PHYSICAL PROPERTIES OF SOIL MIXES USED BY NURSERIES

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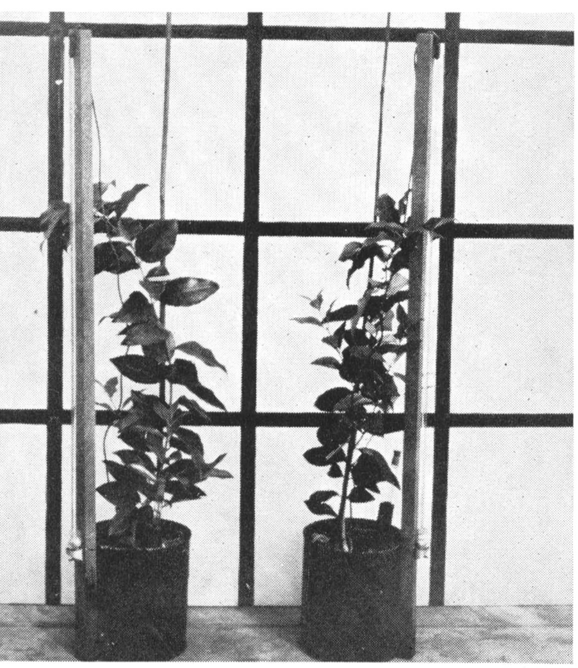
Soil mixes have been proposed and are being used by nurseries for various reasons. Evaluations of their properties relating to disease control and fertilization have been well documented. The selection of mixes for favorable physical properties is equally important, but methods for routine evaluations of such properties have not been sufficiently explored. The following data show evaluations of physical properties measured with laboratory techniques and, for comparison, similar measurements on mixes as they are used in gallon cans under nursery conditions.

Bulk density of a soil mix affects the shipping of plants from wholesale to retail outlets. A less dense soil mix makes it possible to ship more plants in a truck where the load limit is determined by weight.

A mix for can use must have a moderate to high water conductivity. Irrigation water should penetrate the soil readily, and some of the applied water must be conducted through the soil and out of the can in order to maintain salt balance at a moderate to low level.

Growing plants in cans with tensiometers attached for measuring water-release properties of soil mixes.



The water retention ability of the soil should also provide the plant with as much water as possible so that the irrigation program will be less exacting. To emphasize the soil-plant water system, this property of the soil is expressed as the amount of water "released" from the soil to the plant.

Methods of evaluation

In contrast with field soils, nursery soil must be handled, mixed, and repacked into soil containers. After several irrigation cycles, a soil mix adjusts to its natural level of compaction. However, continued root development may continuously change the compaction or bulk density condition. To make predictive measurements on a soil mix, a standardized method of compaction was developed. A motor-driven compactor was devised to compact subsamples of each mix into brass cylinders about 2 inches in diameter and 2 inches high. Part of the compaction technique involved a controlled wetting procedure prior to compaction. Subsamples of each mix were saturated and the water condition was then controlled by applying a given suction using porous ceramic wall equipment.

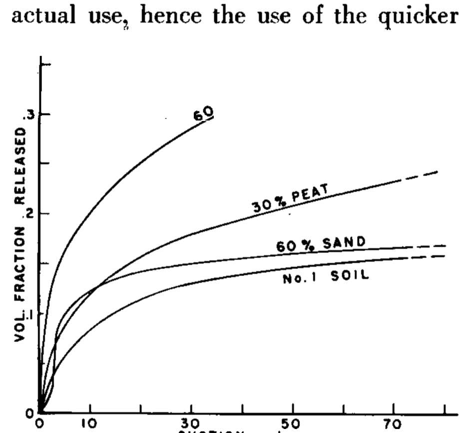
Water conductivities and water release values of the compacted samples were measured as the samples were subjected to controlled suction levels starting from saturation or zero suction. For comparison with laboratory measurements, separate samples of the soil mixes were used to grow waxleaf privet plants in gallon-sized soil containers. After nine months of growth under greenhouse conditions, the bulk density values were measured and water release curves obtained by successive weighings of the entire can systems, while suction values were obtained from tensiometers installed in each can. Two of the cans with mercury manometers attached for reading suction are shown in the photo.

Three soils were collected from areas near nurseries in Orange County. Table 1 gives their textural data and water conductivity values obtained on the compacted subsamples. While infiltration rates of irrigation water into the soil cans might have been correlated with these conductivity values, no attempts were made to measure infiltration quantitatively.

Table 2 shows a comparison of measurements made on compacted laboratory samples with similar properties measured on soil mixes in greenhouse cans. To obtain the water release data under greenhouse conditions, complete curves similar to those shown in the graph were obtained for each soil mix. The value of water released for the appropriate suction increment was read from the curve.

Table 3 gives similar evaluations of the physical properties of soil mixes showing the effects of two levels of several amendments, but only for a single soil.

Water released by the soil to the root system over the range from 0 to 30 centibars (cb) suction appears to be a good index for evaluating soil mixes in relation to irrigation management. Because of the limited amounts of water released by most of the mixes above 30 cb, a safe irrigation program for potted plants should be based on irrigating when tensiometer readings reach 30 cb. A higher suction value at which to irrigate would be justified for the 60% peat mix since a greater water release above 30 cb is indicated from the curve for this mix. The laboratory measurements compare favorably with physical properties measured on soil mixes under conditions of actual use, hence the use of the quicker



Typical curves showing the effects of soil amendments on the volume fraction of soil water released to plant roots as related to soil suction values read on tensiometers.

laboratory methods for routine evaluation of soils and other types of amendments may be justified.

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TABLE 1. TEXTURE OF THREE SOILS COLLECTED FROM NURSERY AREAS IN ORANGE COUNTY AND WATER CONDUCTIVITY VALUES FOR SOIL MIXES USING THE INDICATED AMENDMENTS AT 60% BY VOLUME

Soil Number	13	18	1
Texture:		% by weight	
Sand	75	58	43
Silt	18	25	34
Clay	8	17	23
		Water Conductivity; cm per hour	
Amendment Added:			
None	6	0.2	0.5
Sand	31	20	28
Redwood shavings	14	16	10
Pine shavings	16	9	9
Peat	10	8	4

TABLE 2. A COMPARISON OF BULK DENSITY AND WATER RELEASE VALUES OBTAINED ON LABORATORY COMPACTED SOILS AND SOIL MIXES WITH EQUIVALENT MEASUREMENTS UNDER GREENHOUSE USE IN POTS

Soil No.	Laboratory			Greenhouse Pots		
	13	18	1	13	18	1
Amendment 60% by volume			Bulk Density, gm/cc			
None	1.53	1.45	1.36	1.50	1.32	1.30
Sand	1.56	1.55	1.52	1.58	1.51	1.57
Redwood shavings	.98	.96	.88	.92	.77	.74
Pine shavings	.90	.93	.86	.73	.76	.78
Peat	.88	.78	.79	.80	.68	.65
		Water released from 0 to 10 cb vol. fraction				
None	.18	.10	.16	.12	.10	.08
Sand	.24	.21	.24	.14	.11	.12
Redwood shavings	.26	.20	.21	.22	.19	.17
Pine shavings	.24	.20	.22	.27	.26	.16
Peat	.27	.29	.30	.24	.25	.20

TABLE 3. PHYSICAL PROPERTIES OF SOIL MIXES SHOWING THE EFFECTS OF TWO LEVELS OF AMENDMENTS USING SOIL NO. 1

Amendment and amount by volume	Bulk density	Hydraulic conductivity	Water, released, volume fraction	
			0–30 cb	30–50 cb
	gm/cc	cm/hr		
None	1.36	0.5	.13	.02
30% Redwood shavings	1.15	2.2	.18	.02
60% Redwood shavings	.88	10	.24	.03
30% Pine shavings	1.12	2.8	.19	.02
60% Pine shavings	.86	9	.22	.03
30% Peat	1.09	0.6	.18	.03
60% Peat	.79	3.8	.29	.05

Cyclic Production Of Capsules in Flax

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Experiments in the Imperial Valley confirmed that flax does not produce blooms and capsules continuously but in distinct, successive cycles. Even in a high-yielding field of flax only a small proportion of mature capsules were found to have the full complement of ten seeds.

A MATURING FIELD of flax presents both growers and scientists with questions concerning probable yield, variability of capsule load, and fullness of the capsules. Studies underway at the Department of Agronomy, University of California, Riverside, resulted in some interesting data obtained from an experiment completed last summer regarding the seed setting pattern of flax. Observations in the Imperial Valley have previously indicated that flax flowers do not appear in one continuous bloom but in two or more successive cycles. In fact, flax growers plan fertilization and irrigation practices to stimulate more than one such cycle of blooms.

No experimental data has been available, however, to confirm the existence of such bloom and capsule cycles and to assess the magnitude of the yield increments obtained from each one of them. Furthermore, no experimental information is available on whether such bloom cycles can be stimulated by appropriate management practices, or whether this property is under genetic control with variable expression among flax varieties.

In these tests, two commercial varieties of flax (Imperial and New River) and an experimental line were grown at the Imperial Valley Field Station, University of California, Meloland. The test was planted December 14, 1962 using a 47 lb-per-acre seeding rate on a 1/6-acre plot with two replications. The plot area was fertilized with 230 lbs of nitrogen per acre applied in three portions and was given a total of 12 irrigations.

Capsules per plant

The first problem considered was the rate of increase in number of capsules per plant from the initiation of bloom to maturity. Twenty single plants from each variety (10 per replication) were harvested approximately every two weeks and the number of capsules 1/4 inch in diameter or larger were counted. As shown in graph 1, their numbers increased sharply at first but leveled off about six weeks after March 15, the date on which blooming had started. Eight to nine weeks after bloom the number of

Graph 1. Rate of increase in number of capsules from bloom to maturity in the varieties Imperial, New River and an experimental variety.