# Cotton Gin Compost as an Alternative Substrate for Propagation[1]©

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**Selection of substrates for use in propagation is often based on cost, availability, ease of handling, and reproducibility. Peat (P) and pine bark (PB) are common substrate components for propagators in the Southeastern United States. Availability and cost of P and PB can be inconsistent or unpredictable with forecast for restrictions on future supply of these materials. Cotton gin compost (CGC) is readily available in the Southeastern U.S.A. and may hold potential as a substrate substitute or extender suitable for propagation. In May of 2002, cuttings of *Solenostemon* 'Defiance', *Lagerstroemia* 'Natchez', and *Nandina domestica* 'Atropurpurea Nana' were stuck in six substrate blends. Cuttings were evaluated for root initiation and development. In all three species, cuttings rooted in CGC and perlite ( 1 : 1, v/v) were equal to or greater than those that were stuck in an industry standard peat and perlite (1 : 1, v/v) substrate in all categories of root evaluation. CGC could be used as a substrate and substitute for peat in the propagation of coleus, crapemyrtle, and dwarf nandina.**

## INTRODUCTION

Potential uses of composts and other organic materials in the horticultural industry are frequently evaluated. With availability and cost of materials like peat and pine bark affected by the timber industry, transportation, and/or environmental conditions, supply can be inconsistent and unpredictable (Shumack et al., 1991; Wang and Blessington, 1990). Alternative products as substrate blending components for use in propagation are evermore urgent. Factors such as transportation costs, consistency of product, disease and insect infestation, and availability of compost are production concerns for growers. Benefits of composts are often overlooked due to a lack of scientific literature on their usage. Some positive benefits of properly composted materials free of weed seed and pathogenic diseases include: its organic content, improvement of soil structure, and increased water holding capacity (Griffis and Mote, 1978; Mayfield, 1991; Shumack et al., 1991; Sterne et al., 1979; Wang and Blessington, 1990).

Cotton gin compost (CGC) is a prospective substrate component for production of ornamental crops (Owings, 1994), 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 (Mayfield, 1991). Cotton gin waste (CGW) is a term used to describe the byproducts of the cotton ginning process that typically include leaves, stems, burrs, and some fiber. The end result of composting CGW is a fine, dark topsoil-like product. Cotton gins throughout the South are located in close proximity to nurseries, providing justification for further research on CGC.

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The objective of this research was to compare various blends of CGC with peat and pine bark for potential use as a propagation substrate. The study evaluated rooting response in cutting propagation of three common ornamental species. Comparison of physical and chemical properties was also conducted.

## MATERIALS AND METHODS

Six substrates composed of peat (P), pine bark (PB), or perlite (PRL) were blended with the following ratios, P and PRL (1 : 1, v/v); PB and PRL (1 : 1, v/v); CGC and PRL (1 : 1, v/v); CGC, P, and PRL (1 : 1 : 2, by volume); CGC, PB, and PRL (1 : 1 : 2, by volume); and P, PB, and PRL (1 : 1 : 2, by volume). Medial cuttings of *Solenostemon* 'Defiance' (Defiance sun coleus) and *Lagerstroemia* 'Natchez' (*L. indica* × *L. faurei*), and terminal cuttings of *Nandina domestica* 'Atropurpurea Nana' were stuck into each substrate in May 2002. Crape myrtle and dwarf nandina cuttings received a quick-dip application of 2500 ppm IBA + 1250 ppm NAA from Dip N' Grow® (Dip N' Grow, Inc., Clackamas, Oregon). Treatments were arranged in a Randomized Complete Block Design (RCBD) with four blocks and six replications of each treatment per block. Cuttings were placed under mist irrigation cycling every 8 min for a duration of 6 sec for 1 week and then under a cycle of every 16 min for a duration of 6 sec until completion of the study. Coleus cuttings were evaluated for root development at 18 days, crape myrtle cuttings at 32 days, and dwarf nandina cuttings at 40 days after planting using a rating of 0-5, measuring root length of the three longest roots, and recording the number of roots formed. Data were analyzed using Duncan's Multiple Range Test (SAS, 1996).

The N.C. State University Porometer was used to determine the physical properties of the substrates. The parameters measured were air space, water holding capacity, total porosity, and bulk density. Soil solutions from the substrates were collected using the saturated-media-extract method and then analyzed for pH and electrical conductivity (EC).

## RESULTS AND DISCUSSION

For coleus, differences in number of roots occurred between PB and PRL (1 : 1, v/v), which yielded the least number of roots, and the following treatments, CGC and PRL (1 : 1, v/v); CGC, P, and PRL (1 : 1 : 2, by volume); and P, PB, and PRL (1 : 1 : 2, by volume) (Table 1). Visual rating of roots was lowest in PB and PRL (1 : 1, v/v) and was statistically different from all other treatments. Substrates containing CGC and PRL (1 : 1, v/v) and CGC, P, and PRL (1 : 1 : 2, by volume) comprised the largest mean root length and were different from all other treatments.

The number of roots formed by the crape myrtle cuttings was grouped into two classifications. First, primary roots were counted and then the total number of lateral roots formed on the primary roots was determined. This further separated the results of each treatment to give a more complete comparison of root initiation. The CGC and PRL (1 : 1, v/v) blend had the greatest number of primary roots and was different from all other blends (Table 2). There was no difference in number of primary roots for the cuttings stuck in P and PRL (1 : 1, v/v); CGC, P, and PRL (1 : 1 : 2, by volume); CGC, PB, and PRL (1 : 1 : 2, by volume); and P, PB, and PRL (1 : 1 : 2, by volume) blends. Also, the CGC and PRL (1 : 1, v/v) substrate had the greatest lateral root initiation and was different from all other treatments. Blends containing P and PRL (1 : 1, v/v) and CGC, P, and PRL (1 : 1 : 2, by volume) were not dif-

**Table 1.** Root evaluation of *Solenostemon* 'Defiance' medial cuttings in various substrate blends.

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

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

**Table 2.** Root evaluation of *Lagerstroemia* 'Natchez' medial cuttings in various substrate blends.

| Treatment[z] | Number of primary roots | Number of primary and lateral roots | Root length (mm) | Rating | Rooted (%) |
|---|---|---|---|---|---|
| P and PRL (1 : 1, v/v) | 7.29b[y] | 83.25b | 69.26a | 3.29b | 95.83 |
| PB and PRL (1 : 1, v/v) | 3.38c | 18.17c | 20.69c | 1.00c | 50.00 |
| CGC and PRL (1 : 1, v/v) | 11.50a | 119.00a | 81.53a | 4.33a | 95.83 |
| CGC, P, and PRL (1 : 1 : 2, by volume) | 7.21b | 79.21b | 68.14a | 3.17b | 91.67 |
| CGC, PB, and PRL (1 : 1 : 2, by volume) | 7.38b | 43.04c | 42.29b | 1.79c | 79.17 |
| P, PB, and PRL (1 : 1 : 2, by volume) | 5.42bc | 36.29c | 39.85b | 1.67c | 87.50 |

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

**Table 3.** Root evaluation of *Nandina domestica* 'Atropurpurea Nana' terminal cuttings in various substrate blends.

| Treatment[z] | Number of roots | Root length (mm) | Rating | Rooted (%) |
|---|---|---|---|---|
| P and PRL (1 : 1, v/v) | 39.96a[y] | 22.38a | 2.56a | 79.17 |
| PB and PRL (1 : 1, v/v) | 16.08b | 11.78b | 1.00b | 33.33 |
| CGC and PRL (1 : 1, v/v) | 41.38a | 15.81ab | 1.94ab | 75.00 |
| CGC, P, and PRL (1 : 1 : 2, by volume) | 24.50ab | 14.42ab | 1.42b | 58.33 |
| CGC, PB, and PRL (1 : 1 : 2, by volume) | 27.17ab | 11.28b | 1.31b | 54.17 |
| P, PB, and PRL (1 : 1 : 2, by volume) | 35.17a | 17.47ab | 1.81ab | 66.67 |

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

**Table 4.** Physical and chemical properties of various substrate blends.

| Substrate [z] | Air space[y] | Water holding capacity | Total porosity | Bulk density[x] | pH | Electrical conductivity[w] |
|---|---|---|---|---|---|---|
| P and PRL (1 : 1, v/v) | 14.1 | 59.6 | 73.7 | 0.10 | 4.91 | 0.81 |
| PB and PRL (1 : 1, v/v) | 41.6 | 21.0 | 62.6 | 0.13 | 4.36 | 0.11 |
| CGC and PRL (1 : 1, v/v) | 16.0 | 50.8 | 66.8 | 0.23 | 5.65 | 2.83 |
| CGC, P, and PRL (1 : 1 : 2, by volume) | 17.2 | 51.1 | 68.3 | 0.16 | 5.33 | 2.00 |
| CGC, PB, and PRL (1 : 1 : 2, by volume) | 25.3 | 40.8 | 66.1 | 0.19 | 5.62 | 1.41 |
| P, PB, and PRL (1 : 1 : 2, by volume) | 30.3 | 42.3 | 72.6 | 0.11 | 5.05 | 0.41 |

[z] P=Peat; PRL=Perlite; PB=Pine bark; CGC=Cotton gin compost.
[y]Air space, water holding capacity and total porosity are on a percent volume basis.
[x]Bulk density was measured in grams per cubic centimeter.
[w]Electrical conductivity was measured in milli-Siemens per centimeter.

ferent from each other, but were different from all other treatments and yielded the second highest number of primary and lateral roots. Statistical analysis on mean root length showed no difference between P and PRL (1 : 1, v/v); CGC and PRL (1 : 1, v/v); and CGC, P, and PRL (1 : 1 : 2, by volume). Rating results followed similar trends. Crape myrtle cuttings stuck in CGC and PRL (1 : 1, v/v) had the highest visual rating and were different from cuttings stuck in all other substrates. The P and PRL (1 : 1, v/v) and CGC, P, and PRL (1 : 1 : 2, by volume) resulted in the second highest ratings, but were not statistically different from each other. For crape myrtle cuttings, CGC and PRL (1 : 1, v/v) produced the best quality rooted cuttings in every category.

No differences occurred between P and PRL (1 : 1, v/v); CGC and PRL (1 : 1, v/v); CGC, P, and PRL (1 : 1 : 2, by volume); CGC, PB, and PRL (1 : 1 : 2, by volume); and P, PB, and PRL (1 : 1 : 2, by volume) blends in the number of roots for dwarf nandina cuttings (Table 3). Mean root length was statistically the same for dwarf nandina cuttings stuck in P and PRL (1 : 1, v/v); CGC and PRL (1 : 1, v/v); CGC, P, and PRL (1 : 1 : 2, by volume); and P, PB, and PRL (1 : 1 : 2, by volume). There were no differences among the visual ratings of the following substrates P and PRL (1 : 1, v/v); CGC and PRL (1 : 1, v/v); and P, PB, and PRL (1 : 1 : 2, by volume).

Substrate moisture is important in production of quality rooted cuttings. Therefore, poor root initiation in the PB and PRL (1 : 1, v/v) substrate could have resulted from low water holding capacity (Table 4). Physical properties of substrates containing CGC were similar to those containing P. Physical property analysis indicates that addition of CGC to the substrates evaluated increased bulk density. The EC of the substrates containing CGC were higher than those that did not contain CGC, but are still well below toxic levels.

The results of this study indicate CGC is a viable substitute for peat in propagation substrates. Rooting results in most blends containing CGC were equivalent to or better than all other materials. Across all three species, CGC and PRL (1 : 1, v/v) was equal to or better than P and PRL (1 : 1, v/v) in all categories of root evaluation. CGC can be used as a substrate for propagation of 'Defiance' coleus, 'Natchez' crape myrtle, and dwarf nandina. CGC is prevalent throughout the Southeast U.S. and is readily available. The burden of disposal costs can be decreased from cotton ginning operations while at the same time possibly decreasing production costs for nurseries located in the Southeastern and Southwestern U.S.

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