Propagation Medium Moisture Level and Rooting of Woody Stem Cuttings

Robert D. Wright, William H. Rein, and John R. Seiler
Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061-0327

INTRODUCTION

Intermittent mist systems are commonly used to reduce transpirational water loss from cuttings during propagation. A problem with this system is maintaining a wet leaf surface without overwetting the rooting medium. Water and air compete for pore space in a medium (Loach, 1985), and oxygen availability may be reduced as the volume of water in the medium is increased. Propagators face a dilemma in providing adequate but not excessive moisture to stem cuttings both above and below the medium surface. The objective of this study was to determine the influence of a range of moisture levels in the propagation medium on the cutting water potential, adventitious rooting, quality, and survival of stem cuttings of 'Blue Rug' juniper, 'Hino-crimson' azalea, and 'Helleri' holly.

MATERIALS AND METHODS

Stem cuttings of 'Blue Rug' juniper (*Juniperus horizontal* Moench 'Wiltonii') 'Hino-crimson' azalea [*Rhododendron* (Lindl.) Planch 'Hino-crimson'], and 'Helleri' holly (*Ilex crenata* Thunb. 'Helleri') were propagated in 1 peat : 1 perlite (v/v) at one of five moisture levels based on medium dry weight (125%, 250%, 375%, 500%, or 625%). Under normal intermittent mist situations, a peat/perlite medium would be at 400% to 500% moisture. Thus, the 625% treatment contained excessive water compared to a "normal" propagation situation. Please consult the *Journal of the American Society for Horticultural Science* 116:632-636 for more details of this experiment.

RESULTS AND DISCUSSION

Stem cutting quality and rooting percentages. In most cases, percent survival and adventitious rooting of stem cuttings were highest in the wettest propagation medium and lowest in the driest medium (Tables 1 and 2). Survival was high in juniper at all medium moisture levels, with 77% of cuttings in the lowest medium moisture level (125%) alive and green 8 weeks after insertion (Table 1). It is possible that the surviving cuttings may have rooted later, since juniper cuttings may take 12 weeks to root. Generally, survival of azalea and Japanese holly cuttings was low at the lowest moisture treatment.

The variability in rooting percentages between species was expected. Stem cuttings of juniper are generally slower to root than those of either 'Helleri' holly or 'Hino-crimson' azalea. However, the repeated experiments with 'Helleri' holly illustrated that rooting success can vary with time of year or growth stage of the stock plants (Table 2). It usually is recommended to take these cuttings between the periods of shoot growth (Dirr and Heuser, 1987).

In no case was the incidence of basal rot significantly related to the percentage of moisture in the propagation medium (Tables 1 and 2). Instead, basal rot in this study seemed related more to the growth stage of the cutting. For example, basal rot of 'Helleri' holly cuttings taken in August was much more severe than on cuttings taken in March or April (Table 2).

Table 1. Survival, basal rot, and rooting percentages of stem cuttings propagated in a peat/perlite medium at five moisture levels. Data are shown as actual percentages.

Medium moisture (%)	Survival (%)	Basal rot (%)	Rooting (%)
		'Blue Rug' juniper	
125	77[z]	43	0
250	95	24	0
375	100	43	10
500	100	43	5
625	100	33	48
Significance (P values of components)			
Linear	0.01	0.99	0.05
Quadratic	0.03	0.99	0.40
		'Hino-crimson' azalea	
125	13	0	0
250	19	0	0
375	81	0	19
500	100	0	38
625	100	0	75
Significance (P values of components)			
Linear	0.04	0.99	0.02
Quadratic	0.70	0.99	0.33

[z] Percentage data transformed via arcsin [square root (proportion)] prior to statistical analysis. For 'Blue Rug' juniper, n = 20; for 'Hino-crimson' azalea, n = 16.

Water uptake by stem cuttings. Stem cuttings in the wettest medium generally showed the greatest amount of water uptake (Table 3). This result is in agreement with the findings of Grange and Loach (1983) that water uptake by stem cuttings is limited by the availability of water to the cut stem base. Our data also show that water uptake by cuttings is greatest during the first 4 days of propagation, followed by a period of lower water absorption from the propagation medium until adventitious rooting formed. The later increase in uptake by 'Helleri' holly cuttings occurred between the 3rd and 4th weeks after insertion, corresponding to the period in which rooting was noted.

Table 2. Survival, basal rot, and rooting percentages of 'Helleri' holly stem cuttings in a peat/perlite medium at five moisture levels. Data are shown as actual percentages.

Medium moisture (%)	Survival (%)	Basal rot (%)	Rooting (%)
		31 Mar. - 22 Apr. 1989	
125	0[z]	0	0
250	74	0	26
375	96	0	74
500	91	0	74
625	100	0	92
Significance (P values of components)			
Linear	0.05	0.99	0.02
Quadratic	0.18	0.99	0.18
		27 Apr. - 26 May 1989	
125	30	0	20
250	80	20	60
375	90	0	60
500	100	20	90
625	100	20	70
Significance (P values of components)			
Linear	0.01	0.42	0.10
Quadratic	0.12	0.99	0.23
24 Aug. - 21 Sept. 1989			
125	79	50	0
250	75	75	0
375	75	71	4
500	83	88	4
625	88	83	8
Significance (P values of components)			
Linear	0.04	0.09	0.05
Quadratic	0.06	0.37	0.91

[z] Percentage data transformed via arcsin [square root (proportion)] prior to statistical analysis. For 31 Mar., n = 22; 27 Apr., n = 10; 22 Aug., n = 24.

The high initial water uptake by cuttings may be due to the continued transpirational water loss through stomata that have not yet responded to the stress of propagation. The application of greater quantities of water to stem cuttings during this period could help reduce water stress. Our results indicate that the wetter medium, which may result from heavy water application during propagation, does not necessarily adversely affect rooting

Table 3. Water uptake by 'Helleri' holly stem cuttings from a peat/perlite medium at five moisture levels (cuttings inserted 27 Apr.).

	Water uptake (g)[z]					
	Days after sticking (%)					
Medium moisture (%)	4	8	12	16	23	27
125	0.16	0.12	0.11	0.06	0.02	0.03
250	0.28	0.17	0.16	0.06	0.32	0.42
375	0.34	0.18	0.12	0.07	0.31	0.42
500	0.20	0.20	0.20	0.05	0.31	0.42
625	0.41	0.35	0.21	0.08	0.17	0.53
Significance						
(P values of components)						
Linear	0.08	0.02	0.12	0.79	0.18	0.03
Quadratic	0.94	0.37	0.83	0.82	0.01	0.32

[z] Mean uptake of 10 cuttings, over previous 4 days. Linear and quadratic P values for uptake data over time were <0.05 except for the 125% treatment..

An increase in contact between the cut stem base and the water in the medium probably accounted for greater water uptake by stem cuttings in the higher medium moisture treatments (Grange and Loach, 1983). The duration and extent of this contact could control stem cutting water potential and adventitious rooting.

The level of moisture in a propagation medium influences the ability of stem cuttings to absorb water and produce adventitious roots. The availability of moisture in a propagation medium at least partially controls the ability of a stem cutting to absorb enough water to offset transpirational and nonstomatal water losses. A standard 1 peat : 1 perlite medium under intermittent mist may contain 400% to 500% moisture on a dry weight basis. We found that stem cuttings inserted into a relatively wet propagation medium (625%) exhibited greater water absorption, less negative water potential, and greater adventitious rooting percentages than cuttings propagated at lower percent moisture levels. Cuttings in a finer textured medium may have exhibited basal rot and reduced rooting under conditions of excessive moisture. However, within the range of moisture and species tested here, a reduction in stem cutting quality due to basal rotting was not a direct result of high moisture levels in the propagation medium, even when the cuttings were at least partially submerged in water. The basal rotting of stem cuttings appeared to be more closely linked to the growth stage of the cutting tissue.

LITERATURE CITED

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