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USE OF ROCKWOOL AS A POTTING MIXTURE COMPARISON WITH PEATMOSS, SOIL AND VERMICULITE[1]

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Prices on rockwool were quoted at 15½¢ per pound, 10 pounds per cubic foot packed, 2½ pounds per cubic foot when broken up. The material is adequate as a soil amendment although shrinkage is high compared to peat moss. Rockwool has little exchange capacity, is inert and is sterile. Any mixtures with rockwool should be shredded through a screen. This article describes the experiments undertaken to examine rockwool as a potting mixture.

Introduction

Rockwool is an inert insulation material produced from a granite-like rock, diabas or basalt. It is heated to 1600 C and blown to form the common insulation utilized in ceilings. In Europe, the material is being used increasingly as an inert medium in vegetable and ornamental production. The material is formed into various shapes with the addition of binders and wetting agents. Work several years ago showed its adequacy as a growth medium for carnations.

At the request of Rockwool Industries, we undertook, during Summer, 1982, a comparison of rockwool and peatmoss in various combinations with perlite and vermiculite to test rockwool's use as a soil amendment in production of three flowering pot plants: geraniums, chrysanthemums and kalanchoes. With a dribble tube irrigation system, and constant feed, there was very little difference in plant quality between those mixtures using rockwool versus peatmoss. There are certain modifications that must be made in handling rockwool, but the decision to use it, versus other materials examined in this experiment, is more likely to be based upon competitive costs. Rockwool has very little cation exchange capacity (buffering), and therefore no nutrition reserve unless combined with soil or vermiculite. It makes a heavier mixture than the average peatmoss-perlite-vermiculite media, and should be shredded after mixing through a soil shredder with a screen having 1½-inch to 2-inch holes. Unshredded rockwool will "pill" in mixing operations, especially if wetted. Shrinkage is higher than with peatmoss, and one may have to allow for as much as 30% loss in volume when rockwool is mixed with some soils and perlite. Shrinkage is less when using perlite and vermiculite. The ordinary insulation type rockwool comes with an oil to reduce dust. This should be excluded when using the material as a soil amendment.

Methods

Un-oiled rockwool was furnished in bales. Six potting mixtures were made for testing:

- RW-P-S = Rockwool-perlite-Ft. Collins clay loam in equal parts,
- RW-P-V = Rockwool-perlite-vermiculite in equal parts,
- PM-P-S = Peatmoss-perlite-Ft. Collins clay loam in equal parts, and
- PM-P-V = Peatmoss-perlite-vermiculite in equal parts.

These media were mixed in a cement mixer, with limestone (5 lbs. per cu.yd), superphosphate (20%, 1 lb. per cu.yd) and Amway LOX wetting agency (about 3 oz. per cu.yd) added. Each mixture was wetted to a good potting consistency during mixing which caused the rockwool to "ball" or "pill", so all mixtures were passed through a Lindig shredder having a screen with 1½-inch diameter holes. Shrinkage was very noticeable when rockwool was mixed with soil, and was estimated at about 30%. Shrinkage was less when vermiculite and perlite was employed.

The mixtures were dried at 70 C and 100 g samples passed through a series of 7 sieves to determine particle size distribution. Representative samples were packed with the procedure described by Kerr (CGGA Bul. 390), and the maximum moisture-holding capacity and bulk density of 6-inch deep columns determined.

[1]Study carried out with a grant from the Rockwool Industries. Appreciation is expressed to Yoder Brothers, J & L Plants and Busch Greenhouses for supplying plant materials.

[2]Professor, Department of Horticulture. Students Martha Norris and Barbara Jose assisted in gathering data.

The first trial began with geraniums, cv. 'Wendy Ann', transplanted from 4-inch liners into 6-inch plastic pots, 16 pots per replication, two plots per treatment, on June 2, 1982. These were pinched hard at the time of potting. Chrysanthemums cv. 'Spice', were potted, 6 plants per 6-inch plastic pot, on June 3, 1982, and pinched and shaded on June 11. A Cycocel treatment was given. The kalanchoe variety 'Adobe Rose' was potted in 6-inch containers on June 5. Number of pots and replications for chrysanthemums and kalanchoes were the same as for geraniums. All plants were given a Benlate-Dexon drench within one week after potting, followed by a Temic application. All plants were watered with dribble tubes, one per pot, and fed at each watering using the standard recommended rates employed for most of the plants in the research range (CGGA Bul. 384).

When the plants had reached a marketable size, a representative sample was taken to determine fresh and dry weights of the tops and total leaf area. Another sample was transferred to a keeping room maintained at 21 C (70 F) with 12 hours of fluorescent light per day, with an intensity of about 50 to 70 foot-candles (ft-c).

Results

Physical analysis (Figures 1 and 2) showed some differences between mixtures in terms of moisture content, density and particle distribution. The completely inert mixtures (RW-P-V and PM-P-V) has the greatest proportion of particles in the range between 0.08 and 0.02 inches, whereas when soil was used, there was a greater range in particle size with a considerable increase in the number of particles between 0.02 and 0.006 inches diameter (Fig. 1).

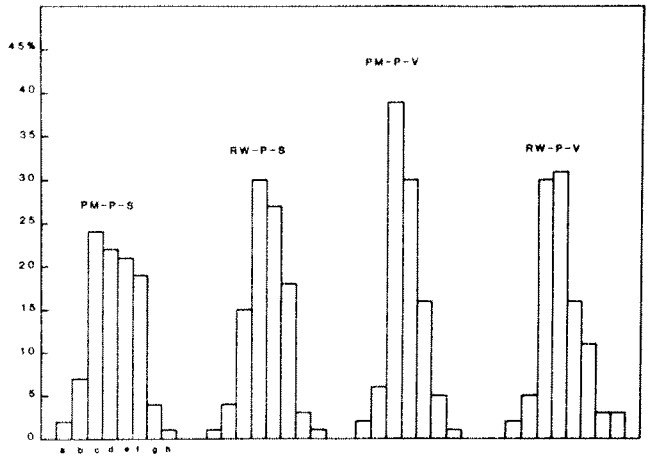

Fig. 1: Particle size distribution of 4 potting mixtures. The bars indicate the percentage of particles retained on a screen from a soil sample of 100 grams (means of 3 trials).
Screen size: a= 7.925 millimeters (0.3 inches)
b = 4.8 millimeters (0.19 inches)
c = 0.2 millimeters (0.08 inches)
d = 850 micrometers (0.03 inches)
e = 425 micrometers (0.02 inches)
f = 150 micrometers (0.006 inches)
g = 75 micrometers (0.003 inches)
h = remaining or smaller than "g"
PM-P-S = Peatmoss-perlite-soil
PM-P-V = Peatmoss-perlite-vermiculite
RW-P-S = Rockwool-perlite-soil
RW-P-V = Rockwool-perlite-vermiculite

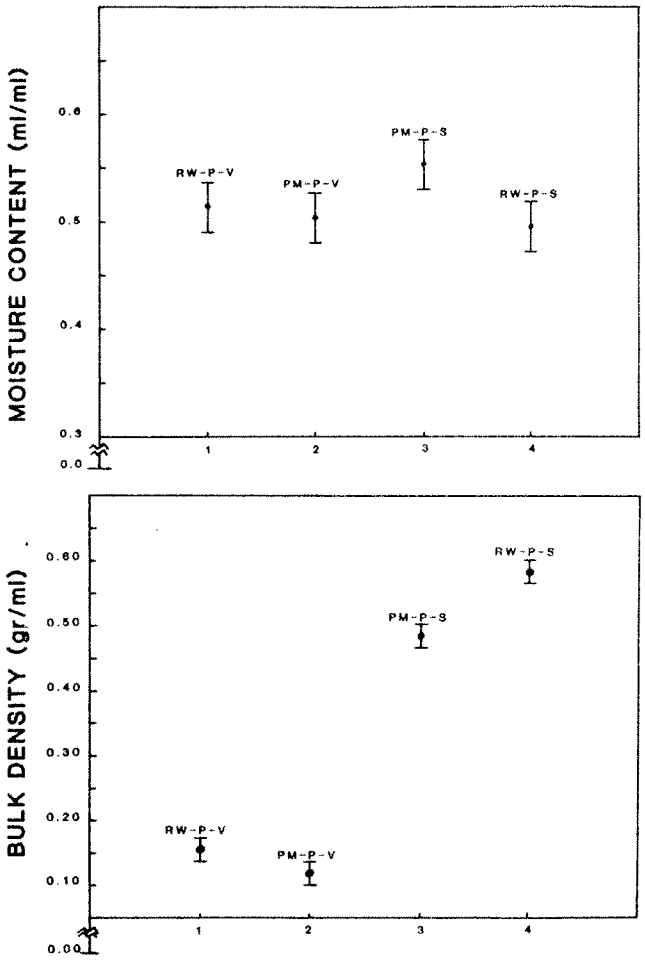

Fig. 2: Upper: Moisture content of 16 cm (6-in) deep potting mixtures after wetting and drainage (values can be read as percentages).
Lower: Bulk density of four potting mixtures (weight per unit volume) (conversion to pounds per cu.ft. multiply by 62.43).
RW-P-V = Rockwool-perlite-vermiculite
PM-P-V = Peatmoss-perlite-vermiculite
PM-P-S = Peatmoss-perlite-soil
RW-P-S = Rockwool-perlite-soil
Vertical bars indicate the difference required for significantly different averages (center points).

PM-P-S retained a higher percentage of moisture than RW-P-S, but all mixtures had moisture contents at maximum capacity within the range of 50 to 56%. From the standpoint of weight, RW-P-S had the highest bulk density, on the order of 37.5 pounds per cubic foot, as compared to RW-P-V which had a density of about 10 pounds. The slightly heavier weight of RW-P-V as compared to PM-P-V (7 pounds per cu.ft) would tend to stabilize pots containing large plants (Fig. 2).

The cation exchange capacity of each mixture was determined to indicate the requirement for constant feeding. The results were (milliequivalents per 100 grams):

RW-P-S = 9.8

RW-P-V = 29.8

PM-P-S = 23.4

PM-P-V = 42.0

In another study, Gregory Kerr found an exchange capacity of 2.1 meq (100 g)$^{-1}$ for a mixture of equal parts rockwool and perlite as compared to values of 70.2 and 61.1 meq (100 g)$^{-1}$ for peatmoss and perlite or peatmoss and vermiculite respectively. The basic Ft. Collins loam had an exchange capacity of 20.3. This would indicate that rockwool has no significant buffering capacity, and its use with other materials having low exchange capacities requires a constant feed system unless slow release fertilizers are employed.

Plant responses were not consistent, the general rule being no statistically significant differences between plants grown in any of the mixtures (Tables 1 and 2, Figures 3 through 6). There were some exceptions. Leaf area for geraniums grown in peatmoss-containing media was significantly less than those grown in rockwool, and this difference was observable (Fig. 3). This difference had to be noted by comparing several plants at once. Pictures of single plants did not always show perceptible differences (Fig. 4), although when plants were moved to the postharvest rooms, growth generally ceased in comparison to those remaining in the greenhouse (Figures 4 and 5).

In the case of chrysanthemums, differences were very difficult to observe (Fig. 5), but the analyses showed that plants grown in mixtures with soil were larger and heavier than those grown in mixtures containing vermiculite. There was no significant effect of rockwool or peatmoss (Tables 1 and 2). There were no statistically significant differences in growth of kalanchoes in any of the mixtures (Fig. 6) although RW-P-S had the heaviest plants (Table 1).

Table 1: Effect of four potting mixtures on the growth of three flowering pot plants.[a]

Species	Potting mixture[b]	Fresh weight (g)	Dry weight (g)	Leaf area (cm^2)
Geranium	RW-P-S	336	42	5065
	PM-P-S	310	41	3727
	RW-P-V	347	45	5027
	PM-P-V	301	45	3922
	Analysis	ns[c]	ns	ns
Chrysanthemum	RW-P-S	235	35	2526
	PM-P-S	242	35	2651
	RW-P-V	195	28	2027
	PM-P-V	201	30	2244
	Analysis (HSD = 5%)[c]	25	5	643
Kalanchoe	RW-P-S	1515	107	4792
	PM-P-S	1358	105	5665
	RW-P-V	1344	89	5599
	PM-P-V	1277	84	5550
	Analysis	ns	ns	ns

[a] — Geraniums, cv 'Wendy Ann', repotted from 4-inch June 2, 1982, harvested for data July 14 and 22.
Chrysanthemums, cv 'Spice', potted as rooted cuttings, June 3, 1982, harvested for data July 29.
Kalanchoes, cv 'Adobe Rose' potted as liners June 5, 1982, harvested for data Sept. 24.

[b] — RW-P-S = Rockwool-perlite-soil, PM-P-S = peatmoss-perlite-vermiculite, RW-P-V = rockwool-perlite-vermiculite, PM-P-V = peatmoss-perlite-vermiculite.

[c] — ns = not significant, HSD = honestly significant difference with 5% probability of being wrong.

Table 2: Effect of rockwool, peatmoss, soil and vermiculite in the potting mixture on the growth of three flowering pot plants.[a]

Species[b]	Measurement	Rockwool	Peatmoss	Analysis[c]	Soil	Vermiculite	Analysis[c]
Geranium	Fresh weight (g)	341	306	ns	324	324	ns
	Dry weight (g)	43	43	ns	42	45	ns
	Leaf area (cm^2)	5046	3825	853	4397	4475	ns
Chrysanthemum	Fresh weight (g)	214	221	ns	238	197	13
	Dry weight (g)	31	32	ns	35	29	3
	Leaf area (cm^2)	2276	2448	ns	2589	2135	333
Kalanchoe	Fresh weight (g)	1430	1318	ns	1436	1311	ns
	Dry weight (g)	98	95	ns	106	87	ns
	Leaf area (cm^2)	5196	5607	ns	5228	5575	ns

[a] — Equal volumes of these components plus perlite in each mixture, RW-P-S, RW-P-V, PM-P-S and PM-P-V.

[b] — Geraniums, cv 'Wendy Ann', repotted from 4-inch June 2, 1982, harvested July 14, July 22 for leaf area.
Chrysanthemums, cv 'Spice' rooted cuttings potted June 3, 1982, harvested July 29.
Kalanchoes, cv 'Adobe Rose', liners potted June 5, 1982, harvested Sept. 24.

[c] — ns = not significant, numbers indicate the honestly signifcant difference between means with a 5% probability of being wrong.

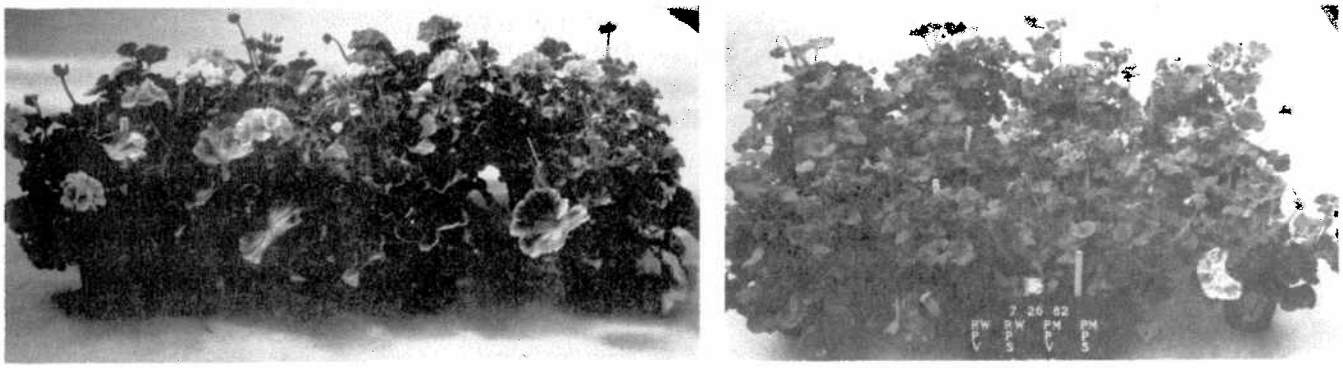

Fig. 3: Geraniums prior to postharvest study (left picture). From left to right: Peatmoss-perlite-vermiculite (PM-P-V), rockwool-perlite-soil (RS-P-S), rockwool-perlite-vermiculite (RW-P-V) and peatmoss-perlite-soil (PM-P-S). The right picture as indicated after three weeks in a postharvest room at 70 F and about 50 ft-c light intensity.

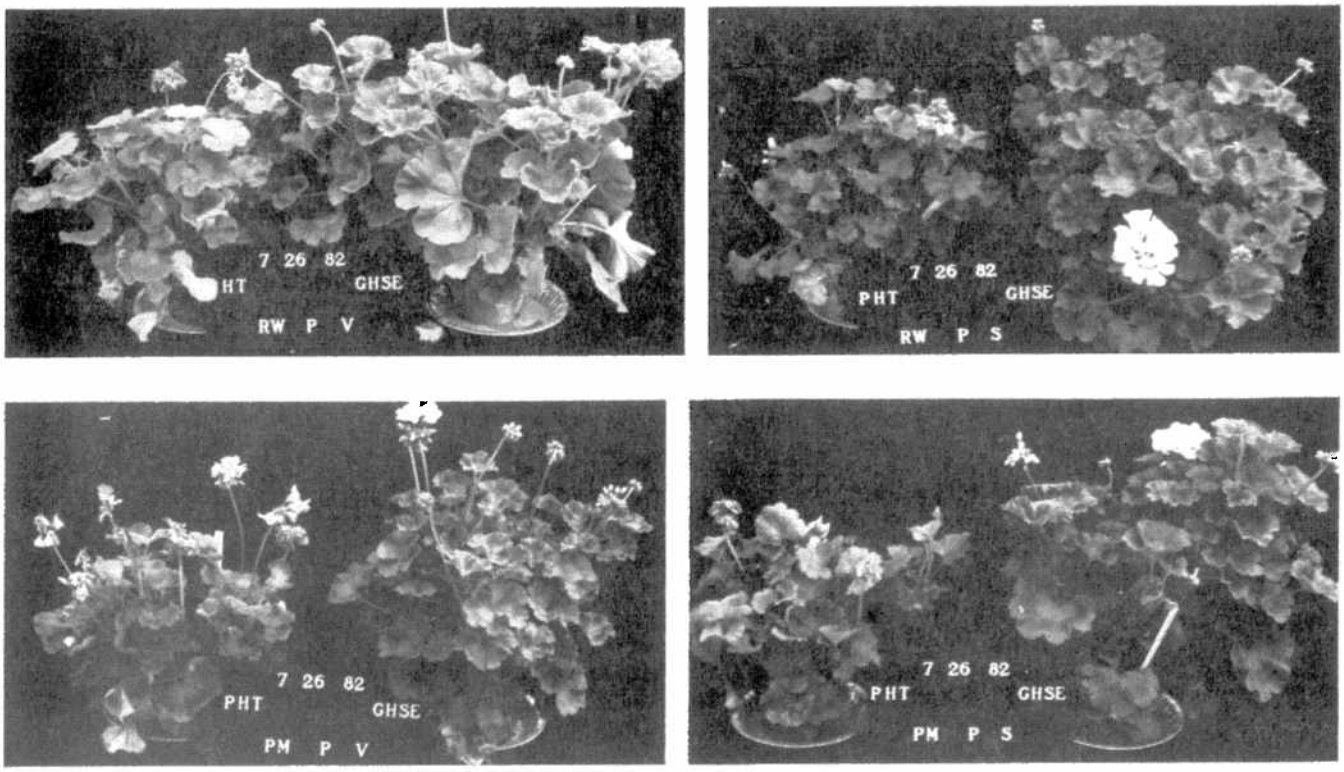

Fig. 4: Effect of four potting mixtures on growth of geraniums (on the right in each picture) compared to geraniums in the same mixtures and subjected to three weeks at 70 F and 50 ft-c light intensity (on the left in each picture).
Upper left: RW-P-V = Rockwool-perlite-vermiculite
Upper right: RW-P-S = Rockwool-perlite-soil
Lower left: PM-P-V = Peatmoss-perlite-vermiculite
Lower right: PM-P-S = Peatmoss-perlite-soil

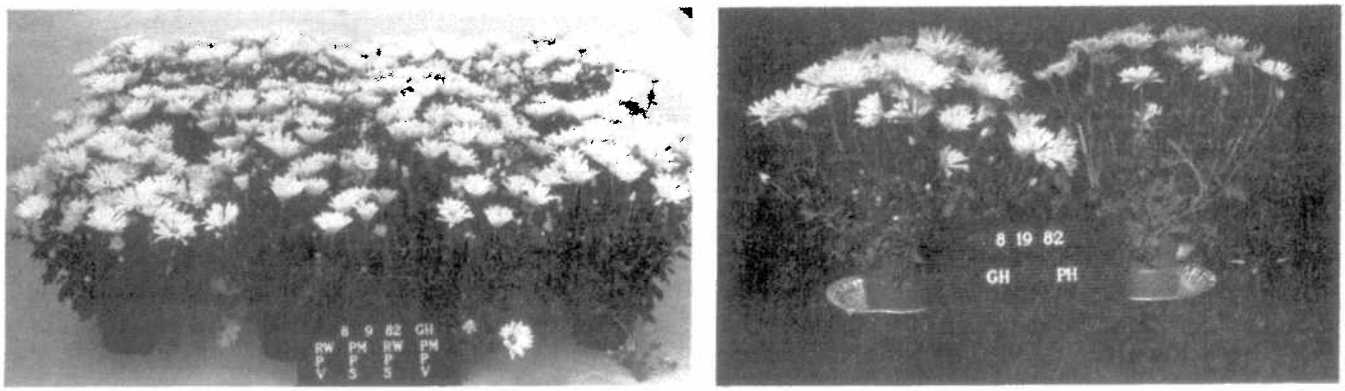

Fig. 5: Effect of four potting mixtures on growth of chrysanthemums (left), and comparison between plants kept in the greenhouse versus one kept in a keeping room for 3 weeks at 70 F and 50 ft-c light intensity (right).

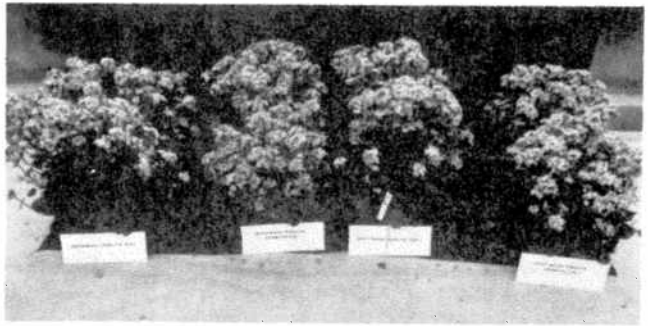

Fig. 6: Effect of four potting mixtures on growth of Kalanchoes. Picture taken after three weeks in a keeping room at 70 F and 50 ft-c light intensity. Bleaching of flowers to a pale, non-intense color was highly noticeable compared to plants in the greenhouse.

Discussion

Rockwool is a perfectly acceptable potting mixture amendment if some precautions are taken in handling. The low exchange capacity indicates that a high exchange material such as vermiculite may be desirable as an amendment, especially if plants are not fed on a regular schedule in the irrigation water. Rockwool will make a heavier potting medium as compared to peatmoss, and its tendency to clump, or pill, in mixing requires some type of shredding process to achieve uniformity in the mixture. It is inert and sterile, and relatively light when dry as compared to peatmoss. The high shrinkage found when mixed with a relatively "heavy" soil indicates that one must compensate with additional materials to obtain the desired final volumes. The differences in price may be most important in the decision to use rockwool versus peatmoss as a potting mixture amendment.