Container Crop Response to Slow-Release Fertilizers, Placement, and Mixes©

Calvin Chong
University of Guelph, Department of Plant Agriculture-Vineland, Vineland Station, ON L0R 2E0, Canada

Many types of controlled- or slow-release fertilizers are available to the nursery industry, and new formulations are constantly being updated (Gallant, 1995). Optimum usage varies with factors such as formulation, placement, species, and cultural factors (Lumis, 1997; Lumis and Taurins, 1997).

This study compared the response of red osier dogwood (*Cornus sericea*), ninebark (*Physocarpus opulifulius*), and weigela (*Weigela* 'Bristol Ruby') grown from liners through one season in #2 containers filled with either a pine bark, peat, and soil mix (80 : 15 : 5, by volume) or a peat mix (a commercial peat-based formulation containing also compost, perlite, and vermiculite) incorporated or topdressed with one of three slow-release fertilizers, Osmocote 15N-2.6P-12.5K (15N-11P_2O_5-13K_2O), Osmocote 19N-2P-8.7K (19N-6P_2O_5-12K_2O), and Sierra 17N-2P-8.7K (17N-6P_2O_5-12K_2O) (Table 1). Plants were arranged by species in separate factorial (3 fertilizers × 2 placement methods × 2 mixes) randomized complete block designs. There were four replications of each treatment and four plants per plot. Selected physical and chemical properties of the mixes were determined at planting (Table 2). The pH and electrical conductivity (EC, an indication of the soluble salts concentration) were determined using substrate and water (1 : 2, v/v) extracts at planting and at various intervals during the season. Each plant received 1 liter of trickle-irrigated water per container twice daily.

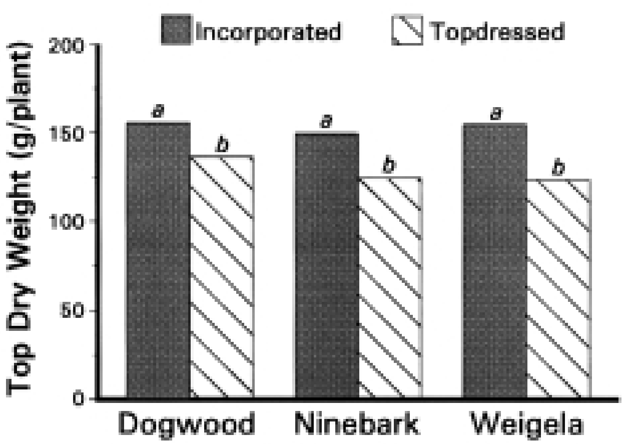

Figure 1. Comparative response of three container nursery crops to incorporated vs. topdressed slow-release fertilizers in bark mix (mean over three fertilizers). Different letters (*a* and *b*) within species indicate significant difference by LSD test at the 5% level of probability.

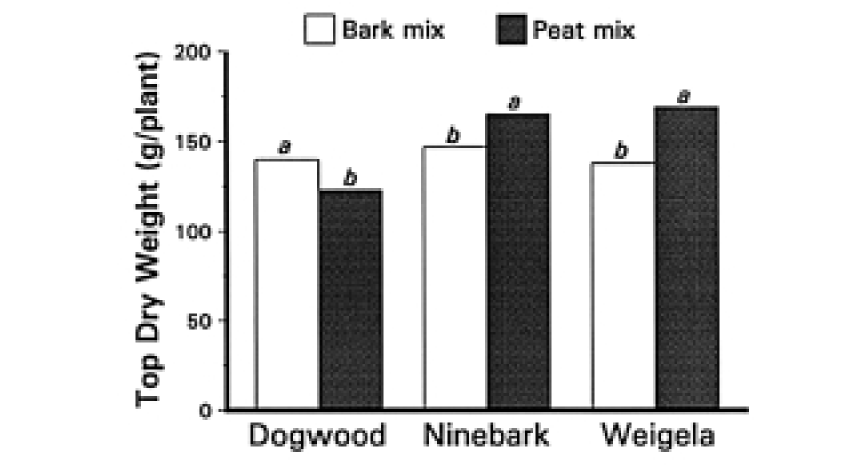

Figure 2. Comparative response of three container nursery crops in bark mix vs. peat mix (mean over three fertilizers and two placement methods). Different letters (*a* and *b*) within species indicate significant difference by LSD test at the 5% level of probability.

Table 1. Slow-release fertilizers and application rates.

	Osmocote $15N\text{-}11P_2O_5\text{-}13K_2O$	Osmocote $19N\text{-}6P_2O_5\text{-}12K_2O$	Sierra $17N\text{-}6P_2O_5\text{-}12K_2O$
Release time (months)	3 - 4	3 - 4	3 - 4
Incorporated			
$kg \cdot m^{-3}$	4.2	3.1	3.5
1b per yd^3	12	9	10
actual N, g per pot	5.9	5.5	5.5
Topdressed			
g per plot	39	29	32
oz per pot	1.4	1.0	1.0
actual N, g per pot	5.9	5.5	5.5
Micronutrients	Yes; present inside the prills	None; applied separately by incorporation into media[z]	Yes; present outside the prills

[z] 0.5 $kg \cdot m^{-3}$ (1.5 lb per yd) of Micromax.

The bark mix was low in salts (0.2 dS·m^{-1}; 1.0 dS·m^{-1} considered desirable) due to low or acceptable concentrations of all macro- and micronutrients (Table 2). The peat mix had more salts (0.7 dS m^{-1}) due to higher but acceptable concentrations of NO_3-N, K, Ca, and Mg and excessive concentrations of P, Na, and Cl. Both mixes were light with desirable and somewhat comparable pore space characteristics (Table 2).

Most, if not all plants, were of marketable size by end of season. The three fertilizer formulations per se had no effect on harvested top dry weight (g per plant) of each of the three test species: dogwood, 140; ninebark, 160; and weigela, 180 (fertilizer main effect, mean over two placement methods and two mixes; no treatment interactions). With bark mix, each of the three species grew better with incorporated than with topdressed fertilizers (mean over three fertilizer formulations; Fig. 1). With peat mix, however, there was no difference in growth due to fertilizer placement (data not shown). Both ninebark and weigela grew better with peat mix

Table 2. Chemical and physical analysis of the two growing media[z] at the start of the experiment.

Variable	Recommended values	Bark mix	Peat mix
	Chemical Properties		
pH	5.5-7.0	5.3	4.5
Soluble salts (dS·m^{-1})	<1.0	0.2	0.7
NO_3^--N (ppm)	100-200	14	191
P (ppm)	6-9	5	30
K (ppm)	150-200	47	110
Ca (ppm)	200-300	27	104
Mg (ppm)	70-200	12	63
Na (ppm)	0-50	32	192
Cl (ppm)	0-50	57	104
Fe (ppm)	0.3-3.0	2.7	0.1
Mn (ppm)	0.3-3.0	0.7	0.1
Zn (ppm)	0.3-3.0	0.1	<0.1
Cu (ppm)	<0.6	<0.1	0
	Physical Properties		
Bulk density (g·cm^{-3})	--	0.28	0.14
Total pore space (%)	>50	74	79
Air pore space (%)	15-30	21	17
Water pore space (%)	35-50	53	62

[z] Triplicate samples.

while dogwood grew better with bark mix (mean over three fertilizers and two placement methods; Fig. 2).

There was a tendency for salts to be highest in mixes with the incorporated Osmocote 15N-11P_2O_5-13K_2O, especially in early season (data not shown), likely due to the slightly higher (+5%) applied rate of N compared with the other formulations (all manufacturer-recommended rates; Table 1). Also, pH values in the mixes were low or lowest with Osmocote 15N-11P_2O_5-13K_2O (incorporated or topdressed). Analysis of mid-August leaf samples indicated adequate quantities of N and other foliar nutrients, but a buildup of Fe in dogwood and ninebark (not weigela) supplied with this fertilizer, particularly with peat mix due to its very low pH (4.5; Table 2). Notwithstanding these differences, there was no sign of nutrient deficiency or toxicity in any of the three species.

Acknowledgements: This research was supported in part by The Scotts Company and Specialities Robert Legault Inc.

LITERATURE CITED

Gallant, A. 1995. Advances in control release technology. Landscape Trades 17(3):14, 16.

Lumis, G.P. 1997. Controlled release fertilizers for container-grown nursery stock. Landscape Trades 19(4):46-47.

Lumis, G. and **L. Taurins.** 1997. A comparison of topdressed Nutrilease, ProGrow and Woodace fertilizers for container-grown stock. Hort. Rev. (Ontario) 15(10):8-9.