Cooperative Extension Service
C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

Horticulture Research Note
Nov. 1997
HRN-12

Substituting Hawaii composts for peat in growing media for hibiscus

Julie Yogi[1], David Hensley[1], and James Hollyer[2]
[1]Department of Horticulture and [2]Department of Agricultural and Resource Economics

Sphagnum peat imported from Canada and the U.S. mainland has been the primary organic constituent of nursery mixes in Hawaii. As the cost of peat continues to increase, the interest in using compost produced in Hawaii in nursery media also increases. There are presently companies composting landscape debris on Hawaii, Kauai, Maui, and Oahu, and a company on Maui composts a mixture of sewage sludge and landscape debris.

Composted organic materials have been successfully used as a nursery container medium on the Mainland and in Europe and Australia. In Hawaii, acceptable growth and quality of several container-grown foliage species resulted when fresh or composted bagasse replaced one-third of the sphagnum peat used in potting medium (Uchida et al. 1979). Plant growth and quality were reduced at higher percentage of bagasse replacement.

The purpose of this study was to compare the growth of hibiscus produced in media containing various levels of locally produced composts.

Materials and methods

Rooted cuttings of Chinese hibiscus (*Hibiscus rosa-sinensis*) were planted in 4-inch pots using a media in which local composts were substituted for peat. The control mix consisted of 2:2:1 peat:perlite:soil. Green landscape debris composts from three Oahu producers and composted macadamia husk from the Big Island were substituted for Canadian sphagnum peat at 0% (control), 25%, 50%, or 100%. Each treatment was replicated five times. Nutrient content and pH of the composts and peat were analyzed by the CTAHR Agricultural Diagnostic Service Center. Each media was supplemented with 8.5 lb 18-6-12 Osmocote®, 1.7 lb Micromax®, and 5 lb dolomite per cubic yard.

Height measurements were taken on May 4 and 24, June 23, July 17, and September 29, 1995. The tops of the plants were harvested at the end of the study and fresh weights were measured. Total porosity was measured on May 24 using modified techniques described by Davidson and Mecklenburg (1991).

Results and discussion

The results of the nutrient and pH tests are presented in Table 1. Peat, as expected, was very acidic and low in nutrients. The pH and nutrient levels of the composts varied. The green landscape debris composts contained higher levels of nitrogen and other nutrients. This reflects incomplete composting; that is, the materials were not truly finished composts. These materials would have continued to compost and reduce in volume. Yard trimmings and debris that have completed the composting process will have a nitrogen content of about 1% to 3%. The macadamia husk compost was a finished compost as indicated by the nitrogen content.

This does not mean that the green landscape debris compost products cannot be used in a nursery media, however. They will provide a reasonable organic material for plant growth. Some of the nutrients contained in these composts would become available to the plants over time. Most of the nitrogen, however, is held in a very slowly released organic form. Plant damage from heat generated by continued aerobic composting would be unlikely in small nursery containers, because a much larger volume of material is required in order to gener-

Table 1. Nutrient content (ppm) and pH of organic materials used to grow hibiscus.

Compost	pH	Total N	P	Ca	Mg
green debris M	8.4	5.2	1.5	138.5	52.0
green debris A	6.7	4.1	4.0	30.5	13.5
green debris K	7.7	6.5	20.0	51.5	35.5
macadamia husk	6.1	1.6	0.0	9.0	11.0
peat (control)	4.1	0.3	2.5	4.5	3.0

Published by the College of Tropical Agriculture and Human Resources (CTAHR) and issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Charles W. Laughlin, Director and Dean, Cooperative Extension Service, CTAHR, University of Hawaii at Manoa, Honolulu, Hawaii 96822. An Equal Opportunity / Affirmative Action Institution providing programs and services to the people of Hawaii without regard to race, sex, age, religion, color, national origin, ancestry, disability, marital status, arrest and court record, sexual orientation, or veteran status.

Table 3. Fresh weights of hibiscus grown in media with various percentages of compost.

	Percent substitution for peat			
	0	25	50	100
Compost	Fresh weight at harvest (g)			
green debris K	61.0	57.3	56.5	48.0
green debris A	61.0	66.5	58.8	62.3
green debris M	61.0	53.0	51.5	45.3
macadamia husk	61.8	67.5	63.7	74.5

There were no statistical differences among any substitution levels for any of the materials.

Table 2. Porosity of media with various percentages of compost substituted for peat.

	Percent substitution for peat			
	0	25	50	100
Compost	Media porosity (%)			
green debris M	21.1	24.0	35.0	30.0
green debris A	21.1	31.3	35.4	39.1
green debris K	21.5	22.8	29.9	36.3
macadamia husk	21.5	30.2	22.9	25.6

There were no statistical differences among any substitution levels for any of the materials.

ate heat of decomposition in the materials tested.

Water-holding capacity and porosity of the media would be directly affected by the level of composting of the organic material. As organic materials compost, their particle size is reduced. Finished compost would have smaller particle size and therefore better water holding capacity.

Porosity

Porosity of organic materials is a concern for nursery growers for several reasons. The mix must have adequate large pore space to be well aerated for the roots. Excessively large pores decrease the amount of water the media can store. The particles of organic material may become smaller with time due to decomposition and can sift down in the pot, clogging the pores and reducing aeration. The material needs to be relatively stable to avoid this problem.

For outdoor production, container media should have large or drainable pore space of 20 to 30 percent of the volume (Ingram and Henley 1989). This range provides good aeration and water capacity and allows excess water to drain away.

Green landscape debris compost "A" was the coarsest compost tested, and this is reflected by the greater porosity in each level of substitution for peat (Table 2). This material would require additional irrigations if used as a high percentage of a container mix. Green landscape debris compost "K" would also require additional irrigation to maintain adequate moisture for the plants if the material were used as the primary organic material in a mix. The coarseness of these two materials reflects incomplete composting. Green landscape debris compost "M" and macadamia husk compost, both more completely composted, were within the desirable porosity range.

Growth

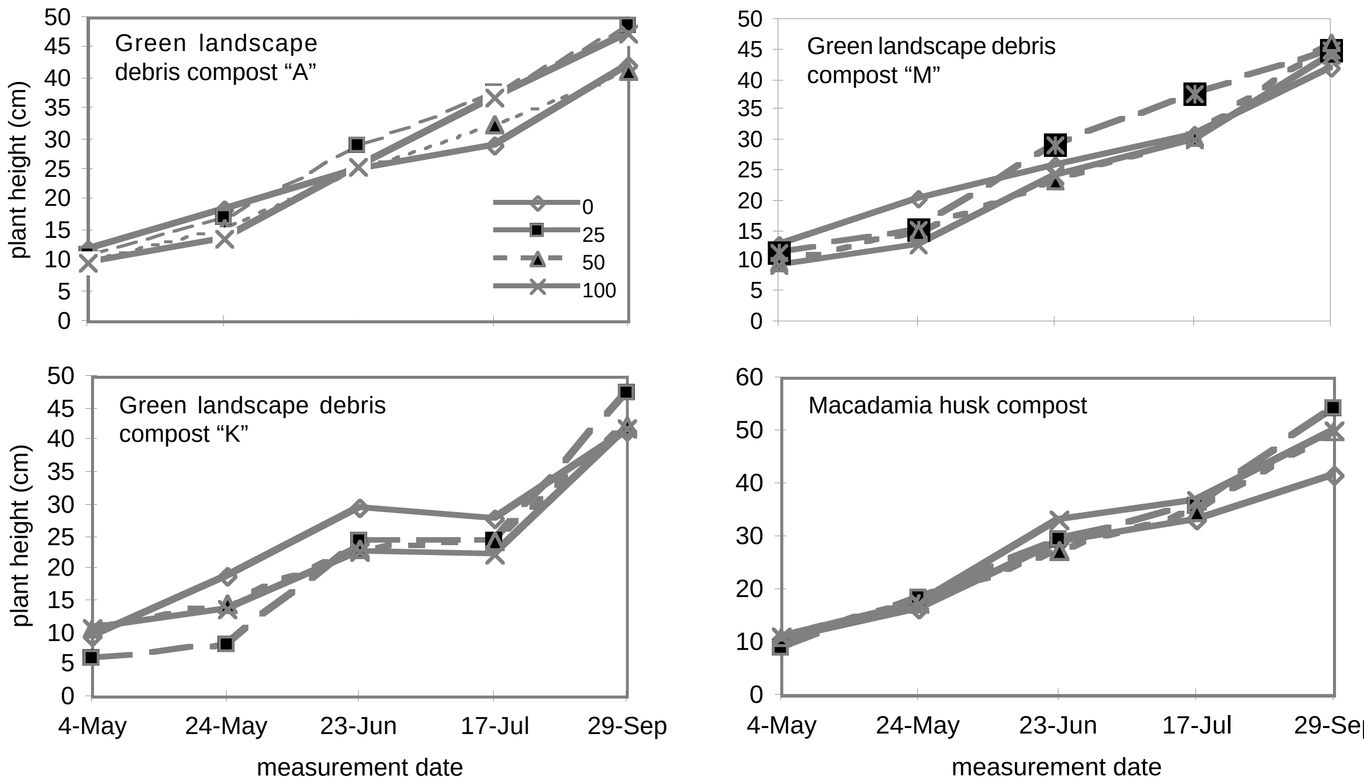
Hibiscus grew successfully in all media tested. There was no statistical difference in plant height during the course of this study among any of the levels of composts substituted for peat.

There were, however, noticeable differences in the fresh weights of the harvested plants at the end of the study (Table 3). There were no statistical differences among any substitution levels for any of the materials. Plant weights in media containing green landscape debris compost "M" were slightly less than the peat control at all levels. Compost "K" provided growth equivalent to the peat control except when used alone. The total size of the plants produced in the third green landscape debris and macadamia husk composts were equivalent or slightly greater than peat alone.

Conclusions

The goal of this study was to determine if locally produced composts could be substituted for peat in production of red hibiscus, a common landscape plant. The results indicate that growth of red hibiscus in media containing 25%, 50%, or 100% of the composts substituted for peat was comparable to peat alone. Two of the materials tested were coarse and would likely require more irrigation than finer-textured mixes if these materials were used alone or as a majority portion of the organic constituent. Research elsewhere has also indicated that

Figure 1. Hibiscus plant height grown either in peat (0), four compost materials (100), or peat-compost mixture at 25 or 50 percent compost substitution for peat.



compost can successfully replace at least some of the peat in nursery mixes

We do not mean to suggest from these results that growth or quality would be the same with every plant in a compost or compost-peat media. Do some experimentation in your operation to determine the suitability of a locally available organic material. Evaluate which level of substitution works best for particular plants, and compare cost and quality. Supplemental fertilization may also require some fine-tuning.

Research conducted in Hawaii and elsewhere indicates that there can be differences in the quality of compost. Variation can occur with batch, season, and changes in the raw inputs. Look particularly for a finished or mature product. Look at stability in particle size, pH, and soluble salts. Soluble salts of some composts can be quite high but can be reduced by leaching. Variation in batches of compost diminishes as producers gain experience and technology. Most composters in Hawaii have found stable sources of input material and are now producing a consistent product..

None of the composts tested would be suitable for producing certified nursery material for export. All of the materials are produced or stored on the ground and thus do not meet quarantine requirements for export. They appear, however, to have good potential for production of nursery stock for local consumption.

Literature cited

Davidson, H., and R. Mecklenburg. 1991. Nursery management: administration and culture. Prentice Hall.

Ingram, D., and R. Henley. 1989. Engineering a container growth medium. The Woody Ornamentalist 14(3), Univ. Florida Dept. Environ. Hort., Gainesville, FL.

Uchida, R., R. Criley, and F. Rauch. 1979. Substitution of bagasse for peat in growing mediums. Horticulture Digest No. 52. Dept. of Horticulture, University of Hawaii at Manoa, Honolulu, HI.