UTILIZATION OF WOOD WASTE COMPOST IN CONTAINER PRODUCTION

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Abstract. A high rate composting process was used successfully to produce a compost from paper mill wood waste and poultry manure that was very acceptable for a container mix amendment. The composting process was complete within 7 days. Three species of nursery stock were grown in several wood waste compost amended mixes fertilized with a water soluble and an incorporated slow-release fertilizer. The quantity and quality of growth was good in the compost media with the exception of euonymus in one mix-fertilizer combination.

REVIEW OF LITERATURE

In the past 10 to 15 yr a considerable amount of information has been compiled on the use of wood by-products such as sawdust, chips and bark as soil conditioners. The advantages and disadvantages of the use of wood wastes have been discussed in several reports (1, 5, 9). Much of the recent work has focused on wood by-products as potting mix ingredients for container growing (6, 7, 8).

Wood residues in their natural state seldom possess desirable physical or chemical properties for amending soil. Most wood products are high in carbon and if used for plant growth soon after harvesting, will cause N deficiency. One way to overcome this problem is by composting. High rate composting of agricultural (animal) waste, municipal garbage and wood bark has been studied for several years at the University of Guelph (2, 3, 4). Materials have been used successfully to supply organic matter in reclaiming worked-out gravel pits and to encourage the growth of vegetation on mine tailing.

The purpose of this study was to determine the usefulness of a composted wood waste as a mix ingredient for container-grown stock.

MATERIALS AND METHODS

Clarifier sludge or clarifier screenings from a large pulp-paper mill were the wood waste source. The high rate compost unit consisted of a hammermill, horizontal batch mixer, horizontal concrete silo with an air distribution system in the floor and an inclined mixing conveyor mounted on a gantry atop the silo walls (3). The procedure is based on continuous operation, mechanical mixing and forced aeration. For rapid stabilization, the material undergoing high rate decomposition should have a moisture content near 50%, a carbon to nitrogen ratio of approximately 30:1

and a course structure to allow adequate air circulation. Since the clarifier screenings had a moisture content near 70% and no drying method was available, corn cobs (a grain industry waste product) were added to reduce moisture content. Ground corn cobs, clarifier screenings and poultry litter manure were blended in a ratio of 1:3:1 by volume. The material was stockpiled in a storage shed for 1 to 2 weeks prior to use.

Juniperus sabina 'Blue Danube', *Thuja occidentalis* 'Pyramidalis' and *Euonymus fortunei* 'Emerald Gaiety' were grown for 1 season in 3 mixes utilizing 2 fertilizer regimes. The 3 mixes were: 1) compost-sand (1:1 v/v), 2) compost-perlite (1:1 v/v) and 3) compost-soil-perlite (2:3:1 v/v). The 2 fertilizer treatments were: 1) MagAmp (15 lbs/cu yd) and 2) 20-20-20 (2 lbs/100 gal/wk). Watering frequency averaged 2.5 times per week. A split plot design with 3 replicates was utilized with fertility the main split. Rooted cuttings were potted into 2 gal pots in late May. In December of the same year data were collected.

A simultaneous experiment with *Juniperus sabina* 'Blue Danube' included compost-sand (1:1 v/v) and peat-sand (1:1 v/v) mixes fertilized with 20-20-20 at either 2 or 3 lbs/100 gal/wk. Watering frequency averaged 2.5 times per week. Samples for foliar analysis from both experiments were taken in August.

RESULTS AND DISCUSSION

Initially, we had difficulty in obtaining biological activity in the composted materials. After several trial mixtures we obtained a working compost by blending. Once the process was underway composting was complete in 7 days, provided a small amount of finished compost was used as an inoculum for each batch. The initial problems appeared to be the high moisture content and low carbon content of the clarifier screenings, which were corrected by the addition of corn cobs (Table 1), as well as the season of the year (winter).

Table 1. Analysis of the raw products for high rate composting.

Analysis[1]	Poultry Manure	Wood Pulp Waste	Corn Cobs
Bulk density (lbs/cu ft)	24.8	26.3	6.0
Moisture content, %	65.6	74.0	39.5
Fixed solids, %	24.5	6.8	1.6
Carbon, %	42.0	5.2	54.7
C:N, ratio	9:1	19:1	122:1
NH_4 - N, ppm	6,300	136	318
Organic - N, ppm	9,730	595	2,395

[1] Based on original moist sample where applicable.

Table 1. (cont.)

Analysis[1]	Poultry Manure	Wood Pulp Waste	Corn Cobs
Total - N, % (dry wt.)	4.7	0.3	0.5
Total - N % (wet wt.)	2.1	.03	
Phosphorus, %	1.24	0.013	
Potassium, %	0.92	0.025	
Calcium, %	1.97	3.95	
Magnesium, %	0.47	0.051	
Manganese, ppm	21	13	
Copper, ppm	25	0	
Zinc, ppm	242	9	
Boron, ppm	16	1	
pH	6.0	7.6	

After composting and a short stabilization period (1 to 2 wk) the compost was ready for use as a growing additive (Table 2). It was free of obnoxious odors and exhibited an excellent compost appearance. Soluble salts were initially high but appeared to have no adverse effect and within 3 weeks were considerably lower due to continued watering.

Table 2. Analysis of the finished compost.

Analysis	Compost[1]
Nitrogen, %	0.58
Phosphorus, %	0.29
Potassium, %	0.30
Calcium, %	1.25
Magnesium, %	0.14
Manganese, ppm	166
Copper, ppm	27.5
Zinc, ppm	132.5
Boron, ppm	9.5
Dry Matter, %	29.5
pH	7.3

[1] Average of 2 samples

From observations during the growing season the juniper and thuja grew well with no indication of cultural problems and few treatment differences. The compost-sand mix produced plants with a deeper and richer color regardless of whether MagAmp or 20-20-20 was used. This mix provided better drainage than the peat-sand. The only significant difference between the two conifers was that the top growth of thuja was greater in the soil-amended mix when fertilized with 20-20-20 (Table 3).

Table 3. Dry weight of tops and roots of plants grown in mixes containing compost (C), sand (Sd), perlite (P) and soil (So) with two fertilizer sources.

		Dry weight in grams			
		Tops		Roots	
Crop	Mix	MagAmp	20-20-20	MagAmp	20-20-20
Juniper	C-Sd	11.3	10.9	8.6	8.4
	C-P	10.8	10.2	8.0	5.9
	C-So-P	10.4	11.9	6.2	6.2
Thuja	C-Sd	8.5	11.1	10.3	7.8
	C-P	9.8	11.6	7.9	6.7
	C-So-P	10.6	15.0*	12.3	10.0
Euonymus	C-Sd	2.7*	7.5	3.6*	7.9
	C-P	8.4	7.5	11.0	8.1
	C-So-P	6.3	10.3	7.4	11.7

* Significant at 5% level within genus.

The top and root growth of euonymus was significantly smaller in the compost-sand mix fertilized with MagAmp (Table 3). All plants from this treatment were small, with little new growth and that which occurred was distinctly yellow. Nitrogen and manganese were at low levels in the foliage. The pH of the compost-sand mix was above 7.0 for much of the growing season and was apparently the reason for the manganese deficiency.

In the compost-sand, peat-sand comparison using 2 rates of water soluble fertilizer, observations during the growing season revealed no difference with respect to either mix or fertilizer rate. Measurement at the end of the season (November) confirmed the observations, revealing no significant difference in top growth. However, root growth of Juniper was significantly better in the compost-sand mix. The better aeration and drainage of the com-

Table 4. Foliar nutrient levels of Juniper grown in 2 mixes with 2 fertilizer rates.

Mix and Fertilizer	Elemental analysis N %	P %	K %	Ca %	Mg %	Mn ppm	Cu ppm	Zn ppm	B ppm	Fe ppm
compost-sand										
2[1]	2.5	.28	1.5	.87	.30	80	3	21	53	52
3	2.4	.27	1.5	.84	.30	92	3	22	54	69
peat-sand										
2	2.1	.29	1.9	1.5	.33	136	3	36	40	61
3	2.1	.31	1.8	1.5	.28	201	3	25	40	63

[1] lbs. 20-20-20/100 gal/wk

post mix may have resulted in better root growth. I suspect that had the plants been grown for another year there would have been a difference in top growth also.

Foliar analysis showed that plants grown in the compost-sand mix had lower levels of K, Ca and Mg, and higher N than did those in the peat-sand mix (Table 4). However, these were not great enough to alter growth or quality, and were all within acceptable levels.

Composted wood waste can be used successfully as the organic component of a container growing mix. All crops do not react similarly as in the case of euonymus where additional nutrients were needed. The shoot growth of juniper and thuja in compost mixes was as good as but not superior to growth in the peat mix, considering both quantity and quality. In contrast, root-growth of juniper was greater in the compost mix than in the peat mix. There were no differences among the compost amended mixes. Although not included in this study, supplementation would seem to easily overcome the nutrient problems which arose. The compost as produced for this work is no less expensive than peat. However, environmental concern is stimulating a closer look at waste materials which are of potential use to nursery growers.

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MODERATOR ROLLER: Thank you, Glen. Our next speaker is Dr. Roger Uhlinger who will tell us about some of the new garden carnations.

DEVELOPING GARDEN CARNATIONS

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The carnation breeding program at the University of Nebraska, North Platte Station, is entering its 5th year. Our long term goal is to develop garden carnations with the following characteristics:

1. Sufficient hardiness to survive and perform well in the environment of the Great Plains.
2. Florist quality blooms.
3. "Open" inflorescence that will not require disbudding.
4. Erect stems that will not require support.
5. Sufficient field resistance to soil-borne pathogens to remain attractive throughout the growing season.
6. Everblooming habit of flowering.
7. Frost tolerant buds.
8. Evergreen foliage.

This ideal will not be reached quickly. However, these characteristics are all present in the breeding complex we are using and I believe we can eventually get them all together.

The material that forms the basis for our breeding and development program originated from three sources. The first is advanced generation offspring from crosses between the Grass Pink (*Dianthus plumarius*) and Chabaud carnations which were made by Glenn Viehmeyer 10 or 15 years ago. This material is perfectly hardy under our environmental conditions. The flowers are small, single or semidouble, moderately fragrant, and quite fertile. The plants tend to be of open habit and have fine-textured foliage. Flowering stems are slender with buds well spaced in the inflorescence. Stem attachment at the crown is weak so the plants either develop in a decumbent mode or they are easily broken down by wind and rain.

The second source of germplasm is material from the U.S.D.A. Carnation Breeding program at the Cheyenne Horticultural Field