Engineering, Economics Structures and Innovations

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Evaluation of Cotton Gin Compost as a Horticultural Substrate

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Index Words: Greenhouse Production, Propagation, *Coleus* x *hybridus*, *Euphorbia pulcherrima*, *Ficus benjamina*, *Rosa sp.*, Agricultural Byproducts.

Nature of Work: Potential use of composts and other organic materials in the horticultural industry are frequently evaluated. With availability and cost of materials like pine bark (PB) and peat (P) regulated by the timber industry or environmental regulations, supply can be inconsistent or unpredictable (3,4). Alternative products as substrates in the area of container and greenhouse production, as well as propagation are evermore urgent. Factors such as transportation costs, consistency of product, disease and insect infestation, and availability of the compost have been concerns for growers and left them with skepticism. Benefits of composts are often overlooked due to a lack of scientific literature on which to base beneficial claims. Some positive features of compost include addition of an organic fraction to soils, improvement of soil structure, and increased water holding capacity (1,3,4). Incorporation of composted cotton gin waste (CGC) is a prospective substrate component (2), while at the same time providing an avenue of disposal of this waste product for cotton gin operations. There is a current dilemma of cost effective and legal disposal of this cotton byproduct (1). 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. The end result of composting CGW is a fine, dark topsoil-like product.

The objective of this research was to compare various blends of CGC and PB for potential use as a horticultural substrate. There were two studies. The first study evaluated potential blends in greenhouse production based on plant growth, as well as chemical and physical properties of substrates. The second study evaluated rooting response in cutting propagation.

In the first study, PB and CGC were sifted through a 15mm (1 inch) screen. Each substrate contained a 6:1:1:1 (v:v:v:v) ratio of PB and/or CGC:sand:P:perlite (PRL) amended with 11 pounds Osmocote 18-6-12 (The Scotts Company, Marysville, OH), 1.5 pounds Micromax (The Scotts Company, Marysville, OH), and 5 pounds dolomitic limestone per cubic yard. Six substrates were blended with the following ratios of PB to

CGC (100:0, 80:20, 60:40, 40:60, 20:80, 0:100). A seventh and eighth treatment were mixed with ratios of 100:0 PB:CGC and 0:100 PB:CGC containing no fertilizer. Liners of *Euphorbia pulcherrima* cv. 'Red Sails' (poinsettia), *Ficus benjamina* (weeping fig), and *Rosa* x cv. 'Red Cascade' (rose) were potted into trade-gallon pots containing the eight treatments in October 2001 and grown for 15 weeks under production conditions in a double layer polyethylene-covered greenhouse at the Paterson Greenhouse Complex, Auburn, AL. Each pot received 10 fluid ounces of water twice per day using drip emitters.

Growth indices were measured at planting and every five weeks thereafter on three replicates of each species and treatment. Three representative samples of each species were destructively harvested at soil level for initial shoot fresh and shoot dry weights (SDW) determination. Three replicates of each species and treatment were harvested and weighed every five weeks thereafter.

In the second study, six substrates were blended with the following ratios; 1:1 P:PRL, 1:1 PB:PRL, 1:1 CGC:PRL, 1:1:2 CGC:P:PRL, 1:1:2 CGC:PB:PRL, 1:1:2 P:PB:PRL. Medial cuttings of *Coleus* x *hybridus* (sun coleus) were stuck into each substrate in May 2002. Cuttings were placed under mist irrigation cycling every eight minutes for a duration of six seconds for one week and then under a cycle of every sixteen minutes for a duration of six seconds for the next two weeks. Cuttings were evaluated for root development at 18 days using a rating of 0-5, measuring root length of the three longest roots and recording the number of roots formed. Data were analyzed by appropriate statistical procedures.

Results and Discussion: In the first study, no differences occurred in growth index (GI) in weeping fig across all treatments except for non-fertilized 100:0 PB:CGC and 20:80 PB:CGC (Table 1). Results for SDW in weeping fig only exhibited differences between non-fertilized 100:0 PB:CGC and the remaining treatments. GI for poinsettias demonstrated differences between non-fertilized 100:0 PB:CGC and the rest of the treatments. Differences for SDW of poinsettias were present among non-fertilized 100:0 PB:CGC, 100:0 PB:CGC and the other five treatments. Non-fertilized 100:0 PB:CGC and non-fertilized 0:100 PB:CGC were different from each other and the remaining treatments for GI of roses. There were no differences among treatments for SDW of roses except for non-fertilized 100:0 PB:CGC and non-fertilized 0:100 PB:CGC.

In the second study, differences in number of roots occurred between 1:1 PB:PRL and the following treatments, 1:1 CGC:PRL, 1:1:2 CGC:P:PRL and 1:1:2 P:PB:PRL (Table 2). Rating of roots showed differences between 1:1 PB:PRL and all other treatments. Substrates containing 1:1 CGC:PRL and 1:1:2 CGC:P:PRL comprised the largest average root length and were different from all other treatments.

Significance to Industry: CGC is a viable substrate for use in the production of greenhouse crops and in propagation. All blends of PB and CGC were equivalent or better than the industry standard. CGC can be used as a partial substitute for PB in greenhouse production of weeping figs, poinsettias and roses as well as a substrate for propagation of coleus. CGC is prevalent throughout the Southeast U.S. and availability is not a concern. The burden of disposal costs can be decreased from cotton ginning operations while at the same time possibly decreasing production costs for nurseries.

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Table 2. Root evaluation of *Coleus* x *hybridus* medial cuttings[z].

Treatment[y]	Number of roots	Root length (mm)	Rating
1:1 P:PRL	60.92ab	109.31c	3.92a
1:1 PB:PRL	50.29b	63.28d	2.46b
1:1 CGC:PRL	68.08a	138.35a	3.92a
1:1:2 CGC:P:PRL	72.88a	141.86a	3.96a
1:1:2 CGC:PB:PRL	61.08ab	124.50b	3.63a
1:1:2 P:PB:PRL	64.58a	110.76c	3.58a

[z]Means within columns followed by a different letter are significantly different according to Duncan's Multiple Range Test (P=0.05).
[y]P=Peat; PRL=Perlite; PB=Pine bark; CGC=Cotton gin compost.

Table 1. Effects of substrate on growth and shoot dry weight at 10 weeks after planting[z].

Species	Treatment[y]	Growth index[x]	Shoot dry weight[w]
Ficus	100 PB no CRF	16.83b	-0.47b
benjamina	100 PB	34.67ab	9.71a
	80:20 PB:CGC	45.50a	8.27a
	60:40 PB:CGC	33.83ab	4.40ab
	40:60 PB:CGC	30.33ab	2.86ab
	20:80 PB:CGC	27.33b	2.91ab
	100 CGC	32.83ab	5.02ab
	100 CGC no CRF	30.17ab	6.39ab
Euphorbia	100 PB no CRF	8.83b	0.50c
pulcherrima	100 PB	48.33a	21.65b
'Red Sails'	80:20 PB:CGC	53.06a	24.53ab
	60:40 PB:CGC	48.33a	25.69ab
	40:60 PB:CGC	37.44a	28.61a
	20:80 PB:CGC	53.33a	29.75a
	100 CGC	57.39a	28.34a
	100 CGC no CRF	*	*
Rosa x	100 PB no CRF	5.92c	0.11b
'Red Cascade'	100 PB	109.67a	10.03a
	80:20 PB:CGC	96.50ab	6.51ab
	60:40 PB:CGC	85.58ab	6.64ab
	40:60 PB:CGC	101.92a	7.18ab
	20:80 PB:CGC	108.75a	10.65a
	100 CGC	105.17a	5.82ab
	100 CGC no CRF	63.33b	2.17b

[z]Means within columns for each species followed by different letters are significantly different according to Duncan's Multiple Range Test (P=0.05).

[y]Blends of cotton gin compost (CGC) to pinebark (PB) were amended with standard control release fertilizer (CRF) at 2.0 pounds of Nitrogen per cubic yard.

[x]Growth indices (cm) were determined by adding height + largest width + width perpendicular to largest width all divided by three for poinsettia and rose, growth index indicates a height measurement for weeping fig, increase over initial.

[w]Shoot dry weight (g) was determined for all plant parts above the soil line, increase over initial.

Nursery as a Potential Alternative Enterprise for Small Farmers

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Index Words: Nursery, Alternative Enterprise, and Small Farmers.

Nature of Work: Small farmers, the vast majority of whom are found in the southern region, have been facing a number of problems over the years, which are becoming increasingly challenging with the growing trend towards globalization, development of new technologies, and regulations. Their reliance on mono production and the associated price and income volatility pose serious threat to their economic viability. In recent years, some small farm products such as tobacco have begun to decline in importance. In light of these circumstances it is imperative that potential alternatives that could enhance income of such farmers be sought. Although fruits and vegetables are well-known traditional alternative enterprises, this paper focuses on ornamental nurseries as one potential alternative enterprise and advances the basis for it.

Results and Discussion: Availability of land and labor are critical inputs for nursery operation (1,2,4). Small farmers have control over a sizeable portion of assets including land and their operations are labor intensive (3,8). Thus, small farmers have relative advantage regarding both resources. A recent survey of small farm operators in Tennessee shows that the large majority would like to stay in farming and expand their operation. The question that arises is how best to achieve this. Nursery production could be one possible alternative crop especially in areas where climatic and soil conditions are favorable. Another consideration is its impact on the community in which it is located through use of local resources including labor and by providing opportunities for emergence of complementary businesses. To the extent that the enterprise yields benefits to the community it should be of interest (5).

The decision to go into the nursery business will vary among farmers in different states and within states. It should be based on careful understanding of the costs and the returns associated with different types of products, the demand for such products and ability to stay competitive. It may also require reallocating labor from off farm employment to nursery operation. Small farmers should also seize every opportunity to secure credit and utilize technical assistance from government and non-government sources that are critical for entry into the business. Once in the industry, small farmers should adopt a strategy aimed at developing niche products that will command a segment of the market. It is however important to recognize that developing niche products in itself will not guarantee continued demand unless the producer remains competitive both in terms of quality and price.

Significance to Industry: Entry of small producers into the industry will reduce the current concentrated pattern of production in the hands of large producers. Not only would this diversify the structure of production in the industry but could also provide choice for consumers in terms of diversity of products. With fast growth of the nursery industry (6,7) and potential for better income than from the traditional agricultural commodities, entry to the industry could be attractive for existing and beginning small farmers.

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