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ASSESSMENT OF SEWAGE SLUDGE COMPOST MIXTURES AS CONTAINER GROWING MEDIA[1]

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Abstract. **The ability of 2 separate sewage sludge composts, one produced in Maryland using the Beltsville aerated-pile technique and one produced in Florida using the windrow procedure, to serve as soil-less potting media for woody ornamental plants was assessed by comparing plant growth in these 2 materials with growth in 2 commercially available potting mixes, a 4 Florida peat: 4 sawdust: 2 sand (v:v:v) and a 5 Florida peat: 4 cypress chips: 1 sand (v:v:v). Five individuals each of dwarf oleander** (Nerium oleander **L.), ligustrum** (Ligustrum japonicum **Thunb.), cocoplum** (Chrysobalanus icaco **L.) and pittosporum** (Pittosporum tobira **Thunb.) were grown for 7 months in 25-cm diameter containers in each of the 4 potting mixes and in mixtures of each compost to each commercial medium of 50:50, 30:70, and 10:90 (v:v), for a total of 16 different potting mix combinations. Growth was evaluated by means of a size index and at the end of the production period there were no significant differences or only slight differences in size in ligustrum, cocoplum and pittosporum attributable to the potting mix. The dwarf oleander, however, exhibited significantly faster growth in the sludge compost mixes as compared to the commercial mixes.**

Selection of a correct medium for optimum plant growth is one of the most important aspects of container plant production. Most potting mixes have fundamental similarities in that they consist of organic and inorganic components. These components and their relative ratios may be adjusted to achieve the desired growing environment as defined by bulk density, water-holding capacity, pH level, soluble salt level, and other parameters (1, 4).

In Florida, the organic component of potting mixes has consisted of materials such as sphagnum peat moss, sawdust, wood chips, and muck (also called Florida peat). In recent years growers have been experiencing varying amounts of difficulty in procuring adequate supplies of these materials at reasonable prices. As a result, significant attention has been given to finding suitable substitutes for some of the traditional organic constituents of potting mixes.

One substitute that has shown considerable promise is composted sewage sludge. Sewage sludge, the solid by-product of sewage treatment, is available in copious quantities in virtually all urban areas. In raw forms, sludges are very unstable mixtures of organic substances that have objectionable odors and may contain high concentrations of pathogenic bacteria and viruses as well as other hazardous and undesirable materials. Careless disposal of sludges can cause serious water pollution problems, but detoxification and conversion of sludges into humus through high temperature composting can be an environmentally acceptable and economically attractive recycling procedure.

There are 2 basic procedures used in composting sewage sludge, the windrow procedure (3) and the Beltsville aerated-pile method (5). Both methods involve production of high temperatures (>55°C) through aerobic microbial activity and both procedures produce composts that are physically stable with a rich, humus-like appearance. Composts made by either method have been used successfully as potting mixes (2, 6), but there are no comparisons reported in the literature on relative performance of composts made by either method. The objectives of this research were to determine the relative performance of sludge composts made by the 2 methods, and to determine the relative performance of blends of sludge compost and traditional, standard types of potting mixes in influencing growth in container grown plants.

Materials and Methods

Liners of dwarf oleander, ligustrum, cocoplum, and pittosporum were potted in 25-cm diameter (3 gal) black plastic containers. One sludge compost was obtained from Maryland Environmental Service, Annapolis, MD, and had been composted, with wood chips as the bulking agent, by the Beltsville aerated-pile technique at the Dickerson Interim Facility in Montgomery County, Maryland (5). After composting, the wood chips were removed by screening. The second sewage sludge compost medium was obtained from the Broward County Streets and Highways Division. This material had been composted, using wood chips as the bulking agent, by the windrow technique at the Division's composting facility in Pompano Beach, Florida. After composting, the wood chips were removed with a Royer® separator. The 2 commercial potting mixes, a 4 Florida peat: 4 sawdust: 2 sand (v:v:v) (PmA) and a 5 Florida peat: 4 cypress chips: 1 sand (v:v:v) (PmB) were purchased from commercial vendors. In addition to the 4 potting mixes described, mixtures of the 2 sludge compost and the 2 commercial mixes were made at the following ratios, based on volume: 50:50, 30:70, and 10:90, for a total of 16 different media mixture combinations. The ratios of mixes are given in the tables.

Plant growth was evaluated at approximately 6-wk intervals, through the use of a size index in which plant height and average width (in centimeters) were measured and summed. The analysis of variance was employed to determine any effect on growth attributable to media composition, and the Tukey multiple comparison test was used to achieve mean separation.

Results and Discussion

Growth of ligustrum as influenced by composition of potting medium is shown in Table 1. Statistical evaluation supported no significant effect on growth; all media and media combinations exhibited comparable results.

In pittosporum, there were only 2 media mixtures that supported significantly slower plant growth: PmB full strength and the 50:50 mixture of the compost made in Florida (windrow procedure) (Table 2). All other mixtures supported growth that was not significantly different.

Cocoplum exhibited variable growth patterns, but most compost-commercial potting mix combinations produced growth that was comparable to or superior to growth seen in the 2 standard, commercially available mixes (Table 3).

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Table 1. Growth of ligustrum (*Ligustrum japonicum*) as influenced by potting media amended with composted sewage sludge.

Growing medium[z]	Avg. size index (plant height plus average width) (cm)[y]					
	8-10-82	9-23-82	11-2-82	12-13-82	2-3-83	3-17-83
Compost M, full strength	25.4 a	31.6 a	50.6 a	73.8 a	83.4 a	94.8 a
Compost M: Pm A, 50:50	25.0 a	34.2 ab	63.2 abc	81.0 a	97.0 a	99.0 a
Compost M: Pm B, 50:50	25.0 a	34.4 ab	60.6 abc	79.6 a	89.6 a	91.4 a
Compost M: Pm A, 30:70	25.6 a	35.8 ab	63.2 abc	78.0 a	84.0 a	88.0 a
Compost M: Pm B, 30:70	26.0 a	38.2 ab	59.6 abc	78.2 a	87.2 a	95.6 a
Compost M: Pm A, 10:90	25.0 a	37.2 ab	58.4 abc	76.6 a	86.6 a	91.2 a
Compost M: Pm B, 10:90	26.6 a	39.6 ab	62.4 abc	79.0 a	82.6 a	87.6 a
Compost F, full strength	24.0 a	33.6 ab	60.4 abc	76.6 a	80.0 a	83.2 a
Compost F: Pm A, 50:50	25.2 a	32.4 a	62.4 abc	86.2 a	89.8 a	94.0 a
Compost F: Pm B, 50:50	27.4 a	39.8 ab	65.6 abc	78.8 a	85.8 a	88.2 a
Compost F: Pm A, 30:70	24.4 a	38.0 ab	56.8 ab	72.6 a	80.0 a	81.4 a
Compost F: Pm B, 30:70	26.6 a	40.4 ab	64.8 abc	80.6 a	89.8 a	90.8 a
Compost F: Pm A, 10:90	27.4 a	40.6 ab	74.4 c	86.8 a	90.8 a	95.2 a
Compost F: Pm B, 10:90	25.4 a	40.4 ab	65.0 abc	82.8 a	84.8 a	84.2 a
Pm A, full strength	26.0 a	40.0 ab	64.4 abc	84.8 a	89.2 a	92.4 a
Pm B, full strength	27.6 a	43.8 b	70.2 bc	86.0 a	93.2 a	96.6 a

[z]Each media mix combination, where shown, is based upon volume. Compost M is sewage sludge compost made in Montgomery County, Maryland; Compost F is sewage sludge compost made in Broward County, Florida; Pm A is a commercially available potting mix composed of 4 Florida peat: 4 sawdust:2 sand (v:v:v); and PmB is a commercially available potting mix composed of 5 Florida peat: 4 cypress chips:1 sand (v:v:v).
[y]Each value is the average of 6 determinations. Mean separation within columns by Tukey's HSD procedure, 5% level.

Table 2. Growth of pittosporum (*Pittosporum tobira*) as influenced by potting media amended with composted sewage sludge.

Growing medium[z]	Avg. size index (plant height plus average width) (cm)[y]					
	8-10-82	9-23-82	11-2-82	12-13-82	2-3-83	3-17-83
Compost M, full strength	21.6 a	20.8 a	28.4 ab	40.8 abc	51.4 ab	50.8 abc
Compost M: Pm A, 50:50	24.0 a	26.8 a	34.8 ab	44.8 abc	52.2 ab	53.8 abc
Compost M: Pm B, 50:50	21.4 a	23.6 a	35.0 ab	46.4 ab	56.0 a	58.2 a
Compost M: Pm A, 30:70	26.4 a	24.6 a	33.2 ab	42.6 abc	50.4 ab	56.8 ab
Compost M: Pm B, 30:70	22.0 a	27.0 a	35.6 ab	48.6 a	46.0 ab	54.0 abc
Compost M: Pm A, 10:90	22.4 a	24.8 a	31.2 ab	40.8 abc	47.6 ab	48.4 abc
Compost M: Pm B, 10:90	23.8 a	22.0 a	32.0 ab	42.4 abc	45.8 ab	47.4 abc
Compost F, full strength	22.8 a	22.6 a	28.6 ab	37.4 abc	48.6 ab	52.4 abc
Compost F: Pm A, 50:50	24.0 a	22.0 a	27.2 ab	32.2 c	44.2 ab	46.0 abc
Compost F: Pm B, 50:50	21.6 a	21.6 a	31.4 ab	38.8 abc	46.2 ab	52.0 abc
Compost F: Pm A, 30:70	24.4 a	20.2 a	24.0 b	34.2 bc	39.4 b	43.4 c
Compost F: Pm B, 30:70	26.4 a	25.8 a	34.4 ab	47.2 ab	50.4 ab	50.2 abc
Compost F: Pm A, 10:90	25.2 a	27.8 a	37.4 a	47.4 ab	53.2 ab	55.8 abc
Compost F: Pm B, 10:90	24.8 a	26.0 a	34.8 a	40.4 abc	46.2 ab	51.0 abc
Pm A, full strength	25.0 a	21.2 a	28.2 ab	39.0 abc	44.4 ab	47.6 abc
Pm B, full strength	24.2 a	21.2 a	28.8 ab	39.2 abc	45.0 ab	44.0 bc

[z]Each media mix combination, where shown, is based upon volume. Compost M is sewage sludge compost made in Montgomery County, Maryland; Compost F is sewage sludge compost made in Broward County, Florida; Pm A is a commercially available potting mix composed of 4 Florida peat: 4 sawdust:2 sand (v:v:v); and PmB is a commercially available potting mix composed of 5 Florida peat: 4 cypress chips:1 sand (v:v:v).
[y]Each value is the average of 6 determinations. Mean separation within columns by Tukey's HSD procedure, 5% level.

The most pronounced differences in growth attributable to potting media composition were seen in dwarf oleander (Table 4). Both composts used full strength resulted in faster growth than the standard, commercially available mixes and, in general, the mixtures of compost and standard potting mixes performed better with the higher ratios of compost.

In general, with all 4 plant species, sludge compost made in Florida by the windrow method performed equally well as a potting medium as did compost made in Maryland by the Beltsville aerated-pile method. Additionally, sludge compost performance as a potting mix, either alone or in combination with standard, commercially-available potting mixes, was quite favorable. Depending on the plant species tested, compost performance was equal to or superior to that of the standard potting mixes. Additional work to determine growth performance of sludge compost among a wider taxonomic range of plants will help define the extent to which compost products may be economically used in horticultural production.

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Table 3. Growth of cocoplum (*Chrysobalanus icaco*) as influenced by potting media amended with composted sewage sludge.

Growing medium[z]	Avg. size index (plant height plus average width) (cm)[y]					
	8-10-82	9-23-82	11-2-82	12-13-82	2-3-83	3-17-83
Compost M, full strength	21.6 a	32.6 a	51.8 a	71.0 a	81.4 a	82.0 a
Compost M: Pm A, 50:50	22.4 a	37.4 abc	64.0 abc	85.4 ab	95.4 abc	101.0 abcd
Compost M: Pm B, 50:50	25.8 a	44.6 abc	75.0 abc	99.4 b	103.0 abc	105.8 bcd
Compost M: Pm A, 30:70	22.8 a	39.0 abc	58.4 ab	84.4 ab	87.6 abc	90.6 abcd
Compost M: Pm B, 30:70	25.4 a	50.4 c	86.2 c	102.8 b	111.8 c	113.0 d
Compost M: Pm A, 10:90	26.6 a	45.8 abc	80.4 bc	101.8 b	105.6 abc	106.0 bcd
Compost M: Pm B, 10:90	23.4 a	40.0 abc	66.6 abc	85.8 ab	93.2 abc	93.4 abcd
Compost F, full strength	24.2 a	37.6 abc	63.2 abc	81.0 ab	86.0 ab	93.2 abcd
Compost F: Pm A, 50:50	21.6 a	36.6 ab	61.2 ab	83.2 ab	91.2 abc	92.8 abcd
Compost F: Pm B, 50:50	25.2 a	44.0 abc	73.2 abc	89.0 ab	91.2 abc	92.6 abcd
Compost F: Pm A, 30:70	22.0 a	40.8 abc	61.6 abc	81.0 ab	87.2 abc	89.0 abc
Compost F: Pm B, 30:70	24.6 a	47.6 bc	75.8 abc	98.4 b	105.4 abc	100.6 abcd
Compost F: Pm A, 10:90	23.8 a	47.6 bc	76.4 abc	102.4 b	107.2 bc	108.0 cd
Compost F: Pm B, 10:90	24.4 a	42.4 abc	66.2 abc	88.0 ab	86.4 ab	84.2 ab
Pm A, full strength	24.6 a	41.0 abc	68.8 abc	89.6 ab	94.6 abc	96.8 abcd
Pm B, full strength	25.2 a	46.2 bc	73.2 abc	89.0 ab	95.2 abc	97.0 abcd

[z]Each media mix combination, where shown, is based upon volume. Compost M is sewage sludge compost made in Montgomery County, Maryland; Compost F is sewage sludge compost made in Broward County, Florida; Pm A is a commercially available potting mix composed of 4 Florida peat: 4 sawdust:2 sand (v:v:v); and PmB is a commercially available potting mix composed of 5 Florida peat: 4 cypress chips:1 sand (v:v:v).
[y]Each value is the average of 6 determinations. Mean separation within columns by Tukey's HSD procedure, 5% level.

Table 4. Growth of oleander (*Nerium oleander*) as influenced by potting media amended with composted sewage sludge.

Growing medium[z]	Avg. size index (plant height plus average width) (cm)[y]					
	8-10-82	9-23-82	11-2-82	12-13-82	2-3-83	3-17-83
Compost M, full strength	34.6 a	53.8 a	77.6 a	94.0 a	103.4 a	107.4 a
Compost M: Pm A, 50:50	32.2 a	46.6 a	64.0 a	83.2 abc	90.0 defg	95.4 bcde
Compost M: Pm B, 50:50	35.2 a	50.2 a	69.4 a	90.6 ab	97.0 abcd	99.4 abcd
Compost M: Pm A, 30:70	33.0 a	53.8 a	75.8 a	94.5 a	101.0 abc	108.0 a
Compost M: Pm B, 30:70	35.8 a	47.4 a	67.0 a	88.8 ab	102.8 a	105.4 ab
Compost M: Pm A, 10:90	33.6 a	51.4 a	71.2 a	85.2 abc	94.0 abcdef	96.2 bcde
Compost M: Pm B, 10:90	33.8 a	53.8 a	73.0 a	93.2 a	94.4 abcde	100.4 abcd
Compost F, full strength	35.4 a	58.4 a	82.4 a	95.0 a	101.8 ab	103.2 ab
Compost F: Pm A, 50:50	32.2 a	52.2 a	75.2 a	89.2 ab	98.0 abcd	101.6 abc
Compost F: Pm B, 50:50	31.8 a	51.4 a	69.2 a	83.6 abc	90.6 cdefg	90.4 de
Compost F: Pm A, 30:70	33.4 a	45.8 a	61.2 a	75.2 c	82.4 g	87.8 e
Compost F: Pm B, 30:70	32.8 a	47.4 a	66.0 a	85.2 abc	90.2 defg	99.2 abcd
Compost F: Pm A, 10:90	33.6 a	47.8 a	66.2 a	79.4 bc	89.4 defg	95.4 bcde
Compost F: Pm B, 10:90	34.8 a	47.2 a	62.0 a	77.6 bc	83.6 fg	86.6 e
Pm A, full strength	33.0 a	47.2 a	63.4 a	85.3 abc	91.5 bcdefg	99.5 abcd
Pm B, full strength	32.8 a	47.0 a	60.8 a	78.8 bc	84.4 efg	91.2 cde

[z]Each media mix combination, where shown, is based upon volume. Compost M is sewage sludge compost made in Montgomery County, Maryland; Compost F is sewage sludge compost made in Broward County, Florida; Pm A is a commercially available potting mix composed of 4 Florida peat: 4 sawdust:2 sand (v:v:v); and PmB is a commercially available potting mix composed of 5 Florida peat: 4 cypress chips:1 sand (v:v:v).
[y]Each value is the average of 6 determinations. Mean separation within columns by Tukey's HSD procedure, 5% level.

Literature Cited

1. Dickey, R. D., E. W. McElwee, C. A. Conover, and J. N. Joiner. 1978. Container growing of woody ornamental nursery plants in Florida. Tech. Bul. No. 793, Inst. Food Agr. Sci., Univ. Florida, Gainesville. 122p .
2. Fitzpatrick, G. 1981. Evaluation of potting mixes derived from urban waste products. Proc. Fla. State Hort. Soc. 94:95-97.
3. Foss, E. W. 1976. Composting for municipalities. Agr. Engineering Exten. Bul. No. 378. N.Y. State College of Agr. and Life Sciences. Cornell Univ., Ithaca, NY. 18p.
4. Joiner, J. N. and C. A. Conover. 1965. Characteristics affecting desirability of various media components for production of container-grown plants. Proc. Soil Crop Sci. Soc. Fl. 25:320-328.
5. Willson, G. B., J. F. Parr, E. Epstein, P. B. Marsh, R. L. Chaney, D. Colacicco, W. D. Burge, L. J. Sikora, C. F. Tester, and S. Hornick. 1980. Manual for composting sewage sludge by the Beltsville aerated-pile method. U.S. Environ. Protection Agency, Washington, DC. Tech. Rpt. EPA-600/8-80-022.
6. Wootton, R. D., F. R. Gouin, and F. C. Stark. 1981. Composted digested sludge as a medium for growing flowering annuals. J. Amer. Soc. Hort. Sci. 106:46-49.