Cotton Gin Compost as a Substrate Component in Container Production of Ornamental Plants

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Significance to Industry: Growth of 'Winter Gem' boxwood and 'Atropurpurea Nana' nandina were higher in substrates containing higher ratios of CGC that when grown in PB:S only, while no differences in growth were observed for azalea. Additionally, root growth in substrates amended with CGC was similar to that occurring in PB:S suggesting that composted cotton gin by-products can provide a viable alternative substrate for production of containerized ornamental crops.

Nature of Work: Availability and cost of materials used as substrate blends for horticultural crop production are of frequent concern. Pine bark (PB) is one of the most widely used substrate components, yet the supply and cost of PB may be inconsistent or unpredictable (5). Alternative substrates for container production of ornamental plants are therefore important. Use of composted agricultural wastes as a replacement for PB is not a new concept, however, factors such as transportation costs, consistency and reproducibility of product, disease and insect infestation, and availability of composted materials represent concerns for growers (2).

Cotton is a major agronomic crop grown in the southeast United States. As a result of the cotton ginning process a large amount of by-product waste is generated. Cotton gin waste (CGW) is a term used to describe the byproducts of the cotton ginning process that includes leaves, stems, burrs, and some fiber (3). Composted cotton gin waste (CGC) has been shown to be a useful substrate component for production of bedding plants, poinsettias, and floral crops (4, 6). Further evaluation of the potential of this material for use as a substrate component for container production of woody ornamental plants is needed. The objective of this study was to evaluate the effect of substrates containing CGC on the growth of shoots and roots of three commonly produced woody ornamental cultivars.

Treatments were four substrate blends that included by volume 6:1 PB:Sand (S), 4.5:1.5:1 PB:CGC:S, 1:1:1 PB:CGC:S, and 1.5:4.5:1 PB:CGC:S. The percent CGC in each substrate was 0, 21, 33, and 64% respectively. The nursery standard 6:1 P:S substrate blend was used as the control substrate for comparison to CGC amended treatments. Substrates were amended with 8.2 kg•m^{-3} (13.9 lbs•yd^{-3}) Osmocote 18-2.6-9.8, (Scotts-Sierra Company, Marysville, OH), 0.9 kg•m^{-3} (1.5 lbs•yd^{-3}) Micromax™(Scotts-Sierra), and 3.0 kg•m^{-3} (5 lbs•yd^{-3}) dolomitic limestone. Initial pH's of amended substrates 6:0:1 PB:CGC:S, 4.5:1.5:1 PB:CGC:S, 1:1:1 PB:CGC:S, and 1.5:4.5:1 PB:CGC:S were 5.4, 5.5, 5.7, and 5.6 respectively. 'Winter Gem' boxwood (*Buxus microphylla* Sieb. & Zucc. 'Winter

Gem'); 'Atropurpurea Nana' heavenly bamboo (*Nandina domestica* Thunb. 'Atropurpurea Nana'); and 'Renee Mitchell' azalea (*Rhododendron indicum* L. & Sweet 'Renee Mitchell') were transplanted from 3.8 liter (1 gal) containers into 13.5 liter (3 gal) containers. Loose substrate particles were shaken off the roots, and roots were loosened before transplanting into the four substrate blends. At transplanting shoots of all plants were uniformly pruned to 20 cm (8 in.) above the substrate surface of each container. Plants were placed on an outdoor container pad in August 2003 under overhead irrigation at the Paterson Greenhouse Complex, Auburn University, in Auburn, AL. Plants were arranged in a randomized complete block design (RCBD) with four blocks and three single container replications per cultivar per treatment per block.

Initial growth indices (GI's) of each plant were determined at transplanting using the following formula: [(height + widest width + perpendicular width)/3]. A second GI was determined 74 days after the initial (DAI) evaluation and then every 40 days thereafter until the conclusion of the study in April 2004. At the end of the study, root development was evaluated visually using a rating scale of 0-5 (Table 1). All data were subjected to analysis of variance procedures and means were separated using protected least significant difference (LSD) at $P = 0.05$.

Results and Discussion: At experiment termination, GI of 'Winter Gem' boxwood and 'Atropurpurea Nana' nandina was higher when grown in substrates containing CGC than when grown without. These effects of container substrate on GI of 'Winter Gem' boxwood and 'Atropurpurea Nana' nandina were observed at the third and first measurements respectively (data not shown). Container substrate had no effect on GI for 'Renee Mitchell' azalea (Table 2). For all cultivars, substrate had no effect on visual root growth ratings (Table 2). Initial pH was higher in all substrates containing CGC as compared to the PB:S control. The higher GI data that were reported for 'Winter Gem' boxwood and 'Atropurpurea' nandina could be attributed to these plants preferring the higher pH levels present in the CGC amended substrates. Results herein are consistent with previous work reported by Cole (1) showing improved plant growth of 'Winter Gem' boxwood and 'Atropurpurea Nana' nandina in CGC amended substrates.

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Table 1. Visual rating scale for root development.

Rating	Overall quality
0	no root growth
1	root ball falls apart when removed from the container
2	root ball loosely stays intact when removed from the container
3	root ball firmly stays intact but does not fill the container
4	roots reach the edge of the container but are not root bound
5	root bound

Table 2. Effect of container substrate on GI and root rating of *B. microphylla* 'Winter Gem', *N. domestica* 'Atropurpurea Nana' nandina, and *R. indicum* 'Renee Mitchell' azalea on April 23, 2004.

Species	% CGC[z]	PB:CGC:S (by vol)[y]	Growth Index (GI)[x]	Root rating
Buxus microphylla 'Winter Gem'	0	6:0:1	50.6 bw	4.5 a[w]
	21	4.5:1.5:1	52.4 ab	4.4 a
	33	1:1:1	54.0 a	4.6 a
	64	1.5:4.5:1	54.1 a	4.4 a
Nandina domestica 'Atropurpurea Nana'	0	6:0:1	48.8 c	3.1 a
	21	4.5:1.5:1	54.9 b	3.1 a
	33	1:1:1	56.4 ab	3.5 a
	64	1.5:4.5:1	58.0 a	3.5 a
Rhododendron indicum 'Renee Mitchell'	0	6:0:1	49.6 a	2.8 a
	21	4.5:1.5:1	53.3 a	3.1 a
	33	1:1:1	53.8 a	3.0 a
	64	1.5:4.5:1	53.5 a	3.2 a

[z]Percentage of CGC incorporated in each treatment.

[y]PB = pine bark, S = sand, CGC = cotton gin compost.

[x]GI = [(height + widest width + perpendicular width)/3].

[w]Means separation by cultivar and within columns by LSD at P = 0.05.