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SELECTION OF ROSE PLANT MATERIAL WITH HIGH AND LOW ROOTING CAPACITY FOR USE IN PHYSIOLOGICAL STUDIES

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INTRODUCTION

East Texas rose producers use *Rosa multiflora* 'Brooks 56' as a rootstock for field plant production because it exhibits disease resistance, thornlessness, and adaptation to the soils and climate of the production area. Despite the beneficial characteristics of the rootstock, producers may experience inadequate field stands due to poor rooting of hardwood cuttings (Pemberton, 1987).

A great deal of variability has been found in the *Rosa multiflora* rootstock clones used by various growers in the area (Lyle, 1978). In addition, many selections/hybrids have been developed and tested over the years (Buck, 1978). *Rosa x fortuniana* is another species promoted as a rootstock in subtropical climates, but can be difficult to root (McFadden, 1962). Further, little work has been done to elucidate the developmental/physiological events associated with adventitious root formation in roses. The objective of this study was to evaluate the rooting characteristics of several rose selections/hybrids so that plant material with high and low rooting capacity can be selected to study these events.

MATERIALS AND METHODS

Two node, semi-hardwood cuttings with two remaining axillary buds of *Rosa x fortuniana* and 15 selection/hybrids of *R. multiflora* were obtained from field grown stock plants at the Texas A&M University Agricultural Research and Extension Center at Overton during the first week of July 1987. The mid-section of the selected stems was used for cuttings. These were cut in the morning and the basal leaf was removed. Whole cuttings were then dipped in fungicide, inserted in perlite, and placed under intermittent mist (2.5 sec every 5 min). The average high temperature in the glasshouse was 88°F and the average low temperature was 70° for the six week time period.

Each treatment consisted of 12 cuttings which was replicated 4 times in a randomized complete block design. Cane caliper, root length, shoot length, fresh weight, and dry weight were measured for each treatment after six weeks in the glasshouse. Root development, root distribution, and shoot grades were also scored on the basis of 1 to 7, 1 to 6 and 1 to 5, respectively. Root development grade was scored as: 1) roots well formed around the base of the cutting, 2) callus with visible roots less than 4.0 cm and more than 2.0 cm, 3) callus with signs of root primordia emergence, 4) callus with no signs of root primordia emergence, 5) no callus formation but cuttings healthy, 6) callus present but senescing, and 7) dead cuttings without callus formation or bud outgrowth. The root distribution grade was scored as: 1) roots evenly distributed around the base of the cutting, 2) roots > 50% of the circumference around the base of the cutting, 3) roots on < 50% of the circumference and/or all on one side of the cutting base with two or three equally large, dominant roots, 5) one large, dominant root, and 6) no visible root primordia formation. Shoot grade consisted of: 1) a developed shoot > 1.0 cm long, 2) a developed shoot < 1.0 cm long with leaves emerged from the bud scales, 3) swollen bud, 4) dormant bud, and 5) die back on a developed bud < than 1.0 cm in length.

RESULTS AND DISCUSSION

Iowa State University (ISU) hybrids 74-4, 81-12, and 71-9, and *Rosa multiflora* 'Brooks 56' had the best overall root regeneration while *R. multiflora* 'Brooks 48' and (ISU) hybrids 81-23 and 81-29 and *R. x fortuniana* had the lowest root regeneration when considering percent rooting, number of roots, and root dry weight (Table 1). In addition to analysis of variance, a cluster analysis was performed on the data using the variables: number of roots, root length, root dry weight, shoot length, and shoot dry weight, standardized to a mean of 0 and a standard deviation of 1. Three clusters were found to fit the data best. Cluster 1 was characterized by the highest number of roots, root length, and root dry weight of the three root clusters as well as exhibiting intermediate shoot length and dry weight (Table 2). Cluster 2 exhibited intermediate values for root number and length, but had the lowest values for shoot length and dry weight. Cluster 3 exhibited the lowest root measurements, but showed the highest shoot measurements. All of the replicate means used for the cluster analysis fell into Cluster 1 for selections 71-9, 81-12, and 74-4 (Table 3). These selections exhibited the highest root regeneration when compared to the selections in the other clusters. Seventy-five percent of the means for Brooks 56, the selection currently used for field plant production in east Texas, also fell into Cluster 1. The means for selections K-1, 80-5, 81-23, 81-29, 76-4, and Brooks 48 fell into Cluster 2, characterized by intermediate root regeneration, but the poorest shoot growth. Seventy-five percent of the means for *Rosa x fortuniana* fell into Cluster 3 as shoot growth was produced in preference to root growth. Means for other selections such as 74-3 and Dan Whiteside, fell into all three clusters indicating more variability in propagules than was seen for the other selections. In conclusion, selections such as 71-9, 81-12, 74-4, and Brooks 56 would be good choices of rose plant materials with a high rooting capacity. On the other hand, K-1, 80-5, 81-23, 81-29, and Brooks 48 would be good choices of rose plant material with a poor rooting capacity. Selections of plant material from each of these groups will allow the physiological events associated with successful adventitious rooting to be studied.

LITERATURE CITED

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Table 1. Measurements taken on two node cuttings after 6 weeks under intermittent mist propagation.

Selection	Root Grade	Root Distr. Grade	Root Number	Root Length (*cm*)	Shoot Grade	Shoot Length (*cm*)	Shoot Dry Weight (g)	Root Dry Weight (g)	Rooting (%)
R. x fortuniana	2.58	5.08	2.15	2.02	2.44	3.29	0.07	0.01	45.8
Rosa multiflora									
K-1	1.98	4.23	5.29	5.38	3.08	0.33	0.01	0.04	72.9
Tyler Park	1.81	3.77	6.98	5.60	2.35	1.18	0.02	0.04	72.9
80-5	1.81	4.35	5.35	4.39	3.62	0.10	0.001	0.02	70.8
71-9	1.12	3.14	9.12	6.82	1.83	2.15	0.04	0.06	97.9
72-18	1.62	4.06	6.04	6.26	2.08	1.57	0.04	0.06	81.2
81-23	1.83	4.69	3.29	4.34	3.46	0.17	0.003	0.03	79.9
81-29	3.00	4.87	3.19	3.18	3.00	0.51	0.01	0.02	50.0
Brooks 48	2.50	4.58	4.73	2.45	3.33	0.17	0.003	0.02	58.3
Ginn 66	1.50	3.73	8.06	5.78	1.98	2.51	0.06	0.07	83.3
Whiteside	1.94	3.94	6.29	4.98	2.17	1.86	0.05	0.05	68.7
81-12	1.00	3.06	9.77	7.25	1.71	2.73	0.05	0.08	100.0
74-4	1.00	2.79	13.42	8.12	2.46	0.93	0.02	0.07	100.0
74-3	1.52	3.50	8.71	7.48	1.48	3.02	0.08	0.07	87.5
76-4	1.21	3.62	6.25	5.29	3.08	0.50	0.01	0.05	93.7
Brooks 56	1.17	3.04	11.19	5.63	3.29	0.34	0.006	0.05	89.5
<u>ANOVA</u>									
F value	3.13*	7.42*	9.78*	5.94*	9.23*	7.61*	7.34*	6.82*	4.96*[z]
MSE	0.44	0.26	3.80	2.04	0.20	0.66	0.0003	0.0002	0.0392
LSD (.05)	0.946	0.729	2.77	2.03	0.64	1.15	0.03	0.02	0.077
CV (%)	38.52	13.11	28.39	26.89	17.40	60.72	64.16	36.04	17.67

[z]Analysis was performed with data transformed to arcsin $\sqrt{x}$. LSD was converted to the original scale.
*Significant at the 5% level.

Table 2. Cluster means.

	Root Number	Root Length (cm)	Root Dry Weight (mg)	Shoot Length (cm)	Shoot Dry Weight (mg)
Cluster 1	4.131	3.906	31	3.505	80
Cluster 2	4.826	4.178	31	0.501	28
Cluster 3	10.670	7.414	73	1.971	43

Table 3. Assignment of replicate means to clusters by percent.

Rootstock Selections	Cluster (%) 1	2	3
71-9	100		
81-12	100		
74-4	100		
Brooks 56	75	25	
72-18	50	50	
Ginn 66	50	25	25
74-3	50	25	25
K-1		100	
80-5		100	
81-23		100	
81-29		100	
Brooks 48		100	
76-4		100	
Tyler State Park		75	25
Dan Whiteside	25	25	50
R. x fortuniana		25	75