2. Anderson, W.C. 1978. Rooting of tissue cultured rhododendrons. Proc. Intern. Plant Prop. Soc. 28:135–139.

3. Dirr, M.A. 1983. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. 3rd ed. Stipes Publishing Co., Champaign, Ill.

4. Duncan, W.H. and T.M. Pullen. 1962. Lepidote rhododendrons of the southeastern United States. Brittonia 14:290–298.

5. Fordham, I., D.P. Stimart and R.H. Zimmerman. 1982. Axillary and adventitious shoot proliferation of Exbury azaleas *in vitro*. HortScience 17:738–739.

6. Gensel, W.H. and F.A. Blazich. 1985. Propagation of *Rhododendron champmanii* by stem cuttings. J. Environ. Hort. 3:65–68.

7. Greenwalt, L.A. 1979. Determination that *Rhododendron chapmanii* is an endangered species. Federal Register 44:24248–24250.

8. Kyte, L. and B. Briggs. 1979. A simplified entry into tissue culture production of rhododendrons. Proc. Intern. Plant Prop. Soc. 29:90–95.

9. Lloyd, G. and B. McCown. 1980. Commercially-feasible micropropagation of mountain laurel, *Kalmia latifolia*, by use of shoot-tip culture. Proc. Intern. Plant Prop. Soc. 30:421–437.

10. McCown, B.H. and G.B. Lloyd. 1983. A survey of the response of *Rhododendron* to *in vitro* culture. Plant Cell, Tissue and Organ Culture 2:77–85.

11. Meyer, M.M. Jr. 1982. *In vitro* propagation of *Rhododendron catawbiense* from flower buds. HortScience 17:891–892.

12. Simons, R.W. 1983. Recovery plan for Chapman's rhododendron, *Rhododendron chapmanii* A. Gray. U.S. Fish and Wildlife Service. Atlanta, Ga. 41 p.

Influence of Root Pruning and Fertilizer on Survival and Quality of Two Bare-Root Rose Cultivars[1]

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Abstract

Bareroot, field-grown 'Mon-Cheri' and 'Olympiad' roses were planted in containers with light or heavy root pruning and 6 fertilizer treatments. Heavy root pruning resulted in a 43% loss of 'Mon-Cheri', but only 2% losses of 'Olympiad' roses. The medium rate of 4.8 kg/m^3 (8.15 yd^3) of Osmocote 18N-26P-9.8K (18-6-12) increased survival, growth and appearance in containers. Following transplanting into the landscape, both slow-release N, P, K fertilizer and a micronutrient fertilizer increased floral counts for both cultivars.

Index words: Containers, field-grown, plant establishment, roses, *Rosa* × *hybrida*

Introduction

Container-grown roses in full flower are a major attraction at garden centers and retail nurseries from mid-spring to early summer. Most of these plants are field-grown for two years, then dug dormant, stored, shipped and transplanted into containers during early spring to be forced into bloom for later sales.

Previous studies with mugo pine showed that root pruning at the time of planting bare-root field-grown specimens into containers did not influence plant survival and subsequent growth (2, 3). Similar results also have been obtained with several species of trees that were field-grown and then planted, bare-root, into containers (1).

Bare-root, field-grown roses have extensive root systems, making them awkward to transplant into 3.8 to 7.6 l (#1 or #2) containers. If the size of the root system can be reduced without sacrificing survival or subsequent plant flowering and quality, the transplant operation would be simplified and perhaps a smaller diameter container could be used, thus reducing costs.

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The purpose of this study was to determine, a) if root pruning at time of planting bare-root roses into containers effects survival and plant quality, b) if the nutrients added to the growth medium at time of potting improves plant appearance, and c) if either the root pruning or nutritional treatments in the containers would influence plant performance in the landscape.

Materials and Methods

Two rose cultivars, 'Olympiad' and 'Mon-Cheri', were obtained from Armstrong Nurseries, Ontario, California. The plants had been field-grown, were two-year-old (one-year graft on a two-year root stock) and were #1.5 grade, bare-root. All plants were received on March 17, 1984 and were transplanted into 2.8 l (#1, 160 in^3) containers. The following treatments, replicated 12 times, in a randomized block design were applied.

Root pruning

1. Light (just enough to get the root mass into the container. Most remaining roots were 15–25 cm (6–10 in) in length.
2. Heavy (remaining roots were 7.6–10 cm (3 to 4 in) in length, making tansplanting very easy).

Fertilizer, incorporated

1. 2.4 kg/m^3 (4 lbs/yd^3) Osmocote 18N-2.6P-9.8K (18-6-12)
2. 4.8 kg/m^3 (8 lbs yd^3) Osmocote 18N-2.6P-9.8K (18-6-12)
3. 7.2 kg/m^3 (12 lbs yd^3) Osmocote 18N-2.6P-9.8K (18-6-12)

Micromax micronutrients

1. 0.0 kg/m^3
2. 0.9 kg/m^3 (1.5 lbs yd^3)

The growth medium for all treatments was ground pinebark, sphagnum peat and sand (4:1:1 by vol) amended with 2.4 kg/m^3 (4 lbs/yd^3) of dolomite. The plants were held in unheated overwintering structures until April 12, 1984 when they were moved into full sun with overhead sprinkler irrigation. No spray program was used and plant foliage was free of disease through the container handling stage.

On May 3, all plants were rated from 1–10 where 1 = dead plant, 2 = some green stems, but no bud swell or growth, 3 = a few weak shoots present, 4 = buds emerging slowly, to 10 = good foliage and new growth.

On June 4, a count of flowers and buds was determined for 'Olympiad' only, as 'Mon-Cheri' was growing poorly with only an occasional bloom.

On June 19, 1984, 6 replications of all treatments of 'Olympiad' were transplanted into a landscape setting with moderately good soil, full sun and drip irrigation. Since most of 'Mon-Cheri' with heavy root pruning died, only plants from the Osmocote and Micromax treatments in combination with light root pruning were transplanted. Counts of flowers were taken weekly June 19 through Sept. 24, 1984.

Results and Discussion

Root pruning was detrimental to one cultivar and had little effect on the other. Only two 'Olympiad' failed to grow (2%) and only 3 were rated 4 (buds emerging but slow) (2%) of the 144 plants. All others were rated 10 on the May 3 evaluation, regardless of treatment. In contrast, 43% of the 'Mon-Cheri' died when heavily root pruned compared to only 17% when lightly root pruned.

Micromax had no effect on either rose cultivar while in the container. However, Osmocote 18N-2.6P-9.8K (18-6-12) at the rate of 4.8 kg/m^3 (8 lbs/yd^3) increased survival of both cultivars over the 2.4 kg/m^3 (4 lbs/yd^3) rate, but there was no further benefit from the highest rate (Table 1). The best treatment combination for 'Mon-Cheri' (92% survival) was 4.8 or 7.2 kg/m^3 (8 or 12 lbs/yd^3) of Osmocote 18N-2.6P-9.8K (18-6-12), with or without Micromax and only light pruning of the roots at time of planting into containers.

The June 4 flower and bud count on 'Olympiad' showed that the 4.8 or 7.2 kg/m^3 (8 or 12 lb/yd^3) rate of Osmocote with or without Micromax and light root pruning averaged 4 flowers or flower buds per plant. Pruning the roots heavily at planting reduced the number of flowers or buds an average of 50%.

This study shows that although heavy root pruning a vigorous rose cultivar such as 'Olympiad' has little effect on survival and initial appearance, it does reduce the number of flowers and buds present during the sales season. On the other hand, heavy root pruning a cultivar such as 'Mon-Cheri' greatly increased plant mortality. It should be emphasized that the two rose cultivars were of similar size and appearance when the study was initiated. There were no visible signs of stress or dehydration that would account for the sizeable difference in survival rates between the two cultivars.

In contrast to smaller plants, larger, field-grown woody plants, especially those grown for only a short time in containers, generally, have not benefitted from adding micronutrients to the container growth media (1). This is probably due to the micronutrients stored in the plant tissues as a result of moderate to good levels available in most field soils.

Total flowers produced in the landscape were greatest with the presence of both Osmocote at 4.8 kg/m^3 (8 lbs/yd^3) and Micromax micronutrient fertilizer at 0.9 kg/m^3 (1.5 lbs/yd^3) for both species (Table 2). Flower counts for 'Olympiad' were restricted by the highest level of Osmocote, whereas flowers on 'Mon-Cheri' were greatest with the 4.8 or 7.2 kg/m^3 (8 and 12 lb/yd^3) rate with micronutrients.

These data show that heavy root pruning of bare-root roses when potting into containers can affect survival or early flower production or both.

Osmocote incorporated into the container growth medium at the medium rate increased survival, but had little effect on early flowering. Following planting in the landscape, both Micromax micronutrients and Osmocote at the medium rate stimulated flower production over no micronutrients and the low rate of Osmocote. The improved landscape performance due to the fertilizer treatments probably reflects more rapid root establishment with less stress.

Table 1. Visual rating[y] of 2 rose cultivars in containers with 3 fertilizer levels.

	Osmocote 18-6-12 lbs/m^3 (yd^3)		
Cultivar	**2.4 (4)**	**4.8 (8)**	**7.2 (12)**
'Olympiad'	7.4a[z]	9.2b	8.9b
'Mon-Cheri'	3.1a	5.6b	5.2b

[z]Based on a scale 1 = dead, 10 = good foliage and new growth

[y]Means followed by the same letter are not significantly different at the 0.05 level using a protected LSD test.

Table 2. Effect of 6 nutritional treatments on total flowers produced by 2 rose cultivars following planting in the landscape (June 19–Sept. 24).

		Osmocote level kg/m^3 (lbs/yd^3)		
Cultivar	**Micromax**	**2.4 (4)**	**4.8 (8)**	**7.2 (12)**
'Olympiad'	–	25.5a[z]	37.4c	28.0ab
	+	32.9bc	43.4d	27.4a
				LSD 0.05 = 5.6
'Mon-Cheri'	–	20.4a[z]	33.0b	40.1c
	+	32.5b	42.6c	41.9c
				LSD 0.05 = 7.1

[z]Means followed by the same letter are not significantly different at the 5% level using a protected LSD test.

To avoid the tedious job of trying to place roots of roses that have been pruned very little into a #1 container, nurserymen should consider using the larger #2 container. The increased materials cost would probably be offset by the reduction in labor during the potting operation and losses in the case of cultivars like 'Mon-Cheri'. In addition, the relatively large rose plants in the #1 container, although attractive, were difficult to manage. They required frequent watering and were very subject to lodging (being blown over).

Significance to the nursery industry:

This study shows that heavy pruning of some cultivars of field-grown bare-root roses when planting into containers, may adversely affect survival, growth and flowering during the prime retail sales period. Adding slow-release fertilizer aided appearance and growth both while in the container and after planting into the landscape. Micronutrient fertilizer proved benefical only after planting into the landscape. Root pruning and fertility in the growth medium does influence both visual quality and landscape performance of roses.

Literature Cited

1. Carney, M.G. and C.E. Whitcomb. 1978. Establishment of bare-root deciduous trees in containers. Okla. Agri. Expt. Sta. Res. Rept. P-777: 21–22.

2. Knapp, M. and C.E. Whitcomb. 1979. Growing mugo pine in containers. Amer. Nur. 149(11):7, 48.

3. Whitcomb, C.E. and T.E. Pinney. 1983. Effects of digging, storage and planting on survival of field grown bare-root mugo pine in containers. J. Environ. Hort. 1:36–38.