Growth of *Dracaena marginata* and *Spathiphyllum* 'Petite' in Sphagnum Peat- and Coconut Coir Dust-based Growing Media[1]

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Abstract

A comparison was made of Canadian sphagnum peat (SP) and Philippine coconut (*Cocos nucifera* L.) coir dust (CD) as growing media components for greenhouse production of *Dracaena marginata* Bak. and *Spathiphyllum* Schott 'Petite'. Three soilless foliage plant growing mixes (Cornell, Hybrid, University of Florida #2 [UF-2]) were prepared using either SP or CD and pine bark (PB), vermiculite (V), and/or perlite (P) in the following ratios (% by vol): Cornell = 50 CD or SP:25 V:25 P, Hybrid = 40 CD or SP:30 V:30 PB, UF-2 = 50 CD or SP:50 PB. Dracaena root growth was not affected by treatments but there were significant mix × media component interactions that affected plant top growth parameters. In general, the growth and quality of *D. marginata* were reduced by using CD in Cornell, had no effect in Hybrid, and increased in UF-2. *S.* 'Petite' grew equally well in all growing mixes regardless of whether CD or SP was used; however, plants grew more in Cornell and Hybrid than in UF-2. *S.* 'Petite' roots, which were infested with *Cylindrocladium spathiphylli*, had higher grades when grown in CD than when the media contained SP.

Index words: *Cocos nucifera*, potting substrates, soilless media, pore space, water-holding capacity, sustainable agriculture, waste utilization.

Species used in this study: Madagascar dragon tree (*Dracaena marginata* Lam.); peace lily (*Spathiphyllum* Schott 'Petite').

Significance to the Nursery Industry

This study indicated that coconut coir dust can successfully be used as a substitute for sphagnum peat in three different growing media used for the production of *Spathiphyllum* 'Petite'. Coir dust may also reduce spathiphyllum root damage due to *Cylindrocladium spathiphylli*; however, further research is needed to confirm this. Results for *Dracaena marginata* show that the effects of substituting coir dust for sphagnum peat can be variable depending on specific crop and growing media combinations. Results also suggest that production of both of these crops in a peat:pine bark (50:50 by vol) mix like University of Florida #2 could be improved by substituting coir dust for sphagnum peat.

Introduction

Most potted tropical foliage plants for indoor use are grown in peat-based media, usually sphagnum peat (22). Sphagnum peat has desirable characteristics for use in soilless growing media including high cation-exchange and water-holding capacities, a structure that allows good aeration, and resistance to decomposition (19). However, peat is difficult to re-wet after it dries and when wet provides an environment that is conducive to fungus gnat development (13). Also, peat is a part of wetland ecosystems and some scientists have raised concerns about possible detrimental effects of peat harvesting (1, 2, 3). The peat industry's stand is that peat harvesting is not a factor, or only a minor factor, causing degradation and loss of wetlands (12, 23). However, there are other reasons to seek peat alternatives for use in horticulture. For example, peat supplies are limited at times of severe weather conditions and peat quality often varies, depending on source (14). Additionally, new substrate components may improve growth of foliage plants or reduce production costs compared to sphagnum peat.

Coconut (*Cocos nucifera* L.) coir dust is reported to have many characteristics that make it equal or superior to peat as a component in growing media (7, 8, 9, 15). To date, coir dust has been evaluated as an alternative to sphagnum peat for production of only a very limited number of tropical foliage plants—*Anthurium* 'Lady Jane' and *Ravenea rivularis* (16), and *Dieffenbachia* 'Camille' (25).

In 1993, the latest year for which there are adequate data, spathiphyllums and dracaenas were the first and fourth most popular indoor foliage plants, respectively, produced in Florida (24). Recommended growing media for these plants should be well-drained and have good aeration and possess a high water-holding capacity (10, 20). The purpose of our experiment was to evaluate the growth and quality of *Dracaena marginata* and *Spathiphyllum* 'Petite' in three foliage plant growing media containing sphagnum peat or coir dust.

Materials and Methods

Chemical and physical properties of these mixes have been reported previously (25). Cornell is based on the Cornell University foliage plant mix formula (17), UF-2 is University of Florida potted foliage plant mix 2 for greenhouse production (22), and Hybrid is a mix utilizing media components found in Cornell (vermiculite) and UF-2 (pine bark).

Coir dust (UniCoir, Laguna province, Luxon, Philippines) was prepared by rehydrating compressed blocks and hand mixing to break up any aggregates. Baled Canadian SP (Yel-

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low, Tourbe Blonde, 2:1 compressed, SOGEVEX, New Rochel, NY) was prepared for use with a shredder (Model M, Lindig Manufacturing, St. Paul, MN). Coarse horticultural vermiculite (Strong-Lite Products, Seneca, IL) and horticultural perlite (Aero-soil, Chemrock, a subsidiary of GREFCO, Torrance, CA) were used as supplied. Dolomite (Asgrow Florida, Plant City, FL) was added to all mixes at the recommended rate of 4.15 kg/m^3 (6.6 lb/yd^3) to supply calcium and magnesium (6).

Twenty-five cm (10 in) tall 48-cell-per-tray liners with two *Dracaena marginata* plants per cell were planted, one plug per pot, into 1.9 liter (0.5 gal) [15.2 cm (6 in) diameter] plastic pots (Green Maxi Grow Pot, REB Plastics, Orlando, FL) on February 22, 1995. Thirty cm (12 in) tall *Spathiphyllum* 'Petite' liners were transferred from 6.4 cm (2.5 in) rose pots and planted as indicated above on the same day. After potting, plants were spaced 25 cm (10 in) apart on raised benches in a glasshouse and watered in. Initially plants were hand-watered twice a week but as environmental conditions promoting evapotranspiration increased and the plants grew larger watering was increased to 3 times/week. Maximum photosynthetic photon flux in the greenhouse was 528 $\mu mol \cdot m^{-2} \cdot s^{-1}$ and the air was maintained between 18C (64F) and 32C (90F). Evaluations of dracaena and spathiphyllum growth were based on 10 single-plant replications in this randomized complete block design.

When potted, fertilizer containing micronutrients was applied as a top-dressing at the recommended rates of 6.4 g (0.23 oz) and 4.5 g (0.16 oz) of 17N–2.6P–10K (Sierra 17–6–12, Scotts, Milpitas, CA) per pot for dracaena and spathiphyllum, respectively (5). After 6½ weeks, plants were given weekly applications of 20N–8.8P–16.6K soluble fertilizer (Peters Florida 20–20–20, Scotts) with N at 600 mg/liter (600 ppm). Electrical conductivity and pH of the irrigation water were 0.38 dS/m and 7.3, respectively.

At 16 weeks after planting (June 6, 1995), most dracaenas had reached marketable size and were graded visually for appearance (size and color) where: 1 = very poor; 2 = substandard quality, unsalable; 3 = good quality, salable; 4 = very good quality, evenly green foliage; and 5 = excellent quality, large, dark green leaves. Height and widths (two, taken at right angles) of the aboveground portion of the plants were then measured and used to derive a plant top growth index (PGI) for each plant where PGI = [(width1 + width2) ÷ 2)] × height. Tops of the plants were cut at the soil line and weighed. Extent of white, healthy-looking roots covering the outside of the soil mass was visually evaluated, where: 1 = ≤20%; 2 = ≥20%≤40%; 3 = ≥40%≤60%; 4 = ≥60%≤80%; and 5 = ≥80% coverage. Root balls were removed from pots, loose medium was removed by hand and then root balls were gently agitated in a tub of water to remove additional medium. Finally, a stream of water was used to remove the remaining medium from the roots. Root systems were shaken and air-dried for 5 min to remove excess water and then weighed.

On June 27, 1995, spathiphyllum flowers were counted and harvested using hand clippers for fresh weight determinations. Spathiphyllum plants were ready for harvest and were rated on September 27, 1995, as described above.

Significance of main treatment and interaction effects were tested by analysis of variance and mean separations for growing mix (Cornell, Hybrid, UF-2) and media component (sphagnum peat, coir dust) were made using Duncan's new multiple range (P = 0.05) and t-test, respectively (SAS, SAS Institute, Cary, NC).

Results and Discussion

***Dracaena marginata*.**

There were significant growing mix (Cornell, Hybrid, UF-2) by media component (sphagnum peat, coir dust) interactions for all three indicators of plant top growth and total fresh plant weight, but not for root weight (Table 1).

Plant top growth index. For Cornell mix, the growth index was 15% larger when sphagnum peat was used than when coir dust was the main media component ($P \le 0.004$). The reverse was true for the UF-2 mix where the growth index

Table 1. Growth and plant grades of *Dracaena marginata* grown in three growing mixes prepared using either sphagnum peat or coconut coir dust.

Mix[z]	Media components (% by vol): Peat	Coir	Vermiculite	Pine bark	Perlite	Growth index[y] (cm^2)	Plant grade[x]	Fresh shoot weight (g)	Fresh plant weight (g)
Cornell	50	0	25	0	25	5200	4.6	138	224
	0	50	25	0	25	4536	4.0	129	205
Hybrid	40	0	30	30	0	4962	4.4	125	213
	0	40	30	30	0	5123	4.5	140	228
UF-2	50	0	0	50	0	4631	4.1	111	190
	0	50	0	50	0	5077	4.4	132	218
Significance									
Growing mix						NS	NS	*	NS
Media component (sphagnum peat or coconut coir dust)						NS	NS	*	NS
Growing mix × media component						***	**	**	*

[z]Cornell = Cornell University foliage plant potting mix, Hybrid = combination mix based on Cornell and UF-2, and UF-2 = University of Florida potted foliage plant mix 2.

[y]Plant growth index (in cm) = ((width 1 + width 2) ÷ 2) × height.

[x]1 = very poor; 2 = substandard quality, unsalable; 3 = good quality, salable; 4 = very good quality, evenly green foliage; 5 = excellent quality, large, dark green leaves.

[w]Nonsignificant (NS) or significant at $P \le 0.05$ (*), 0.01 (**), or 0.001 (***).

was 10% larger when coir dust was used compared to sphagnum peat ($P \leq 0.024$). Media component had no effect on dracaena growth index in the Hybrid mix. Comparing the three mixes when made with sphagnum peat, the growth index in the Cornell Mix was larger than in UF-2 ($P \leq 0.05$) and in the Hybrid Mix was intermediate and not different from the other two mixes. When coir dust was used, the index was larger for Hybrid and UF-2 than for Cornell ($P \leq 0.05$).

Plant top grade. Mean top grades for all treatments were very good and followed the same pattern as indicated above for plant top growth indexes. The use of coir dust lowered ratings in Cornell ($P \leq 0.031$), had no effect in Hybrid, and raised ratings in UF-2 ($P \leq 0.077$) compared to using sphagnum peat.

Fresh shoot weight. For Cornell mix, fresh shoot weight was the same using sphagnum peat or coir dust. However, weight was 12% and 19% heavier when coir dust was used in the Hybrid and UF-2 mixes, respectively ($P \leq 0.041$ and 0.001, respectively). When using sphagnum peat, fresh shoot weight of dracaena varied among mixes (Cornell>Hybrid>UF-2, $P \leq 0.05$). Fresh shoot weight was not different when using coir dust in all three mixes.

Plant root grades. There were no visually detectible differences in plant root grades.

Fresh root weight. Treatments had no effect on fresh root weight, suggesting that the volume of media in the pots may have been the limiting factor affecting root production (Table 1).

Fresh plant weight. Comparison of fresh plant weights using sphagnum peat versus coir dust in the three mixes showed no differences for Cornell or Hybrid. However, fresh weight in UF-2 mix was 15% heavier ($P \leq 0.005$) when using coir dust compared to using sphagnum peat. Fresh plant weight in all three mixes was equivalent when they contained coir dust; however, fresh weight in Cornell and Hybrid were heavier than that in UF-2 when sphagnum peat was used ($P \leq 0.05$).

Contrary to a previously reported companion study in which chemical and physical properties of these same mixes were determined and related to the growth of *Dieffenbachia* ‘Camille’ (25), dracaena growth differences were not associated with initial growing media nutrient contents or physical properties. For example, the coefficient of determination (r^2) for initial media water-holding capacities and mean fresh plant weights was very low (0.23). Since the growing media did become quite dry between waterings during the final experimental period because of the relatively large plant sizes and summertime conditions promoting high evapotranspiration, the non-effect of water-holding capacity was probably related to the xerophytic characteristics of dracaenas (11). Our conclusions are supported by Poole and Conover (21) who reported *Dracaena surculosa* Lindl. irrigated 2 or 4 times a week were not affected by watering frequencies whereas the other crops tested (*Cissus rhombifolia* Vahl and *Syngonium podophyllum* Schott) grew less when watered only twice a week. Finally, it should be noted that *D. marginata* grown in all mix and media component combinations were of high quality.

***Spathiphyllum* ‘Petite’.**

There were no significant interactions between main effects for any of the parameters measured.

Flowering. Treatments had no effect on flower numbers, weights or average flower weights (data not shown).

Plant top growth index. Plant top growth index numbers were not affected by growing mixes or media components (data not shown).

Plant top grade. Plant top growth indexes and top grades were similar for sphagnum peat- and coir dust-containing media (data not shown). Plant top grades averaged 3.1 for sphagnum peat- and 3.3 for coir dust-containing media—good quality, salable plants.

Fresh shoot weight. When comparing shoot fresh weight due to the use of sphagnum peat or coir dust, there were no differences (Table 2); however, shoot fresh weight was 17% less in UF-2 compared to Cornell and Hybrid mixes ($P \leq 0.05$).

Plant root grades. Three months after planting, spathiphyllum plants exhibited symptoms of root rot. The pathogen was determined to be *Cylindrocladium spathiphylli* and plants were subsequently treated five times with triflumizole (Terraguard, Uniroyal Chemical, Middlebury, CN) to suppress this pathogen. The disease may have been part of the reason that root grade differences occurred. Both growing mix and media components affected plant root grades. Root grades were lower in UF-2 than the other two mixes. In addition, root grades were higher for plants growing in coir dust- than sphagnum peat-containing media. Root rots of foliage plants are usually the result of using media

Table 2. Growth and plant grades of *Spathiphyllum* ‘Petite’ grown in three growing mixes prepared using either sphagnum peat or coconut coir dust.

	Fresh shoot weight (g)	Root grade[z]	Fresh root weight (g)	Fresh plant weight (g)
Growing mix[y]				
Cornell	162a[x]	3.2a	203a	365
Hybrid	162a	3.3a	205a	367
UF-2	135b	2.5b	172b	308
Media component				
Spaghnum peat	148	2.6	184	330
Coconut coir dust	159	3.3	203	363
Significance[w]				
Growing mix	*[v]	**	*	*
Media component	NS	**	NS	NS

[z]Soil ball coverage with white, healthy-looking roots: 1 = ≤20%, 2 = ≥20%≤40%, 3 = ≥40%≤60%, 4 = ≥60%≤80%, 5 = ≥80%≤100%.

[y]Cornell = Cornell University foliage plant potting mix, Hybrid = combination mix based on Cornell and UF-2, UF-2 = University of Florida potted foliage plant mix 2.

[x]Mean separation within colums for growing mix by Duncan's multiple range test ($P \leq 0.05$).

[w]None of the interactions between main effects were significant at $P \leq 0.05$.

[v]Nonsignificant (NS) or significant at $P \leq 0.05$ (*) or 0.01 (**), respectively.

with inadequate aeration and poor drainage (11). Regarding *Cylindrocladium*, research has shown that roots from soil held at high moisture content yielded more fungal colonies than roots from less moist soil (13). The higher root grades in coir dust-containing media occurred despite those media having lower initial air-filled pore space, and higher water-filled pore space and water-holding capacity than the sphagnum peat media (25). This suggests that there may be some pathogen-suppressing component in the coir dust. Further research is needed to verify this possibility.

Fresh root weight. Root fresh weights were also less for plants grown in UF-2 compared to the other two mixes but media component had no effect.

Fresh plant weight. There were no media component effects on plant weight. However, fresh plant weights in Cornell and Hybrid mixes were 16% heavier than that in the UF-2 mix.

As with dracaena, spathiphyllum growth differences were not associated with differences in initial growing media nutrient contents or physical properties reported previously (25).

In general, the coir dust used in this experiment appears to be an adequate substitute for sphagnum peat in the three growing mixes we used for *Dracaena marginata* and *Spathiphyllum* 'Petite' production. However, even though total dracaena fresh weight was the same in Cornell mix made with coir dust or sphagnum peat, the reduction in *D. marginata* plant top growth index and grade should be noted.

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