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Potassium Distribution and Retention in Pine Bark and Sand Media[1]

E. F. Brown[2] and F. A. Pokorny
University of Georgia College of Agriculture, College Station, Athens, GA 30602

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Abstract. **Potassium concentration was highest in the upper 5 cm of medium after leaching with 10 cm H_2O, lowest in the middle of the soil column (10 and 15 cm depths), and intermediate at the bottom of the column. Increasing concentrations of applied K (336, 671, and 1007 kg/ha) increased the K level in each medium tested, except 100% sand, and at each depth in the soil column. After leaching, media containing high percentages of sand (75 and 100%) had a lower K concentration at all applied K rates than media containing high percentages of bark (0 and 25% sand). Cation exchange capacity was greater in bark than sand and is probably the most important factor influencing the movement of K in pine bark and sand media.**

Many problems develop in container plant production because plants are confined to small volumes of soil media and thus require frequent watering and fertilization. Under frequent irrigation, cation leaching occurs more readily from small containers of soil (8, 12) than from undisturbed field soils (1, 3). Cation movement in soil columns increases with the amount of water moving through the soil column (6, 9) and with the percentage of large pore space (10). Most potting media, including bark-sand mixtures, are composites of several materials. Cation leaching in composite media has not been determined. This study was undertaken to investigate the leaching of K from pine bark and sand potting mixtures and to relate cation movement patterns to selected physical and chemical properties of these media.

Potting media were prepared from pine bark and sand blended together in proportions of 0, 25, 50, 75, and 100% sand (v/v). Bulk density (BD), particle distribution, and total pore space of the resulting potting mixtures were determined. Percolation rate was standardized by the constant head method (5). Cation exchange capacity (CEC) was measured using the modified ammonium acetate method (4).

Soil columns were constructed by fastening together 4 sections of aluminum tubing, each 7.2 cm in diam and 5.0 cm long. A 10 cm long collar was attached to the top and a fine mesh wire screen and funnel was fitted to the bottom of the column. The column was packed with medium in 5 cm increments. Columns containing media were saturated by sub-irrigation with deionized H_2O after which they were allowed to drain for 24 hr to remove gravitational H_2O. Five ml of KCl solution were applied over the surface of the medium at a solution concentration equivalent to 335.7, 671.4, and 1007.1 kg/ha. The medium was then leached with 10 cm of deionized water. Following drainage for 1 hr, the soil columns were separated into 5 cm segments and oven dried. Four 10 cc samples were taken from each section and K was extracted with a solution of equal parts of 0.05 N HCl and 0.025 N H_2SO_4. The mixture was filtered and the filtrate analyzed for K, using a Model 21 Coleman Flame Photometer.

Texture of a bark-sand potting medium became coarser and BD decreased as the percentage bark in the medium increased (Table 1). Total pore space, percolation rate, and CEC also increased as the percentage bark in the potting mixture increased (Table 1).

For all media, except 100% sand, K concn was significantly greater in the top 5 cm of the soil column than at any other depth. Lowest concn of K was found at the 10 and 15 cm depths, but significantly greater K concn was in the 20 cm depth of the soil column than either in the 10 or the 15 cm depths (Fig. 1).

Generally, K concn decreased as the percentage sand in the potting medium increased regardless of the rate of applied K or the depth sampled (Fig. 1). Increasing applied K generally increased residual K at all depths in the soil column. However, with sand residual K at any depth did not vary with applied K.

The distribution of cations in soils results from the movement of water through the soil (7, 9). Porosity, percolation rate, and CEC are soil properties which have been found to affect cation movement (2, 10, 11). In bark-sand media, as contrasted to soils, an inverse relationship existed between cation movement and total porosity and percolation rate. Media containing low percentages of sand had greater total porosity and percolation rates than media containing high percentages of sand. Also, the CEC of the bark was about 10 times that of the sand (volume basis) and thus decreasing the percentage of sand increased the CEC and the residual K of the medium. In contrast, the tendency for cations to leach in the composite media decreased with increasing total pore space.

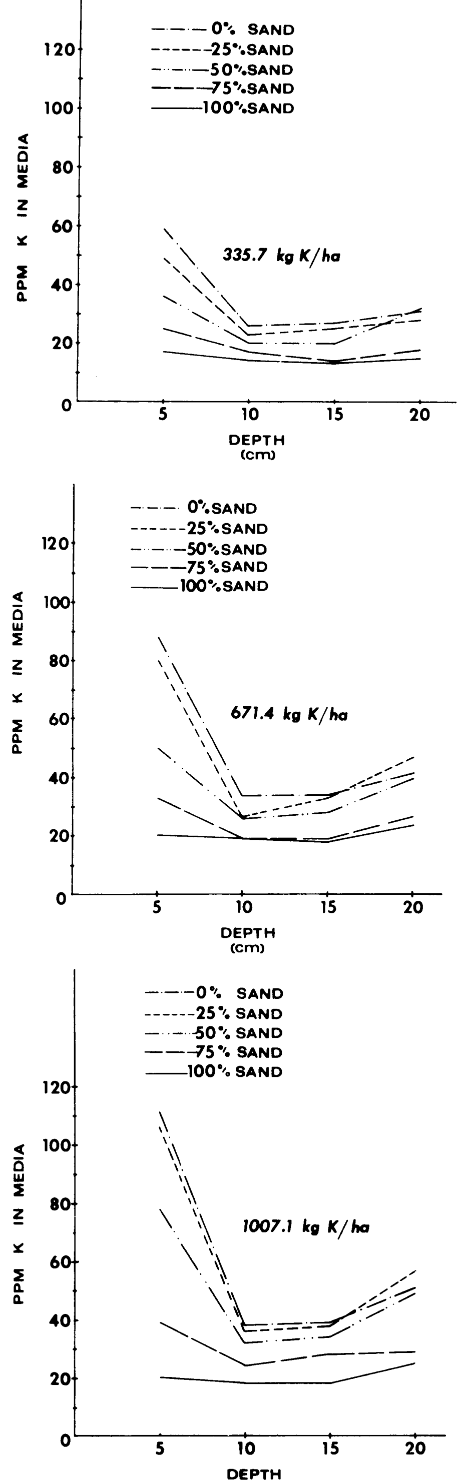

Fig. 1. Effect of media and K level on retention of K.

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[2] Portion of dissertation submitted in partial fulfillment of the requirements for the PhD degree in Plant Science. Present address: Glynn Academy, Brunswick, Georgia.

Table 1. Physical and chemical properties of pine bark-sand potting media.

Media		Particle distribution (%/wt)										
		NBS[z] sieve size										
		4	8	10	20	30	40	Receiver		Total pore		
Sand	Bark	Openings (mm)						pan	BD	space	Percolation	CEC
(%)	(%)	4.76	2.38	2.00	0.84	0.60	0.42	<0.42	(g/cc)	(%/vol)	(cm/15 min)	(meq/100 cc)
0	100	1	33	8	31	8	6	10	0.22	71	91	11
25	75	0	11	3	27	18	15	23	0.58	64	62	8
50	50	0	5	2	30	21	17	24	0.94	54	35	5
75	25	0	2	1	29	22	19	26	1.27	41	23	3
100	0	0	0	1	28	22	19	29	1.56	40	15	1

[z]National Bureau of Standards.

Residual K concn in the top 5 cm of medium was increased by increasing the percentage of bark in the medium. The increased retention is thought to be due to the extensive K saturation of the exchange sites in the surface 5 cm of the medium (8). Also, many exchange sites exist on the internal surface of the bark particles and these may become saturated when K is applied in liquid form. It is also possible that pores existing within the internal structure of bark are relatively small and the soil solution contained therein was not easily removed by H_2O rapidly percolating through the pine bark media. With 100% sand, little K was retained at any depth in the soil column. It is felt that more K was found in the 20 cm depth than at the 10 and 15 cm depths for all media because H_2O percolating through the medium was inadequate to completely remove K in the soil solution. After 24 hr of drainage, the highest percentage moisture was found at the 20 cm depth. When medium at this depth was oven dried, K in the soil solution increased the ppm K found at this depth.

The addition of sand to pine bark as a soil media has no advantage as far as K retention is concerned. Its primary advantage would be to increase BD which would lessen container tippage under field conditions, and to reduce H_2O percolation rate which would reduce the frequency of watering.

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Effect of Methazole Formulation and Rate on Shoot and Root Growth of Three Container-grown Woody Ornamentals[1]

David J. Williams[2]
Department of Horticulture, University of Illinois, Urbana, IL 61801

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Abstract. **Two formulations, 5G and 75WP, of methazole (2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5 dione) applied at 1.7, 3.4 and 6.8 kg ai/ha effectively controlled** *Digitaria sanguinalis* **L. (large crabgrass) and** *Portulaca oleracea* **L. (common purslane) in container-grown** *Cotoneaster apiculata* **Rehd. & Wils.,** *Euonymus kiautschovicus* **Loes. cv. Manhattan and** *Juniperus chinensis* **L. cv. San Jose. All rates of the 75WP formulation reduced the shoot and root dry wt of** *Cotoneaster* **and** *Euonymus.*

Several studies screening pre-emergence herbicides for use in container-grown nursery stock have been conducted (1, 2, 3, 4, 6). This study was established to evaluate the feasibility of using the herbicide, methazole, in the container production of woody ornamental nursery stock.

Uniform plants of cotoneaster, euonymus and juniper were planted on April 17 in 3.8 liter plastic nursery containers. The growing medium consisted of 4 parts composted hardwood bark and 1 part sand (by vol) (5).

A 5% granular (G) and 75% wettable powder (WP) formulations of methazole were applied at rates of 1.7, 3.4 and 6.8 kg ai/ha. The herbicide treatments were applied indoors and 24 hr later the plants were placed out-of-doors for the remainder of the experiment. The G formulation was uniformly applied over the surface of the medium using a hand shaker. The WP formulation was sprayed over the top of the plants with a CO_2 constant-rate sprayer. Immediately following the herbicide application the treated containers were irrigated with 2.5 cm of water to incorporate the herbicide. One week following the application of the herbicide the containers were sown with large crabgrass and common purslane to insure a uniform weed population. On Sept. 15, shoot and root dry wt were taken to determine the phytotoxicity from the methazole treatments. At this time, weed control was also determined. The design of the study was a completely randomized design with 3 replications and 10 plants/replicate.

Large crabgrass and common purslane populations were reduced 90 days after treatment with methazole (Table 1). Control of weed populations increased

[1]Received for publication March 15, 1977.
[2]Assistant Professor of Horticulture.