Phosphorus Requirement of *Rhododendron* 'Victor' and *Cotoneaster adpressa praecox* Grown in a Perlite-Peat Medium[1]

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Abstract

Rooted cuttings of *Rhododendron* 'Victor' (a PJM cultivar) and *Cotoneaster adpressa praecox* were grown in the greenhouse with phosphorus (P) levels ranging from 0 to 15 ppm in a perlite-peat medium. Shoot growth of *Rhododendron* was equal at P levels from 2.5 to 15 ppm. Maximum growth of shoots and roots of *Cotoneaster* was at 10 ppm. Maximum *Rhododendron* leaf P content occurred at 5 ppm in the medium and remained the same at higher P levels. The P content of *Cotoneaster* leaves increased throughout the range of P levels in the growing medium. A P level of 10 ppm in soilless media solution is suggested for most nursery crops.

Index words: Soilless media, media solution, leaf P content, plant nutrition, fertilization

Introduction

The concentration of phosphorus (P) in solution may be the most reliable measure of available P for plants grown in organic and other soilless media (5, 10). Thus, data are needed on media solution P levels required for maximum growth of nursery crops, especially in light of recent reports that P from a superphosphate amendment is rapidly leached from organic media (4, 8, 9). Recommendations range from 6 to 15 ppm P in media solution for ornamental plants (5, 7). Studies using shoot dry weight as the criteria reported maximum growth at 3 ppm P in nutrient solutions for *Betula verrucosa* (2) and *Picea abies* (3) and 10 ppm in southern pine bark for *Ilex crenata* 'Helleri' (9).

The purpose of this study was to determine the minimum P level in solution of a perlite:peat mix for maximum growth of *Rhododendron* 'Victor' (a cultivar of PJM) and *Cotoneaster adpressa praecox.*

Materials and Methods

Cuttings of the *Rhododendron* and *Cotoneaster* were rooted in an essentially P-free medium of 2 perlite: 1 peat (by vol) and transplanted to a growing medium of 4 perlite: 1 peat in 1.2 liter plastic containers (6 in azalea pots). Amendments added were limestone (21% Ca, 12% Mg) at 0.42 kg/m^3 (0.7 lb/yd^3) and fritted trace elements containing 14% Fe at 0.17 kg/m^3 (4.5 oz/yd^3). The media pH averaged 5.1. Each plant was fertilized 3 times per week with 200 ml of a solution containing 100 ppm N as NH_4NO_3, 50 ppm K as KC1 and either 0, 2.5, 5, 10 or 15 ppm P as KH_2PO_4. The plants were grown in a greenhouse (min. 17 °C, 63 °F) with 10 replications in a completely randomized design. Leachate (drainage water) samples (9) of 4 containers of each treatment were collected at 2-week intervals for analysis of P (6). At the end of the experiments, leaves were dried, digested in a mixture of nitric and perchloric acids and analyzed for P (6).

The 2 plant genera were studied in separate experiments. The treatments on *Rhododendron* were for 8 weeks in July and August, 1983, and on *Cotoneaster* for 11 weeks March through May, 1984. The tops of the *Cotoneaster* rooted cuttings were trimmed to 7 cm (2.75 in) at planting. Growth was measured as the dry weights of shoots and roots of *Cotoneaster* and shoot dry weight of *Rhododendron.* The roots of the latter could not be adequately separated from the growing medium.

Results and Discussion

Water extracted P levels (data not shown) were similar to applied levels, varying a maximum of 1.2 ppm from the concentration applied. The 0 ppm treatement had no more than 0.2 ppm P.

Dry shoot weights of *Rhododendron* increased from the 0 to the 2.5 ppm P treatment, but there were no differences in dry weights from 2.5 to 15 ppm P (Table 1). Dry shoot weights of *Cotoneaster* were greater at the 10 ppm than at lower P levels, but there was no further increase at the 15 ppm treatment (Table 2). Dry root weights of *Cotoneaster* were highest at 10 ppm P, but were equal at other levels. These results with *Cotoneaster* are in general agreement with those reported with

Table 1. Dry weight and leaf P in *Rhododendron* 'Victor' fertilized with 5 levels of P for 8 weeks.

P applied (ppm)	Dry wt Shoots (g)	P Leaves (%)
0	0.76 a[z]	0.05 a
2.5	1.74 b	0.11 b
5	1.69 b	0.16 c
10	1.79 b	0.17 c
15	1.81 b	0.16 c

[z]Means within columns followed by the same letter are not significantly different at the 5% level, using Duncan's Multiple Range Test.

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Ilex crenata 'Helleri' (9), except that root growth did not decrease with increasing P levels as with the *Ilex.*

Rhododendron leaves increased in P content as P increased only to the 5 ppm level and then remained the same through the 15 ppm level (Table 1). A similar trend has been reported for *Picea* (3). The P content of *Cotoneaster* leaves increased throughout the range of P levels in the growing medium (Table 2), which was similar to *Ilex* (9), *Rhododendron indicum* 'Formosa,' *Viburnum suspensum* (1) and *Betula* (2).

For simplification of fertilizing nursery crops, it would be desirable to have a standard P level or range that is suitable for a large number of crops. Although *Rhododendron* 'Victor' made as much growth at 2.5 ppm P as at higher levels, concentrations as high as 15 ppm were not harmful (Table 1). The measured response was vegetative growth of young plants and does not necessarily reflect other responses such as flower bud set. Furthermore, this cultivar may not be representative of all species and cultivars of the genus. *Cotoneaster* made the most growth at 10 ppm (Table 2) and we suggest that this could be the target level for P in soilless growing media solutions for nursery crops until further tests reveal exceptions. The 10 ppm level is within recommended ranges previous published (5, 7).

Different types of leaf P accumulation are represented in the 2 genera. *Rhododendron* 'Victor' reached maximum leaf P concentration at a slightly higher medium P level than required for maximum growth (Table 1). A leaf P of 0.16% would indicate adequate P nutrition. On the other hand, *Cotoneaster adpressa praecox* continued to accumulate P in leaves beyond the medium P level required for maximum growth (Table 2). Leaf P of 0.40% would indicate adequate P nutrition for this plant. Obviously, a standard optimum leaf P concentration is required for each species, or even cultivar, if leaf analysis is to be used as a guide for fertilizer practices. Levels of N and K nutrition affect leaf P in some plants, but not in others (1).

Table 2. Dry weight and leaf P in *Cotoneaster adpressa praecox* fertilized with 5 levels of P for 11 weeks.

P applied (ppm)	Dry wt Shoots (g)	Dry wt Leaves (g)	P (%)
0	0.78 a[z]	0.50 a	0.08 a
2.5	2.75 b	0.65 ab	0.20 b
5	2.77 b	0.60 ab	0.35 c
10	3.77 c	0.71 b	0.40 d
15	3.20 bc	0.64 ab	0.50 e

[z]Means within columns followed by the same letter are not significantly different at the 5% level, using Duncan's Multiple Range Test.

Significance to the Nursery Industry

This study, along with others, indicates that a phosphorus level of 10 ppm in soilless growing media solution is desirable for good vegetative growth of several species of nursery plants. Two methods can be used to obtain a sample of the media solution for analysis. The saturated media extract method described by Warncke (5) requires that media samples be submitted to a laboratory that uses this method of extraction. Many laboratories do not. The other method, the pour-through of Wright (7, 10), is to collect a sample of leachate (drainage water) directly from the container. Nurserymen can do this easily and send the solution to a laboratory for analysis.

The results of leaf analysis in this study shows that a general optimum range of leaf P content cannot be used. The desirable leaf-phosphorus contents were 0.14% for the PJM *Rhododendron* and 0.40% for the *Cotoneaster.* Thus, great variation occurs among kinds of plants.

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