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Compost-Amended Media for Growth And Development Of Mexican Heather

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Growth of *Cuphea hyssopifolia*, H.B.K. (Mexican Heather) transplants was evaluated in media containing 0, 25, 50, 75, or 100% compost derived from biosolids and yard trimmings. Compost was amended with a commercial coir- or peat-based media. As compost composition in peat- or coir-based media increased from 0 to 100%, carbon/nitrogen (C/N) ratios decreased, and media stability, N mobilization, pH, and electrical conductivity (EC) increased. Bulk density increased and percent moisture decreased as more compost was added to either peat- or coir-based media. Plants grown in media with high volumes of compost (75 or 100%) had reduced growth as compared to controls (no compost). However, regardless of the percentage of compost in either peat- or coir-based media, all plants were considered marketable after 8 weeks.

Introduction

Commercial potting media containing peat is an expensive, nonreusable component to the nursery industry. Developing inexpensive and nutrient-rich organic media alternatives can potentially reduce fertilization rates, irrigation rates, and ultimately, nursery costs. Compost has been utilized to successfully grow a wide range of crops including bedding annuals (Klock-Moore 1999), vegetables (Roe *et al.* 1997), woody shrubs and trees (Fitzpatrick *et al.* 1998), and foliage plants (Fitzpatrick 1986). In addition, Inbar *et al.* (1993) have reviewed physical, chemical, and biological properties of compost used as a containerized media. However, minimal information is available in using yard waste/biosolid compost for containerized perennial plant production.

Besides peat, there are other products that have potential to supplement compost in the growing medium. Coconut coir dust is a waste product of the coconut palm husk industry that offers a reliable, economical, and absorbent growing medium alternative (Evans and Stamps 1996). Results from this investigation will provide scientific information on the use of compost as a complete or partial additive to commercial peat- and coir-based media commonly used by the nursery industry.

Materials and Methods

Plant Material and Media Composition

Organic waste compost was mixed with peat- or coir-based commercial media. Plugs of *Cuphea hyssopifolia*, H.B.K. (Robrick Nursery, Hawthorne, Florida) were transplanted into 4.5 L round, plastic pots filled with 0, 25, 50, 75, or 100 percent (by vol.) compost (Solid Waste Authority, Palm Beach County, Florida) amended with peat-based soilless media (Metro-Mix 200; The Scotts Co., Marysville, Ohio). The compost consisted of a 1:1 ratio (w:w) of biosolids (polymer dewatered) and yard trimmings screened to 13 mm. Compost was made using an in-vessel agitated bed system. Additional 4.5 L round pots were filled with 0, 25, 50, 75, or 100 percent (by vol.) compost amended with

coir-based soilless media (Yoder Mix, The Scotts Co., Marysville, Ohio). All plants were topdressed at a standard rate of 15 g/pot of 15N-9P-12K Osmocote Plus® and treated with a 1 percent Marathon® granular systemic insecticide at a standard rate of 0.37 g/L (Olympic Horticultural Products™, Bradenton, Florida). Mean minimum and maximum temperatures in the greenhouse were 24 and 35°C, respectively.

Three replicates of each mixture were evaluated initially for pH, electrical conductivity (EC), percent moisture, and bulk density (BD). Percent moisture was determined by drying a known weight of media at 105°C for 24 h and weighing before and after. Bulk density was determined by dividing the weight of the dried substrate by the volume of the pot as described by Niedziela and Nelson (1992). Initial composition of the media was analyzed for pH, EC, total nitrogen (N), and total carbon (C). pH and EC were determined by preparing a saturated media extract and using a pH/ion/conductivity meter. Total C and N concentrations were determined by a CNS analyzer (Carlo-Erba NA-1500; BICO, Burbank, California). Compost samples were air dried for 2 days (60°C) and ground to a powder with a ball grinder before combustion.

Plant Growth and Development

Final shoot characteristics (height, weight, and width) were measured 8 weeks after initial transplanting. Chlorophyll content was measured from leaves on the 4th, 5th, and 6th branch from the apex of each plant using a Spad-502 chlorophyll meter (Spectrum Technologies Inc., Plainfield, Illinois). Growth index was determined by averaging the plant width and height. Shoots were severed at the crown and dried for 1 week in a 50°C oven.

Statistical Analysis

A randomized complete block experimental design was used for peat- and coir-based media experiments. Each treatment (mixture) was replicated five times. All data were subjected to an analysis of variance (ANOVA) and main effects of treatments were partitioned into orthogonal contrasts.

Results and Discussion

Media Nutrient Composition and Chemical Characteristics

As the volume of amended compost increased, nitrogen (N) increased quadratically (0.8 to 2.23 %, peat media) or linearly (1.26 to 2.13 %, coir media) (Table 1). Carbon/nitrogen (C/N) ratio decreased with increasing volume of compost in either peat (40 to 13) or coir (20 to 14) based media. Davidson *et al.* (1994) suggested that C/N ratios less than 20 are considered optimum for plant growth. Plant phytotoxicity and N immobilization may occur in composts with C/N greater than 30 (Zucconi *et al.* 1981).

Electrical conductivity (EC) increased linearly with increasing volumes of compost in either peat or coir-based media (Table 1). EC values of 0.63 to 1.56-dS·m⁻¹ were recommended for container-grown foliage plants (Poole *et al.* 1981). High salt content has been reported in composts with yardwaste/biosolid feedstocks (Sanderson 1980; Shiralipour *et al.* 1996). pH value increased cubically with increasing compost in either media (Table 1). However, pH values (5.4 to 6.9 for peat media) (6.5 to 7.1 for coir media) were within the reported 6.7 to 7.7 range for commercially produced compost (Fitzpatrick 1998).

TABLE 1.
Chemical properties and nutrient concentrations of compost amended
peat- and coir-based media.

Compost (% by vol.)	pH	EC (S·m ⁻¹)	Moisture (%)	Bulk density (g·cm ⁻³)	Nitrogen (N) (%)	Carbon (C) (%)	C/N (ratio)
Peat							
0	5.4	0.13	52.82	0.075	0.81	32.33	39.91
25	6.2	0.14	52.84	0.140	1.50	30.15	20.10
50	6.4	0.17	49.17	0.205	1.94	35.65	18.38
75	6.6	0.21	50.61	0.260	2.23	31.56	14.15
100	6.9	0.24	42.95	0.296	1.99	25.66	12.89
Significance ^z	C**	L**	L**	Q**	Q**	Q*	C**
Cair							
0	6.5	0.04	77.69	0.104	1.26	25.36	20.13
25	6.3	0.09	66.08	0.159	1.54	27.66	17.96
50	6.7	0.13	60.62	0.213	1.71	28.58	16.71
75	6.9	0.16	53.57	0.255	2.10	29.92	14.25
100	7.1	0.20	42.38	0.302	2.13	29.17	13.70
Significance ^z	C**	L**	C**	Q*	L**	Q**	L**

* or ** indicates significance at $P < 0.05$ or 0.01 , respectively.

^z L, Q, or C indicates a significant linear, quadratic, or cubic response.

Percent moisture in the media prior to planting increased linearly (peat media) or cubically (coir media) as compost volume increased (Table 1). The initial 100% compost had a lower moisture (42%) content than either the peat (53%) or coir (78%) media. Substrates amended with compost also were reported to have a low water content (Siminis and Manios 1990). As the volume of the compost increased, the bulk density increased quadratically in either peat (0.075 to 0.296) or coir (0.104 to 0.302) based media, suggesting that media with large volumes of compost may have poorer drainage.

Plant Growth and Development

Plant SPAD readings (an indicator of leaf greenness or chlorophyll content), eight weeks after initial transplanting, did not differ among compost amended peat or coir-based media (Table 2). This suggests that N concentration of the compost and rate of N mineralization was appropriate to maintain a similar leaf greenness than the standard peat or coir media without compost (Li *et al.* 1998).

Stem length decreased with increasing volume of compost in the peat-based media, but was unaffected in the coir-based media (Table 2). Growth indexes (a measurement of plant size) decreased quadratically or linearly with increasing compost in peat- and coir-based media, respectively (Table 2). Shoot dry weight decreased linearly with increasing compost in either peat or coir media (Table 2). However, all plants, regardless of compost composition, were considered marketable (Figure 1). While the largest reduction in shoot length, size, and weight occurred in media amended with the highest volumes of compost, plants grown with 50% or less compost in either media had a similar appearance than plants grown without compost (Figure 1). Bedding annuals such as impatiens (*Impatiens wallerana* Hook) (Klock 1997; Klock-Moore 1999) and snapdragons (*Antirrhinum majus* L) (Klock 1997) were reported to have grown to a commercial marketable standard with 100% yard-waste/biosolid compost.

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TABLE 2.
Growth and development characteristics of *Cuphea hyssopifolia* plants grown for 8 weeks in compost amended peat- or coir-based media.

Compost (% by vol.)	Chlorophyll (spad units)	Stem Length (cm)	Growth Index (cm)	DW shoot (g)
Peat				
0	56.62	30.12	36.28	19.59
25	55.70	28.46	31.67	16.37
50	54.74	28.43	29.17	14.11
75	53.12	25.15	25.67	11.11
100	55.08	26.55	26.37	10.08
Significance ^z	ns	L**	Q**	L*
Coir				
0	55.52	29.27	29.68	15.48
25	54.90	28.83	30.19	16.15
50	52.92	27.62	27.94	13.05
75	54.36	28.04	27.69	12.67
100	54.52	28.08	26.78	10.15
Significance ^z	ns	ns	L*	L**

* or ** indicates significance at $P < 0.05$ or 0.01 respectively.

^z NS, L, Q, or C indicates a non significant or significant linear, quadratic or cubic response.

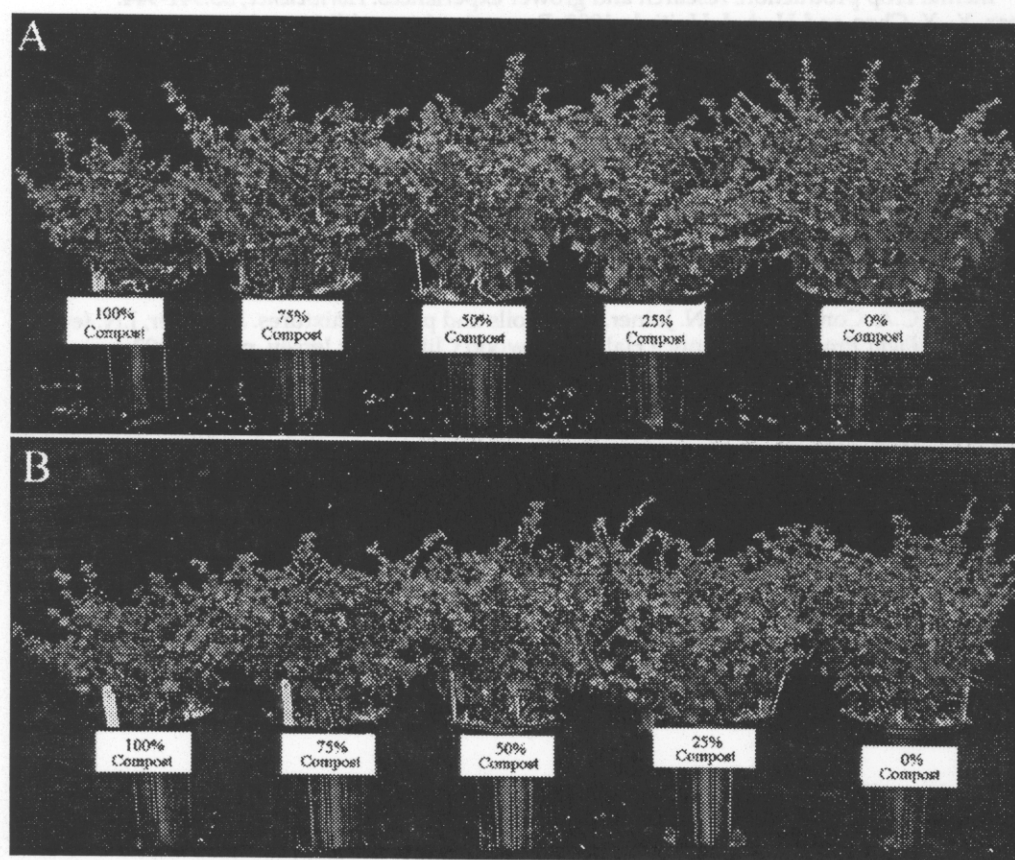


Figure 1. Effects of medium composition on growth of *Cuphea hyssopifolia* 8 weeks after planting. Compost (biosolids and yard trimmings) was amended with 0, 25, 50, 75, or 100% (by vol.) commercial peat-based (A) or coir-based (B) media.

In conclusion, peat- or coir- based media amended with yardwaste/biosolid compost produced marketable *Cuphea hyssopifolia* plants. However, plants grown in media with 75 or 100% compost were smaller than plants grown with 50% or less compost. Further investigations are needed to improve media amended with large volumes of compost. With increasing substrate cost, particularly peat, and increasing supplies of commercially available horticultural grade compost, new compost-amended media could be an economical advantage to traditional peat or coir-based media.

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