A COMPARISON OF JUVENILITY IN SEEDLINGS, MICROPROPAGATED, AND MACROPROPAGATED PLANTS[1]

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Characteristics of plant juvenility as described in the literature include ease of rooting, vigorous growth, and heavy basal branching (1). Micropropagated rhododendron, in our experience, provide an excellent example of juvenile growth in a clonal propagule. In contrast, our traditional cuttings or macrocuttings are often difficult-to-root, slow-growing and demonstrate little basal branching resulting in the need for extensive pruning. Since we are a commercial nursery, our experience is largely with named cultivars, consequently no parallel could be drawn with seedling populations. Considering our hypothesis that the growth pattern of micropropagated plants is an expression of juvenility, we designed an experiment to compare micropropagated rhododendron with seedlings, the most juvenile, and macrocuttings, presumably the most mature. Because we needed seed for this comparison, we were limited to rhododendron species and these species had to be available as micropropagules. Thus, we selected the native and commercially important species *Rhododendron vaseyi* and *R. prinophyllum* as test plants. The objective of this study was to explore the juvenility of microcuttings by comparing their growth with seedlings and macrocuttings on the bases of ease of rooting, degree of basal branching, and growth rate of shoots produced.

MATERIALS AND METHODS

Seed was collected in October, 1989 from native, established plants of *R. vaseyi* and *R. prinophyllum.* In December, the seed was sown according to Dirr and Heuser (2). In early February, seedlings were transplanted to flats containing standard potting mix and were then maintained in an accelerated-growth house as described by Knuttel and Benoit (7). Temperature averaged 25 °C; relative humidity (RH) averaged 70%. Baseline growth measurements were taken of shoot length and mean width as determined by leaf span. Number of basal branches was recorded. Subsequent growth measurements were conducted at bi-weekly intervals.

[1] The advice and assistance of D D McCown, Knight Hollow Nursery, Madison, Wisconsin, were essential to the completion of this work

Macrocuttings (stem-tip cuttings) of *R. vaseyi* and *R. prinophyllum* were taken in early June from the same plants that provided the seed. The cuttings were handled as described by Knuttel and Addison (6).

The microcuttings were provided by Knight Hollow Nursery (Madison, Wisconsin). The maintenance medium consisted of Woody Plant Medium (8) solidified with 4g/l gelrite + 1.4 g/l agar mixture, supplemented with 8 μM 2iP. Since hormone "carry-over" had been suggested as a possible cause of the heavy basal branching, individual tips (approximately 0.5 cm with bases cut off and discarded) were grown for 8 weeks prior to shipment. The microcuttings were received by Knuttel Nursery in mid-March and inserted into flats containing fine-consistency sphagnum peat. Microcuttings were rooted in a pit-house with average temperatures of 25 °C and RH 70% in a 16-hour photoperiod. Rooted microcuttings were transplanted to standard potting mixture in June and grown in the accelerated-growth house. Baseline growth measurements were taken when rooted microcuttings and seedlings were as close to equal size as possible. Growth rates and number of basal branches were recorded at bi-weekly intervals.

Data on rooting was reported as the percentage of cuttings rooted; growth rate as an index (average of height and width). Data on basal branching was reported as the percentage of plants exhibiting basal branching.

RESULTS

Ease of Rooting. Microcuttings rooted with greater frequency than macrocuttings (Table 1). Also, based on the time from propagation to rooting, the microcuttings rooted faster.

Table 1. The percentage of propagules (variable sample sizes) that rooted and the time, in weeks, from propagation to rooting.

Species and source	Rooting (%)	Time to rooting (weeks)
R. prinophyllum microcuttings	51	3
R. prinophyllum macrocuttings	4	8
R. vaseyi microcuttings	23	4
R. vaseyi macrocuttings	3	10

Growth Rate of Shoots Produced. In general, the growth rate of the micropropagated plants most closely resembled that of the seedlings (Figures 1 and 2). *R. prinophyllum* (Figure 2) was more uniform in growth than *R. vaseyi* (Fig. 1) and therefore provides an appropriate example of growth rate, which will be discussed later. Although the growth rate of the micropropagated *R. prinophyllum* most closely resembled that of the seedlings, the micropropagated plants were even more vigorous. This vigorous response continued through the duration of the experiment (Fig. 2).

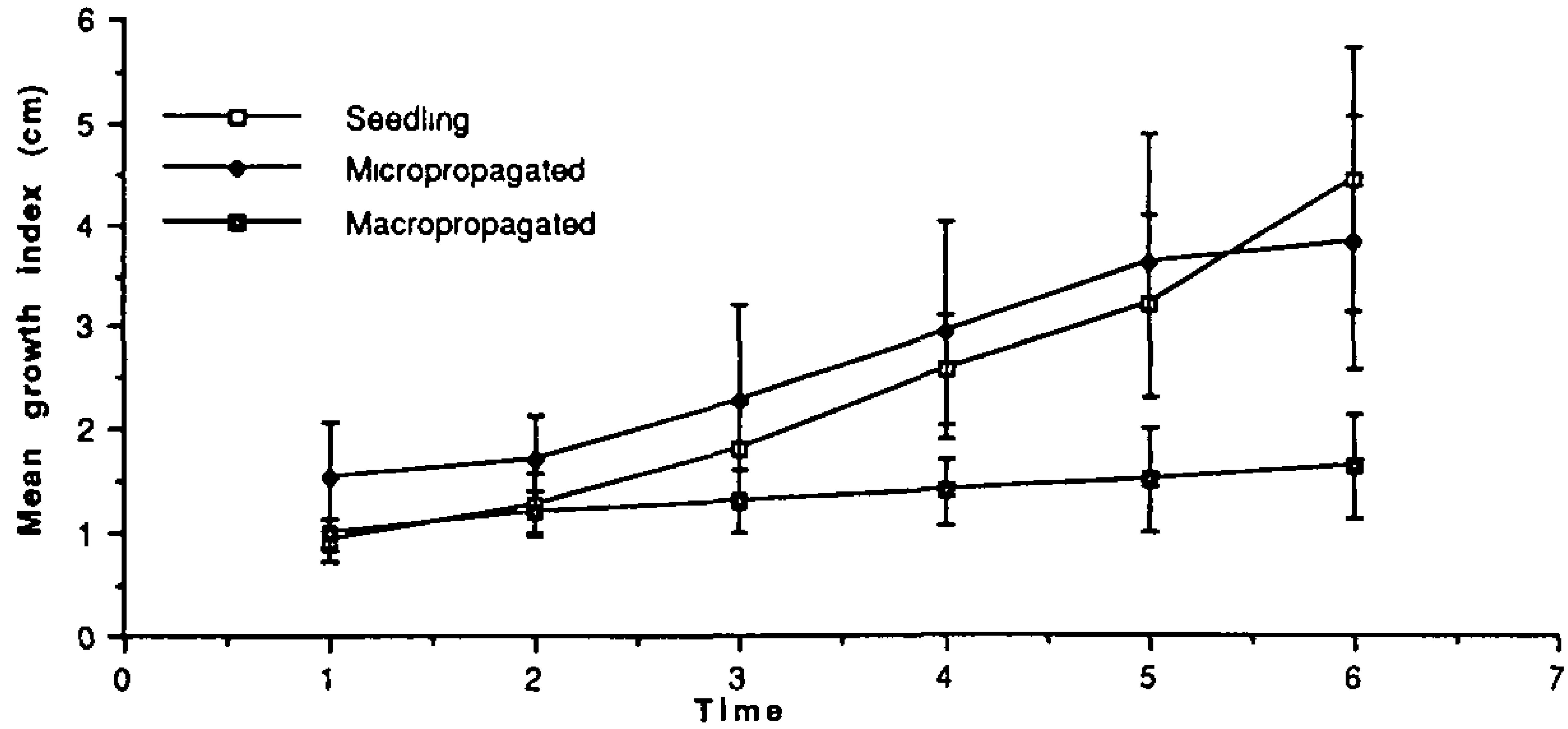

Figure 1. The growth index (average of height and width) of 3 different types of *R. vaseyi* propagules. Measurements were taken at 2-week intervals; data is reported at ± one standard deviation.

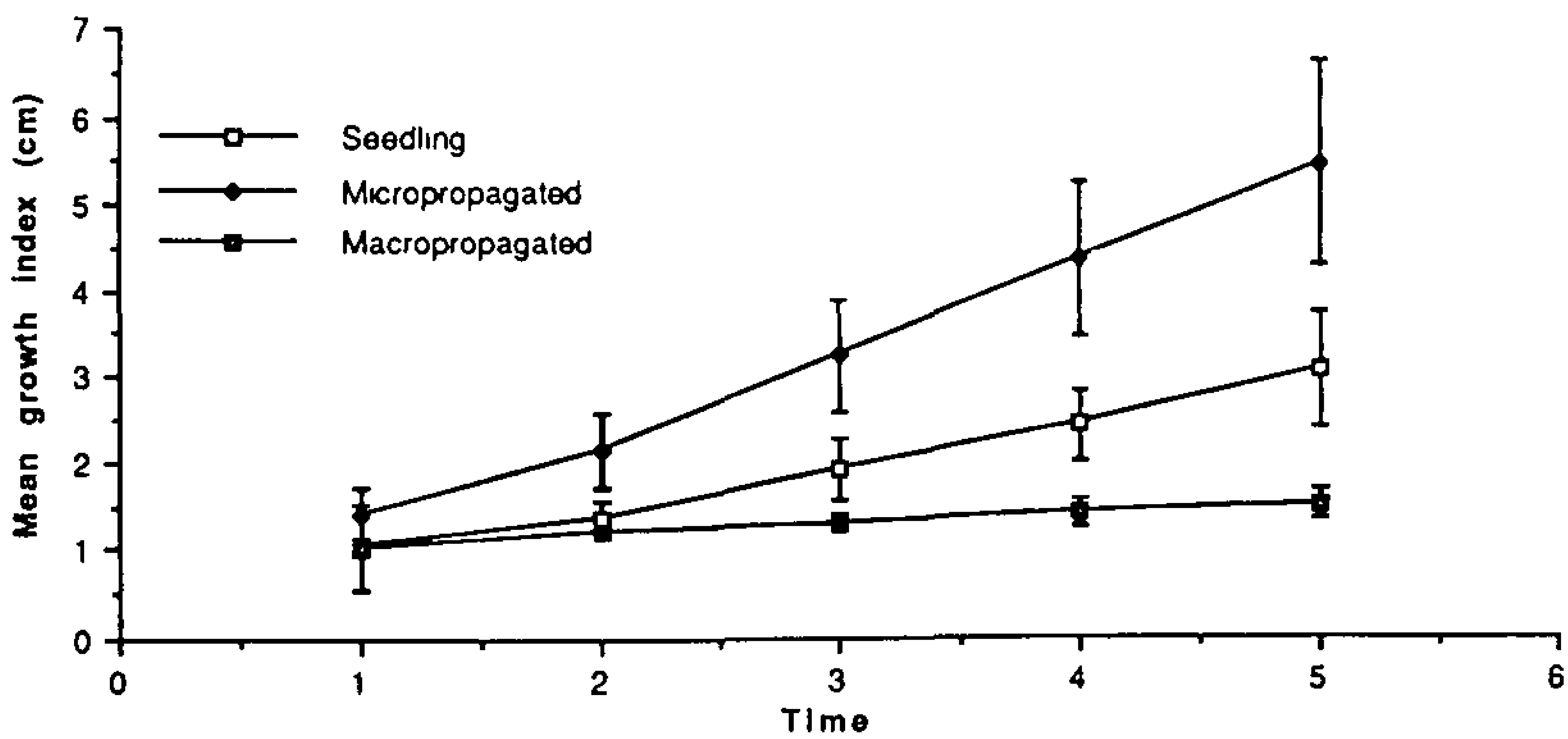

Figure 2. The growth index (average of height and width) of 3 different types of *R. prinophyllum* propagules Measurements were taken at 2-week intervals; data is reported at ± one standard deviation.

Basal Branching. For *R. prinophyllum*, basal branching occurred in 34% of the micropropagated plants, 6% of the seedlings, and 0% of the macropropagated plants (Table 2). *Rhododendron vaseyi* seedlings demonstrated basal branching (33%) but neither micropropagated nor macropropagated *R. vaseyi* demonstrated basal branching.

Table 2. The percentage of plants with basal branching; plants are from variable sample sizes

Species and source	Plants with basal branching (%)
R prinophyllum micropropagated	34
R. prinophyllum seedling	6
R. prinophyllum macropropagated	0
R. prinophyllum micropropagated	0
R. vaseyi seedling	33
R. vaseyi macropropagated	0

DISCUSSION

The enhanced rooting ability and vigorous growth rate of the micropropagated plants in this study was consistent with our expectations.

Our results agree with similar observations on micropropagated plants with respect to rooting (3, 9) and growth response (4, 5). Also, the expected recalcitrance of the macrocuttings is typical of many species of rhododendrons.

The basal branching response of the two species was quite different. The *R. prinophyllum* microcuttings had higher levels of basal branching than the comparable seedling population. Hormone carry-over cannot be a logical explanation since bases of microcuttings in contact with cytokinin medium were removed and cuttings grown for an additional 8 weeks with no hormone. Another possibility is that, because the single plant that provided both the seed and the macrocuttings was not the same as the parent explant source for the microcuttings, the genetic predisposition of the two genotypes to produce basal branches may have been different. For example, in *R. prinophyllum*, the plant that supplied both the seed and macrocuttings may not normally exhibit a high degree of basal branching and the small number of seedlings that did show basal branching may be the result of heterozygosity due to cross-pollination.

No basal branching was observed on *R. vaseyi* microcuttings over the measurement period while 33% of the seedlings had basal branches. Interestingly, on our normal production of micro-

CONTAINER PRODUCTION OF HARD-TO-FIND OR HARD-TO-TRANSPLANT SPECIES

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The Ohio Production System (OPS), a method for rapidly producing container-grown whips, was first described in these Proceedings (1). The evolution and development of OPS is fully described in the August 15th, 1990 issue of the American Nurserymen, "Turning Copper Into Gold" (2). This article briefly describes the system, why it works, and it lists some benefits. Also, results from a 1990 species trial are presented and some OPS production challenges are discussed.

DESCRIPTION OF OPS

The following procedures are for Columbus, Ohio climatic conditions; if climatic conditions differ significantly from those of Columbus, Ohio appropriate modifications should be made. Between February 15 and March 15 seeds are sown in germination flats while rooted cuttings, either stem or tissue culture microcuttings, are potted in copper-treated one-gallon containers. Following germination, seedlings are transplanted to copper-treated one gallon containers when the first true leaves appear. On coarse-rooted species, the main root is pruned before potting. Our plastic containers are now being coated with Kocide 101 formulation of copper hydroxide at 100 g/l rather than cupric carbonate. We have switched from cupric carbonate for two reasons. First, copper hydroxide gives better root control than cupric carbonate and second, the Griffin Corporation (contact Mark Crawford at the Agricultural Chemicals Group, P.O. Box 1847, Valdosta, GA 31603-1847, (912) 242-8635) is pursuing EPA registration, through label expansion, for Kocide 101 as a root controlling compound. Registration is expected for spring, 1991. Also, Keiding, Inc (4545 West Woolworth Ave., Milwaukee, WI 53218, (414) 353-9790) plans to manufacture a copper treated fiber container for spring, 1991.

Plants are grown in a heated greenhouse until the last frost date, about May 15. The plants are moved outdoors under 70% shade for two weeks of acclimation and then upcanned to three-gallon, copper-treated containers. For the last three years, we have used Kord's 1109 copper-treated fiber container (Kord Products Limited, 390 Orenda Road, Bramalea, Ontario, Canada, L7M-1H4 (416) 791-2600. The plants are then grown under standard container production conditions. Good cultural practices must be maintained or OPS' growth potential will be lost.