Effect of Slow-Release Fertilizers on Propagation Medium and on Rooting and Growth of Cuttings

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Two 17N-3.1P-8.1K (17-7-10) 12-14 month-release fertilizer formulations were surface applied at a rate of 0.5 lbs N/cu.yd. (22.58 g/1763 sq cm) to a rooting medium of peat and perlite (1 : 7, v/v) in comparison to peat and perlite (1 : 7, v/v) without fertilizer, and to composted sewage sludge and perlite (1 : 7, v/v). Cuttings of *Ilex* 'September Gem' showed a significant difference in the number of shoots produced per cutting between the two formulations. Cuttings in the fertilizer treatments were taller than the control. Composted sewage sludge in the medium did not produce better results than perlite alone. The number of roots and shoots per cutting and height of *Forsythia* × *intermedia* 'Spring Glory' cuttings was increased by the 3-4, 8-9, and 12-14 month-release Osmocote formulations as compared to the control. The largest cuttings occurred with the 12-14 month formulation.

INTRODUCTION

Extensive research has been carried out in recent years by a number of organizations throughout the world in development and evaluation of various slow-release fertilizers (SRF). Substantial experience and knowledge has been gained from this work and progress is still being made in this field. Interest by many people in SRF sources of plant nutrients is based on the recognition that conventional fertilizer programs are generally not very efficient (Barron, 1974); and SRFs are considered to be a potential means of optimizing crop yields with improved fertilizer efficiencies (Allen and Mays, 1974; Cardarelli, 1976; Russel and Williams, 1977).

A wide range of SRF materials with varying release rates are available for almost every type of crop (George, 1987). Various SRFs have characteristics that improve fertilizer efficiency and optimize plant nutrition. These long lasting fertilizers have significant effects on root dry weight, shoot dry weight, flower bud break, stem caliper, and growth index in various ornamental and forestry plants (Furuta, 1976; Torres, 1987; Przeradzki and MacCarthaigh, 1988). SRFs are especially effective for producing container nursery stock due to the limited nutrient and water holding capacity of soilless media and leaching from porous mixes, particularly of nitrogen and potassium (Ticknor, 1979 and Smith et al., 1991). In addition, the use of only one application of SRF for an entire growing season is very appealing (Sharma, 1979).

The purpose of this study was to: (1) determine the effect of two 12-14 month release products and three rooting media on rooting and subsequent growth of *Ilex*

cuttings, and (2) determine the effect of three slow-release fertilizer formulations with different release rates on the rooting and subsequent growth of *Forsythia* cuttings.

MATERIALS AND METHODS

The experiments were carried out in a glass-covered greenhouse at Oregon State University (OSU), Corvallis. The greenhouse is equipped with a mist irrigation system.

Experiment 1. (*Ilex* 'September Gem'). Cuttings were inserted in 2.25 in. × 3.25 in. pots on October 18, 1991 with six pots per replication and 12 replications. There were four treatments in the trial: (1) peat and perlite (1 : 7, v/v), (2) peat and perlite (1 : 7, v/v) plus Osmocote 17N-3.1P-8.1K (17-7-10) 12-14 month release rate, (3) peat and perlite (1 : 7, v/v) plus Helena 17N-3.1P-8.1K (17-7-10) 13.3 month release rate, and (4) composted sewage sludge and perlite (1 : 7, v/v).

Fertilizers (Osmocote and Helena) were applied to the surface of pots at the rate of 0.5 lb N/yd^3 or 22.58 grams of 17N-3.1P-8.1K (17-7-10) to a 1763 cm^2 (272 in.^{2}) area containing 48 pots. Treatments 1 to 4 were then randomized in the flats with two replications of six pots of each treatment in a flat.

The cuttings were wounded by removing basal leaves, dipped in 10% Wood's Rooting Compound (1013 ppm IBA plus 510 ppm NAA) for 5 sec, and stuck in 2.25-in. square × 3.25-in. deep pots. The flats were then placed on greenhouse benches equipped with mist irrigation. Mist intervals were 3 sec every 5 min from 8 a.m. to 6 p.m. daily. Roots were rated on March 24, 1992 when the maximum number of cuttings were rooted. A five-number scale was used in this observation on the basis of pot surface covered by roots: 0= dead, 1= no visible roots, 2= roots up to 1/4 of pot surface, 3= roots up to 1/2 of pot surface, 4= roots more than 1/2 of pot surface.

After rating roots, cuttings were shifted to 4-in. pots at North Willamette Research and Extension Center (OSU-NWREC), Aurora and were grown on capillary beds. Number of shoots per cutting was counted on April 24, 1992. Length and width of cuttings were measured on July 9-10, 1992.

Experiment 2. (*Forsythia* × *intermedia* 'Spring Glory'). This trial was started on April 2, 1992. Four six-inch cuttings with at least three internodes and similar stem thickness were taken from a single plant at OSU-NWREC, Aurora. The propagation medium was perlite. Three formulations of Osmocote with different release rates, all supplying 0.5 lb N/cu^3 of medium, were surface applied before inserting cuttings. Treatments were: (1) perlite without fertilizer, (2) perlite plus Osmocote 17N-3.1P-8.1K (17-7-10) 12-14 month release, (3) Perlite plus Osmocote 18N-2.6P-9.8K (18-6-12) 8-9 month release, and (4) Perlite plus Osmocote 19N-2.6P-9.8K (19-6-12) 3-4 month release.

Treatments 1 through 4 were randomized in each flat with two replications per flat. The same procedure was used for preparation and sticking of cuttings as in the case of *Ilex* 'September Gem'.

Length of liners was recorded on April 19, 1992. Roots were rated on May 26, 1992 when the maximum number of cuttings were rooted. Number of shoots per plant was recorded on June 27, 1992.

The experiment was carried out as a randomized complete block design with fertilizer formulations and type of medium as the main effects. Data was analyzed

using General Linear Model (GLM) procedure of SAS. The Fisher Protected Least Significant Difference (FPLSD) test was used to compare the differences between data means.

RESULTS AND DISCUSSION

Osmocote 17N-3.1P-8.1K (17-7-10) significantly increased the number of shoots and height of *Ilex* 'September Gem' cuttings as compared to the control (Table 1). No significant difference in roots per cutting, plant height, and plant width was noted between plants which received Osmocote and Helena 17N-3.1P-8.1K (17-7-10). However, plants receiving Osmocote produced more shoots per plant as compared to Helena. Composted Sewage Sludge (CSS) had no beneficial effect when included in the rooting media.

Table 1. Effect of 3 SRFs on growth performance of *Ilex* 'September Gem' cuttings treated with 1013 ppm IBA plus 510 ppm NAA on 10/18/1991 (6 plants per treatment with 12 reps).

Growth parameters	Evaluation date	Osmocote 17N-3.1P-8.1K (12-14 month release)	Helena 17N-3.1P-8.1K (13.3 month release)	Composted Sewage Sludge	Control
Roots/plant	3/24/92	3.6 a[1]	3.6 a	3.0 b	3.5 a
Shoots/plant	4/24/92	4.0 a	3.3 b	1.6 c	1.6 c
Plant height (cm)	7/9/92	19.0 a	19.0 a	16.2 b	17.1 b
Plant width (cm)	7/10/92	5.4 a	5.7 a	4.5 a	4.4 a

[1] Means in same row followed by the same letter are not significantly different at 0.05 level using FPLSD test.

The effects of three Osmocote formulations on growth performance of *Forsythia* cuttings as compared to a control are shown in Table 2. All three Osmocote formulations increased the number of roots and shoots per plant compared to the control. Furthermore, the use of the 12-14 month formulation 17N-3.1P-8.1K significantly increased the number of shoots per plant compared to the other formulations by 4½ months. These results are consistent with those of Gibson et al. (1977), Ward and Whitcomb (1977), Carlson and Preisig (1981), and Whitcomb (1983).

The three Osmocote formulations used in this study had different release rates. In addition, the release in relation to initial application also varies. The 19N-2.6P-9.8K (3-4 mo) has a rapid initial release rate (Sierra Chemical Company Milpitas, California 95035). The 17N-3.1P-8.1K (12-14 mo.), by contrast is slower to initially release than 19N-2.6P-9.8K and 18N-2.6P-9.8K. Much of the nutrients released by these shorter-term fertilizers are leached out and lost since during the first 2 to 3 weeks, and cuttings have limited ability to take up nutrients. It appears that the Osmocote formulation (17N-3.1P-8.1K) with the slowest initial release rate (12-14 mo.) is better suited for top-dressing on the surface of propagation media under mist irrigation systems.

Table 2. Comparison of Osmocote formulations on the growth of *Forsythia intermeida* × 'Spring Glory' treated with 1030 ppm IBA plus 510 ppm NAA on 4/2/92 (7 plants per treatment with 10 reps).

Growth parameters	Evaluation date	Osmocote 17N-3.1P-8.1K (12-14 month release)	Osmocote 18N-2.6P-9.8K (8-9 month release)	Osmocote 19N-2.6P-9.8K (3-4 month release)	Control
Plant height (cm)	4/19/92	13.1 a[1]	9.7 b	11.4 ab	6.9 c
Roots/plant	5/26/92	3.5 a	3.5 a	3.5 a	3.1 b
Shoots/plant	6/27/92	8.2 a	7.1 b	7.0 b	4.0 c

[1] Means in same row followed by the same letter are not significantly different at 0.05 level FPLSD test.

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