Table 1. Effects of a preseeding water soak treatment on germination of *Freesia refracta* seeds.[z]

Treatment	No. of days until the first seed germination	No. of days from first to last day of germination	No. of days to maximum percent germination	% germination after 22 days	% germination after 30 days	Slope of germination curve (%/day)
Control – no soak	18.3	7.8	25.0	62.5	82.5	11.9
Control with seed coat removed	17.6	7.8	24.3	52.5	72.5	9.3
Intact seed coats						
13.0°C soak	18.7	6.7	24.3	48.1	66.9	11.2
18.5° soak	18.3	9.8	27.0	51.3	70.0	6.3
24° soak	18.8	7.5	25.3	49.4	69.4	9.0
29.5° soak	18.2	7.3	24.4	53.8	70.0	8.6

[z]Treatment effects were not sifnificant at the 5% level, by LSD.

Table 2. Effects of germination temps and black or clear polyethylene covering the germination trays of *Feeesia refracta* seeds.

Treatment (°C)	No. of days until the first seed germinated	No. of days from first to last day of germination	No. of days to maximum % germination	% germination after 22 days	% germination after 30 days	Slope of germination curve (%/day)
Black polyethylene						
13.0	16.8 c[z]	6.9 bcde	22.6 bc	61.7 abcd	75.8 abc	12.3 ab
15.5	16.5 c	9.8 ab	25.4 ab	66.7 abc	78.3 ab	8.1 abcd
18.5	17.6 bc	11.8 a	28.5 a	47.5 bcde	73.3 abc	4.8 d
21.5	15.7 c	6.3 cde	21.1 c	68.3 ab	72.5 abc	11.7 abcd
Clear polyethylene						
13.0	20.3 ab	8.5 bc	27.6 a	29.2 e	67.5 abc	8.3 abcd
15.5	16.1 c	7.7 bcd	23.4 bc	78.3 a	84.2 a	12.1 abc
18.5	21.1 a	4.0 e	24.1 bc	43.3 bcd	69.2 abc	12.8 a
21.5	21.6 a	7.3 bcde	27.8 a	28.3 b	54.2 c	5.1 cd

[z]Mean separation within columns by LSD test, 5% level.

cedure for obtaining rapid, uniform freesia seedlings. Starting germination at 15.5° under CP then increasing to 18.5° when emergence begins may give similar results.

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Comparison of Chrysanthemum Growth in Pine Bark or Commercial Soilless Mixes[1]

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Abstract. **Growth of *Chrysanthemum morifolium* Ramat was evaluated in ground pine bark:sand mixes; a soil:peat:perlite mix; and commercially mixed media. Flowering stem:dry weight of plants grown in bark:sand (3:1 or 2:1, by volume) were comparable to commercial mixes but 100% pine bark or soil:peat:perlite significantly reduced plant height and flowering stem dry weight.**

Commercial growers of pot plants have traditionally used soil and peat moss combined with a neutral aggregate such as sand, perlite, or vermiculite. The diminishing supply of peat (5) and the cost of locating and processing soil have recently directed growers toward alternative potting mixes. A 1973 survey (6) indicated the average cost for the grower preparing 1 m^3 of soil was \$43 (\$33/yd^3). Many commercial soilless mixes are available which contain peat, vermiculite, or bark (6). These mixes are sterile, uniformly mixed, and can be obtained in 0.084m^3 (3 ft^3) bags which can be easily stored. However, present costs of \$44 (\$34/yd^3) to \$61 per m^3 (\$47/yd^3) in bulk quantities has been a deterrent to grower acceptance. An alternative to the above group of media is for the grower to blend ground pine bark sand. This medium would require

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preparation but the raw material cost is quite low and the final product could be less expensive. An equally important factor is that pine bark and sand, if selected from constant sources, would be consistent in their composition. Consequently, these substrates when blended together would yield a reproducible media.

However, any cost advantage may be lost if the quality of plants grown in pine bark mixes were considerably less than the quality of plants grown in commercial mixes. This study compared chrysanthemum growth in 4 commercially mixed media and in various combinations of pine bark and sand.

Rooted cuttings of *Chrysanthemum morifolium* Ramat. cvs. Florida Marble or Mountain Peak were planted, 3 per 15 cm clay std pot, in pine bark: sand at 2:1, 3:1, 4:1, 5:1 ratios (by vol) and in a 100% bark medium. The pine bark was composed of loblolly pine (*Pinus taeda* L.) that had been hammermilled and composted for 90 days with no additives. After hammermilling, the screen analysis of the pine bark showed that 19% of the particles were greater than 6.4 mm in diam, 65% were from 0.5 mm to 6.4 mm and 16% of the particles were less than 0.5 mm in diam. A similar analysis of the sand showed that 3% of the particles were greater than 6.4 mm, 81% were between 0.5 mm and 6.4 mm and 16% of the particles were less than 0.5 mm. Bark pH (4.5) was adjusted to about 6.5 by adding 10 g of $CaCO_3$ per 1.8 kg bark. Other cuttings were planted in Pro Mix[3] (peat-vermiculite), Jiffy Mix[4] (peat-vermiculite), Choice Greenhouse Mix[4] (1 milled pine bark: 1 vermiculite), and Choice Nursery Mix[4] (7 milled pine bark: 3 vermiculite). Control plants were grown in a 1 soil: 1 sphagnum peat moss:1 perlite medium (by vol). All media were thoroughly wetted before the cuttings were potted. Plants were hand watered daily with 300 ml modified Hoagland's No. 1 solution (3) containing 300 ppm N as NH_3NO_3 (4, 8). The % air pore space was determined on all media (2).

The experiment was repeated 3 times during 1976: 'Florida Marble' was grown from Jan. 10 to March 23, and 'Mountain Peak', from April 14 to July 9 and again from Oct. 1 to Dec. 10. Data from all 3 experiments were similar and, for brevity, are presented from the 3rd experiment using 'Mountain Peak'. Plants were grown to flowering, harvested, dried at 60°C until no further weight losses occurred and the dry wt of stems and flowers determined.

[3]Premier Peat Moss Corp.

[4]Jiffy Products of America.

Table 1. Dry wt and ht of 'Mountain Peak' chrysanthemums grown in various pine bark:sand media or commercial soilless media fertilized daily with 300 ppm N as NH_4NO_3, Oct. 1 – Dec. 10.

Medium	Dry wt (g)	Ht (cm)
Choice Greenhouse Mix	25.3	22.5
Pro Mix	23.5	21.8
Choice Nursery Mix	23.4	21.7
Bark:sand (3:1)	23.2	20.3
Bark:sand (2:1)	22.6	20.5
Jiffy Mix	22.1	23.0
Bark:sand (4:1)	21.0	18.7
Bark:sand (5:1)	20.5	19.6
Bark (100%)	18.3	16.8
Soil:peat:perlite	17.6	18.0
LSD 5%	3.9	2.1

Plants grown in 2:1 or 3:1 pine bark:sand were the only ones whose dry wt did not differ significantly from plants grown in any of the 4 commercial mixes (Table 1). Plants grown in mixes containing 4:1 or 5:1 bark:sand did not differ significantly from plants grown in 2:1 or 3:1, although the dry wt declined. The lowest dry wt occurred with plants grown in 100% bark. In the 100% bark medium, plants were consistently shorter than those grown in 2:1 or 3:1 bark:sand. All media received the same amount of water which accounts for the lower dry wt of plants grown in 4:1, 5:1, or 100% bark. The 100% bark medium had an air-pore space of 22.6% compared to 14% for the 2:1 bark:sand medium. Consequently, the drainage in 100% bark was faster than in other media. Plants grown in soil:peat:perlite had a lower dry wt and were shorter than plants grown in 2:1 or 3:1. Other research (7) has indicated better chrysanthemum growth in soilless mixes than in soil: peat:perlite.

Although the dry wt of plants grown in the commercial mixes or in 3 bark: 1 sand did not differ significantly, plant ht was significant. Plants grown in Jiffy Mix and Choice Greenhouse Mix were significantly taller than plants grown in 3:1. While the plants grown in 3:1 were shorter, they were no less desirable as they were full and compact. In contrast, plants grown in Jiffy Mix were vigorous but tended to break easily. Previous research (1) has shown this to be characteristic of plants grown in Jiffy Mix.

Plants grown in 100% pine bark were significantly shorter than plants grown in any other media except 4 bark: 1 sand and soil:peat:perlite. This corresponds to the low dry wt of plants grown in 100% bark previously noted.

This study indicates that comparable growth can be obtained by growing chrysanthemums in certain pine bark: sand media or in commercial media; however, the percentage of bark in the mix may affect growth. Under one given watering regime. a high % bark in a mix may reduce plant dry wt and ht. If the particle size distribution was adjusted to a finer grade to increase water retention, mixes containing over 80% bark might be suitable for plant culture.

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