Growth and Interior Performance of Poinsettia in Media Containing Composted Cotton Burrs

Yin-Tung Wang¹ and Thomas M. Blessington²

Texas A&M University Agricultural Research and Extension Center,
2415 East Highway 83, Weslaco, TX 78596

Additional index words. *Euphorbia pulcherrima*

Abstract. Rooted cuttings of *Euphorbia pulcherrima* Willd. ex Klotzsch cv. Gutbier V-14 Glory were planted in 2-liter containers with growth media having 0% to 75% composted cotton burrs (CCB) in combination with sphagnum peat and/or composted pine bark. Leachates from media with 50% or more CCB had higher initial electrical conductance (EC) (3.7 to 4.0 dS·m⁻¹) than that from media with 25% or no CCB (2.8 to 3.0 dS·m⁻¹) 2 weeks after planting. The differences in leachate EC declined after an additional 9 weeks. Media containing CCB produced slightly shorter and narrower plants with 10% smaller inflorescences and less dry weight than plants grown in a medium consisting of equal volumes of peatmoss and bark. Number of branches and bracts, days to bloom, and plant grade after 30 days under 15 $\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$ photosynthetic photon flux were unaffected by media.

Most potted ornamental plants are produced in artificial growing media without mineral soil. These media are usually a mixture of peatmoss, bark, perlite, and/or vermiculite. Sawdust and other porous organic and inorganic materials having good water retention and nutrient-holding properties are also used. The composition of growing media has been shown to affect plant growth, sometimes being a determinant factor between profit and crop loss (Sheehan and Tjia, 1976).

Peatmoss has been traditionally used as an important ingredient in preparing potting media because of its high water-holding and cation exchange capacities. Due to the high cost and unstable supply of peatmoss, other substitute materials have been studied. Medium composition was previously found to affect the growth of poinsettia (Blessington et al., 1981; Fonteno et al., 1981) and may influence the performance of pot-grown plants under interior conditions (Wang and Sauls, 1988).

Cotton burrs is a waste product generated in large quantities by the cotton industry that must be disposed of properly to reduce environmental or pest problems. Since cotton burrs absorb water, they may have potential, after being composted, for use in media for producing potted flowering plants. The objective of this study was to determine the effect of composted cotton burrs in media on

chemical properties of the media and on greenhouse production and interior performance of poinsettia.

Rooted poinsettia cuttings with four to five leaves were obtained from a commercial source and planted one per 16.4-cm white plastic pot (2 liters) on 15 Sept. 1988. The ingredients of the growing media included Canadian sphagnum peat, composted pine bark (<12 mm), and composted cotton burrs (CCB). The CCB was used in conjunction with one or two of the above ingredients (Table 1). A medium with equal volumes of composted pine bark and peatmoss was used as the control. Ingredients for each medium were blended for 2 min in a rotary mixer. Finely ground dolomitic lime and Micromax (a micronutrient source, W.R. Grace and Co., Fogelsville, Pa.) were added to media at rates of 4.0 and 1.0 kg·m⁻³, respectively. A wetting agent (Aqua-Grow, Aquatrols Corp. of America, Pennsauken, N.J.) was added to all media at the manufacturer's recommended rate. Plants were grown in a greenhouse with a maximum photosynthetic photon flux (PPF) of 720 $\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$, pinched to ≈ 7.5 cm on 30 Sept., and sprayed with paclobutrazol at 50 ppm on 16 Oct.; the medium surface was covered with a layer of polyethylene to prevent contamination.

Water containing 24N-3.4P-12.3K soluble fertilizer (W.R. Grace and Co.) at 1.0 g·liter⁻¹ was used for irrigation until 1 Nov., at which time fertilizer rate was increased to 1.5 g 20N-8.6P-16.6K/liter. Ammonium molybdate was added to fertigation water at 3.7 mg·liter⁻¹ to ensure adequate Mo supply (Hammer and Bailey, 1987). All fertilization was discontinued after 27 Nov. Plants were irrigated two or three times a week, depending on weather conditions, and never showed any symptoms of water stress. The maximum day and minimum night air temperatures during the period of active color development were 31 and 15C, respectively.

Leachate samples were taken from each pot at 2, 8, and 11 weeks after potting by the use of the pour-through technique (Yeager et al., 1983; Wright, 1986). Pots were watered in the late afternoon with fertilizer solution, except on the last collection date, when water without fertilizer was used. The following morning, a sufficient amount of water with an electrical conductance (EC) <0.01 dS·m⁻¹ was evenly added to the medium surface to collect 35 to 50 ml of leachate. Leachates were placed in the laboratory overnight to equilibrate with room temperature (24 to 26C) and then analyzed for EC (indicative of total soluble salts) and pH.

Bloom date was recorded for each plant as pollen started to shed from a cyathium. Number of branches was counted and plant height (pot rim to the tallest point) and width (average of two measurements made at perpendicular angles), as well as width of the inflorescence, number of large and small bracts, and number of leaves on the tallest shoot were recorded.

Plants were removed into postharvest rooms held between 18 and 23C and with a 12-hr photoperiod of 15 $\mu\text{mol}\cdot\text{s}^{-1}\cdot\text{m}^{-2}$ PPF (from cool-white fluorescent tubes) at plant level to simulate a common interior environment. Relative humidity was not controlled, but was monitored and varied between 50% and 72%. Plants were evaluated after 30 days for number of abscised bracts and leaves and overall plant grade. Shoots then were severed at the soil line, dried for 72 hr at 70C in a forced-air oven, and dry weights recorded.

There was one plant per pot as an experimental unit replicated 8 times in a randomized complete-block design. Data were subjected to analysis of variance using SAS

Table 1. Electrical conductance and pH of medium leachate as affected by medium composition.

Medium composition ² (ratio by volume)			Electrical conductance (dS·m ⁻¹)			pH		
			Weeks after planting			Weeks after planting		
			2	8	11 ³	2	8	11 ³
CCB	BK	PM						
3	0	1	3.75	4.30	3.65	6.82	5.91	5.81
2	1	1	4.03	4.14	3.47	5.81	5.62	5.57
2	2	0	3.66	3.59	3.15	5.90	5.52	5.56
1	2	1	2.98	3.95	3.51	6.15	5.37	5.39
0	2	2	2.79	3.84	3.97	5.90	5.07	5.06
HSD _{0.05}			0.11	0.39	0.34	0.27	0.11	0.11

²CCB = composted cotton burrs, BK = composted pine bark, and PM = sphagnum peatmoss; 0:2:2 was the control.

³Leachates were taken following two irrigations with water containing no fertilizer.

Received for publication 5 May 1989. Poinsettia cuttings were donated by Paul Ecke Poinsettias, Encinitas, Calif. Composted cotton burrs and partial financial support were provided by Back to Earth Resources, Dallas, Texas. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked *advertisement* solely to indicate this fact.

¹Assistant Professor.

²Professor and Center Director.

Table 2. Effect of medium composition on growth and flowering response of poinsettia.

Medium composition ² (ratio by volume)			Plant ht (cm)	Plant width (cm)	Diam of inflorescence (cm)	Dry wt (g)
CCB	BK	PM				
1	3	0	25.3	47.7	29.6	13.8
2	1	1	23.9	46.1	29.7	13.1
2	2	0	24.2	46.4	29.2	11.9
1	2	1	24.4	48.0	29.6	13.0
0	2	2	27.8	56.8	32.4	17.1
HSD _{0.05}			3.4	7.2	2.5	2.8

²CCB = composted cotton burrs, BK = composted pine bark, and PM = sphagnum peat; 0:2:2 was the control.

Table 3. Effect of media composition on the quality of poinsettia after exposing plants to an interior environment for 30 days.

Medium composition ² (ratio by volume)			Abscised bracts (no./plant)	No. of abscised leaves
CCB	BK	PM		
3	0	1	2.7	3.6
2	1	1	4.1	2.4
2	2	0	0.9	4.9
1	2	1	2.8	5.9
0	2	2	1.0	6.5
HSD _{0.05}			NS	3.6

²CCB = composted cotton burrs, BK = composted pine bark, and PM = sphagnum peat; 0:2:2 was the control.

statistical programming. Tukey's honest significant difference (HSD) was used for mean comparisons.

There were substantial differences in EC among medium leachates 2 weeks after planting (Table 1). Media containing 50% or more CCB had higher EC than media with less or no CCB, suggesting that CCB either had lower cation exchange capacity or contained higher levels of soluble salts than peatmoss and bark, resulting in more nutrients or salts being carried out by the leachate. The differences in EC among media leachates declined at 8 and 11 weeks, probably a result of constant fertilizer application.

Leachates from media containing 75% CCB had the highest pH (6.82) at 2 weeks after planting, with the others ranging between 5.9 and 6.2 (Table 1). Leachate pH declined between 2 and 8 weeks and changed little thereafter. The magnitude of pH change depended on medium composition. This result was expected since the same amount of lime was added to media that might have different buffering capacity. Leachate pH was more stable in media with 50% CCB. The pH of leachates from the medium with 50% peatmoss (control) was the lowest after 8 weeks (Table 1).

Plants produced in media amended with CCB were slightly shorter and narrower when compared to those grown in a medium with equal volumes of peatmoss and bark (Table 2). There was no difference in growth characteristics among plants produced in media amended with CCB. Height of poinsettia was previously found to be affected by medium

composition (Blessington et al., 1981; Fonteno et al., 1981; Sanderson and Drane, 1988). 'Annette Hegg Diva' was reported to grow taller in a medium with 50% peat than in media with 25% peat (Blessington et al., 1981), consistent with the results of this study. Plant height in this study was shorter than in other reports (Blessington et al., 1981; Fonteno et al., 1981), which may be the result of late planting (15 Sept.), heavy fertilization (Nell and Barrett, 1986), cultivar difference, or environmental factors. Number of branches (5.6 to 6.0) and mean number of leaves per shoot (4.0 to 5.0) were not affected by medium composition. Media amended with CCB produced plants with smaller inflorescences. The wider plants produced in the medium consisting of equal volumes of bark and peatmoss may have resulted from the slightly larger inflorescences of these plants. Mean number of bracts (large, 6.0 to 6.5; small, 5.9 to 6.0) were similar, regardless of medium composition.

Plants grown in media with CCB were observed to show red pigmentation earlier than those in the medium without CCB, but there was no statistical difference in days to bloom (75.6 to 79.3). All plants grown in CCB-amended media had similar dry weights, which were lower than the dry weights of plants produced in the medium having 50% peatmoss (Table 2). Medium with 50% CCB and 50% bark produced plants with the lowest dry weight.

Although EC of some initial and final leachates was high (Table 1), no necrosis was observed on leaves and bracts at the end of production, which may have been due to the use of liquid fertilizer. Nell and Barrett (1985) reported that using only liquid fertilizer reduced the number of necrotic spots on leaves, compared to Osmocote applied at similar rates. More than 25% of the N in both fertilizers used in this study was in the nitrate form, which has previously been found to reduce leaf necrosis (Nell and Barrett, 1985).

Plant grade (4.5-4.9; 1 = poor and 5 = excellent) after 30 days in an interior environment was unaffected by medium composition. Medium had no effect on the abscission of bracts, although the range was wide (Table 3). The only significant difference was in the amount of leaf abscission between the control (6.5 leaves) and plants grown in a medium containing 50% CCB,

25% bark, and 25% peatmoss (2.4 leaves). However, the above difference was not visually noticeable. Most stems on plants grown in 50% peatmoss and 50% bark could not support the inflorescence and required staking to maintain the sturdiness, possibly due to their larger size. It is not clear if the low pH in this medium (Table 1) resulted in weak stems. Application of paclobutrazol (Wilfret, 1981) and uniconazole (Wang and Gregg, 1989) have been shown to cause weakness in stems of poinsettia and hibiscus, respectively. The greater width of these plants at the end of production (Table 2) may have been the result of weak shoots spreading out from the center.

Results of this study suggest that media with up to 75% composted cotton burrs may be used satisfactorily for producing good poinsettia plants with excellent post-production quality. Media with 50% CCB maintained acceptable levels of EC and stable pH during the course of this study. A minimum of 25% peatmoss is recommended to prevent a severe decline in plant dry weight.

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