EFFECT OF SLOW RELEASE FERTILIZER SOURCES ON FLOWER FORMATION AND NUTRIENT COMPOSITION IN RHODODENDRONS

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Abstract. Eight slow-release fertilizers supplying the same amount of N were applied twice during the growing season to 'Vulcan' rhododendrons growing in bark mixes with two ratios of calcium to magnesium, with and without trace elements. Poorest growth and flower bud set occurred in 3 nitrogen-only treatments. One nitrogen-only treatment (Organiform 23-0-0) had the highest number of well-budded plants. There was greater response to trace elements in the high magnesium treatment.

REVIEW OF LITERATURE

Leaf analysis surveys of several rhododendron cultivars have established tentative standards for the foliar mineral content (2,4). Higher levels of nitrogen, phosphorus, manganese, and boron were found in good than in poor plants. More calcium in relation to magnesium was also characteristic of the good plants (3). 'Vulcan' rhododendrons grown in containers at the North Willamette Experiment Station during 1977 (Table 1) had lower nitrogen, manganese, and boron, higher phosphorus and potassium, and a lower ratio of calcium to magnesium than good field-grown plants.

Table 1. Comparison of foliar analysis values from good and poor field-grown 'Vulcan' rhododendrons with container-grown plants which received Osmocote 18-6-12 top dressing.

	Percent of Dry Weight					ppm of Dry Weight					
	N	P	K	Ca	Mg	Mn	Fe	Cu	B	Zn	Al
Good Plants	1.84	0.22	0.43	1.39	0.19	1260	138	3	33	29	106
Poor Plants	1.78	0.18	0.62	1.15	0.27	637	59	2	30	38	66
Container Plants[1]											
1977 Crop on 1/27/78	1.69	0.22	0.62	1.28	0.31	233	869	1	20	15	23
1978 Crop on 6/12/78	1.19	0.18	0.64	1.53	0.41	437	371	3	19	56	24
on 9/14/78	1.61	0.24	1.29	0.72	0.31	108	763	3	16	43	14

[1] Top dressing fertilizer applied 6/20 on 1977 crop and 6/19 and 8/29 on 1978 crop.

METHODS AND MATERIALS

Two ratios of calcium to magnesium were used in ¼" minus Douglas fir bark potting mixes. Dolomite 65G (34.4% magnesium carbonate 44.2% calcium carbonate), 3 lbs. per cubic yard, was compared to 2 lbs limestone (93.0% calcium carbonate 0.7% magnesium carbonate), plus 1 lb. dolomite 10G (42.6% magnesium carbonate, 54.7% calcium carbonate). Other

components of the potting mix were 11.1 lbs Osmocote 18-5-11 (2 lbs. N/yd, 3.76 lbs of 0-45-0, and 1.5 lbs of gypsum per cubic yard.

Eight sources of slow-release nitrogen were used to supply the same amount of nitrogen to each plant in two surface applications on both June 19 and August 29, 1978. Four sources contained nitrogen only: IBDU (31-0-0), isobutylidene diurea; Organiform (23-0-0), a methylene urea reacted leather tankage; Osmocote (40-0-0), a plastic coated urea; and SCU (36-0-0), sulfur-coated urea. Four sources were complete fertilizers: Osmocote 18-6-12, plastic coated 8-9 month formulation; Scott 25-10-10 and 31-5-3, based on methylene urea; and Webfoot 10-6-4, with 50% ureaform nitrogen and the balance from leather tankage and ammonium phosphates.

Cuttings of 'Vulcan' rooted in 2¼" square by 3½" deep plastic pots during the summer of 1977 were placed into 1 gallon plastic pots during February 1978. The night temperature was raised from 35° to 45°F when potting started. On March 1st, the night temperature was raised to 55°F and cool white fluorescent lights were turned on to provide a 24 hr day until May 26 when the lights were turned off. The plastic cover was removed from the house on June 5th and the plants remained in full sun during the growing season.

Trace elements were applied to half of the plants in each calcium-magesium slow-release fertilizer treatment resulting in 32 treatments. Ten plants which were randomized on the benches during the growing season were used in each treatment. S.T.E.M. (Soluble Trace Element Mix) from Peters was used at 2 ounces per 25 gallons and one cup of the solution was applied to each treated plant on May 23 and June 26.

Three leaves from each of the 10 plants in a treatment were collected for chemical analysis on September 14th. The leaves, after washing and drying, were sent to the Plant Analysis Laboratory in the Horticulture Department at Oregon State University for analysis. A Direct Reading Spark Emission Spectroscope (1) was used to determine the amount of phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), iron (Fe), copper (Cu), boron (B), zinc (Zn) and aluminum (Al) in the leaf tissue. Total nitrogen (N) was determined by the Kjeldahl method.

Since the 32 treatments were not replicated, the 4 calcium-magnesium treatments served as replicates for the slow-release fertilizer treatments (Table 2). The 8 slow-release fertilizer treatments were used as replicates for the calcium-magnesium treatments (Table 3).

Physical measurements, height to tip of the tallest bud,

maximum width between buds, and the number of vegetative and flowering shoots were recorded on September 23rd.

Table 2. Number of 'Vulcan' rhododendron plants with five or more flower buds per plant following surface application of several slow release fertilizers. (10 plants per treatment with 4 reps.)

Fertilizer	Grams*/6" Pot	No. Budded of 10 Plants	Duncan's Multiple Range Comparison 5 percent level
Osmocote (40-0-0) Sulfur Coated Urea (36-0-0)	4.79	6.0	A
IBDU (Fine) (31-0-0)	5.56	6.25	A
Osmocote (18-6-12)	9.58	7.0	AB
Scott (25-10-10)	6.9	7.75	ABC
Scott (31-5-3)	5.56	8.5	BC
Webfoot (10-6-4)	17.25	8.5	BC
Organiform (23-0-0)	7.5	9.0	C

* Based on manufacturer's recommendation of 6.9 grams per 6" pot for the 25-10-10. Same amount of nitrogen applied in each treatmenmt on 6/19 and 8/17/78.

Table 3. Number of 'Vulcan' rhododendron plants with five or more flower buds per plant in potting mixes containing dolomite or both dolomite and calcium carbonate with and without trace elements.* (10 plants per treatment with 8 reps.)

Calcium-magnesium Treatments	Amount in lbs. 1 cubic yard	No. Budded of 10 Plants	Duncan's Multiple Range Comparison 5 percent level
1. Dolomite 65G	3	6	A
2. Dolomite 10G + Calcium Carbonate	1 2	7.5	B
3. Dolomite 10G + Calcium Carbonate + Trace	1 2	7.75	B
4. Dolomite 65G + Trace	3	8.25	B

* Trace elements = Peters S.T.E.M. (Soluble Trace Element Mix). Used at 2 oz/25 gallons and applied at 1 cup/6" pot on 5/23 and 6/26/78.

RESULTS

There were marked differences in flower bud formation between the plants with and without trace elements in the dolomite only treatments. Examples include SCU 8 plants with 5+ flower buds with, and 3 without, or Webfoot 10-6-4 which contains some fritted trace elements, 10 with and 6 without. These differences were not as noticeable in the dolomite-calcium carbonate combinations.

Three of the four nitrogen-only treatments resulted in the fewest flower buds. The fourth nitrogen-only treatment, Organiform (23-0-0), which had the highest number of flower buds

of any treatment, is based upon natural organic materials.

The next highest flower bud formation occurred with the two complete fertilizers having the lowest amount of potassium. The differences among the four complete fertilizers were not statistically significant.

Average plant height for the 8 nitrogen treatments varied by a maximum of 0.63 inches whereas the average width varied by a maxium of 0.97 inches. The calcium-magnesium trace element average plant height varied only 0.3 inches but the width range was greater — 1.6 inches. The plants receiving trace elements in the dolomite-only treatment averaged 1.6 inches wider than those without trace elements.

Table 1 shows leaf analysis data from plants receiving dolomite-only from 1977 and 1978 trials which were top-dressed with Osmocote 14-14-14 in 1977 and 18-6-12 in 1978. Nitrogen was low in 1977 from one application so two were used in 1978. The first 1978 sample was taken before any top application and is very low in N. The second sample, one month after the second application, is still low in nitrogen.

Potassium was very high after two applications in 1978. After the first Osmocote application there was a better ratio of Ca to Mg than after the second application.

Statistical relationships between surface-applied fertilizers and leaf analysis data are shown in Table 4. Only one treatment, Organiform, resulted in a nitrogen level statistically different from the others. This low level, 1.44%, was associated with the highest number, 36 of 40 plants, having 5 or more flower buds per plant. The two treatments which had 34 of 40 well-budded plants, had the highest level of N — 1.70%. These were Scott 31-5-3 and Webfoot 10-6-4.

There was statistical separation among the foliar phosphorus levels resulting from the different slow-release fertilizer applications. Again, the lowest level of P was in the Organiform treatment and the highest in the 10-6-4 treatment.

Contrary to our field experience, the lowest potassium levels were associated with the least flower bud formation. The intermediate levels, 1.17 to 1.24%, were associated with the highest flower bud formation.

There were no significant differences in calcium content of the foliage. Again, contrary to our field observations, the three highest magnesium levels were associated with the greater flower bud formation.

Only one top-applied fertilizer, Webfoot 10-6-4, which contains some fritted trace elements, had a boron level different from the others.

There was no statistical difference in the calcium or magnesium content of the leaves from the two calcium/magnesium treatments. The level of boron was significantly higher when S.T.E.M. was applied.

Table 4. Foliar analysis values of rhododendron 'Vulcan' on September 14, 1978, following surface application of slow release sources of nitrogen on June 19 and August 29, 1978.

	Percent of dry weight					ppm of dry weight
	N	P	K	Ca	Mg	B
IBDU 31-0-0	1.67B*	0.205A	1.09A	0.71 N.S.	0.27A	21A
Organiform 23-0-0	*1.44A*	*0.20 A*	*1.23BC*	*0.71 N.S.*	*0.31AB*	*19.3A*
Osmocote 18-6-12	1.65B	0.258D	1.35C	0.73 N.S.	0.29A	23.3A
Osmocote 40-0-0	1.66B	0.22AB	1.14AB	0.69	0.29A	23.8A
Scott 25-10-10	1.66B	0.248C	1.24BC	0.69	0.27A	19.3A
Scott 31-5-3	1.70B	0.24BC	1.17AB	0.68	0.30AB	18.5A
SCU 36-0-0	1.63B	0.23BC	1.06A	0.71	0.28A	23.3A
Webfoot 10-6-4	1.70B	0.273E	1.24BC	0.79	0.33B	47.3B

* Mean separation within columns by Duncan's Multiple Range Test, 5% level.

DISCUSSION

Plant appearance was better when a complete N-P-K fertilizer was used instead of a nitrogen-only treatment. One nitrogen-only treatment did have the most flowers, 36 of 40 plants with 5 or more flower buds per treatment. The highest average number of flower buds, 9.7 per plant, was from the 10-6-4 treatment. This treatment resulted in the highest (but not statistically significant) levels of most elements, except potassium.

There was a visible growth response from the application of trace elements to the dolomite-only treatments. The plants receiving both calcium, limestone and dolomite were the most uniform in appearance.

LITERATURE CITED

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