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REQUIREMENTS FOR SUCCESSFUL PRE-PLANT STORAGE OF ROSA MULTIFLORA 'BROOKS 56' HARDWOOD CUTTINGS

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The months of November, December, and January are very labor intensive months for rose plant producers. During this time, budwood is collected from the finished crop, the finished crop is harvested, and canes are cut from rootstock plants to prepare hardwood cuttings for the initiation of a new crop. Inclement weather and unavailability of sufficient seasonal labor can make accomplishment of these tasks difficult within the desired time frame.

Preparation of rootstock hardwood cuttings involves several steps. First, the canes are cut from the field and sawed into 20 cm (8 inch) sections. Next, all buds are removed except the top two or three to prevent any future suckering. Cuttings are then planted as soon as possible. In order to schedule these tasks around labor availability and desirable weather conditions, storage of cuttings is common. Traditionally, cuttings have been buried until needed, but heavy plastic bags are now commonly used for storage in covered, unheated conditions. The objective of this experiment was to determine the effects of cutting date, storage time, storage temperature, and pre- or post-storage disbudding on the survival and growth of rootstock hardwood cuttings planted under field conditions.

MATERIALS AND METHODS

Canes of Rosa multiflora 'Brooks 56' were cut on 15 December 1985 and 1 and 15 January 1986. On each cutting date the canes were sterilized by soaking in a 1.05% sodium hypochlorite solution for 10 minutes prior to being cut into 20 cm (8 inch) segments to prevent disease development during storage. The resulting hardwood cuttings were wrapped in plastic bags and stored for 0, 2, or 4 weeks at -1, 4, or 9°C (30, 39, or 48°F) with all but the top two buds removed either before or after storage. After storage treatment, cuttings were field planted 15 cm (6 inches) apart in raised beds using rows 102 cm (40 inches) apart. Single row plots were 180 cm (6 feet) long laid out in a randomized complete block design with four replications.

In May 1986, plants were harvested using a U-shaped digger. This time period is when a crop of roostock plants would normally be T-bud grafted with a desired scion bud. After digging, data were taken on percent live per plot and new shoot number, new shoot dry weight, root number, and root grade per plant. Root grade ratings ranged from 1, denoting main roots evenly distributed around the base of the plant, to 5, denoting the presence of one very dominate main root which is unacceptable for a high quality plant. A rating of 6 was given to plots where all plants died due to a treatment effect.

Prior to running analysis of variance, percent live data were transformed Arcsin$\sqrt{x}$ with 0.025 added to 0 and subtracted from 1.00 values before transformation. All other variables were transformed log (x+1) because means were correlated to standard deviations. Orthogonal polynominals were used to separate means. Means are presented on the original scale.

RESULTS AND DISCUSSION

There was a significant interaction between cutting date and storage time for shoot number, shoot dry weight, root number, root grade, and percent live plants (see Table 1). There were no differences between storage times for any of the variables measured at the 15 December cutting dates. For the 1 January cutting date, percent live, shoot number, shoot dry weight, and root number exhibited a quadratic relationship with storage time. Values for these variables decreased dramatically for plants from cuttings treated for 4 weeks of storage when compared with those treated with 0 or 2 weeks of storage regardless of storage temperature or condition. In addition, root grade increased with storage time indicating that root quality decreased linearly with storage time. For the 15 January cutting date, percent live and root number decreased and root grade increased linearly with storage time. Shoot number and dry weight decreased for plants from cuttings treated with 2 or 4 weeks of storage when compared with those treated with 0 weeks storage indicating a quadratic relationship to storage time. Generally, cuttings planted in the field after 15 January resulted in plants which were significantly lower in quality than those growing from cuttings planted prior to this date.

Percent live plants decreased linearly as storage temperature of cuttings increased regardless of cutting date or storage time or condition (see Table 2). Also, root number exhibited an interaction between storage condition and storage time (see Table 3). Root number on resulting plants deteriorated more rapidly with storage time if cuttings were disbudded before storage vs. after storage. After 4 weeks of storage, root number was lower on plants from cuttings which were disbudded prior to storage than on those which were disbudded after storage. Root number also exhibited an interaction between storage time and temperature (see Table 4). Root number decreased on plants from cuttings stored at 4° or 9°C (39° or 48°F) when compared to those from cuttings stored at -1°C (30°F) for 4 weeks, but root number was the same on plants from cuttings stored for 2 weeks at any temperature. All other effects were nonsignificant.

In general, planting of cuttings prior to January 15 is recommended regardless of whether they are stored or not. If cuttings are stored, a temperature of -1°C to 4°C (30° to 48°F) should be used for up to 2 week storage periods. For longer periods, storage at -1°C (30°F) is recommended. Storage of cuttings at -1°C (30°F) for periods of longer than 4 weeks without a loss of vigor in resulting plants may be possible, but was not tried in this study. Storage at 9°C (48°F) can be used for periods of only a few days. But, storage of cuttings at this temperature for periods of longer than one or two weeks resulted in a serious decrease in the vigor of resulting plants in this experiment. Finally, cuttings should be disbudded just prior to planting for optimum survival and growth in the field.

Table 1. Mean growth measurements taken on plants grown from cuttings stored for 0, 2, or 4 weeks on three cutting dates (cutting date x storage time interaction).

Cutting Date	Storage Time (Weeks)	Percent Live	Shoot Number	Shoot Dry Weight (g)	Root Number	Root Grade
15 December	0	75	2.7	11.4	12.0	2.5
	2	73	2.9	11.0	12.3	2.4
	4	76	2.8	9.7	11.5	2.8
	Linear	NS[z]	NS	NS	NS	NS
	Quadratic	NS	NS	NS	NS	NS
1 January	0	80	2.7	8.4	11.5	2.7
	2	75	2.8	8.2	10.3	3.1
	4	42	1.5	3.8	6.6	3.9
	Linear	**	**	**	**	**
	Quadratic	*	**	*	*	NS
15 January	0	64	2.4	7.5	10.5	2.8
	2	44	1.6	3.9	7.7	3.8
	4	35	1.6	3.9	7.2	3.8
	Linear	**	**	**	**	**
	Quadratic	NS	*	*	***	NS
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Cutting Date x Storage Date		**	**	**	**	**

[z]NS=nonsignificant, *=significant at the 5% level, **=significant at the 1% level, ***=significant at the 10% level.

Table 2. Percent live for cuttings stored at various storage temperatures (storage temperature main effect).

Storage Temperature (°C)	Percent Live
-1	63
4	61
9	59
Anova	
Storage Temperature	*[z]
Linear	*
Quadratic	NS

[z]NS=nonsignificant, *=significant at the 5% level.

Table 3. Root number on plants grown from cuttings disbudded either before or after storage for various time periods (storage condition x storage time interaction).

Storage Condition	Storage Time (Weeks)	Root Number
Disbudded	0	11.2
Pre-Storage	2	10.0
	4	7.6a[z]
	Linear	**[y]
	Quadratic	NS
Disbudded	0	11.4
Post-Storage	2	10.2
	4	9.3*b
	Linear	*
	Quadratic	NS
Anova		
Storage Condition x Storage Time		*

[y] NS=nonsignificant, *=significant at the 5% level, **=significant at the 1% level.

[z] These two treatments were significantly different at the 5% level using a T-test.

Table 4. Root number on plants grown from cuttings stored for various time periods at three temperatures (storage time x storage temperature interaction).

Storage Time (Weeks)	Storage Temperature (°C)	Root Number
0	-1	11.4
	4	11.3
	9	11.3
	Linear	NS[z]
	Quadratic	NS
2	-1	9.8
	4	10.8
	9	9.7
	Linear	NS
	Quadratic	NS
4	-1	9.7
	4	7.7
	9	7.9
	Linear	*
	Quadratic	***

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Storage Time x Storage Temperature

[z]NS=nonsignificant, *=significant at the 5% level, ***=significant at the 10% level.