and serology indicate a strain of CMV as the causal agent, but the identity does not correspond with other known strains; thus, it will be tentatively described as CMV-strain Sc. A literature search failed in finding any other instance of CMV infecting a member of the family Goodeniaceae.

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Proc. Fla. State Hort. Soc. 94:95-97. 1981.

EVALUATION OF POTTING MIXES DERIVED FROM URBAN WASTE PRODUCTS[1]

GEORGE FITZPATRICK
University of Florida, IFAS,
Agricultural Research and Education Center,
3205 S.W. College Avenue,
Fort Lauderdale, FL 33314

Additional index words. Composted sewage sludge, incinerator ash.

Abstract. **Experimental potting mixes derived from 4 different ratios of composted sewage sludge, sifted incinerator ash, and coarse sand were evaluated against a commercially available medium composed of peat, sawdust, and sand. Each mix was used to grow 3 species of plants, dwarf oleander** (Nerium oleander), **jasmine** (Jasminum volubile), **and ligustrum** (Ligustrum japonicum, **var.** rotundifolium). **Ten individuals of each species were grown in each medium in 3 gallon containers for a 5 month period. Growth was evaluated monthly by use of a size index based on plant height and average diameter. Jasmine grown in the compost based media were comparable to those grown in the peat, sawdust, and sand mixture after 5 months. Ligustrum and dwarf oleander grew significantly ($P < 0.05$) faster in the compost media than in the peat, sawdust, and sand mix. After 5 months, the latter plants grown in the compost averaged > 25% larger than those grown in the conventional medium.**

Of all the varied forms of agriculture, ornamental horticulture is particularly well suited for urbanized areas. Horticulture is less susceptible to pressure caused by increased land values and can benefit by close proximity to expanding markets. The location of many ornamental plant growing operations either in or close to rapidly urbanizing areas presents certain unique opportunities for the utilization of urban wasteproducts that could otherwise, if improperly disposed, cause environmental quality degradation. Waste products such as sewage sludge have become increasingly difficult to dispose of using conventional means such as landfilling (9) but there have been numerous instances of agricultural or horticultural uses for this type of material, such as in the growing of sod (8), field crops (7, 11), and in tree nurseries (6). There are, however, certain problems that have prevented the more rapid agricultural exploitation of sewage sludge. Among these are various levels of physical instability, particularly with liquid sludges, presence of pathogenic organisms, particularly in sludges which have not been heat-treated, and high levels of toxic substances, such as heavy metals that may be especially serious in the case of food-chain crops.

Most of these problems can be effectively managed by composting the sludge and using it to grow plants that are not intended for human or animal consumption. This points to the ready potential for use of composted sludge in growing ornamental crops.

Media selection is an important aspect of ornamental plant production. Potting media generally consist of various combinations of mineral components such as sand, organic matter such as peat, muck, bark or sawdust, and other components such as vermiculite or perlite. The actual components may not be important for most plants, providing that porosity, water-holding capacity, and cation-exchange capacity of the mix fall within certain ranges (1, 5).

Since sludges are, in general, labile putrescible materials (3) heterotrophic decomposition and humification must occur before they can be used as a soil component in agriculture. Composting accomplishes this through aerobic microbiological action and the ultimate breakdown product, compost, is a stable, humus-like substance suitable for many agricultural uses (2). The use of tree bark compost as a container media has been investigated (4), and the use of sewage-refuse compost as a mulch in field-grown ornamental plants has been reported (10). The production and availability of large quantities of sewage sludge in urban areas is coupled with the need to find appropriate and productive uses for it. This study was conducted to evaluate composted sewage sludge in various combinations with sifted

[1]Florida Agricultural Experiment Station Journal Series No. 3453 Mention of any trademark or product name does not constitute an endorsement by the University of Florida. This research could not have taken place without the kind generosity of Raymond Oglesby who donated plant material and nursery space. I am also grateful to William R. Farrell of the Broward County Tree Nursery for providing composted sewage sludge and sifted incinerator ash, Rick Stratton of Oglesby Nursery for logistic support, and to Nina Carter for her expert technical assistance.

incinerator ash and coarse sand as growth media for 3 species of container-grown ornamental plants.

Materials and Methods

Composted sewage sludge and sifted incinerator ash were obtained from the Broward County Tree Nursery and coarse sand and a peat, sawdust, sand mixture (6:4:1, determined by volume) were obtained from commercial sources. The sludge had been composted for ca. 30 days using the windrow method (2) and allowed to cure for ca. 8 months before combining with municipal incinerator ash, which had been sifted through coarse, 9.5 mm., screening (ca. 3/8" openings). The experimental media mixes consisted of sewage sludge compost, sifted incinerator ash, and coarse sand in the following ratios (determined by volume): 4:1:0, 4:1:5, 8:2:5, and 16:4:5. The peat, sawdust, sand (6:4:1) mix was used as a standard.

Liners of 3 species of plants, dwarf oleander (*Nerium oleander*), jasmine (*Jasminum volubile*), and ligustrum (*Ligustrum japonicum*, var. *rotundifolium*) were potted in 3-gallon pots (*J. volubile* is popularly known as "*J. simplicifolium*" and *L. japonicum*, var. *rotundifolium* is as popularly known as "*L. recurvifolia*" in the Florida horticultural trade). Ten individuals of each species were used in each of the 5 media mixes. Osmocote® 14-14-14 and Esmigram® micronutrients were applied to each container at recommended rates. All plants were grown in full sunlight and watered by an overhead irrigation system.

All plants were evaluated at 30-day intervals for a 5-month period, until the fastest growing plants reached market size. A size index was used in which plant height and average diameter were summed. The size index data were evaluated by the analysis of variance and the Tukey test was used to determine the confidence intervals of the mean values.

Results and Discussion

Growth rates for jasmine are indicated in Table 1. One of the experimental mixes (16:4:5) produced slightly slower growth than all the other media combinations. These differences were statistically significant ($P<0.05$) but were not great in a purely numerical sense in that the range from the lowest to the highest mean size index value was less than 7 cm (approximately 10% of the average size indices of the plants) after 5 months of growth.

Differences in growth were somewhat more pronounced in ligustrum (Table 2) and dwarf oleander (Table 3). In both species, the compost, ash (4:1) medium produced much faster growth than did the standard peat, sawdust, sand mixture. After 5 months of growth, the ligustrum and dwarf oleander in the compost ash media were both an average of 27% larger than those grown in the standard peat, sawdust, sand mix. The mixes of compost, ash, and sand were intermediate between the highest response produced by the compost, ash mixture and the lowest response produced by the standard peat, sawdust, sand medium. With the single exception of ligustrum grown in a compost, ash, and sand mix (4:1:5), the standard peat, sawdust, and sand medium yielded consistently slower growth ($P<0.05$) with dwarf oleander and ligustrum after 5 months than all of the compost mixes.

Table 1. Growth rates of jasmine, *Jasminum volubile*, in different media.

Medium (v:v:v)	Average size index (n=10)[z]				
	Apr.	May	June	July	Aug.
Compost, incinerator ash (4:1)	24.4a	29.8a	50.3a	63.8ab	79.3ab
Compost, incinerator ash, sand (4:1:5)	24.5a	28.8a	47.4ab	62.8abc	80.9ab
Compost, incinerator ash, sand (8:2:5)	26.5a	30.0a	43.9bc	59.6bc	78.1ab
Compost, incinerator ash, sand (16:4:5)	23.5a	28.2a	40.7c	56.9c	75.6b
Peat, sawdust, sand (6:4:1)	22.8a	31.6a	52.1a	68.1a	82.5a

[z]Size index determined by summing the height plus average diameter (from 2 measurements) of each plant. Means in a column not followed by the same letter are significantly ($P<0.05$) different as determined by the Tukey test.

Table 2. Growth rates of ligustrum, *Ligustrum japonicum*, var. *rotundifolium*, in different media.

Medium (v:v:v)	Average size index (n=10)[z]				
	Apr.	May	June	July	Aug.
Compost, incinerator ash (4:1)	28.1a	42.2a	65.0a	85.8a	105.0a
Compost, incinerator ash, sand (4:1:5)	27.8a	43.9a	58.0ab	74.9ab	89.5bc
Compost, incinerator ash, sand (8:2:5)	28.8a	41.1a	59.0ab	78.4ab	99.8ab
Compost, incinerator ash, sand (16:4:5)	26.9a	39.3a	55.9ab	77.3ab	93.3b
Peat, sawdust, sand (6:4:1)	21.8a	37.0a	52.0b	68.9b	83.1c

[z]Size index determined by summing the height and average diameter (from 2 measurements) of each plant. Means in a column not followed by the same letter are significantly ($P<0.05$) different as determined by the Tukey test.

Table 3. Growth rates of dwarf oleander, *Nerium oleander*, in different media.

Medium (v:v:v)	Average size index (n=10)[z]				
	Apr.	May	June	July	Aug.
Compost, incinerator ash (4:1)	36.9a	50.3a	83.6a	104.1a	121.4a
Compost, incinerator ash, sand (4:1:5)	37.9a	50.5a	80.3a	98.1ab	113.5b
Compost, incinerator ash, sand (8:2:5)	39.1a	46.9a	76.7ab	95.3b	111.9b
Compost, incinerator ash, sand (16:4:5)	38.1a	51.9a	83.1a	102.5ab	119.2ab
Peat, sawdust, sand (6:4:1)	32.9a	47.1a	68.6b	84.2c	95.3c

[z]Size index determined by summing the height and average diameter (from 2 measurements) of each plant. Means in a column not followed by the same letter are significantly ($P<0.05$) different as determined by the Tukey test.

None of the media treatments produced any chlorosis or other problems in any of the 3 plant species tested. Reports of chlorosis problems with plants grown in sewage-refuse sludge compost in other experiments have generally been attributed to decomposition of the compost in the container (10). Thorough, complete composting, followed by adequate curing, as was done with the media used in this research, should minimize or eliminate any chlorosis problems.

With the increasing awareness of the utility of sewage sludge compost as a medium for container-grown ornamental plants that is capable of producing results comparable to or better than standard peat-based media, questions of availability become more important. In Broward County, Florida, (where this research was conducted), 17,020 yd^3 of heat-treated sewage sludge, 25,985 yd^3 of dried but not heat-treated sewage sludge, and 140,594 yd^3 of liquid sewage sludge were produced in 1979 by nearly 100 sewage treatment plants (9). Liquid content of heat-treated sludge is ca. 75%, dried sludge ca. 65% and liquid sludge ca. 98%, so if all of this material were composted a total of 26,937 yd^3 of compost (ca. 40% liquid) could be produced in one year. It seems very likely that local or regional horticultural uses would have little difficulty in exploiting this resource.

Increased utilization of urban wasteproducts such as composted sewage sludge in ornamental horticulture would have numerous benefits. It would insure growers of a readily-available, locally-produced, inexpensive, humus-like material which would produce adequate or superior growth characteristics for many ornamental crops. It would also eliminate many of the disposal and potential pollution problems associated with urban sludge lagoons and landfills. The composting process converts raw sludges into a product that is easy to handle, stable, and safe. Research results in this and other studies support its expanded use in ornamental horticulture.

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Proc. Fla. State Hort. Soc. 94:97-99. 1981.

SHIFTING PRODUCTION AND CONSUMPTION PATTERNS IN THE TROPICAL FOLIAGE PLANT INDUSTRY[1]

CECIL N. SMITH
University of Florida, IFAS,
Food and Resource Economics Department,
Gainesville, Florida 32611

Additional index words. foliage trends, foliage consumption, foliage production trends, marketing foliage plants.

Abstract. **Despite the rapid rise in foliage plant production and consumption during the early and mid-1970s, the real value of foliage plants produced in the United States has been declining since 1977. Despite a continuation of the upward trend in terms of current dollars, industry sales have been trending downward for the past three years when measured in terms of money of constant value. Although there was a rise from 96¢ in 1970 to $3.99 in 1980 in estimated per capita consumption valued in constant 1980 dollars, a high of $5.28 was reached in 1977. This was followed by a decline to $3.99 in 1980. Various reasons, including a decrease in construction of homes, apartments, commercial buildings and shopping centers, a shift in demand from foliage plants to potted flowering plants, and other factors, have been advanced to explain the recent drop in demand for foliage plants.**

During the decade of the 1970s the tropical foliage industry in the United States increased its size at a rate probably faster than that of any other sector of U.S. agriculture. Growth in the southern tier of states—Florida, California, and Texas—was also accompanied by industry expansion in some northern states.

A demand explosion for foliage plants in the '70s brought, in addition to a plethora of many new growers, fresh investment capital, new transportation and production input agencies, the organization of distribution agencies in terminal market centers to serve retail outlets in the surrounding area, an expansion in plant species, and a host of other changes. Among the other changes were the entry of conglomerates, the increased production of plant propagating material in the tropics, the entry of specialized plant stores as another retail marketing agency, the growth and marketing of larger plants for use in shopping malls, places of business, etc.

The purpose of this paper is to analyze production and consumption patterns for foliage plants in the United States. Also included is an analysis of the relationship between the consumption of foliage plants and other floricultural products and per capita disposable income.

Production Patterns

In terms of 1980 constant dollars, foliage plant production in the United States increased from $68 million in 1949 to a high of $381 million in 1977, but dropped to $296 million in 1980 (Table 1). The level in 1977 represented

[1]Florida Agricultural Experiment Stations Journal Series No. 3400.