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WASTE COMPOSTS AS COMPONENTS OF CONTAINER SUBSTRATES FOR ROOTING FOLIAGE PLANT CUTTINGS

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Abstract. **Waste composts have been used as components of potting media for the production of bedding, foliage and landscape plants. However, limited information is available on the use of composts as components of media for rooting foliage plant cuttings. In this study, three representative composts: (1) municipal solid waste with biosolids, (2) yard trimmings and (3) yard trimmings with biosolids, each in percent combinations with sphagnum peat and pine bark were used to formulate 13 media, in which African violet leaf cuttings, Croton, *Dracaena sanderiana* and *Schefflera* tip cuttings, Christmas cactus offshoots and Pothos eye cuttings were rooted. Based on root tip number of Christmas cactus and *Dracaena sanderiana* and root-ball coverage ratings of African violet, Croton, *Schefflera* and Pothos, it was found that the degree of rooting is inversely related to soluble salt levels of these media. Results also suggested that several compost-formulated media can provide equal or better rooting environments than a pine bark/sphagnum peat control medium.**

Waste composts amended into soils have been shown to increase yields of field crops, fruits and vegetables (Ozores-Hampton et al., 1998; Shiralipour et al., 1992; Smith, 1995). Waste composts have also been used for growing bedding (Klock, 1997; Logan and Lindsay, 1996), landscape (Beeson, 1996; Jarvis et al., 1996) and tropical foliage plants (Chen and Robinson, 1999; Conover and Poole, 1990; McConnell and Shiralipour, 1991). However, limited information is available on the use of waste composts as components of media for rooting foliage plant cuttings.

The objectives of this study were (1) to formulate rooting media using different types and percentages of waste composts in combination with sphagnum peat and pine bark, (2) to determine if certain chemical properties attributable to compost addition would affect the rooting capability of different foliage plant cuttings, (3) to identify compost-formulated media equal or superior to a pine bark/sphagnum peat control medium.

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Materials and Methods

Three representative composts: (1) MSW/BS, two parts municipal solid waste mixed with one part biosolids based on weight, (2) YT, yard trimmings, and (3) YT/BS, three parts YT mixed with two parts BS based on weight, each in combination with sphagnum peat and pine bark were formulated to obtain the following 13 potting media: (1) UF-2 potting mix (Poole et al., 1981): 50% sphagnum peat (SP) and 50% pine bark (PB) as a control, (2) 40% SP + 40% PB + 20% MSW/BS, (3) 25% SP + 25% PB + 50% MSW/BS, (4) 10% SP + 10% PB + 80% MSW/BS; (5) 40% SP + 40% PB + 20% YT, (6) 25% SP + 25% PB + 50% YT, (7) 10% SP + 10% PB + 80% YT, (8) 40% SP + 40% PB + 20% YT/BS, (9) 25% SP + 25% PB + 50% YT/BS, (10) 10% SP + 10% PB + 80% YT/BS; (11) 32% SP + 32% PB + 12% MSW/BS + 12% YT + 12% YT/BS, (12) 20% SP + 20% PB + 20% MSW/BS + 20% YT + 20% YT/BS, and (13) 8% SP + 8% PB + 28% MSW/BS + 28% YT + 28% YT/BS.

After the determinations of soluble salts, total carbon to total nitrogen ratio (C/N), cation exchange capacity (CEC) and pH of each medium, two experiments were carried out: (1) Experiment one: Offshoots of *Zygocactus truncatus* 'White Fantasy' and shoot cuttings of *Dracaena sanderiana* 'Gold' were stuck in 4" (10.1 cm) pots containing the 13 media. Seventeen days after sticking, total number of root tips was counted. (2) Experiment two: Leaf cuttings of *Saintpaulia ionantha* 'Cenesse', shoot cuttings of *Codiaeum variegatum* 'Petra' and *Schefflera arboricola* 'Hong Kong', and single eye cuttings of *Epipremnum aureum* 'Marble Queen' were stuck in 4" pots. One month after sticking, percent root-ball coverage was determined based on the following rating scales: 1 = 0 to 20%, 3 = 41 to 60% and 5 = 81 to 100% root coverage.

The experiments were conducted in an 80% shaded greenhouse with a light intensity of 470 $\mu mol \cdot m^{-2} \cdot s^{-1}$ (2,500 foot candles) and arranged in a completely randomized design with four replications. No fertilizer was applied, but pots were watered daily to maintain a moisture level of approximately 90%.

Results and Discussion

Soluble salt levels, C/N ratio, CEC and pH of the 13 media were presented in Table 1. In general, as compost percentage increased, soluble salts, pH and CEC increased. The C/N ratio is often related to compost maturity and matured composts should have a range between 15 and 25 (Ozores-Hampton et al., 1998). The C/N ratios of the 13 media, presented in Table 1, were within the desired range (15-25) except media 1 and 2, which were slightly below 15. Heavy metals were not a concern in these media because the concentrations of Cd, Co, Cr, Cu, Hg, Mo, Ni, Pb and Zn were below the EPA's maximum permissible levels (data not shown).

The average number of root tips initiated from Christmas cactus offshoots varied significantly among media (Table 2); but there was no significant difference in the number of *D. sanderiana* root tips. Media 2, 5, 6, 8 and 11 produced numbers of Christmas cactus root tips comparable to those of pine

Table 1. Soluble salts (µmhos/cm), C/N ratio, cation exchange capacity (meq/100g) and pH of the compost, sphagnum peat and pine bark formulated media[z].

	Medium No.[y]												
Property	1	2	3	4	5	6	7	8	9	10	11	12	13
Soluble salts	158	787	2723	5247	518	1807	2850	1342	5757	9117	1428	3130	4623
C/N	14.3	13.2	18.7	27.5	24.5	22.6	24.9	16.8	18.1	18.0	24.0	24.8	20.4
CEC	3.9	7.7	14.4	15.7	5.3	13.5	15.4	11.9	24.0	32.1	12.5	19.2	21.8
pH	3.7	3.8	6.7	7.9	4.4	5.8	6.9	5.1	5.7	5.4	4.6	5.9	7.2

[z]Analyzed by Agro Services International, Inc., Orange City, FL.
[y]Potting media (1): 50% SP + 50%PB, (2) 40% SP + 40% PB + 20% MSW/BS, (3) 25% SP + 25% PB + 50% MSW/BS, (4) 10% SP + 10% PB + 80% MSW/BS; (5) 40% SP + 40% PB + 20% YT, (6) 25% SP + 25% PB + 50% YT, (7) 10% SP + 10% PB + 80% YT, (8) 40% SP + 40% PB + 20% YT/BS, (9) 25% SP + 25% PB + 50% YT/BS, (10) 10% SP + 10% PB + 80% YT/BS; (11) 32% SP + 32% PB + 12% MSW/BS + 12% YT + 12% YT/BS, (12) 20% SP + 20% PB + 20% MSW/BS + 20% YT + 20% YT/BS and (13) 8% SP + 8% PB + 28% MSW/BS + 28% YT + 28% YT/BS.

Table 2. Average number of root tips initiated from *Zygocactus truncatus* 'White Fantasy' and *Dracaena sanderiana* 'Gold' cuttings 17 days after sticking in the compost, sphagnum peat and pine bark formulated media.

	Medium No.[z]												
Cuttings	1	2	3	4	5	6	7	8	9	10	11	12	13
Z. truncatus	5.4	5.0	3.6	3.4	5.2	5.0	3.0	5.0	3.9	2.5	5.1	3.9	3.6
D. sanderiana	11.0	10.6	8.1	10.1	8.8	10.8	10.8	10.6	9.5	11.4	12.6	8.8	6.9

[z]For medium compositions see Table 1.

bark/sphagnum peat control medium, all of which had relatively low soluble salt levels. These results suggest that initial rooting of Christmas cactus is affected to a greater degree by soluble salt levels than *D. sanderiana.*

Media with root-ball coverage ratings comparable to the control were 6 and 11 for African violet, 5, 6, 8 and 11 for Croton, 5, 8 and 11 for Schefflera and 2, 5, 6, 7, 8, 11 and 12 for Marble Queen (Table 3). These data did not completely agree with the expected relationship of low soluble salts resulting in a high percentage of root-ball coverage, but did demonstrate that soluble salt levels were a major factor influencing initial root formation and growth in compost-formulated media.

No media C/N ratio in this study affected rooting. Medium pH was not considered to be a major factor, as root initiation and growth were not significantly or consistently affected by pH above or below the recommended range of 4.5 to 6.5 (Joiner et al., 1981). Several media with pH readings of approximately 5.0, such as media 9 and 12, did not promote good rooting.

Media 3, 4, 7, 9, 10, 12 and 13 containing high percentages of composts had soluble salt levels higher than 2,000 µmhos·cm^{-1} and root initiation and root ball coverage in these media were generally poor. It appeared that the degree of rooting in these compost-formulated media was predominately affected by soluble salt levels rather than by pH and C/N ratios. Whether or not CEC alone influenced rooting was not distinguishable in this study because of the interrelationship between CEC and soluble salt levels. Media 2, 5, 6, 8 and 11 were most comparable to, and in some plant species superior to, the experimental control in promoting rooting of foliage plant cuttings.

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Table 3. Root-ball coverage rating of *Saintpaulia ionantha* 'Cenesse', *Codiaeum variegatum* 'Petra', *Schefflera arboricola* 'Hong Kong', *Epipremnum aureum* 'Marble Pothos' cuttings one month after rooting in the compost, sphagnum peat and pine bark formulated media.

	Medium No.[z]												
Cuttings	1	2	3	4	5	6	7	8	9	10	11	12	13
S. ionantha	3.5	1.9	1.5	1.4	2.5	4.0	2.9	3.0	1.5	1.0	5.0	2.5	1.5
C. variegatum	3.8	2.0	1.5	1.3	3.8	3.0	1.0	3.5	1.5	1.3	3.3	1.3	1.1
S. arboricola	3.5	3.0	2.0	1.0	5.0	2.7	2.8	4.0	1.8	2.2	4.3	3.0	2.3
E. aureum	3.4	3.4	1.6	1.5	3.4	3.5	3.3	5.0	2.0	2.4	3.0	3.3	1.8

[z]For medium compositions see Table 1.

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A PEER REVIEWED PAPER

PATHOGENICITY OF THE FERN ANTHRACNOSE FUNGUS, *COLLETOTRICHUM ACUTATUM*, ON WILD AND CULTIVATED FERNS IN FLORIDA

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Abstract. **The fern anthracnose pathogen *Colletotrichum acutatum*. H. Simmonds is now well-established in leatherleaf fern production systems throughout Central Florida. Fern anthracnose is the most significant disease that affects leatherleaf fern production. In controlled-environment experiments, *C. acutatum* was also found to infect several wild fern species which occur in natural habitats near fern production systems; some of these ferns are regarded as weeds, or potential weed species. Thus far, however, the fungus has not been detected on susceptible wild fern species growing in their natural habitats. Several, but not all, cultivated fern species which are likely to be produced by horticulturists for planting in Florida landscapes were also tested and found to be susceptible to fern anthracnose. Infection of both wild and cultivated fern species resulted in varying levels of disease damage which depended greatly on the growth habit of the species. As the pathogen can be easily spread by workers or equipment during outdoor nursery production and, to a lesser degree, in greenhouse facilities, these results indicate potential disease hazards for cultivated ferns and identify possible sources of inoculum and opportunities for the survival and persistence of *C. acutatum* in the absence of its primary host.**

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Leatherleaf fern (*Rumohra adiantiformis* [Forst.] Ching) is produced extensively in Central Florida for cut foliage. Approximately 1,738 ha (4,295 acres) of leatherleaf fern were grown in 1997; the estimated annual wholesale value was over $57 million (U.S. Dept. Agr., Fla. Agr. Stat. Serv., 1998). About two-thirds of the production is artificially shaded (60-80% shade) with polypropylene shade fabric, and the remainder is naturally shaded by trees (Stamps, 1992, 1995). Both types of production systems are commonly interspersed with, or surrounded by, patches of natural vegetation. Most plantings are maintained for several years (Stamps, 1992). Ferns grow all year long and mature leaves are periodically harvested in response to market requirements.

In 1994, a new anthracnose disease appeared which was incited by a pathotype of *Colletotrichum acutatum.* Since its appearance, fern anthracnose has caused large economic losses (Leahy et al., 1995; Stamps et al., 1997). Presently, anthracnose can be managed, but the costs of control are high and the amounts of fungicide used to control the disease might lead to environmental problems (Stamps et al., 1997; Strandberg et al., 1997).

Disease management is the best approach to reducing fungicide use and is quite feasible in both greenhouses and cut foliage production. Many management tactics such as mowing severely diseased foliage then applying intensive fungicide programs and applying strict sanitation procedures are now widely used to manage fern anthracnose including appropriate cultural activities. However, to effectively manage anthracnose, it is important to understand how the pathogen can be introduced into production systems and to avoid these events (Stamps et al., 1997; Strandberg et al., 1997). The ability of the pathogen to survive and persist outside the host (for example, survival in soil or plant debris) is an additional con-