in 1982. Two replications were installed using both 3-month-old potted plants and 1-year-old bare-root plants of S. alterniflora and S. patens. There were two fertilizer treatments: 30 grams of 10-10-10 soluble fertilizer per hill or 30 grams of 19-6-12 slow release osmocote fertilizer per hill.

First year results for S. patens indicated that survival was best for the osmocote fertilizer treatment but the type of plant (bare-root vs. potted) did not make a difference. Percent cover was, also, better for the osmocote and again was not affected by the plant type.

The results for S. alterniflora was also inconclusive. The best stand of plants was obstained from potted/10-10-10 fertilizer treatment while the best vigor was exhibited by the potted/osmocote treatment.

Table 1

Effect of fertilizer and planting stock [1]
on two cordgrasses on a tidal bank, 1982

Species[2]/ treatment/ replication	Hills (No.)	Culms[3] (No.)	Spread[4] (cm)	Vigor	Cover
Saltmeadow					
Potted/10-10-10				[5]	[5]
I	53	87-24	21-14	4	5
II	51	27-13	13-11	5	6
Ave.	52	38	15	4.5	5.5
Potted/osmocote					
I	60	110-53	24-13	3	3
II	45	83-68	27-16	3	4
Ave.	52	78	20	3	3.5
Bare-root/10-10-10					
I	42	68-36	20-27	4	7
II	32	44-14	32-18	6	8
Ave.	37	40	24	5	7.5
Bare-root/osmocote					
I	47	73-23	40-14	3	5
II	48	47-41	24-26	4	5
Ave.	48	46	26	3.5	5
Smooth					
Potted/10-10-10					
I	84	9-8	28-10	3	5
II	70	20-10	28-11	5	6
Ave.	77	12	19	4	5.5
Potted/osmocote					
I	73	25-6	35-18	2	4
II	89	18-18	19-20	2	3
Ave.	81	17	23	2	3.5
Bare-root/10-10-10					
I	30	16-7	32-15	4	6
II	48	5-5	13-8	6	7
Ave.	39	8	17	5	6.5

Table 1
(cont.)

Effect of fertilizer and planting stock
on two cordgrasses on a tidal bank, 1982

Species/ treatment/ replication	Hills (No.)	Culms (No.)	Spread (cm)	Vigor	Cover
Smooth(cont.)					
Bare-root/osmocote					
I	31	11-4	20-17	5	7
II	58	20-8	25-9	3	4
Ave.	44	11	18	4	5.5

1/60 hills of saltmeadow and 100 hills of smooth cordgrass were planted on May 26 in Northumberland Co., Virginia; data recorded Aug. 17.

2/Treatments = Potted: 3 month old plants; Bare-root: Saltmeadow-5 culms/hill, smooth-2 culms/hill; 10-10-10: 30 grams soluble fertilizer/hill; osmocote-30 grams 4 months release/hill.

3/Typical large and small hill size selected at random - 2 per treatment; No. of culms per hill.

4/Spread - Distance of plant spread at base of hills used for culm count.

5/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 2

Effect of fertilizer and planting stock [1]
on two cordgrasses on a tidal bank, 1982

Species[2] Treatment/ Replication	Hills (No.)	Cover	Protection
Saltmeadow			
Potted/10-10-10		[3]	[3]
I	39	4	5
II	38	8	7
Ave.	38	6	6
Potted/osmocote			
I	42	5	6
II	40	4	4
Ave.	41	4.5	5
Bare-root/10-10-10			
I	32	5	6
II	31	8	7
Ave.	32	6.5	6.5
Bare-root/osmocote			
I	43	6	7
II	46	3	3
Ave.	44	4.5	5
Smooth			
Potted/10-10-10			
I	39	4	5
II	75	5	5
Ave.	57	4.5	5
Potted/osmocote			
I	53	5	4
II	40	4	4
Ave.	46	4.5	4
Bare-root/10-10-10			
I	57	7	7
II	38	8	7
Ave.	48	7.5	7
Bare-root/osmocote			
I	43	6	7
II	46	3	3
Ave.	44	4.5	5

Table 2
(cont.)

Effect of fertilizer and planting stock
on two cordgrasses on a tidal bank, 1982

1/60 hills of saltmeadow and 100 hills of smooth cordgrass per treatment per replication on May 26 in Northumberland County, Virginia; Data recorded November 16.

2/Treatments = Potted: 3-month-old plants; Bare-root: Saltmeadow-5 culms per hill, smooth=2 culms per hill; 10-10-10: 30 grams soluble fertilizer/hill; osmocote-30 grams 4 month release/hill.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 3

Relative rating for two cordgrasses by treatments, 1982[1/]

Species	Replication I	Replication II
Saltmeadow		
Best	Potted/10-10-10	Bare-root/osmocote
2nd Best	Potted/osmocote	Potted/osmocote
3rd Best	Bare-root/10-10-10	Potted/10-10-10
Worst	Bare-root/osmocote	Bare-root/10-10-10
Smooth		
Best	Potted/osmocote	Potted/osmocote
2nd Best	Bare-root/10-10-10	Bare-root/osmocote
3rd Best	Potted/10-10-10	Potted/10-10-10
Worst	Bare-root/osmocote	Bare-root/10-10-10

1/Rating based on general appearance of stand, cover, vigor, foliage and ability to protect the tidal bank; ratings made November 16.

Revegetation of Sand Dunes

Binational Agriculture Research and Development (BARD)

34C024C

Ammophila breviligulata (American beachgrass) has been successful for the initial stabilization of sand dunes. However, the long term cover it provides is not adequate to prevent strong winds from blowing and depositing sand onto agriculture or other type lands. While *A. breviligulata* is considered effective as a sand stabilizing plant, stands are often short-lived due to natural deterioration.

Salt tolerant plants which are persistent on sandy soils and can be interplanted with *A. breviligulata* are needed to provide quality vegetation to prevent the blowing of sand onto prime lands. Proven fertilization methods are also necessary to increase the vigor of existing woody plants on sand dune areas.

The BARD project is a cooperative effort between Israel and the United States. The project encompasses studies in Israel, Delaware, Virginia and California. The New Jersey portion of the project began in March 1981 near Fenwick, Delaware and Virginia Beach, Virginia. Two types of plantings were evaluated at each location during the establishment year. One study involved "Interplanting of long-lived herbaceous species with *A. breviligulata* 'Cape'." These plantings were established on unstable sand dunes that had previously been vegetated with *A. breviligulata* but were barren at planting time. The second situation was located on stable dunes that were partially covered with native perennial vegetation in a poor state of vigor. This study involved "An evaluation of the effect of fertilizer treatments on the invasion of long-lived perennial ground cover species and improved vigor of plant growth on mid-Atlantic sand dunes". Both of these studies were duplicated in 1982 under similar conditions.

The five herbaceous species which were interplanted with *A. breviligulata* during 1981 were Carex kobomugi (Japanese sedge); *C. arenaria* (European sedge), *Elymus arenarius* (European wildrye), *E. vancouverensis* (Vancouver wildrye) and *Panicum amarum* (bitter panicgrass). However, due to the poor performance of *C. arenaria*, this species was not used in the 1982 herbaceous study.

In the spring of 1982, the 1981 herbaceous plantings at both the Virginia and Delaware locations were split into sub-plots. One-half of these plantings were fertilized with 750 kg/ha of 10-10-10 and the other half served as a control. By July, plants at both locations exhibited increased vigor on the fertilized portion of the plots. However, this trend was more apparent at the Virginia location than the Delaware location. Plant growth at both locations was hampered by sand accumulation blown onto the plots. This was more apparent in Delaware than in Virginia. The best species based upon cover, density, stand, spread and vigor for both the fertilized

and control area were C. kobomugi and P. amarum.

The 1982 herbaceous planting was rated successful at both locations. As with the 1981 planting, E. arenarius was outstanding in initial survival and vigor. While vigor ratings in most cases were lower for C. kobomugi and P. amarum during this initial establishment period, both species were competitive with the Elymus spp.

Effect of Fertilizer on the Invasion of Long-Lived Perennials

Prunus serotina (black cherry) and Myrica spp. are the dominant woody species for the 1981 study at the Virginia location while Myrica spp. are clearly dominant at the Delaware location. There was not any significant change or even a trend in the dominant species during the first year. Total canopy and canopy afforded by each species did not significantly change. The amount of variation for canopy from spring to fall evaluation was greater within a fertilizer treatment than among treatments. While vigor was not clearly improved by fertilizer, the trend at the Virginia location was toward increased vigor with increases in fertility.

The second study for this project began in April of 1982. The two locations were the same as for the 1981 study, however, the named species involved at the Delaware location were somewhat different while those for the Virginia location were similar.

This is a long term project and will require additional evaluations to confirm the trends. Funds were approved under an International Agreement for the period June 6, 1981 to June 5, 1983. The existing plantings will be evaluated for several years but no additional plantings will be established.

Table 1

Second year survival and vigor for five herbaceous species growing on a sand dune, 1982[1]
(1981 Study-Virginia Location)

Species	Survival (No. of Hills)	Vigor
	R-I	
Elymus arenarius	0	-[2]
E. vancouverensis	26	6
Carex kobomugi	41	4
C. arenaria	0	-
Panicum amarum	25	4
	R-II	
P. amarum	2	5
E. arenarius	11	7
C. arenaria	10	7
E. vancouverensis	31	5
C. kobomugi	34	3
	R-III	
E. vancouverensis	-[3]	6
C. arenaria	3	7
P. amarum	31	5
C. kobomugi	32	4
E. arenarius	15	6

1/80 hills planted/accession/replication on March 10, 1981 at Virginia Beach, Virginia; data recorded April 28.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Sand accumulation prevented survival count.

Table 2

Relative rating for five herbaceous species growing on a sand dune, 1982 1/
(1981 Study-Virginia Location)

	R-I	R-II	R-III
Best	Carex kobomugi	C. kobomugi	C. kobomugi
2nd Best	P. amarum	Elymus vancouverensis	P. amarum
3rd Best	E. vancouverensis	E. arenarius	E. arenarius

1/80 hills planted/accession/replication on March 10, 1981 at Virginia Beach, Virginia; data recorded April 28.

2/Best accession selected based upon survival, vigor and regrowth.

Table 3

Evaluations for five herbaceous plant species interplanted in 1/ *Ammophila breviligulata* during the second growing season, 1982 (1981 Study-Virginia Location)

Species	Fertilized				Control			
	Vigor 2/	Stand 2/	Cover (%) 3/	Cover (%) 4/	Vigor 2/	Stand 2/	Cover (%) 3/	Cover (%) 4/
R-I								
Elymus arenarius	7	9	< 5	35	9	8	<5	30
E. vancouverensis	5	8	10	30	6	8	<5	25
Carex kobomugi	3	5	5	20	5	6	<5	35
C. arenaria	8	9	< 5	25	10	10	0	55
Panicum amarum	3	7	5	40	5	7	<5	35
R-II								
P. amarum	3	9	<5	30	7	8	<5	25
E. arenarius	6	8	<5	25	7	8	<5	20
C. arenaria	7	9	<5	30	7	9	<5	25
E. vancouverensis	7	8	<5	20	6	7	<5	20
C. kobomugi	5	5	5	25	6	6	<5	15
R-III								
E. vancouverensis	10	10	<5	20	10	10	0	15
C. arenaria	10	10	0	10	10	10	0	5
P. amarum	4	7	5	10	5	7	5	10
C. kobomugi	5	7	<5	25	6	7	<5	10
E. arenarius	5	9	<5	55	10	10	0	15

1/Planting was established at Virginia Beach, Virginia on March 10, 1981. Replications were divided into equal subplots and fertilized with a split application of 10-10-10 at the rate of 750 lbs/A; Data recorded June 16.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

3/Percent of soil cover provided by the interplanted species only.

4/Percent of soil cover provided by the interplanted species within the plot plus the *Ammophila breviligulata*.

Table 4

Early fall vigor and cover for five herbaceous plant species interplanted in *Ammophila breviligulata* during the second growing season, 1982[1/] (1981 Study-Virginia Location)

Species	Fertilized Vigor	Fertilized % Cover Interplanted Species	Fertilized % Cover Total	Control Vigor	Control % Cover Interplanted Species	Control % Cover Total
			Rep I			
Elymus arenarius	10[2/]	0	40[3/]	10	0	25
E. vancouverensis	6	5	35	7	5	20
Carex kobomugi	4	5	20	6	5	20
C. arenaria	10	0	45	10	0	50
Panicum amarum	3	35	70	3	30	35
			Rep II			
P. amarum	5	5	45	6	5	35
E. arenarius	8	5	35	8	5	20
C. arenaria	8	5	55	9	5	40
E. vancouverensis	10	0	30	7	5	40
C. kobomugi	5	10	45	6	5	25
			Rep III			
E. vancouverensis	10	0	20	10	0	25
C. arenaria	9	5	10	10	0	5
P. amarum	5	10	20	5	10	20
C. kobomugi	3	20	55	6	5	20
E. arenarius	10	0	80	10	0	25

1/Planting was established at Virginia Beach, Virginia on March 10, 1981. Replications were divided into equal subplots and fertilized with a split application of 750 kg/ha of 10-10-10 in the spring of 1982. Data recorded September 20.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

3/Number indicates the percent cover for both the four rows of interplanted species plus the two rows of 'Cape' American beachgrass positioned between each row of them.

Table 5

Evaluations for five herbaceous plant species interplanted in *Ammophila breviligulata* during the second growing season, 1982[1]/
(1981 Study-Virginia Location)

Species	Fertilized					Control				
	Seed Production	Seed Quality	Stem Density			Seed Production	Seed Quality	Stem Density		
			1	2	3			1	2	3
			R-I							
	[2]/	[3]/			[4]/					
Elymus arenarius	0	-	0	0	0	0	-	0	0	0
E. vancouverensis	19	P	7	12	27	0	-	5	3	7
Carex kobomugi	0	-	3	3	4	0	-	2	3	4
Carex arenaria	0	-	0	0	0	0	-	0	0	0
Panicum amarum	1	P	5	7	6	1	P	7	4	9
			R-II							
P. amarum	0	-	3	2	2	1	P	3	3	2
E. arenarius	0	-	5	7	8	0	-	8	6	7
C. arenaria	0	-	72	13	17	0	-	28	12	19
E. vancouverensis	0	-	0	0	0	0	-	3	1	3
C. kobomugi	0	-	5	3	4	0	-	2	3	2
			R-III							
E. vancouverensis	0	-	0	0	0	0	-	0	0	0
C. arenaria	0	-	0	0	0	0	-	0	0	0
P. amarum	0	-	7	2	7	6	G	4	4	5
C. kobomugi	0	-	5	8	6	0	-	2	3	4
E. arenarius	0	-	0	0	0	0	-	0	0	0

1/Planting was established at Virginia Beach, Virginia on March 10, 1981. Replications were divided into equal subplots and fertilized with a split application of 750 kg/ha of 10-10-10 in the spring of 1982; data recorded September 20.

2/Number indicates the number of seedheads within the second interplanted row beginning on the north side of plot.

3/Ratings are - G=Good; P=Poor or immature; - = Not rated.

4/Stem density represents the number of stems counted for three individual randomly selected plants.

Table 6

First year relative rating for four herbaceous accessions growing on a sand dune, 1982[1/]
(1982 Study-Virginia Location)

	R-I	R-II	R-III
Best[2/]	Elymus arenarius	E. arenarius	E. arenarius
2nd Best	Panicum amarum	P. amarum	E. vancouverensis
3rd Best	Carex kobomugi	E. vancouverensis	P. amarum
4th Best	E. vancouverensis	C. kobomugi	C. kobomugi

1/Planting installed on March 23 at Virginia Beach, Virginia; data recorded June 16.

2/Ratings based on plant vigor.

Table 7

First year evaluations for four herbaceous plant species interplanted in *Ammophila breviligulata*, 1982[1/] (1982 Study-Virginia Location)

Species	Survival (%)	Vigor[5/]	Height[2/,4/]			Width[2/,4/]			Stem Density[3/,4/]		
			3	10	17	3	10	17	3	10	17
R-I											
Panicum amarum	70	6	35	20	25	95	5	6	8	1	3
Elymus vancouverensis	66	6	30	35	20	35	45	10	1	2	1
Carex kobomugi	70	5	20	20	25	35	35	45	2	2	5
E. arenarius	93	5	35	40	45	40	35	50	7	5	8
R-II											
P. amarum	70	5	25	30	40	75	15	40	1	1	4
E. arenarius	94	4	35	50	45	40	45	30	9	10	2
E. vancouverensis	79	6	30	35	20	55	35	30	5	4	1
C. kobomugi	81	5	15	15	20	55	30	60	5	5	2
R-III											
C. kobomugi	79	5	25	25	25	50	45	40	9	2	2
E. arenarius	96	4	45	50	50	50	35	5	6	6	1
P. amarum	65	6	45	50	35	55	70	85	6	6	4
E. vancouverensis	53	6	35	30	30	40	35	25	2	4	2

1/80 hills/accession/replication were planted on March 23 at Virginia Beach, Virginia; data recorded September 20.
2/Measurements were taken at the tallest and widest points-seedheads were not included.
3/Represents the number of stems produced by the parent plant.
4/Plants number 3, 10 and 17 within the second interplanted row from the north were designated for measurement. Plants immediately east were measured in lieu of missing hills.
5/ Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor.

Table 8

First year
evaluations for four herbaceous plant species interplanted in Ammophila breviligulata, 1982[1]/
(1982 Study-Virginia Location)

Species	Percent Cover Interplanted Species	Percent Cover Total[2]/	Seed Prod.[4]/	Seed Quality[5]/	Comparative Rating[3]/
		R-I			
Panicum amarum	15	55	4	G	5
Elymus vancouverensis	10	55	0	-	6
Carex kobomugi	20	65	0	-	4
E. arenarius	25	65	11	G	4
		R-II			
P. amarum	30	70	16	G	3
E. arenarius	30	65	4	G	4
E. vancouverensis	15	65	0	-	6
C. kobomugi	25	65	0	-	4
		R-III			
C. kobomugi	25	55	0	-	4
E. arenarius	30	65	30	G	3
P. amarum	20	60	7	G	5
E. vancouverensis	15	55	0	-	6

1/80 hills/accession/replication were planted on March 23 at Virginia Beach, Virginia; data recorded September 20.
2/Number indicates the percent cover for both the four rows of interplanted species plus the two rows of 'Cape' Ammophila breviligulata positioned between each row.
3/Rating based on vigor, stand and soil cover.
4/Indicates the number of seedheads within the second interplanted row beginning on the north side of plot.
5/Ratings are - G=Good; P=Poor or immature.

Table 9

Regrowth of interplanted species during late winter on a sand dune, 1982 1/
(1981 Study-Delaware Location)

Species	Replication I 2/	II	III
Carex arenaria	10	9	7
C. kobomugi	9	8	9
Elymus arenarius	9	8	6
E. vancouverensis	8	7	9
Panicum amarum	10	10	10

1/Planting established April 1981 at Fenwick, Delaware; data recorded March 30.

2/Rating based on regrowth from individual plants; stand was not a factor: Ratings are 5=Fair; 7=Poor; 9=Very Poor; 10=None.

Table 10

Second year growth characteristics for six dune species, 1982
(1981 Study-Delaware Location)

Species/ Replication	Cover 2/ F2/ (%)	Cover 2/ NF (%)	Stand F	Stand NF	Vigor F	Vigor NF
'Cape'			3/		3/	
I	30	15	3	4	4	6
II	30	20	3	3	4	5
III	35	30	3	3	3	4
Carex arenaria						
I	0	0	10	10	-	-
II	0	0	10	10	-	-
III	0	0	10	10	-	-
C. kobomugi						
I	<10	0	5	9	3	-
II	<10	<10	6	6	4	6
III	<10	<10	8	8	6	7
Elymus arenarius						
I	0	0	10	10	-	-
II	<10	<10	8	9	7	8
III	<10	<10	7	8	6	8
E. vancouverensis						
I	0	0	10	10	-	-
II	<10	<10	9	9	7	7
III	<10	<10	9	9	8	7
Panicum amarum						
I	0	0	10	10	-	-
II	<10	<10	7	7	6	7
III	<10	<10	6	6	5	7

1/Planting established on Fenwick Island sand dune April 1981; data recorded June 10.

2/Replications were fertilized in 1981; plots were split in 1982; F=Fertilized plots 375 kg/ha 10-10-10. NF=Control no fertilizer in 1982.

3/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead; - = No rating.

Table 11

Relative rating for five interplanted salt tolerant species growing on a sand dune, 1982[1/] (1981 Study-Delaware Location)

	Replication		
	I	II	III
Best[2/]	Carex kobomugi	C. kobomugi	P. amarum
2nd Best	-	P. amarum	E. arenarius
3rd Best	-	Elymus arenarius	C. kobomugi

1/Species established at Fenwick Island, Delaware April 1981; data recorded June 10.

2/Ratings based on cover, density, stand, spread and vigor.

Table 12

Wind speed, soil and air temperatures [1] for salt tolerant species growing on a sand dune, 1982
(1981 Study-Delaware Location)

Rep	Air Temperature [2]		Wind Speed [3]	
	In Plot	Outside	In Plot	Outside
I	95	99	13	20
II	97	102	10	21
III	98	96	5	21
Ave.	97	99	9	21

Rep	Species	Soil Temperature [4]			
		In Plot		Outside Plot	
		5cm	15cm	5cm	15cm
I	Cape-fert.	97	92		
	Cape-unfert	98	93	98	96
II	PAAR	98	95		
	CAKO	97	93	100	92
III	PAAR	99	93		
	CAKO	97	92	94 [5]	89 [5]
Ave.		98	93	97	92

1/ Planting established Fenwick Island, Delaware April 1981; data recorded July 28.
2/ Degrees fahrenheit - within plot measured at 10cm above soil surface; outside plot on bare ground.
3/ Miles per hour at 10cm above surface.
4/ Degrees fahrenheit - measurements inside plot were within the row of the species indicated, those outside the plot were in bare ground.
5/ Wet ground.

Table 13

Relative rating for five interplanted salt tolerant species growing on a sand dune, 1982 [1/]
(1981 Study-Delaware Location)

	TMT [2/]	Replication I	II	III
Best [3/]	F	Panicum amarum	P. amarum	P. amarum
	NF	P. amarum	P. amarum	P. amarum
2nd Best	F	Carex kobomugi	C. kobomugi	C. kobomugi
	NF	-	C. kobomugi	C. kobomugi
3rd Best	F	Elymus vancouverensis	-	E. arenarius
	NF	-	-	E. arenarius

1/Species established at Fenwick Island, Delaware April 1981; data recorded October 4.

2/Treatments are - F = 375 kg/ha of 10-10-10 applied on April 22 and repeated June 10; NF = No fertilizer in 1982.

3/Ratings based on cover, density, stand, spread and vigor.

Table 14

Survival and vigor of four interplanted salt tolerant species three months after planting on a sand dune, 1982[1/]
(1982 Study-Delaware Location)

Species	R-I			R-II			R-III		
	No.	Vigor Rating		No.	Vigor Rating		No.	Vigor Rating	
		2/	3/						
'Cape'	631	2	1	628	2	1	640	2	1
Carex kobomugi 4/	37	6	6	40	6	6	43	6	6
Elymus arenarius	80	3	2	78	3	4	79	4	2
E. vancouverensis	41	4	3	44	5	5	57	3	4
Panicum amarum 4/	65	4	4	56	4	3	35	5	3

1/80 hills per accession per replication except for Cape-680 hills planted March 30; data recorded June 10.

2/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

3/Comparative rating - 1-9 same as 2/

4/Some hills that exhibit no green growth may be alive but dormant.

Table 15

Survival and vigor for four interplanted salt tolerant species six months after planting on a sand dune, 1982[1/] (1982 Study-Delaware Location)

Species	Replication I		Replication II		Replication III	
	No.	Vigor[2/]	No.	Vigor	No.	Vigor
'Cape'	634	3	628	3	640	3
Carex kobomugi	36	4	29	5	28	4
Elymus arenarius	32	7	35	5	24	6
E. vancouverensis	41	4	38	5	52	4
Panicum amarum	64	3	60	4	48	3

1/80 hills per accession per replication except for Cape-640 hills planted March 30; data recorded Ocotber 4.

2/Vigor ratings - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 16

Wind speed, soil and air temperatures [1] for four salt tolerant species growing on a sanddune, 1982
(1982 Study-Delaware Location)

Rep	Air Temperature [2] In Plot	Air Temperature [2] Outside [4]	Wind Speed [3] In Plot	Wind Speed [3] Outside
I	100	92	10	20
II	99	98	7	20
III	99	99	5	22
Ave.	99	96	7	21

Rep	Species	Soil Temperature [5] In Plot 5cm	In Plot 15cm	Outside Plot 5cm	Outside Plot 15cm
I	ELVA	95	88		
	CAKO	95	89	93	89
II	ELVA	94	90		
	PAAR	91	88	90	88
III	PAAR	92	90		
	CAKO	90	87	91	89
Ave.		93	89	91	89

1/Planting established Fenwick Island, Delaware March 30; data recorded July 28.
2/Degrees Fahrenheit-within plot measured at 10cm above soil surface; outside plot on bare ground.
3/Miles per hour at 10cm above surface.
4/There was a noticeable drop in temperature while the measurements were being made.
5/Degrees Fahrenheit - measurements inside plot were within the row of the species indicated, those outside the plot were in bare ground.

Table 17

Plant density, sand cover and plant dimensions [1]
for four interplanted species on a sand dune, 1982
(1982 Study-Delaware Location)

Species/ Rep	Replication		
	Density (No.)	Cover (%)	Dimensions (cm)
'Cape'	[2]	[3]	[4]
I	59	40	50x60; 55x60
II	61	45	70x80; 60x50
III	81	50	60x75; 75x85
Carex kobomugi			
I	2	<10	10x25; 15x40
II	2	<10	10x50; 10x35
III	5	<10	15x30; 25x65
Elymus arenarius			
I	3	<10	25x10; 20x15
II	2	<10	35x40; 35x25
III	2	<10	30x30; 35x65
E. vancouverensis			
I	6	<10	30x25; 55x45
II	3	<10	40x20; 25x20
III	7	<10	25x15; 30x30
Panicum amarum			
I	22	15	45x55; 60x95
II	8	10	45x100; 40x50
III	17	15	40x120; 45x55

1/Planting established on Fenwick Island, Delaware March 30; data recorded October 4.

2/80 planting units established per accession per replication; No. = living plants.

3/Percentage of sand cover afforded by interplanted species.

4/Dimensions of one large and one average plant expressed in centimeters.

Table 18

Relative rating for four interplanted salt tolerant species growing on a sand dune, 1982 1/
(1982 Study-Delaware Location)

	Replication		
	I	II	III
Best	Panicum amarum	P. amarum	P. amarum
2nd Best	Carex kobomugi	Elymus vancouverensis	E. vancouverensis
3rd Best	E. vancouverensis	C. kobomugi	C. kobomugi

1/Species established at Fenwick Island, Delaware March 31; data recorded October 4.

2/Ratings are based on cover, density, stand, spread and vigor.

Table 19

Fall vigor and cover rating for woody species growing on a sand dune, 1982[1]

1981 Study - Virginia Location

Woody Species	Vigor[4]	Percent Cover[2] 1st Rater	Percent Cover[2] 2nd Rater
	R-I		
	Treatment A[3]		
Myrica sp.	5	20	20
Prunus serotina	2	55	50
Rhus toxicodendron	4	5	5
Ilex glabra	2	5	5
Vaccinium corymbosum	4	10	15
Acer rubrum [5]	4	5	-5
Total Cover		(70)	(70)
	Treatment B		
P. serotina	3	70	65
Myrica sp.	4	20	25
Quercus virginiana	4	10	10
Total Cover		(45)	(40)
	Treatment C		
V. corymbosum	4	10	10
Myrica sp.	3	30	35
P. serotina	4	55	50
R. toxicodendron	5	5	5
Total Cover		(60)	(50)
	R-II		
	Treatment A		
V. corymbosum	3	35	35
Myrica sp.	3	30	30
P. serotina	4	20	20
I. glabra	2	10	10
Q. virginiana	3	5	5
Total Cover		(70)	(65)

Table 19
(cont.)

Fall vigor and cover rating for woody species growing on a sand dune, 1982[1]/

1981 Study - Virginia Location

Woody Species	Vigor	Percent Cover 1st Rater	Percent Cover 2nd Rater
	R-II Treatment B		
V. corymbosum	3	30	30
P. serotina	4	10	10
Myrica sp.	3	40	40
Pinus sp.	5	5	5
I. glabra	2	10	10
Rubus sp.	5	5	5
Total Cover		(45)	(45)
	Treatment C		
V. corymbosum	4	20	20
Myrica sp.	5	10	15
Q. virginiana	3	5	5
Pinus sp.	4	5	5
P. serotina	4	60	55
Total Cover		(75)	(70)
	R-III		
	Treatment A		
Myrica sp.	2	50	45
V. corymbosum	3	5	10
P. serotina	4	35	35
Q. virginiana	3	5	5
I. glabra	2	5	5
Total Cover		(65)	(65)
	Treatment B		
V. corymbosum	3	35	35
Myrica sp.	3	30	30
I. glabra	2	5	5
P. serotina	4	20	20
A. rubrum	4	10	10
Total Cover		(55)	(50)

Table 19
(cont.)

Fall vigor and cover rating for woody species growing on a sand dune, 1982

1981 Study - Virginia Location

Woody Species	Vigor	Percent Cover	
		1st Rater	2nd Rater
	R-III Treatment C		
V. corymbosum	4	20	20
P. serotina	4	25	30
R. toxicodendron	5	10	5
Myrica sp.	4	35	35
A. rubrum	5	5	5
Rubus sp.	5	5	5
Total Cover		(60)	(65)

1/These are the dominant woody species which represent 5% or more of the total cover. Plots were initially fertilized in 1981 and again in 1982; Data recorded October 18.

2/Percentage represents the respective portion of the total area as determined by two raters.

3/Treatments are - A=High fertility - 1,000 kg/ha 10-5-5
B=Medium fertility - 500 kg/ha 10-5-5
C=Control - No fertilizer

4/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

5/Total woody cover for all dominant species within a treatment.

Table 20

Fall vigor and
cover ratings for native woody species
growing on a sand dune, 1982[1]
(1981 Study-Delaware Location)

Fertilizer Rate/ Species[2]	Vigor 1st Rtr.	Vigor 2nd Rtr.	Percent Cover 1st Rtr.	Percent Cover 2nd Rtr.
		R-I		
High				
Total Cover	[4]		(50)[3]	(55)
Myrica sp.	4	2	45[5]	50
Pinus sp.	5	5	30	15
Rhus copallina	5	4	10	15
Rubus Sp.	3	3	10	10
R. toxicodendron	6	5	5	10
Medium				
Total Cover			(55)	(60)
Myrica sp.	3	2	40	55
Pinus sp.	3	4	20	20
Rubus sp.	2	4	10	10
R. copallina	4	5	10	5
R. toxicodendron	6	6	5	5
Vaccinium sp.	5	4	5	5
Low				
Total Cover			(30)	(25)
Myrica sp.	3	3	70	65
Pinus sp.	4	5	15	15
Vaccinium sp.	5	4	10	10
Rubus sp.	3	3	5	10
		R-II		
High				
Total Cover			(30)	(35)
Myrica sp.	4	3	40	55
Vaccinium sp.	4	3	30	20
Rubus sp.	3	4	20	10
R. toxicodendron	6	3	5	10
Pinus sp.	5	5	5	5
Medium				
Total Cover			(65)	(60)
Myrica sp.	3	2	55	60
Pinus sp.	5	5	10	15
Rubus sp.	3	4	15	10
Vaccinium sp.	4	3	10	10
R. copallina	4	6	5	5
R. toxicodendron	5		5	

Table 20
(cont.)

Fall vigor and
cover ratings for native woody species
growing on a sand dune, 1982
(1981 Study-Delaware Location)

Fertilizer Rate/ Spread	Vigor 1st Rtr.	Vigor 2nd Rtr.	Percent Cover 1st Rtr.	Percent Cover 2nd Rtr.
		R-II		
Low				
Total Cover			(20)	(25)
Myrica sp.	3	4	30	45
Vaccinium sp.	3	3	40	30
Pinus sp.	4	5	25	20
Acer sp.	6	7	5	5
		R-III		
High				
Total Cover			(10)	(15)
Myrica sp.	3	3	45	40
Vaccinium sp.	3	3	40	45
Pinus sp.	4	4	10	10
Rubus sp.	3	3	5	5
Medium				
Total Cover			(20)	(20)
Myrica sp.	4	3	50	35
Pinus sp.	4	3	35	40
Vaccinium sp.	5	3	10	20
R. copallina	5		5	
Rubus sp.		4		5
Low				
Total Cover			(15)	(10)
Myrica sp.	3	3	45	45
Vaccinium sp.	3	3	35	35
Pinus sp.	4	5	15	15
R. copallina	6	6	5	5

1/1982 fertilization schedule: High-500 kg/ha of 10-5-5 equivalent May 12, repeated July 1; Medium-250 kg/ha of 10-5-5 equivalent May 12, repeated July 1: Low-None.
2/Dominant woody species that provide 5% or more of the cover; data recorded October 7.
3/Total woody cover within a treatment.
4/Ratings - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.
5/The percentages represent density or the respective portion of the total cover; i.e. 45 = .45 x .50 or 22.5% total area.

Table 21

Fall vigor and cover ratings for woody species growing on a sand dune, 1982 [1]

1982 Study - Virginia Location

Woody Species	Vigor [4]	Percent Cover 1st Rater	Percent Cover 2nd Rater
R-I [3] Treatment A			
Quercus virginiana	3	55	60
Pinus sp.	5	15	10
Vaccinium corymbosum	5	30	30
Total Cover [5]		(60)	(65)
Treatment B			
Q. virginiana	3	55	50
V. corymbosum	3	35	40
Myrica sp.	4	10	10
Total Cover		(40)	(45)
Treatment C			
Q. virginiana	2	50	55
V. corymbosum	4	35	25
Pinus sp.	5	15	20
Total Cover		(35)	(40)
R-II Treatment A			
Myrica sp.	3	20	15
Q. virginiana	4	40	40
Rhus toxicodendron	5	5	5
V. corymbosum	4	30	30
I. glabra	2	5	10
Total Cover		(30)	(35)
Treatment B			
P. serotina	3	10	10
Q. virginiana	3	30	25
V. corymbosum	3	30	30
Myrica sp.	3	20	25
Diospyros virginiana	4	10	10
Total Cover		(20)	(25)
Treatment C			
Q. virginiana	3	70	65
V. corymbosum	5	20	25
Pinus sp.	7	10	10
Total Cover		(30)	(30)

Table 21
(cont.)

Fall vigor and cover ratings for
woody species growing on a sand dune, 1982

1982 Study - Virginia Location

Woody Species	Vigor	Percent Cover	
		1st Rater	2nd Rater
	R-III		
	Treatment A		
Q. virginiana	3	85	75
V. corymbosum	3	10	20
R. toxicodendron	7	5	5
Total Cover		(40)	(35)
	Treatment B		
Pinus sp.	6	15	25
Q. virginiana	3	80	70
V. corymbosum	4	5	5
Total Cover		(30)	(35)
	Treatment C		
Pinus sp.	5	35	35
P. serotina	3	5	5
Q. virginiana	3	20	25
Myrica sp.	5	5	10
V. corymbosum	3	25	20
A. rubrum	3	10	5
Total Cover		(40)	(45)

1/These are the dominant woody species which represent 5% or more of the total cover; Data recorded September 21.
2/Percentage represents the respective portion of the total area as determined by two raters.
3/Treatments are - A = High fertility-1500 kg/ha 10-5-5
B = Medium fertility-750 kg/ha 10-5-5
C = Control - No fertilizer
4/Ratings: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.
5/Total woody cover for all dominant species within a treatment.

Table 22

Fall vigor and cover ratings for native woody species growing on a sand dune, 1982[1]
(1982 Study-Delaware Location)

Fertilizer Rate/ Species[2]	Vigor 1st Rater	Vigor 2nd Rater	Percent Cover 1st Rater	Percent Cover 2nd Rater
	R-I			
High				
Total Cover	4[4]		(40)[3] 5[5]	(35)
Myrica sp.	4	4	45	35
Pinus sp.	4	5	25	40
Vaccinium sp.	3	4	15	10
Prunus sp.	4	4	10	5
Acer sp.	5	5	5	5
Rhus toxicodendron		5		5
Medium				
Total Cover			(15)	(10)
Myrica sp.	3	4	60	70
Vaccinium sp.	3	4	15	10
Pinus sp.	5	5	10	10
Rubus sp.	5	4	10	5
Liquidambar sytraciflua	4	5	5	5
Low				
Total Cover			(55)	(45)
Pinus sp.	4	6	50	50
Prunus sp.	2	4	15	10
Ilex sp.	2	4	5	10
Myrica sp.	5	4	10	5
Rubus sp.	5	7	10	5
Acer sp.	6	6	5	5
R. copallina	5	5	5	5
Vaccinium sp.		4		5
R. toxicodendron		5		5
	R-II			
High				
Total Cover			(10)	(15)
Myrica sp.	5	3	30	45
Prunus sp.	4	2	35	35
Pinus sp.	5	5	10	5
I. opaca	2	2	10	5
Rubus sp.	3	5	5	5
R. toxicodendron	6	5	5	5
Vaccinium sp.	4		5	

Table 22
(cont.)

Fall vigor and cover ratings for native woody species growing on a sand dune, 1982
(1982 Study-Delaware Location)

Fertilizer Rate/ Species	Vigor		Percent Cover	
	1st Rater	2nd Rater	1st Rater	2nd Rater
		R-II		
Medium				
Total Cover			(45)	(35)
Pinus sp.	5	5	20	25
Myrica sp.	4	5	10	20
Pyrus sp.	3	6	20	10
R. copallina	5	6	10	10
Acer sp.	5	5	10	10
P. arbutiflora	5	4	10	5
Quercus sp.	3	3	5	5
Vaccinium sp.	3		10	
Rubus sp.		4		10
R. toxicodendron	5		5	
Low				
Total Cover			(75)	(60)
Myrica sp.	4	4	40	30
Pinus sp.	5	4	25	40
Rubus sp.	4	3	10	10
Vaccinium sp.	3	4	10	5
Prunus sp.	4	3	5	5
R. copallina	3	5	5	5
R. toxicodendron	5	5	5	5
		R-III		
High				
Total Cover			(40)	(40)
Myrica sp.	3	3	60	60
Pinus sp.	4	5	25	25
Rubus sp.	3	3	10	10
Vaccinium sp.	3	4	5	5
Medium				
Total Cover			(60)	(50)
Myrica sp.	2	4	35	20
Pinus sp.	3	5	20	20
Quercus sp.	5	4	15	20
Prunus sp.	3	5	5	15
Rubus sp.	3	4	10	10
Acer sp.	5	6	5	5
R. toxicodendron	6	4	5	5
P. arbutiflora	3		5	
Vaccinium sp.		4		5

Table 22
(cont.)

Fall vigor and cover ratings for native woody species growing on a sand dune, 1982
(1982 Study-Delaware Location)

Fertilizer Rate/ Species	Vigor 1st Rater	Vigor 2nd Rater	Percent Cover 1st Rater	Percent Cover 2nd Rater
	R-III			
Low				
Total Cover			(10)	(10)
Myrica sp.	3	3	60	60
Pinus sp.	4	4	35	40
Rubus sp.	4		5	

1/1982 fertilization schedule: High-750 kg/ha 10-5-5 equivalent May 18, repeated July 12; Medium-375 kg/ha 10-5-5 equivalent May 13, repeated July 12; Low-none.

2/Dominant woody species that provide 5% or more of the cover; data recorded October 7.

3/Total woody cover within a treatment.

4/Ratings are - 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

5/The percentages represent density or the respective portion of the total cover; i.e. 45 = .45 x 40 or 18% total area.

Table 23

Leaf analyses for dominant woody species on a fertilized sand dune, 1982[1/]

Species	Tmt.[2/]	State/Rep		N[3/]	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Myrica sp.	High	DE	I	2.25	.07	.68	.49	.20	74
"	"	"	II	2.06	.07	.74	.50	.19	32
"	"	"	III	2.03	.08	.72	.63	.25	116
		DE	Ave.	2.11	.07	.71	.54	.21	74
"	"	VA	I	1.58	.05	.47	.43	.22	82
"	"	"	II	1.73	.06	.70	.41	.23	38
"	"	"	III	1.99	.05	.66	.47	.20	268
		VA	Ave.	1.77	.05	.61	.44	.22	129
		1982	Ave.	1.94	.06	.66	.49	.22	102
		1981	Ave.	1.98	.06	.93	.58	-	209
Myrica sp.	Low	DE	I	2.40	.08	.67	.28	.16	32
"	"	"	II	2.45	.08	.68	.43	.22	50
"	"	"	III	2.40	.08	.75	.61	.22	129
		DE	Ave.	2.42	.08	.70	.44	.20	70
"	"	VA	I	2.03	.05	.53	.80	.29	446
"	"	"	II	1.86	.06	.58	.33	.22	26
"	"	"	III	1.97	.06	.48	.49	.21	60
		VA	Ave.	1.95	.06	.53	.54	.24	177
		1982	Ave.	2.19	.07	.62	.49	.22	124
		1981	Ave.	1.82	.05	.83	.60	-	249

Table 23 (cont)

Leaf analyses for dominant woody species on a fertilized sand dune, 1982

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Myrica sp.	Control	DE	I	1.64	.08	1.01	2.20	.39	734
"	"	"	II	1.74	.05	.61	.65	.19	102
"	"	"	III	1.96	.06	.67	.77	.28	138
		DE	Ave.	1.78	.06	.76	1.21	.29	325
"	"	VA	I	2.22	.05	.56	.97	.25	708
"	"	"	II	1.64	.04	.42	.42	.15	215
"	"	"	III	2.13	.05	.67	1.01	.26	269
		VA	Ave.	2.00	.05	.55	.80	.22	397
		1982	Ave.	1.89	.06	.66	1.00	.26	361
		1981	Ave.	1.79	.04	.80	.71	-	276
Vaccinium sp.	High	DE	II	1.30	.08	.66	.60	.29	19
"	"	"	III	1.20	.09	.66	.58	.26	40
		DE	Ave.	1.25	.08	.66	.59	.28	30
"	"	VA	II	1.20	.06	.49	.49	.26	34
		VA	Ave.	1.20	.06	.49	.49	.26	34
		1982	Ave.	1.22	.07	.58	.54	.27	32
		1981	Ave.	1.54	.08	.82	.28	-	25

Table 23
(cont)

Leaf analyses for dominant woody species on a fertilized sand dune, 1982

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Vaccinium sp.	Low	VA	II	1.16	.07	.55	.54	.28	34
"	"	"	III	1.10	.06	.59	.59	.29	32
		VA	Ave.	1.13	.06	.57	.56	.28	33
		1982	Ave.	1.13	.06	.57	.56	.28	33
		1981	Ave.	1.22	.06	.73	.47	-	62
Vaccinium sp.	Control	DE	II	.98	.06	.68	.92	.37	44
"	"	"	III	.91	.07	.62	.67	.34	46
		DE	Ave.	.95	.06	.65	.80	.36	45
		1982	Ave.	.95	.06	.65	.80	.36	45
		1981	Ave.	.90	.05	.70	.57	-	44
Prunus spp.	High	VA	I	2.32	.21	.87	.75	.42	313
"	"	"	III	2.81	.25	.92	.70	.50	317
		VA	Ave.	2.57	.23	.90	.72	.46	315
		1982	Ave.	2.57	.23	.90	.72	.46	315
		1981	Ave.	2.68	.19	1.11	.75	-	481

Table 23
(cont.)

Leaf analyses for dominant woody species on a fertilized sand dune, 1982

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Prunus spp.	Low	VA	I	1.83	.19	.71	.52	.39	161
"	"	"							
		VA	Ave.	1.83	.19	.71	.52	.39	161
		1982	Ave.	1.83	.19	.71	.52	.39	161
		1981	Ave.	2.60	.23	1.16	1.05	-	739
Prunus spp.	Control	VA	I	1.82	.21	.81	.95	.73	449
"	"	"	II	2.19	.29	1.06	.65	.40	486
"	"	"	III	1.82	.34	.92	.76	.66	307
		VA	Ave.	1.94	.28	.93	.79	.60	414
		1982	Ave.	1.94	.28	.93	.79	.60	414
		1981	Ave.	2.04	.19	1.14	.87	-	722
Pinus taeda	High	DE	I	1.74	.14	.43	.11	.09	66
		DE	Ave.	1.74	.14	.43	.11	.09	66
		1982	Ave.	1.74	.14	.43	.11	.09	66
		1981	Ave.	-	-	-	-	-	-

Table 23
(cont.)

Leaf analyses for dominant woody species on a fertilized sand dune, 1982

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Pinus taeda	Low	DE	I	1.59	.13	.63	.10	.13	59
" "	"	"	II	1.76	.16	.52	.08	.14	56
" "	"	"	III	1.54	.14	.65	.12	.11	63
		DE	Ave.	1.63	.14	.60	.10	.13	59
		1982	Ave.	1.63	.14	.60	.10	.13	59
		1981	Ave.	1.56	.12	.87	.13	-	85
Pinus taeda	Control	DE	I	1.76	.13	.62	.20	.15	240
		DE	Ave.	1.76	.13	.62	.20	.15	240
		1982	Ave.	1.76	.13	.62	.20	.15	240
		1981	Ave.	-	-	-	-	-	-

1/Plots established at Fenwick, DE and Virginia Beach, VA - April 1981.

2/Treatments are: High = 1500 kg/ha of 10-5-5 applied 1981 and 1000 kg/ha of 10-5-5 applied 1982; Low = 750 kg/ha of 10-5-5 applied 1981 and 500 kg/ha of 10-5-5 applied 1982; Control = No fertilizer.

3/1981 leaf samples taken during September; 1982 leaf samples taken during October.

Table 24

Leaf analyses for dominant woody species on a fertilized sand dune, 1982[1/]
(1982 Study)

Species	Tmt.[2/]	State/Rep		N[3/]	P	K	Ca	Mg	Mn
				%			micrograms/grams		
Myrica spp.	High	DE	I	2.03	.08	.93	.93	.21	181
"	"	"	II	1.85	.08	.80	.44	.18	60
"	"	"	III	1.79	.06	.78	.38	.22	144
		DE	Ave.	1.89	.07	.84	.58	.20	128
		1982	Ave.	1.89	.07	.84	.58	.20	128
		1981	Ave.	1.98	.06	.93	.58	-	209
Myrica spp.	Low	DE	I	1.96	.08	.85	.59	.21	77
"	"	"	II	1.59	.05	.83	.78	.25	372
"	"	"	III	1.96	.06	.81	.69	.21	341
		DE	Ave.	1.84	.06	.83	.69	.22	263
		1982	Ave.	1.84	.06	.83	.69	.22	263
		1981	Ave.	1.82	.05	.83	.60	-	249
Myrica spp.	Control	DE	II	1.69	.05	.83	.83	.20	323
"	"	"	III	1.84	.06	.85	.44	.25	94
"		DE	Ave.	1.77	.06	.84	.64	.22	209
		1982	Ave.	1.77	.06	.84	.64	.22	209
		1981	Ave.	1.79	.04	.80	.71	-	276

Table 24

Leaf analyses for dominant woody species on a fertilized sand dune, 1982
(1982 Study)

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Vaccinium sp.	High	VA	I	0.85	.05	.55	.69	.24	58
"	"	"	II	0.97	.06	.46	.45	.15	56
"	"	"	III	1.03	.06	.44	.50	.26	38
		VA	Ave.	0.95	.06	.48	.55	.22	51
		1982	Ave.	0.95	.06	.48	.55	.22	51
		1981	Ave.	1.54	.08	.82	.28	-	25
Vaccinium sp.	Low	DE	I	1.25	.08	.84	.67	.24	68
		DE	Ave.	1.25	.08	.84	.67	.24	68
Vaccinium sp.	Low	VA	I	1.15	.06	.63	.69	.30	47
"	"	"	II	1.00	.06	.56	.67	.36	33
		VA	Ave.	1.08	.06	.60	.68	.33	40
		1982	Ave.	1.17	.07	.72	.68	.29	54
		1981	Ave.	1.22	.06	.73	.47	-	62
Vaccinium sp.	Control	VA	I	0.97	.06	.48	.60	.27	32
"	"	"	II	0.76	.05	.48	.64	.22	42
		VA	Ave.	0.87	.06	.48	.62	.25	37
		1982	Ave.	0.87	.06	.48	.62	.25	37
		1981	Ave.	0.90	.05	.70	.57	-	44

Table 24

Leaf analyses for dominant woody species on a fertilized sand dune, 1982
(1982 Study)

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Quercus spp.	High	VA	I	2.00	.15	.72	.49	.28	546
"	"	"	II	1.82	.12	.60	.33	.22	229
"	"	"	III	2.03	.13	.54	.35	.21	328
		VA	Ave.	1.95	.13	.62	.39	.24	368
		1982	Ave.	1.95	.13	.62	.39	.24	368
		1981	Ave.	-	-	-	-	-	-
Quercus spp.	Low	VA	I	2.24	.14	.63	.36	.23	416
"	"	"	II	1.79	.14	.54	.26	.20	285
"	"	"	III	2.03	.13	.55	.23	.22	199
		VA	Ave.	2.02	.14	.57	.28	.22	300
		1982	Ave.	2.02	.14	.57	.28	.22	300
		1981	Ave.	-	-	-	-	-	-
Quercus spp.	Control	VA	I	1.62	.12	.64	.39	.23	321
"	"	"	II	1.64	.11	.47	.32	.33	384
"	"	"	III	1.84	.13	.49	.43	.23	384
		VA	Ave.	1.70	.12	.53	.35	.26	363
		1982	Ave.	1.70	.12	.53	.35	.26	363
		1981	"	-	-	-	-	-	-

Table 24

Leaf analyses for dominant woody species on a fertilized sand dune, 1982
(1982 Study)

Species		Tmt.	State	/Rep	N	P	K	Ca	Mg	Mn
					%			micrograms/gram		
Pinus	taeda	High	DE	I	1.49	.14	.77	.16	.11	176
"	"	"	"	III	1.69	.14	.73	.11	.11	125
			DE	Ave.	1.59	.14	.75	.14	.11	150
			1982	Ave.	1.59	.14	.75	.14	.11	150
			1981	Ave.	-	-	-	-	-	-
Pinus	taeda	Low	DE	II	1.67	.12	.72	.12	.09	122
"	"	"	"	III	1.57	.12	.73	.16	.09	156
			DE	Ave.	1.62	.12	.72	.14	.09	139
Pinus	taeda	Low	VA	III	1.32	.15	.50	.18	.13	173
"	"		VA	Ave.	1.32	.15	.50	.18	.13	173
			1982	Ave.	1.47	.14	.61	.16	.11	156
			1981	Ave.	1.56	.12	.87	.13	-	85
Pinus	taeda	Control	DE	I	1.69	.11	.72	.15	.12	188
"	"	"	"	II	1.41	.13	.75	.18	.11	159
"	"	"	"	III	1.36	.11	.73	.14	.10	83
			DE	Ave.	1.49	.12	.73	.16	.11	143

Table 24

Leaf analyses for dominant woody species on a fertilized sand dune, 1982
(1982 Study)

Species	Tmt.	State/Rep		N	P	K	Ca	Mg	Mn
				%			micrograms/gram		
Pinus taeda	Control	VA	III	1.31	.13	.42	.12	.12	122
" "		VA	Ave.	1.31	.13	.42	.12	.12	122
		1982	Ave.	1.40	.12	.58	.14	.12	133
		1981	"	-	-	-	-	-	-
Prunus sp.	High	DE	II	2.28	.14	.83	.27	.33	78
		DE	Ave.	2.28	.14	.83	.27	.33	78
		1982	Ave.	2.28	.14	.83	.27	.33	78
		1981	Ave.	2.68	.19	.11	.75	-	481
Prunus spp.	Control	DE	I	1.64	.13	.95	1.42	.84	372
		DE	Ave.	1.64	.13	.95	1.42	.84	372
		1982	Ave.	1.64	.13	.95	1.42	.84	372
		1981	Ave.	2.04	.19	1.14	.87	-	722

1/Plots established at Virginia Beach, VA and Fenwick, DE in April.

2/Treatments are: High = 750 kg/ha of 10-5-5 applied when regrowth began and repeated 60 days later; Low = 375 kg/ha of 10-5-5 applied when regrowth began and repeated 60 days later; Control = No fertilizer.

3/Leaf samples taken in October.

Germination Test Results on 'Atlantic' Coastal Panicgrass[1/]

Seed of 'Atlantic' Coastal panicgrass, Panicum amarulum (PI-421137), from the Cape May Plant Materials Center was germinated under various conditions to determine criteria for testing germination. Four replications of one hundred seeds each were tested on wet double blotters under the following conditions:

Distilled water

Potassium nitrate solution (2%)

Distilled water with prechill

Potassium nitrate solution (2%) with prechill

The seed was germinated at a daytime (eight hours with lights on) temperature of 35° C and a nighttime (sixteen hours with lights off) temperature of 15° C. Prechilled seed was subjected to two weeks of 5° C temperature without lights before exposure to alternate day-night conditions. Seed of three crop years (1978, 1979, 1980) was tested. The prechill started on March 23, 1981; alternate day-night conditions started on April 6, 1981; the final (28-day) count was taken on May 3, 1981.

Average germination percentages are presented in Table 1 by year, treatment, and length of test. Figures followed by the same letter are not significantly different at the 95% confidence level. Significant differences occur on or before the fifteenth day in all treatments.

Germination percentages at 15 days are presented in Table 2. Figures followed by the same letter are not significantly different at the 95% confidence level. The absence of difference among 1978 KNO_3, 1978 H_2O, and 1979 H_2O does not seem as important as the difference between 1978-1979 and 1980, or the difference between 1980 prechilled and non-prechilled.

A gross analysis of the fifteen day germination indicates simply that any 1978-1979 (two to three year old) seed germinated better than 1980 (one year old) seed, and non-prechilled seed germinated better than prechilled. There was a mold problem with the prechilled seed that might account for that difference. Even the amount of hard seed in the non-prechilled(1.125%) was greater than the prechilled (0.37%), suggesting that a good bit of the prechilled seed rotted.

Overall there seems to be no advantage to the use of KNO_3 solution or to prechilling the seed, and no need for a 28-day test period. A 15-day test in water with 35° C daytime (eight hours with light) and 15° C nighttime (sixteen hours without light) temperatures seems adequate.

Table 1. Average Germination Percentages of Four Replications of Panicum amarulum by Crop Year, Duration of Test, and Treatment.

Duration (Days)	H_2O	KNO_3	Prechill In H_2O	Prechill In KNO_3	Year
7	80.75 A	81.25 A	75.25 A	77.00 A	1978
10	85.00 AB	88.25 AB	76.75 A	77.25 A	1978
15	88.25 B	90.25 B	79.25 A	78.50 A	1978
21	88.25 B	90.75 B	80.50 A	78.50 A	1978
28	88.25 B	90.75 B	80.50 A	78.50 A	1978
**	***	***	***	***	**
7	79.50 A	75.50 A	75.75 A	78.50 A	1979
10	83.25 AB	80.50 B	78.00 A	81.00 A	1979
15	85.00 B	82.25 B	79.50 A	81.25 A	1979
21	86.50 B	83.25 A	80.25 A	81.25 A	1979
28	86.50 B	83.50 B	80.50 A	81.25 A	1979
**	***	***	***	***	***
7	65.25 A	64.00 A	68.50 A	66.75 A	1980
10	72.25 A	75.00 B	71.50 B	69.75 A	1980
15	77.75 BC	77.25 B	72.75 B	70.75 A	1980
21	78.50 C	79.50 B	72.75 B	71.25 A	1980
28	79.25 C	79.75 B	72.75 B	71.25 A	1980

Table 2. Average Germination Percentages of Four Replications of Panicum amarulum at 15 Days by Crop Year and Treatment.

1978	KNO_3	90.25 A	
1978	H_2O	83.25 A	
1979	H_2O	85.50 A	B
1979	KNO_3	82.25	B C
1979	PC KNO_3	81.25	B C D
1979	PC KNO_3	79.50	C D
1978	PC H_2O	79.25	C D E
1978	PC KNO_3	78.50	C D E
1980	H_2O	77.75	D E
1980	KNO_3	77.25	D E
1980	PC H_2O	72.75	E
1980	PC KNO_3	70.75	E

Percentages followed by the same letter are not different at the P.05 level of significance.

1/All tests and information were conducted and written by the National Plant Materials Center Staff, Beltsville, Maryland.

Table

Nutritional analyses for samples of herbaceous plant species, 1982[1/]

Species	Percent					
	Magnesium	Sodium	Cellulose	Calcium	Phosphorus	Potassium
Andropogon caucasicus	.36	.025	41.4	.38	.21	2.15
Coronilla varia	-[2/]	-	23.2	-	.34	-
Lathyrus sylvestris	.43	.041	19.7	.49	.51	-
Panicum amarulum	.28	.042	39.5	.51	.35	2.79
P. virgatum	-	-	38.5	-	.30	-
Spartina patens	.19	.149	46.5	.48	.16	1.40

1/Samples were taken from production fields at the Cape May PMC and analyzed by the Department of Animal Science, Utah State University.

2/(-) indicates the species was not analyzed for that particular element.

SEED AND PLANT PRODUCTION

1982 SEED PRODUCTION

No.	Name	Origin	Hectares	Production (kg)(bulk)
PI-78758	*Andropogon caucasicus*	-	3.2	25
'Lathco'	*Lathyrus sylvestris*	WA	3.2	1,140
'VA-70'	*Lespedeza thunbergii*	Manchuria	1.6	186
'Rem-Red'	*Lonicera maackii*	MD	.04	17
PI-421136	*Panicum amarum* var. *amarulum*	VA	1.6	252
PI-421138	*P. virgatum*	NC	0.8	21
'Balboa'	*Secale cereale*	-	1.2	1,009

1982 PLANT PRODUCTION

No.	Name	Origin	Hectares	Production (number)
'Cape'	*Ammophila breviligulata*	MA	.09	82,000
PI-433953	*Carex kobomugi*	Japan	Nil	4,925
PI-421132	*Elaeagnus umbellata*	PA	Nil	50
PI-348865	*Elymus arenarius*	Belgium	Nil	2,850
PI-421134	*E. vancouverensis*	MA	Nil	3,075
'Emerald Sea'	*Juniperus conferta*	Japan	Nil	120
'VA-70'	*Lespedeza thunbergii*	Manchuria	.06	5,000
'Rem-Red'	*Lonicera maackii*	MD	Nil	65
T-02747	*Myrica cerifera*	NJ	Nil	225
PI-434159	*M. pensylvanica*	NJ	Nil	400
Composite	*M. pensylvanica*	NJ	Nil	938
T-02773	*Panicum amarum*	NC	Nil	3,800
Composite	*Rosa rugosa*	-	Nil	125
Various Accessions	*Spartina alterniflora* (bare-root)	-	.02	9,450
T-27033	*S. alterniflora* (potted)	-	Nil	416
Various Accessions	*S. patens* (potted)	-	Nil	11,100
Various Accessions	*S. patens* (bare-root)	-	.04	27,450

1/Production areas less than 0.02 hectare are recorded as Nil.

ENGLISH-METRIC CONVERSION

Conversion Table

1	inch	=	2.54 centimeters (cm)
1	foot	=	30.48 centimeters
1	yard	=	91.44 centimeters
1	pound	=	0.454 kilogram (kg)
1	acre	=	0.405 hectare (ha)
1	pound/acre	=	1.121 kilogram/hectare
1	bushel	=	0.352 hectoliter
100	centimeters	=	1 meter (m)

1	centimeter	=	0.394 inch
10	centimeters	=	3.94 inches
1	meter	=	39.37 inches
1	kilogram	=	2.205 pounds
1	hectare	=	2.471 acres
1	kilogram/hectare	=	0.892 pound/acre