A COMPARISON OF MEDIA COMMONLY USED FOR PROPAGATION OF RHODODENDRON CULTIVARS[1]

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Abstract. Commonly used propagating media were compared for efficiency and speed of rooting *Rhododendron* cultivars. Peat/perlite, peat/vermiculite, and vermiculite were found to be efficient when used at a depth of 19 cm under mist at a minimum temperature of 19°C. A 3 year comparison of the two peat mixtures showed peat-vermiculite to give the best results in the shortest time.

INTRODUCTION

The effect of propagating media on root initiation has been studied for over 60 yr. Long (16) found that medium factors essential for rooting included aeration and water content. He found these not only influenced rooting percentage but also root texture. Roots developed in a medium with high water content were more brittle and less fibrous. Others have since supported these observations though controversy has arisen because different plants were used in each experiment, and environmental conditions also varied (1, 4, 5, 10, 13, 26).

More recently, medium depth was found to strongly influence aeration (8, 12, 18). Lunt (17) found a coarse medium in a shallow container would retain as much water as a clay soil in the field, regardless of whether the medium was amended with organic matter or not. When Paul (21) compared 13 media under frequent irrigation, he found they had a range of percent free pore space of from 0 to 20 at container capacity at a depth of 12 cm. He found media with organic matter at 40 to 90% (v/v) had the best aeration and concluded that a medium of equal parts vermiculite and peatmoss was the best of those tested. He also noted that the measurement of percent free pore space was not as reliable as measuring oxygen diffusion rate as an indicator of a well aerated media.

Reisch (25) published a comprehensive review of research of propagating media. He concluded that many materials could be used as propagating media as long as they provided ample drainage and aeration. He recommended the medium be as deep as possible. He noted that success depended upon both the physical properties of the medium and the management program. Reisch felt that the apparent contradictions in the literature could be attributed to a failure by researchers to recognize or report differences in compo-

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nents of media and environmental conditions. Two such differences are pH of medium and temperature.

While pH has been found to influence rooting of *Thuja* (2), balsam poplar (6), and chrysanthemum (6, 19, 20), it had little effect on rooting of other woody plants, including rhododendron (7). There is some evidence that soil pH of stock blocks may influence subsequent rooting of cuttings (29).

Temperature has been reported to play an important role in root initiation. Optimum temperatures as high as 29°C have been reported (15). Optimum temperature for rooting rhododendron cuttings has been reported to be 25°C (28). Dykeman (9) found that the optimum temperature of root initiation was higher than that required for root development on forsythia. He found optimum temperatures for initiation ranged from 27 to 33°C while those for root development were 17 to 25°C. Unfortunately, few other researchers have reported that they manipulated temperatures during the two processes. Turner (28) rooted 22 cultivars of rhododendron in a pulverized pine bark medium at 25°C while maintaining the air temperature at 10 to 12°C. This is a common commercial practice for fall propagated woody crops.

Research reports on propagation of rhododendron and other crops often do not include the time required for rooting, yet when one considers the cost for fuel required to maintain a minimum temperature of 25°C it should be considered.

Kinsey (14) propagated rhododendron in 2 to 3 months while Proebsting (24) allowed them to remain in the bed 4 to 5 months. Smith (27) made his final harvest after 17 weeks. Turner (28) however, propagated most of the 22 cultivars he tested in 8 weeks. The time required to root rhododendron cuttings obviously can be reduced if one maintains the optimum temperature and a well aerated medium (11).

Research has been done to find substitutes for sphagnum peatmoss as the source of organic matter for propagation and container plant production (22, 23, 28). This is being done because of a decline in availability and increased cost. Other sources of organic matter have served equally well as long as they met the criteria of a good medium, i.e., they should have a free pore space of 18 to 20% and a depth of at least 10 to 12 cm.

The present work was done as part of a regional project, (NE 136, Engineering greenhouse and other controlled plant production systems). One objective was to develop efficient production methods of woody ornamentals at low cost. One of the greatest costs in the northeast is fuel, and this cost can be reduced if the time required to produce the crop is reduced. One approach was to identify propagating media which would provide an environment for rapid propagation of a major crop in the region. The rhododendron was chosen since high optimum temperatures are required for that crop. Summer propagation was done to further reduce but not eliminate heating costs.

PROCEDURES

Commercially accepted propagating media were compared for the efficient propagation of hybrid rhododendron cultivars in the summers of 1984, 1985, and 1986. Cultivars used were: 'Boule de Neige', 'English Roseum', 'Nova Zembla', 'P.J.M.', 'Scintillation', and, 'Chionoides'. Not all cultivars were tested every year, nor were all media compared every year. Those media which provided best rooting were tested in subsequent years.

All media were passed through a 0.5 cm screen before being placed 18 cm deep over a coarse gravel base in raised propagating beds in a heated plastic-covered greenhouse. In addition, bottom heat was provided in the beds and maintained at a minimum of 19°C. This is below the 25°C optimum temperature reported to be required for the crop (28).

Media were not sterilized in 1984 or 1985, but those media that were reused in 1986 were sterilized with methyl bromide in 1986. Media used were: sphagnum peatmoss, sphagnum peatmoss/medium grade vermiculite, sphagnum peatmoss/medium grade perlite, medium grade perlite/shredded pine bark/sphagnum peatmoss, medium grade vermiculite, shredded pine bark, a commercial mixture of sphagnum peatmoss/vermiculite, decomposed granite, commonly referred to as rotted rock, and decomposed granite/medium grade perlite. Media components were always mixed in equal parts by volume.

Cuttings were trimmed to a length of 11 cm and all but the uppermost five leaves were removed. The remaining leaves were trimmed to one half their original length. Cuttings were wounded bilaterally on the lowest 2 cm as is the common commercial practice. They were treated with one of two growth regulators: Hormex, a commercially available talc formulation containing 4.5%, 3-indolebutyric acid (Brooker Chemical Co.), or an aqueous 5-sec. dip of a mixture of 3-indolebutyric acid and 0.5% naphthaleneacetic acid in a solvent of 40% Carbowax (Union Carbide). This mixture was diluted with water to solutions of 1:3 or 1:5, depending on the maturity of the crop being propagated. Specific crops used, dates propagated, and growth regulators applied are listed in the tables under results and discussion.

Cuttings were taken on dates when it was deemed they were sufficiently mature for propagation. They were placed in the propagation beds so that cut ends of leaves did not touch. Intermittent mist was applied at 6 sec/6 min during the daylight hours. The propagating house was cooled by fans and it was shaded to provide 44% shade. Cuttings were placed in a randomized plot design in three replicates of five cuttings each. All cuttings of any cultivar were harvested when one treatment of that cultivar was found to have rooted sufficiently.

Data recorded were: percent free pore space of media as outlined by Buscher and Van Doren (3); pH, percent rooting, average rootball diameter, and date of harvest. Data from rootball diameters were analyzed statistically by analysis of variance and means were separated by Duncan's multiple range test.

RESULTS AND DISCUSSION

The pH of the media varied from 4.2 to 7.5 but did not appear to have a direct influence on rooting percentage or rootball diameter (Table 1). This is similar to results found by Paul (19). Percent free pore space was variable. This can be attributed to the lack of precision of the method. However, those media producing best rooting consistently had a percent free pore space of 20 to 23%, (Table 1).

Table 1. Comparison of different propagating media for rooting cuttings of selected rhododendron cultivars

Media	pH	Percent free pore space	Cultivar			
			Boule de Neige		English Roseum	
			Av. rootball diam. (cm)	% rooted	Av. rootball diam. (cm)	% rooted
Peat/ Vermiculite	.5.5	22	4.69 a[1]	96	3.54 a	100
Peat/Perlite/ Bark	5.8	20	4.25 a	96	3.54 a	92
Vermiculite	7.0	23	3.83 ab	84	2.13 b	92
Granite/ Perlite	7.0	23	2.93 bc	92	1.79 b	88
Pinebark	6.8	18	2.56 bc	44	2.21 b	84
Commercial mix (peat/vermiculite)	7.5	18	2.53 bc	48	1.86 b	72
Granite	7.0	14	2.43 c	52	1.35 b	96
Peat/ Perlite	4.2	14	2.21 c	68	1.45 b	52

[1] Means followed by the same letter within cultivars are not significantly different at 5% level.

While rooting was variable from year to year, which is normal, a medium of peatmoss and vermiculite consistently produced good rooting and large rootballs in the least time (Table 2). This supports results found by Paul (21), and shows that even though cuttings were allowed to remain in the propagating bed for 8 to 10 weeks, they could probably have been harvested in less time with a rootball sufficiently large to sustain growth. This could result in lower production costs and possibly allow for faster crop rotation. Obviously, cultivars vary in time required for rooting, but there was little evidence that the type of growth regulator used greatly influenced rooting results. It should also be noted that keeping the minimum temperature at 19°C instead of 25°C did not appear to reduce time required for rooting. However, this work was done in the summer when maximum temperatures exceeded 25°C in the daytime.

Table 2. A 3-year comparison of rootball development in two propagating media commonly used for rhododendron cultivars.

Cultivar	Av. rootball diam. (cm) Peat/vermiculite	Peat/perlite	Av. no. weeks
'Boule De Neige'	3.83 a[1]	2.66 b	9
'English Roseum'	4.21 a	4.74 a	10
'P. J. M.'	4.42 a	3.32 b	8

[1] Means followed by the same letter within cultivars are not significantly different at 5% level.

The improved rooting in sterilized medium is also worth noting (Table 3). While it was not consistent for all cultivars, it did appear to stimulate faster rooting in two cultivars. If this proves to be consistent in future tests it would enable the propagator to reuse media at least once and reduce operating costs. It did not appear to reduce percent free pore space.

Table 3. Comparison of sterilized and non-sterilized media of peatmoss and vermiculite in rooting cuttings of rhododendron cultivars.

Cultivar	Sterilized media		Non-sterilized media	
	Av. rootball diam. (cm)	% rooted	Av. rootball diam. (cm)	% rooted
'English Roseum'	7.42 a[1]	100	4.03 b	85
'P. J. M.'	4.81 a	85	4.72 a	85
'Scintillation'	4.24 a	80	4.15 a	65
'Nova Zembla'	5.01 a	90	3.52 a	85
'Boule De Neige'	5.12 a	100	1.98 b	45

[1] Means followed by the same letter within cultivars are not significantly different at 5% level.

This was not an exhaustive study of all possible propagating media that could be used to propagate this crop, but it does show that several may be used very effectively. It should be noted that when cuttings in one medium were ready for harvest, all cuttings of that cultivar in all media were harvested. If those cuttings that were poorly rooted but had similar rooting percentages had been permitted to remain in the mist bed, they would have had improved rooting, but this was a study in which time was the critical factor. It was the objective to find media that would produce well rooted cuttings most rapidly. Table 1 indicates that three media produced well rooted cuttings: peat/vermiculite, peat/perlite/bark, and vermiculite, but only one was studied further. Results with peat/perlite were not good but this medium was studied in each successive year because it is the most widely used medium in the commercial trade for propagation of rhododendron. Vermiculite was not studied further. While it is a good medium with some water supplies, when used with no organic matter, it can be a problem if the water in the mistline contains copper or manganese because of the effect of high pH on availability of these metals. The organic matter acts as a buffer and ties up ions in solution (Personal comm. Dr. William Krul, Dept. Plant Science, Univ. R.I., Kingston, R.I.). In later work it was found that mixtures with bark were too variable as particle sizes were difficult to standardize and for that reason that medium was also discontinued. Peat/perlite mixtures produced better rooting in subsequent studies than it did in 1984 (Table 2).

Further work is under way to study the apparent effect of sterilization of the media with methyl bromide and to more accurately determine the optimum temperature for propagating these rhododendron cultivars. This work will be published at a later date.

At this time it is the conclusion of the author that a medium grade vermiculite and screened sphagnum peatmoss medium (1:1, v/v), that has been sterilized with methyl bromide and placed at a depth of at least 18 cm will provide the best rooting medium for the cultivars of the hybrid rhododendrons tested. This is significant because at this time it is not widely used by commercial propagators for this crop. It is further recommended that a minimum temperature of 19°C is sufficient in summer propagation to produce well rooted cuttings in 8 weeks or less if they are made when they are in a semihardwood condition. The medium can be reused at least once if it is sterilized with methyl bromide. While it is recognized that the most commonly used medium for propagation of this crop is peat/perlite the evidence presented here shows a medium of peat/vermiculite is superior and should be tested if time is a cost factor. If time is not an important parameter several media may be used equally as well.

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