

TECHNICAL NOTES

COFFEEVILLE PLANT MATERIALS CENTER

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ROOTING TRIALS FOR PROMISING WILLOWS

Abstract

Tests to compare the rooting abilities of stem cuttings of willows were made in advanced tests at the Coffeeville PMC in 1983. Four promising species (erect, gilg, goat, and prairie), along with three standards ('Streamco' purple, 'Bankers' dwarf, and common black), were planted at two-month intervals for one year.

Rooting depended on environmental conditions as well as species and cutting section. In general, the percentage of cuttings forming roots was:

Erect>goat>Bankers>Streamco>gilg>black>prairie.

Prairie was the only species in which footing was unacceptably low with all treatments. Except for common black willow being a little less, rooting ability of the others was essentially the same.

Rooting was better on cuttings with the large basal sections than from those taken near the tip (top- and mid-sections). Cuttings treated with 'Rootone' hormone rooted only slightly better. For the entire year rooting was better in the greenhouse environment than in the field, but rooting was almost as good in the field during the spring and fall. Spring appeared to be the best season for planting, but fall was almost as good for same. Seasonal differences were not as apparent for greenhouse cuttings.

Introduction

Willows (*Salix* spp.) have been recognized as having potential for streambank erosion control at the Coffeeville Plant Materials Center (PMC) almost from its beginning. Three accessions were planted there in April 1962 (Coffeeville PMC, 1962). By 1965, the number had grown to 77 accessions (Coffeeville PMC, 1965). In 1966, four accessions were selected as promising, and cutting production was reported as 19,260 for seven accessions (Coffeeville PMC, 1966). In 1967, an inundation basin was constructed to test several species for water tolerance, but the two willows in the test, sandbar (*S. exigua*, MS-880) and dwarf purple (*S. purpurea nana*, MS-504), did not survive inundation (Coffeeville PMC, 1967). In 1969, the number of accessions being evaluated had dropped to 43, and only 9460 cuttings were produced from 3 accessions (Coffeeville PMC, 1969). Five new accessions were planted in 1971 (Coffeeville PMC, 1972), and 49 accessions were evaluated in 1973 (Coffeeville PMC, 1974). In 1976, there were 56 accessions evaluated with 18 new accessions being added under project no. 1-76 (Coffeeville PMC, 1976) which was later to become project 28I176E. By 1980, the number being evaluated had been reduced to 30 (Coffeeville PMC, 1980).

In 1981, four accessions were considered to have release potential based on vigor, form, and freedom from disease and insect damage (Coffeeville PMC, 1981). A brief description of these is as follows:

1. Goat Willow (*S. caprea* L., PI-434284) is a deciduous shrub that produces many slender stems mostly from the base. At maturity, it is 10 feet tall and almost as wide. Cutting of this accession came from the Louisiana Tech Arboretum at Ruston.
2. Gilg willow (*S. gilgiana* Seem., PI-9004882) is a small deciduous tree that produces several stems from the base. It grows to about 15 feet tall and equally as wide when grown in the open. This accession was obtained from the National Plant Materials Center but is native to Europe.
3. Prairie willow (*S. humilis* Marsh., PI-9004886) is a deciduous shrub that grows to about 6-feet tall. The trunk divides near the base, producing many branches that grow laterally about 5 feet and root when in contact with moist soil before turning upward. This accession was collected in Bryant County, Oklahoma, by Kenneth Blan.
4. Erect willow (*S. rigida* Muhl., PI-9004885) is a deciduous shrub that reaches about 10 feet in height and width. It produces several stems from the base that may root in contact with the soil. This accession was obtained from the Morton Arboretum in Lisle, Illinois, but is native to Europe.

The standards for comparison were:

1. Black willow (*S. nigra* Marsh., PI-434304), a deciduous tree that is about 40 feet tall at maturity. It is native to the PMC service area and grows in abundance along streams. Landowners object to its use because of its size and rapid spread from seeds.
2. 'Bankers' dwarf willow (*S. X cottetii* Kerner, PI-434285), a 1983 release from the Quicksand (KY) PMC for streambank stabilization.
3. 'Streamco' purpleosier willow (*S. purpurea* L., PI-434309), a 1978 release from the Big Flats (NY) PMC for streambank stabilization.

Average values obtained in initial evaluation for the four selections and the three standards are as follows:

	VIGOR	RESISTANCE TO:				
		DISEASE	INSECTS	COLD	HEAT	
Goat	2.0 (N=4)	2.2 (N=5)	1.0 (N=4)	1.0 (N=4)	1.0 (N=1)	
Gilg	--- (N=0)	1.0 (N=5)	1.8 (N=8)	1.0 (N=8)	--- (N=0)	
Prairie	1.4 (N=5)	1.3 (N=6)	1.0 (N=6)	1.0 (N=5)	1.0 (N=2)	
Erect	3.3 (N=6)	2.6 (N=9)	2.2 (N=18)	1.0 (N=14)	1.0 (N=3)	
Black	2.2 (N=5)	1.7 (N=6)	2.0 (N=6)	1.0 (N=4)	1.0 (N=1)	
Bankers	2.0 (N=4)	4.0 (N=8)	2.1 (N=11)	1.0 (N=12)	1.0 (N=1)	
Streamco	3.0 (N=4)	1.6 (N=7)	1.9 (N=7)	1.0 (N=5)	1.0 (N=2)	

The scale used for the evaluations was 1=excellent, 3=good, and 5=average. The number (N) for evaluations was not the same because earlier evaluations were less sophisticated. In the early years, only survival was noted.

In 1982, advanced evaluations were initiated. This report is for a segment of that project. It was performed to determine how dependable stem cuttings would be to provide material for field plantings.

Materials and Methods

Beginning in December of 1982 and continuing at two-month intervals to October 1983, forty twigs were taken from each of the seven species and planted to determine the extent of rooting. The twigs, having a basal diameter of 1/4 to 3/8 inches, were cut into three sections as follows:

- 1) Top = The terminal 6" section
- 2) Mid = Next 6" below the top
- 3) Bas = The basal 6" section

Twenty cuttings of each group were treated with "Rootone" rooting hormone (Hor) and 20 left for a control (Con). Ten of the 20 were planted in the PMC field (Oaklimer sil.) with the other 10 going into the greenhouse. Stems were stuck about 9" into the soil with one or two buds exposed. Cuttings in the greenhouse were planted into a standard greenhouse mixture and watered as needed. The PMC field was plowed and weed-free before planting and received no further treatment.

At approximately one- and two-month intervals following planting, one half (5) of each treatment was dug to observe rootings. The evaluations were:

- 1) Percent (%) of cuttings forming roots
- 2) Abundance of roots on cuttings (Scale: 5=average, 3=fair, 1=poor, 0=none)

Results

A positive correlation existed between rooting percentage and root abundance. The average percentage of cuttings that formed roots is in Table II. Table III shows root abundance on cuttings that formed roots.

On the average, best rooting was on the basal section treated with Rootone; however, the hormone did not make a spectacular difference. Rooting depended more on the diameter of stem with the top section being poorest.

Prairie willow was consistently the poorest in all classes. Only the basal section with 25-30% success was worthy of consideration. Common black willow was next to worst. The other species showed only minor differences in average rooting ability although some differences were apparent in monthly evaluations.

Cuttings in the greenhouse rooted better and did not show seasonal differences as much as those in the field. However, rooting in the field was almost as good in favorable seasons. Results of the monthly evaluations are shown in Tables IV, V, VI, and VII.

Discussion

Because of the low percentage of prairie willow rooting, both in the field and in the greenhouse, **it** does not appear to be a good release prospect. Rootone had very little benefit also. **If** release of **this** accessions is to be pursued further, this problem would have to be overcome.

The other species rooted as well or better than **common** black willow. Rooting ability of the three remaining candidates was not substantially better than 'Bankers' which tests at Coffeerville showed to be slightly better than 'Streamco'. However, initial evaluations indicated that the candidates were better adapted to the "Deep South."

Although rooting was better in the greenhouse, questions remained unanswered as to whether there would be better establishment and growth from rooted cuttings from the greenhouse than from planting **unrooted** cuttings directly in the field. A check of greenhouse-rooted cuttings that were transplanted to the field after these tests showed that many did not survive (Table VIII), especially in the periods when the unrooted cutting survived poorly, indicating that nothing would be gained by rooting the cuttings in the greenhouse before transplanting to the field.

All cuttings were dug for observation two months after planting. Allowing the cuttings a longer time to root might improve survival. Maybe some of the December planting in the field would have rooted **if** allowed to stay in the field until spring. **Also**, prairie willow may have rooted better **if it** had been given a longer **time** to produce **roots**.

Conclusion

This test showed that prairie willow, the accession that appeared to have the best qualities in initial evaluations, was the most difficult to root. The others did not root substantially better than the standards. Stem sections rooted better in the greenhouse for the entire year, but rooting was almost as good in the field when soil moisture was favorable. Rooted cuttings from the greenhouse apparently survived no better when transplanted under unfavorable planting conditions. Best root production was obtained in the spring, but rooting was almost or as good for erect, prairie, and goat willows in the fall.

For best root production and survival of cuttings in the field, the section should be **1/4** inch or more in diameter. The rooting **hormone**, Rootone, resulted in only slightly better root **production**.

References

- Coffeerville PMC, 1962. Annual Report. p. 18
- _____. 1965. Annual Report. pp. 22-24
- _____. 1966. Annual Report. pp. 5, 23-25
- _____. 1967. Annual Report. pp. 6-7
- _____. 1969. Annual Report. Part 2. pp. 21-22, 31
- _____. 1972. Annual Report. Part 2. p. 36
- _____. 1974. 1973 - 1974 Technical Report. pp. 63-67
- _____. 1976. Project No. 1-76: Initial Evaluation of Plants for Streamchannel and Shoreline Erosion Control. Renamed: Project Plan 28I176E
- _____. 1980. Annual Technical Report, 1979 - 1980. pp. 23-24, 27-28
- _____. 1981. Project Plan 28A482E: Plans for Release of Superior Willows for Streamchannel and Shoreline Erosion Control

TABLE 1. INITIAL EVALUATIONS FOR PROMISING WILLOWS AND STANDARDS
AT THE COFFEEVILLE PLANT MATERIALS CENTER

YR RC	HEIGHT		WIDTH		VIGOR		RESISTANCE			
	FT.	CM.	FT.	CM.	1	2	DI	IN	CO	HE
Goat Willow (<i>Salix caprea</i> ; PI-434284, MS-4417)										
Planted 04/07/77										
77	2	61	1	25			1	1	1	
78	2.5	76	2	60			1	1	1	
79	5	152	4	122						
80	5	152	6	183	3		1	1	1	
81	8	244	6	183	1		5	1	1	1
82	8	245	7	213	3	1	3		1	
'Bankers' Dwarf Willow (<i>S. cottetii</i> ; PI-434285, MS-1963)										
Planted 02/13/65										
68	1.5	46	2.5	76				3	1	
69	3	91	3	91				1	1	
70	3	91	4	122				3	1	
71	4	122	4	122				3	1	
Planted 05/05/66										
74	5	152	5	152			5	3	1	
75							5	3	1	
76	5.5	168	5	152			5	3	1	
77	5.5	168	5	152			7	1	1	
Planted 04/19/76										
78	2.3	71	2.2	101			1	1	1	
79	10	305	12	366	3					
80	6	152	6	183	1		1	1	1	
81	9	274	6	183	1		3	1	1	1
82	9	274	6	183	5		5		1	
Gilg Willow (<i>S. gilgiana</i> ; PI-9004882, MS-815)										
Planted 02/18/63										
67	9	274	8	244				1	1	
68	8	244	6.5	198				3	1	
69	9	274	8	244				1	1	
70	DIED									
Planted 05/05/66										
73							1	3	1	
74	10	305	10	366			1	3	1	
75							1	1	1	
76	11	235	14	427			1	1	1	
77	12	366	16	488			1	1	1	
Prairie Willow (<i>S. humilis</i> ; PI-9004886, MS-4410)										
Planted 04/26/77										
77	1	30	0.8	25			1	1		
78	1.6	48	1.7	50			1	1	1	
79	4	122	6	183	1		1	1	1	
80	4.4	135	8	244	3		1	1	1	
81	5.8	175	10	305	1		1	1	1	1
82	6	183	12	366	1	1	3	1	1	1

Table I Continued

YR RC	HEIGHT		WIDTH		VIGOR		RESISTANCE			
	FT.	CM.	FT.	CM.	1	2	DI	IN	CO	HE
Black Willow (<u>S. nigra</u> ; PI-434304, MS-4438)										
Planted 04/07/77										
77	5	152	5	152			1	1		
78	5	152	5	152			1	1	1	
79	10	305	9	274	1		1	1	1	
80	12	366	11	335	1		1	3	1	
81	17	518	16	488	3		3	3		
82	17	518	14	427	3	3	3	3	1	1
'Streamco' Purpleosier Willow (<u>S. purpurea</u> ; PI-434309, MS4365)										
Planted 05/04/76										
76	0.7	20	1	30			1	1		
77	2	61	3	91			1	1	1	
78	3	91	4	122			1	1	1	
79	4	122	4	122	3		1	3	1	
80	4.5	135	5	152	3		1	3	1	
81	4.5	135	5	152	3		33	1	1	1
82	4.5	135	6	183	3		3	3	1	1
Erect Willow (<u>S. rigida</u> ; PI-9004885, MS-878)										
Planted 03/27/63										
67	6.5	198	8	244					1	
68	5.5	168	6					3	1	
69	5	152	6	183				1	1	
70	7	215	7	215				3	1	
71	8	244	8	244				1	1	
Planted 05/05/66										
74	8	244	8	244			1	3	1	
75							3	3	1	
76	8	244	8	244			3	3	1	
77	10	305	18	249			3	3	1	
Planted 04/19/76										
78	1.3	41	22	71			1	3	1	
80	5.5	165	6	183	1		1	1	1	
81	6	183	9	274	1		3	1	1	1
82	6.2	190	9	274	5	3	5	1	1	1
Planting Date Unknown										
82	4	122	5	152	5	5	3	1	1	1

TABLE II. PERCENT OF WILLOWS ROOTING WITH DIFFERENT TREATMENTS

ACCESS ION	POS	FIELD			GREENHOUSE			ALL LOCATIONS		
		Hor.	Con.	Ave.	Hor.	Con.	Ave.	Hor.	Con.	Ave.
9004882	Top	41.6	33.2	37.4	65.0	66.6	65.8	53.3	49.9	51.6
<i>S. gilgiana</i>	Mid	51.6	41.6	46.6	75.0	71.6	73.3	63.3	56.6	60.0
Gilg willow	Bas	65.0	61.6	63.3	96.6	93.4	95.0	80.8	77.5	79.1
	Average	52.7	45.5	49.1	78.9	77.2	78.0	65.8	61.3	63.6
9004885	Top	45.0	46.6	45.8	86.6	96.6	91.6	65.8	71.6	68.7
<i>S. rigida</i>	Mid	60.0	55.0	57.5	100.0	100.0	100.0	80.5	77.5	78.8
Erect willow	Bas	55.0	46.6	50.8	95.0	93.4	94.2	75.0	70.0	72.5
	Average	53.3	49.4	51.4	93.9	96.7	95.3	73.6	73.0	73.0
9004886	Top	5.0	3.4	4.2	0.0	1.6	0.8	2.5	2.5	2.5
<i>S. humilis</i>	Mid	8.4	0.0	4.2	6.6	1.6	4.1	7.5	0.8	4.2
Prairie w.	Bas	25.0	28.4	26.7	33.4	26.6	30.0	29.2	27.5	28.4
	Average	12.8	10.6	11.7	13.3	9.8	11.6	13.1	10.2	11.7
434284	Top	53.2	51.6	52.4	75.0	75.0	75.0	64.1	63.3	63.7
<i>S. caprea</i>	Mid	61.6	60.0	60.8	86.6	88.4	87.5	74.1	74.2	74.2
Goat willow	Bas	58.4	55.0	56.7	98.6	98.4	98.5	78.5	76.7	76.6
	Average	57.7	55.5	56.6	86.7	87.3	87.0	72.2	71.4	71.8
434285	Top	46.6	40.0	43.3	81.6	75.0	78.3	64.1	57.5	60.8
<i>S. cottetii</i>	Mid	53.4	50.0	51.7	91.6	90.0	90.8	72.5	70.0	71.2
'Bankers'	Bas	66.6	56.6	61.6	100.0	98.4	99.2	83.3	77.5	80.4
	Average	55.5	48.9	52.2	91.1	87.8	89.4	73.3	68.3	70.8
434304	Top	35.0	25.0	30.0	73.4	68.4	70.9	54.2	46.7	50.4
<i>S. nigra</i>	Mid	50.0	36.6	43.3	86.6	83.2	84.9	70.8	63.4	67.1
Black willow	Bas	55.0	43.6	49.3	86.6	83.3	84.9	70.8	63.4	67.1
	Average	46.7	35.1	40.9	79.5	76.6	78.0	63.1	55.8	59.4
434309	Top	55.0	45.0	50.0	78.4	75.0	76.7	66.7	60.0	63.4
<i>S. purpurea</i>	Mid	58.4	43.4	50.9	88.2	81.6	84.9	73.3	62.5	67.9
'Streamco'	Bas	75.0	55.0	65.0	95.0	90.0	92.5	85.0	72.5	78.8
	Average	62.8	47.8	55.3	87.2	82.2	84.7	75.0	65.0	70.0
ALL	Top	40.2	35.0	37.6	65.7	65.5	65.6	53.0	50.2	51.6
	Mid	49.1	40.0	45.0	75.2	73.0	74.1	62.2	57.0	59.6
	Bas	57.1	49.5	53.3	86.4	83.3	84.8	71.8	66.4	69.1
	Average	48.8	41.8	45.3	75.8	73.9	74.8	62.3	57.8	60.1

TABLE III. DEGREE OF WILLOWS ROOTING WITH DIFFERENT TREATMENT

ACCESSION	POS	FIELD			GREENHOUSE			ALL LOCATIONS		
		hor.	Con.	Ave .	Hor .	con .	Ave .	hor.	Con.	Ave .
9004882	Top	0.53	0.37	0.45	1.07	1.28	1.18	0.80	0.82	0.81
<u>S. gilgiana</u>	Mid	0.67	0.50	0.58	1.52	1.30	1.41	1.10	0.90	1.00
Gilg willow	Bas	0.92	0.85	0.88	3.17	2.93	3.05	2.04	1.89	1.96
	Average	<u>0.71</u>	<u>0.57</u>	<u>0.64</u>	<u>1.92</u>	<u>1.84</u>	<u>1.88</u>	<u>1.31</u>	<u>1.20</u>	<u>1.26</u>
9004885	Top	0.52	0.55	0.54	2.84	2.00	2.42	1.68	1.28	1.48
<u>S. rigida</u>	Mid	0.80	0.75	0.78	2.33	2.40	2.36	1.56	1.58	1.57
Erect willow	Bas	0.77	0.68	0.72	2.97	2.83	2.90	1.88	1.76	1.82
	Average	<u>0.70</u>	<u>0.66</u>	<u>0.68</u>	<u>2.71</u>	<u>2.41</u>	<u>2.56</u>	<u>1.70</u>	<u>1.54</u>	<u>1.62</u>
9004886	Top	0.05	0.03	0.04	0.00	0.02	0.01	0.02	0.02	0.02
<u>S. humilis</u>	Mid	0.08	0.00	0.04	0.08	0.02	0.05	0.08	0.01	0.04
Prairie w.	Base	0.30	0.28	0.29	0.57	0.45	0.51	0.44	0.36	0.40
	Average	<u>0.14</u>	<u>0.10</u>	<u>0.12</u>	<u>0.22</u>	<u>0.16</u>	<u>0.19</u>	<u>0.18</u>	<u>0.13</u>	<u>0.15</u>
434284	Top	0.80	0.22	0.51	1.85	1.73	1.79	1.32	0.98	1.15
<u>S. caprea</u>	Mid	1.02	1.02	1.02	2.52	2.52	2.52	1.77	1.77	1.77
Goat willow	Bas	1.13	1.02	1.08	4.42	3.93	4.18	2.78	2.48	2.63
	Average	<u>0.98</u>	<u>0.75</u>	<u>0.89</u>	<u>2.93</u>	<u>2.73</u>	<u>2.83</u>	<u>2.96</u>	<u>1.74</u>	<u>1.85</u>
434285	Top	0.68	0.50	0.59	1.95	1.83	1.89	1.32	1.16	1.24
<u>S. cottetii</u>	Mid	0.70	0.70	0.70	2.52	2.37	2.44	1.61	1.54	1.58
'Bankers'	Bas	1.08	0.91	1.00	3.43	3.05	3.24	2.26	1.98	2.12
	Average	<u>0.82</u>	<u>0.70</u>	<u>0.76</u>	<u>2.63</u>	<u>2.42</u>	<u>2.52</u>	<u>1.73</u>	<u>1.56</u>	<u>1.64</u>
434304	Top	0.45	0.36	0.40	1.27	1.03	1.15	0.86	0.70	0.78
<u>S. nigra</u>	Mid	0.63	0.49	0.56	1.50	1.48	1.49	1.06	0.98	1.02
Black willow	Bas	0.87	0.68	0.78	2.95	2.58	2.76	1.91	1.63	1.77
	Average	<u>0.65</u>	<u>0.51</u>	<u>0.58</u>	<u>1.91</u>	<u>1.70</u>	<u>1.90</u>	<u>1.28</u>	<u>1.10</u>	<u>1.19</u>
434309	Top	0.75	0.58	0.66	1.42	1.43	1.42	1.08	1.00	1.04
<u>S. purpurea</u>	Mid	0.70	0.48	0.59	1.77	1.23	1.50	1.24	0.86	1.05
'Streamco'	Bas	0.93	0.77	0.85	2.22	1.98	2.10	1.58	1.38	1.48
	Average	<u>0.79</u>	<u>0.61</u>	<u>0.70</u>	<u>1.80</u>	<u>1.55</u>	<u>1.67</u>	<u>1.30</u>	<u>1.08</u>	<u>1.19</u>
ALL	Top	0.54	0.37	0.46	1.49	1.33	1.41	1.02	0.85	0.94
ACCESSIONS	Mid	0.66	0.56	0.61	1.75	1.62	1.68	1.20	1.09	1.14
	Bas	0.86	0.74	0.80	2.82	2.54	2.68	1.84	1.64	1.74
	Average	<u>0.68</u>	<u>0.56</u>	<u>0.62</u>	<u>2.02</u>	<u>1.83</u>	<u>1.92</u>	<u>1.35</u>	<u>1.19</u>	<u>1.27</u>

TABLE VI. ABUNDANCE OF ROOTS ON WILLOW CUTTINGS STARTED IN FMC FIELD

PLANTED	CHECK	ACCESSION						
		9004882 Gilg	9004885 Erect	9004886 Prairie	434284 Goat	423285 Bankers	434304 Black	434309 Streamco
Dec.	Jan.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Feb.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jan.	Mar.	0.44	0.00	0.00	0.00	0.00	0.00	0.13
	Apr.	1.30	1.73	0.37	1.76	2.20	2.04	1.66
Apr.	May	0.03	1.17	0.14	1.94	1.00	0.90	0.96
	June	0.37	1.43	0.04	1.33	1.44	0.96	1.14
June	July	0.74	0.76	0.00	0.74	1.10	0.40	1.30
	Aug.	1.24	0.80	0.00	0.93	0.86	0.57	1.13
Aug.	Sept.	0.46	0.10	0.00	0.74	0.30	0.17	0.47
	Oct.	1.04	0.10	0.13	0.84	0.76	0.20	0.76
Oct.	Dec.	0.87	1.00	0.37	1.60	0.64	0.73	0.26
	Jan.	0.93	1.04	0.46	1.66	0.84	0.90	0.60
Average	1 mo.	0.46	0.50	0.08	0.83	0.52	0.36	0.54
	2 mo.	0.82	0.85	0.16	1.08	1.02	0.78	0.88
ALL	Both	0.64	0.68	0.12	0.96	0.77	0.57	0.71

TABLE VII. ABUNDANCE OF ROOTS ON WILLOW CUTTINGS STARTED IN GREENHOUSE

PLANTED	CHECK	ACCESSION						
		9004882 Gilg	9004885 Erect	9004886 Prairie	434284 Goat	423285 Bankers	434304 Black	434309 Streamco
Dec.	Jan.	3.00	1.57	0.26	2.17	2.37	1.97	1.70
	Feb.	2.97	1.03	0.04	3.36	1.93	2.40	1.50
Jan.	Mar.	1.70	3.06	0.54	3.80	3.84	2.70	1.40
	Apr.	1.94	3.24	0.00	2.36	4.13	2.84	0.90
Apr.	May	0.80	2.87	0.07	2.60	3.06	1.83	1.54
	June	1.30	4.26	0.04	3.27	4.24	2.34	2.54
June	July	1.86	2.00	0.06	2.36	2.23	1.70	2.00
	Aug.	2.33	2.84	0.00	2.64	2.14	1.76	3.04
Aug.	Sept.	1.34	1.70	0.06	1.76	1.56	0.60	1.24
	Oct.	1.64	3.20	0.04	3.84	2.56	1.00	2.56
Oct.	Dec.	1.43	1.24	0.36	2.30	0.84	1.06	1.14
	Jan.	2.24	1.77	0.80	3.36	1.30	1.43	1.57
Average	1 mo.	1.69	2.08	0.22	2.50	2.34	1.64	1.50
	2 mo.	2.07	2.72	0.16	3.14	2.72	1.96	2.02
ALL	Both	1.88	2.40	0.19	2.82	2.50	1.80	1.76

TABLE IV. PERCENT OF WILLOWS ROOTING FROM CUTTINGS STARTED IN PMC FIELD

PLANTED	CHECK	ACCESSION						
		9004882	9004885	9004886	434284	423285	434304	434309
		Gilg	Erect	Prairie	Goat	Bankers	Black	Streamco
Dec.	Jan.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Feb.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jan.	Mar.	40.0	0.0	0.0	0.0	0.0	0.0	13.3
	Apr.	96.6	100.0	30.0	96.6	96.6	100.0	100.0
Apr.	May	30.0	100.0	13.4	93.0	100.0	76.6	96.6
	June	30.0	96.6	3.4	83.4	93.4	73.4	100.0
June	July	63.4	63.4	0.0	56.7	80.0	36.7	83.3
	Aug.	73.4	56.7	0.0	63.4	66.6	36.6	76.6
Aug.	Sept.	43.4	10.0	0.0	43.4	30.0	16.7	46.7
	Oct.	53.4	10.0	0.0	13.3	43.4	33.4	13.3
Oct.	Dec.	83.4	96.6	33.4	100.0	56.6	70.0	26.6
	Jan.	76.6	83.4	46.6	100.0	66.7	66.6	50.0
Average	1 mo.	43.4	45.0	7.8	48.9	44.8	33.3	44.4
	2 mo.	55.0	57.8	15.6	64.4	59.4	48.4	60.6
ALL	Both	49.2	51.4	11.7	56.7	52.1	40.8	52.5

TABLE V. PERCENT OF WILLOWS ROOTING FROM CUTTINGS STARTED IN GREENHOUSE

PLANTED	CHECK	ACCESSION						
		9004882	9004885	9004886	434284	423285	434304	434309
		Gilg	Erect	Prairie	Goat	Bankers	Black	Streamco
Dec.	Jan.	96.6	93.3	16.7	96.6	76.6	90.0	86.6
	Feb.	96.6	80.6	3.4	93.3	93.3	93.3	90.0
Jan.	Mar.	83.4	100.0	23.3	96.7	96.6	88.6	70.0
	Apr.	46.6	96.6	0.0	50.0	93.4	90.0	93.4
Apr.	May	36.6	100.0	6.7	66.6	100.0	90.0	76.6
	June	30.0	100.0	3.4	73.4	90.0	60.0	66.6
June	July	96.6	90.0	3.4	90.0	86.6	96.6	100.0
	Aug.	93.3	96.6	0.0	100.0	100.0	93.4	100.0
Aug.	Sept.	93.3	87.2	6.6	93.4	90.0	46.7	96.6
	Oct.	80.0	96.6	3.4	83.4	80.0	46.7	100.0
Oct.	Dec.	96.6	100.0	30.0	100.0	80.0	73.3	93.3
	Jan.	96.6	96.6	43.3	100.0	86.7	70.0	90.6
Average	1 mo.	83.9	95.1	14.4	90.6	88.3	80.5	79.4
	2 mo.	73.9	94.5	8.9	83.3	90.6	75.6	81.8
ALL	Both	78.9	94.8	11.7	87.0	89.4	78.0	80.6

TABLE VIII. SURVIVAL OF ROOTED WILLOWS IN PMC FIELD
(Percent of transplanted cuttings living after one year)

TRANSPLANTED	ACCESSION						
	9004882 Gilg	9004885 Erect	9004886 Prairie	434284 Goat	423285 Bankers	434304 Black	434309 Streamco
APR-1							
Top	16	25	0 *	36	0	22	0
Mid	52	0	0 *	55	16	10	0
Base	71	0 *	50	66	50	24	0
Average	46	8	17	52	22	19	a
APR-2							
Top	0	25	0 *	0	36	0	0
Mid	50	30	0 *	0	80	0	0
Base	90	10	0 *	55	40	70	25
Average	47	22	0	18	52	23	8
MAY							
Top	0	0	0	0	0	20	0
Mid	0	0	0 *	0	0	0	0
Base	0 *	10	0 *	0	0	50	29
Average	0	3	0	0	a	23	10
JUNE							
Top	0	0	0	10	30	0	0
Mid	0 *	20	0 *	12	50	28	0
Base	0 *	0	0 *	100	75	100	83
Average	0	7	0	41	52	46	28
JULY							
Top	0	0	0 f	0	10	0	0
Mid	0	0	0 *	0	0	20	0
Base	0	0	0 *	0	0	10	0
Average	a	0	0	0	3	10	0
ALL MONTHS							
Top	3	10	0	9	15	8	0
Mid	20	10	0	13	29	14	0
Base	32	4	10	44	33	51	27
Average	18	8	3	22	26	24	9
Field Ave.							
Apr.-June	49	79	4	74	67	56	89
All Year	49	51	11	57	52	41	52
Greenhouse Ave.							
Dec.-Apr.	69	94	8	81	91	87	93
All Year	79	95	12	87	89	78	81

* - No cuttings transplanted.