Use of Paper-Mill Sludges and Municipal Compost in Nursery Substrates©

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Municipal compost (Hicklenton et al., 2000) and both raw and composted paper-mill sludges (Campbell et al., 1991; Chong and Cline, 1994) are increasingly being promoted for use in nursery substrates. This study compared raw paper-mill sludge with various composts derived from paper-mill sludges (two sources) and municipal waste (one source), and determined optimum rates of these materials in binary mixtures with bark or hemp chips. The chemical composition of these materials is shown in Table 1.

Silverleaf dogwood *(Corpus alba* Elegantissima syn. Argenteo-marginata), forsythia *(Forsythia* x *in termedr.a* 'Lynwood Variety'), and weigela *(Weigela* 'Red Prince') were grown in #2 (6-L) containers filled with 100% bark or bark mixed with 20%, 40%, or 60% by volume each of raw paper-mill sludge (RB group); Bio Soil

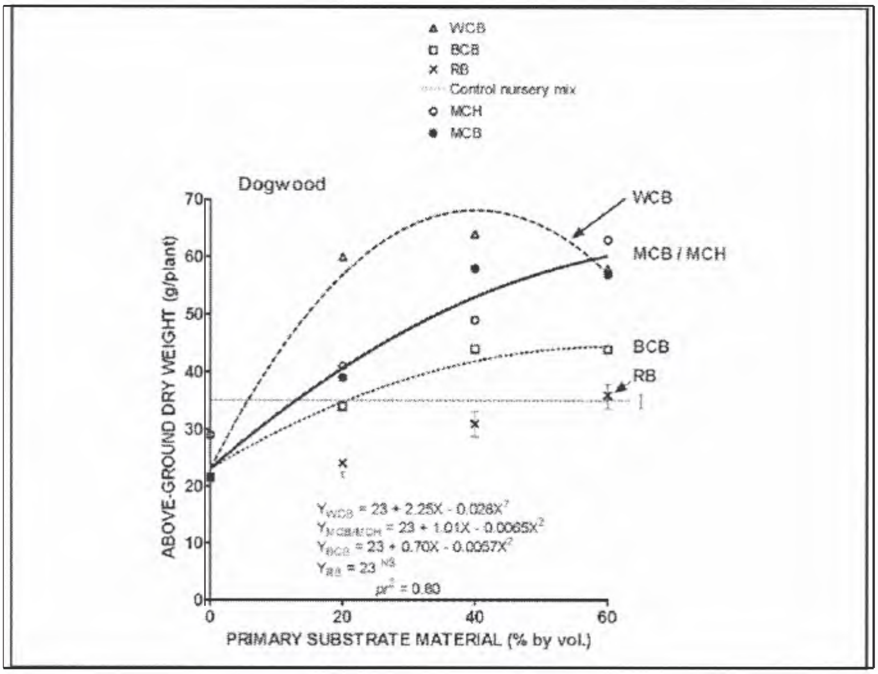

Figure 1. Aboveground dry weight response of container-grown dogwood to increasing rates of five substrate groups. For significant responses, the regression of each group is represented by a broken curved line or of combined groups by a solid curved line. For non-significant response (RB group), the average ± standard error is shown at each rate. The horizontal broken line represents the average aboveground dry weight ± standard error of the control nursery mix. *pr* ' represents the coefficient of determination after removing replication effects. WCB = Waterdown (paper-mill sludge) compost amended with bark; BCB = Bio Soil (paper-mill sludge) compost amended with bark; RB = raw paper-mill sludge amended with bark; MCH = municipal (leaf and yard waste) compost amended with hemp chips; MCB = municipal (leaf and yard waste) compost amended with bark.

Table 2. Correlation between aboveground dry weight (g/plant) of three container-grown nursery species and EC ($dS \cdot m^{-1}$) measured at various intervals during the growing season in waste-derived substrates.

	Correlation coefficient, *r*				
Species	24 May	19 July	18 Aug.	10 Oct.	Average across dates
Dogwood	0.79**	0.49**	0.56**	0.20	0.66**
Forsythia	0.66**	0.59**	0.62**	0.39	0.69**
Weigela	0.76**	0.66**	0.21	0.43	0.72**

**Significant at $P = < 0.01$, n = 21.

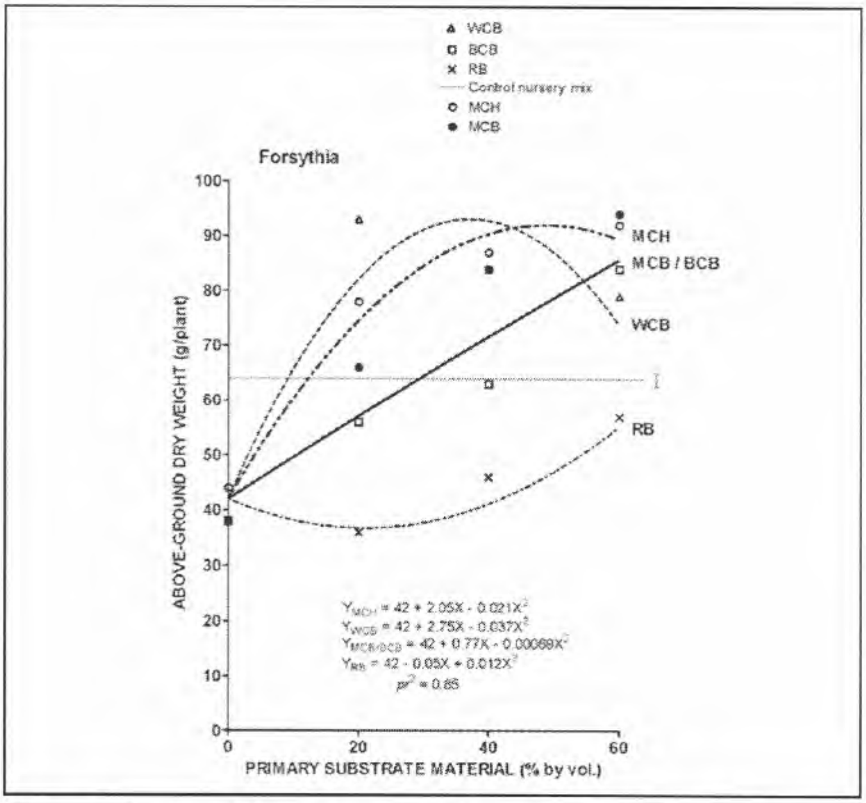

Figure 2. Aboveground dry weight response of container-grown forsythia to increasing rates of five substrate groups. (See Fig. 1 for legend.)

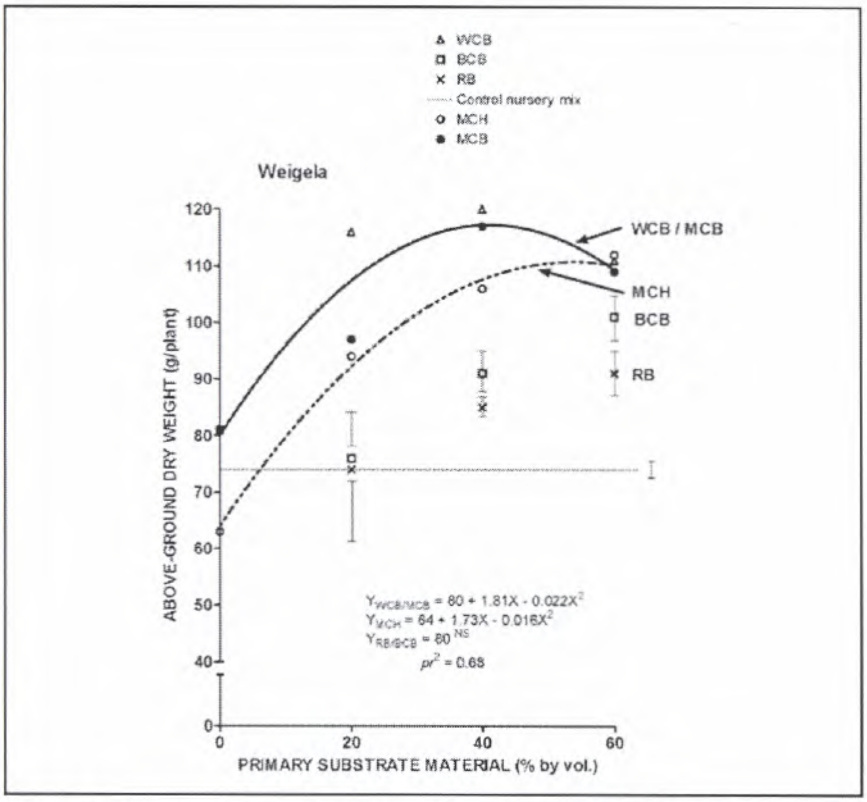

Figure 3. Aboveground dry weight response of container-grown weigela to increasing rates of five substrate groups. (See Fig. 1 for legend.)

compost containing 100% paper-mill sludge (BCB group); Waterdown compost containing 40% paper sludge, 40% chicken manure, and 20% sawdust (WCB group); and municipal compost consisting of leaf and yard waste (MCB group). A fifth substrate group (MCH) consisted of 100% hemp chips or hemp chips mixed with the same rates of municipal compost.

The containers were fertilized with pre-incorporated Nutryon 17-5-12 (17.0N-2.2P-10.0K) controlled-release fertilizer (6.5 kg m^{-3}). Each container received 2 L of hand-applied water immediately after potting and 1-L trickle applied twice daily thereafter. Plants of each species were arranged in a randomized complete block design with four replications and four plants per plot.

Regression analysis indicated that growth among the bark-amended groups was highest for dogwood (Fig. 1) and forsythia (Fig. 2) with WCB, increasing dramatically and peaking at about the 40% rate (68 and 94 g per plant aboveground dry weight, respectively). Growth of these species was intermediate with MCB and BCB and least with RB, increasing to rates >50% in these groups. There was no significant response of dogwood to RB. Growth of weigela (Fig. 3) increased equally with WCB and MCB substrates up to about 40% (117 g per plant), but was not influenced by varying rates of RB and BCB. With the hemp-amended MCH group, growth of all three species increased to rates $\geq$50% (62, 93, and 116 g per plant for dogwood, forsythia, and weigela, respectively). Growth of the three species over most. rates of all substrate groups was similar to, or exceeded that in 8 bark : 1.5 peat : 0.5 topsoil, a proven nursery mix.

Throughout the season, there was no sign of nutrient toxicity or deficiency on any of the plants. Furthermore, chemical analysis (data not shown) indicated that the range in concentrations of individual foliar nutrients within each species was in most cases small or statistically nonsignificant and within sufficiency ranges. Aboveground dry weight of all three species was positively correlated with soluble salts concentrations in the substrates sampled at planting and on other sampling dates during the season (Table 2), suggesting that enhanced growth of plants was related, at least in part, to higher retention or availability of substrate nutrients.

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