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Substitutions for peat in Hawaii nursery production

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Sphagnum peat is the primary organic component of container media in Hawaii. It is expensive and will become even more so as ecological concerns about current harvest methods continue to be raised. This problem is not unique to Hawaii, however. A number of researchers and nursery producers on the U.S. mainland are searching for peat substitutes as more composted organic products become available.

A number of organic materials have been successfully substituted for peat (Henley and Ingram 1989). Bagasse was tested in Hawaii as a peat substitute in 1978 (Uchida et al. 1979). Acceptable growth and quality were obtained only from replacing ⅓ of the peat with fresh or composted bagasse.

Replacement of 50% of the volume of peat in a standard nursery mix in Minnesota produced quality plants (Jarvis et al. 1996). An alkaline, stabilized blend of sewage sludge and peat blend gave growth comparable to Sunshine Mix® for three bedding plants (Logan and Lindsay 1996). Plants grown with up to 75% composted paper sludge from newsprint production grew as well as or better than plants grown in peat-amended media (Tripepi et al. 1996). Composted yard trimmings successfully substituted for peat in azalea and pittosporum media in Florida (Beeson 1996).

Coir pith and dust are the short fibers and dust remaining after the long fibers of coconut are extracted. High-quality coir pith appeared to be an acceptable substitute for sphagnum or sedge peat in soilless container media (Meerow 1995). Coir is already widely used in Europe and Australia. Fertilizer regimes and lime amendment will need to be adjusted if coir or any other organic material is substituted for peat.

We initiated a study to determine if several different organic materials might be substituted for peat in production of some nursery crops. Dwarf poinciana (ohai ali'i, *Caesalpinia pulcherrima*) seedlings were planted into 6-inch pots using various organic materials on December 11, 1995. The media was a 1:1 (v:v) mixture of organic material and medium perlite. The organic materials tested are listed in Table 1. Each test medium was amended with Osmocote® (18-6-12) at 143 g/ft^3 and 43 g/ft^3 of gypsum (calcium sulfate) as a source of calcium. Two controls using sphagnum peat were prepared, one with gypsum and the other with dolomitic lime. Plants were pruned to 10 inches at planting. Each treatment was replicated five times. Plant heights were measured on the following March 6, April 22, and May 30, and fresh weights were taken at the termination of the study. Porosities (air space) of the media were also measured.

Table 1. Organic materials used in media study.

Organic material	Description
Sphagnum peat with dolomitic lime	Control medium (dolomite as Ca and Mg source and pH adjustment)
Sphagnum peat with gypsum	Control medium (gypsum as Ca source)
Coir	Coco-peat™ (coir from Sri Lanka)
Composted municipal sewage waste (MSW)	Bagged product from rapid aerobic compost of MSW (from Japan)
Green waste compost	Green waste compost (from Oahu)
MSW+green waste compost	MSW mixed with green waste and composted together (from Maui)
Macadamia husk compost	Composted macadamia nut husk (from Big Island)

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Table 2. Average heights of dwarf poinciana seedlings grown with different organic materials.

Organic portion	Plant height (cm) March 6	April 22	May 30
peat with lime	14.3 ns	16.5 ns	21.5 ns
peat with gypsum	14.7	19.0	29.4
coir	15.2	21.0	30.0
MSW	13.1	17.6	37.0
composted green debris	14.0	23.0	35.8
composted MSW+green debris	16.6	20.4	32.0
macadamia husk compost	15.6	25.0	38.8

ns = no statistically significant differences between for plant heights within columns (5% probability level)

Table 3. Fresh weight at harvest of dwarf poinciana seedlings grown in various organic materials.

Organic portion	Fresh weight (g)	
peat with lime	14.3	a
peat with gypsum	27.5	ab
coir	33.4	b
MSW	42.4	b
composted green debris	31.6	b
composted MSW+green debris	35.8	b
macadamia husk compost	45.0	b

Means followed by the same letter are not significantly different when tested by Tukey HSD (5% probability level)

Porosity is the volume of the medium occupied by air after the container has been saturated with water and allowed to drain freely.

Plant growth

Growth of the dwarf poinciana seedlings was good in each test media over the duration of the study (Tables 2 and 3). There were no statistically significant differences among the different media at any measurement. Growth of the plants in both peat mixtures was less than that achieved by the other organic materials at the last measurement. The plants in the peat with lime media were noticeably smaller and less thrifty as indicated by fresh weight at the conclusion of the study (Table 3). The plants received no additional fertilization after planting. The plants were able to utilize the higher levels of nitrogen and other nutrients from the composts and coir as they became available.

Porosity

Porosity is a concern with organic materials to growers for several reasons. First, the mix must have adequate large pore space to be well aerated for the roots. Excessive large pores, however, 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. The porosity of all of the media tested was within the 20 to 30 percent range at both examination dates (Table 4).

All of the composted organic materials and coconut coir tested produced dwarf poinciana growth equal to or better than that of peat. The plants in the compost were larger than those grown in peat at the end of the 173 day study. This was undoubtedly due to the release of nitrogen and other nutrients from their organic sources. Peat contains less nitrogen than composts. Since we wanted to look at the effect of the media, we did not add supplemental fertilizer as would be done in nursery production. The plants in the peat, and other media as well, would have grown larger had supplemental fertilizer been added.

The goal of this study was to determine if coir, green landscape debris, and/or municipal composts could substitute for peat in production of a woody plant. The growth we saw indicated that any of the materials tested could be an alternative for peat moss to grow dwarf poinciana seedlings. We do not mean to suggest from these results that this may be the case with every plant. Do some experimentation with your material in your operation to determine the suitability of a substitute. There are a number of factors to consider.

Table 4. Porosity (%) of media containing various organic materials.

	Porosity (%)	
Organic portion	April 22	May 31
peat with lime	26.7 ns	22.5
peat with gypsum	20.8	19.4
coir	31.8	29.5
MSW	21.7	27.1
composted green debris	26.7	24.7
composted MSW+green debris	25.0	23.7
macadamia husk compost	20.1	23.2

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 stability in particle size, pH, and soluble salts. Research has also indicated that these materials can successfully replace at least some of the peat in nursery mixes. Variation in batches of compost diminishes dramatically as producers gain experience and technology. Most commercial composters in Hawaii have found stable sources of input material and are producing a consistent product.

If you are considering trying some of the locally available composted organic materials, do some experimentation. Compost and coir have different chemical and physical characteristics than peat. Adjust the amendments added to reflect the difference in pH. Supplemental fertilization may also require some fine-tuning.

None of the organic materials tested, with the possible exception of coir, 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.

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