Using Turkey Litter Compost in Growing Media©

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INTRODUCTION

Turkey litter compost (TLC) has been evaluated as a soil amendment and disease suppressant in ginseng production in Ontario (Reeleder and Capell, 2001). It is also sold granulated as fertilizer.

As part of our on-going research to examine industrial and farm organic wastes and composts as soil and potting amendments (Chong, 1999), we have been investigating TLC. Tyler et al. (1993) grew nursery crops in unfertilized substrate containing TLC. Ku et al. (1998) grew potted poinsettia in poultry litter compost-amended substrate fertilized at different times. Similar in chemical and physical analysis to spent mushroom compost (SMC), TLC contains excessive nutrients and high EC (an indication of soluble salts concentrations) (Table 1), which are potentially damaging to crops and, thus, a major deterrent to its use in potting mixes.

RATES OF TURKEY LITTER COMPOST

Results of our first study (Chong, 2000), herein summarized, determined the optimum level of TLC and the best time to apply fertilizer in container culture.

In mid-May, silverleaf dogwood (*Cornus alba* 'Argenteo-marginata'), common ninebark (*Physocarpus opulifolius*), and slender deutzia (*Deutzia gracilis*) liners were potted in 6-liter (#2) nursery containers filled with pine bark (2-cm mesh size) amended with 0, 25, 50, 75, or 100% (by vol) of TLC. Nutricote 16-10-10 (16.0N-4.4P -8.3K) T140 controlled-release fertilizer with micronutrients was topdressed (34 g/ pot) at planting (T_0), or two (T_2) or four (T_4) weeks later. Dogwood and ninebark were spaced 60 cm × 60 cm and deutzia 60 cm × 45 cm in separate but similar factorial designs (5 rates of TLC × 3 dates of fertilizer application) with four replications and four plants per plot. Each plant received 1 liter of trickle-irrigated water per container twice daily during the season. The pH and EC from substrate and water (1 : 2 v/v) extracts were determined at planting and at various intervals during the season. In mid-August, samples of leaves were taken for analysis of N, P, K, Ca, Mg, Fe, Mn, and Zn. In mid-September, plant height and top dry weight were determined.

All three species responded positively to the amended substrates and grew best with the T_2 topdress (Fig. 1). The optimum (calculated) rate of TLC and top dry weight by species (g/plant in brackets) with this fertilizer treatment were: dogwood, 63% (88); ninebark, 76% (97); and deutzia, 82% (32). By harvest, most plants of ninebark and dogwood grown with 50% or more of TLC, and the largest of the deutzia plants (slower growing), were of marketable size. Throughout the experiment, there were no signs (visual observation or results of foliar analyses) of any nutrient toxicity or deficiency.

Ku et al. (1998) produced good quality potted poinsettia plants with poultry litter and other composts at levels up to 50% blended with peat and perlite. Growth and quality were only 3% greater when fertilizer (liquid) application was delayed 1 or 2 weeks. Differences in response of *Hemerocallis* 'Red Magic' (daylily) and *Cotoneaster*

×*suecicus* 'Skogholm' in unfertilized pine bark substrate amended with up to 16% TLC were attributed to increased water holding capacity and/or to tolerance (cotoneaster) or sensitivity (daylily) to higher nutrient (salt) levels in the amended substrates (Tyler et al., 1993). Cotoneaster developed more leaves and roots with 8% TLC than a milled pine bark commercial mix topdressed with Osmocote 17-7-12 (17N-3P-10K; 18 g per 3.8-liter pot).

Table 1. Chemical and physical analysis[z] of spent mushroom compost (SMC) and turkey litter compost (TLC).

Variable	Recommended values	SMC	TLC
	Chemical properties		
pH[y]	5.5-7.0	8.2	8.7
EC($dS \cdot m^{-1}$)[y]	1	3.7	4.1
NH_4-N[x]	<10	15	103
$N0_3$-N	100-200	89	232
P	6-9	6	27
K	150-200	2066	2792
Ca	200-300	871	100
Mg	70-200	220	153
Na	0-50	511	501
Cl	0-50	1328	1656
SO_4	<300	894	316
Fe	0.3-3.0	1.9	11.4
Mn	0.3-3.0	0.9	2
Zn	0.3-3.0	0.4	6.3
	Physical properties		
Bulk density ($g \cdot cm^{-3}$)	0.2-0.75	0.39	0.31
Total porosity (%)	>50	71	73
Aeration porosity (%)	15-30	40	45
Water retention porosity (%)	25-35	31	28

[z]Average of 3 samples.
[y]pH and EC (electrical conductivity) measured in substrate and water extracts (1 : 2, by volume).
[x]Concentration of all nutrients expressed in terms of ppm using the saturated medium extraction (greenhouse) procedure.

In the present study, elevated and potentially toxic salt levels (range, 2.1 to 5.9 dS·m^{-1} with 0 to 100% TLC) declined dramatically after the first irrigation (≤1.9 dS·m^{-1}) and to nontoxic levels within days (≤0.9 dS·m^{-1}; ≤1.0 dS·m^{-1} considered desirable). During the rest of the season, salt levels were generally highest with the T_2 topdress treatments (≤1.1 dS·m^{-1}).

As in past experiments (Chong, 1999; Chong and Rinker, 1994), high pH of the substrates, initially up to 8.9 at planting in the unamended (100%) TLC, did not discernibly affect plant response. The pH in this substrate decreased during the season to values between 6.8 and 6.9 at harvest. In contrast, the pH in 100% bark (0% TLC) increased from 4.4 at planting to values between 6.3 and 6.6, due in part to the moderately high bicarbonate content (120 ppm) of the irrigation water (pH 7.3). The pH differed little or not at all due to time of fertilizer topdress.

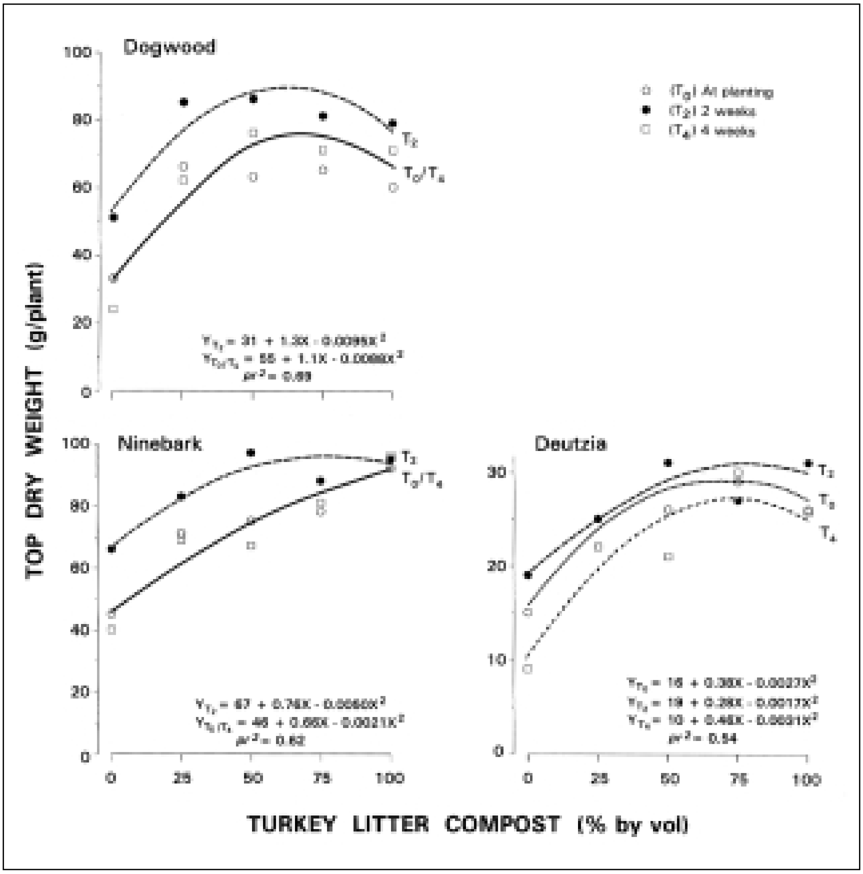

Figure 1. Response of three container-grown nursery species to rate of turkey litter compost (TLC) (0-100% by vol.) and to slow-release fertilizer topdressed at planting (T_0), or two (T_2) or four (T_4) weeks later. When regressions for times of fertilizer application were not significantly different (P≤0.05), a common regression line was fitted (i.e., $Y_{T0/T4}$). pr^2 represents the coefficient of determination after removing replication effects.

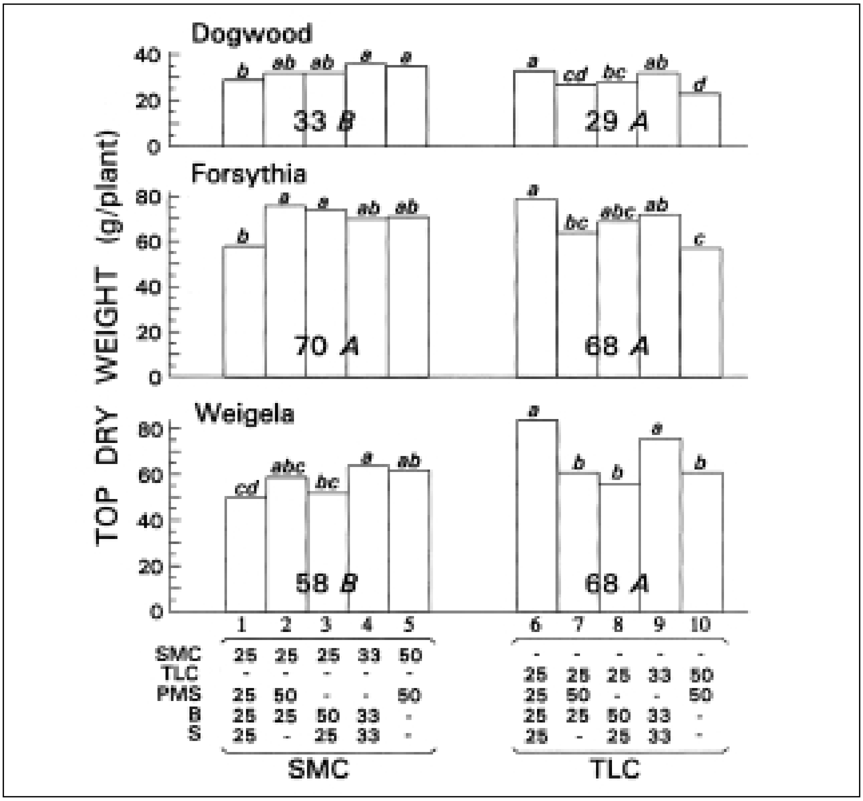

Figure 2. Response of three container-grown nursery species to various amounts of spent mushroom compost (SMC) or of turkey litter compost (TLC) mixed with paper mill sludge (PMS), bark (B), and/or sand (S). Each species showed a significant compost × substrate interaction. Comparisons between the two composts within species (large numbers inside the histograms) are separated (*A*-*B*) by LSD at $P \leq 0.05$. Comparisons between individual substrates within species and compost (histograms) are separated (*a*-*c*) by LSD at $P \leq 0.05$.

COMPARISON WITH SPENT MUSHROOM COMPOST

In a related study (unpublished data) conducted under similar cultural conditions, dogwood (*C. alba* 'Sibirica'), forsythia (*Forsythia* ×*intermedia* 'Lynwood') and weigela [*Weigela* 'Nana Variegata' (syn. *W. florida* 'Variegata Nana')] were grown in substrates containing paper mill sludge (PMS), bark (B), and/or sand (S) mixed with 25%, 33% or 50% spent mushroom compost(SMC) (substrates 1 to 5; Fig. 2) or turkey litter compost (TLC) (substrates 6 to 10; Fig. 2). Nutricote T140 was incorporated into each substrate (7.1 $kg \cdot m^{-3}$). Plants were spaced 60 × 60 cm by species in separate randomized complete block designs with four replications and four plants per plot. Each plant received 2 liters of water (hand-applied) immediately after potting and 1 liter (trickle applied) twice each day thereafter.

There was no clear indication that SMC or TLC was consistently better than the other as an amendment for growth of all three species. Comparisons between compost sources (data averaged over individual substrates, large numbers inside the histograms; Fig. 2) indicated more growth of dogwood with SMC (33g per plant) than TLC (29 g per plant) substrates, reversed results for weigela (SMC, 58 g per plant vs TLC, 68 g per plant) and, for forsythia, similar results with SMC or TLC. Comparisons between individual substrates within each compost source (histograms; Fig. 2) indicated that, with TLC, best growth of each species tended to occur with TLC, PMS, B, and S (1 : 1 : 1 : 1, by volume) (substrate 6) and/or TLC, B, and S (1 : 1 : 1, by volume) (substrate 9). With SMC, growth tended to be least with TLC, PMS, B, and S (1 : 1 : 1 : 1, by volume) (substrate 1) and more similar among the others (substrates 2 to 5).

CONCLUSION AND SUMMARY

These studies extend results of previous ones dealing with the utilization of high-salts, waste-derived composts in nursery container substrates and reconfirm the primary reason for success — rapid initial leaching of potentially toxic salt levels from the containers (Chong, 1999; Chong and Rinker, 1994).

The first study encompassed all possible rates of use (from 0% to 100% by vol) and showed that the three woody nursery species grew optimally with relatively high rates of TLC (>60%) mixed with pine bark. Growth was further enhanced when slow-release fertilizer topdress was delayed 2 weeks after planting versus at planting or 4 weeks later. The second study showed that when mixed with paper mill sludge, bark, and/or sand, there was no clear indication that TLC was consistently better than SMC as a potting amendment for all three species.

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LITERATURE CITED

Chong, C. 1999. Experiences with the utilization of wastes in nursery potting mixes and as field soil amendments. Can. J. Plant Sci. 79:139-148.

Chong, C. 2000. Response of containerized nursery crops to level of turkey litter compost and time of fertilizer application. pp.917-933. In: P.R. Warman and B.R. Taylor (eds.), Proc. Intl. Comp. Symp. (ICS'99), Vol.II. CBA Press, Truro, N.S.

Chong, C. and **D.L. Rinker.** 1994. Use of spent mushroom substrate for growing containerized woody ornamentals: An overview. Compost Sci. Util. 2:45-53.

Ku, C.S.M., J.C. Bouwkamp and **F.R. Gouin.** 1998. Effects of compost source and timing of fertigation initiation on growth of potted poinsettia. Compost Sci. Util. 6:57-66.

Ontario Ministry of the Environment. 1991. Interim guidelines for the end use of aerobic compost in Ontario. Publication 383. No.PIBS 1749. Queen's Printer for Ontario, Toronto, Ont.27 pp.

Reeleder, R. and **B. Capell.** 2001. Efficacy of composted turkey manure and quintozene for control of damping-off in ginseng, 1996-1998. In: Biological and Cultural Tests for Control of Plant Disease. Vol 89.

Tyler, H.H., S.T. Warren, T.E. Bilderback, and **K.B. Perry.** 1993. Composted turkey litter. II. Effect on plant growth. J. Environ. Hort. 11:137-141.