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CONTAINER SOILS ARE DIFFERENT

Almost everyone has grown plants in containers. What is a container? It is any receptacle filled with soil or other growth media in which plants are grown (Figure 1). Commonly used containers include pots, flats, planters, cans, boxes, cartons, greenhouse benches, baskets and others.

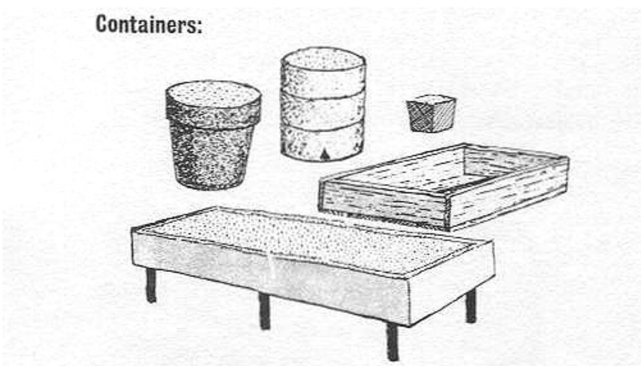


Figure 1. Some commonly used soil containers.

Most floricultural crops are produced in containers and most other horticultural crops (with the exception of field crops) are propagated from seeds or cuttings and grown in containers until large enough to transplant into ground beds in our gardens or yards. House plants and an increasing number of landscape plants in urban areas are grown exclusively in containers. Container culture is therefore a very important aspect of horticulture, and anyone concerned with floricultural crop production and sales must know something about container soils. Although containers are widely used in floriculture, few floriculturists realize that container soils are different from ground bed soils.

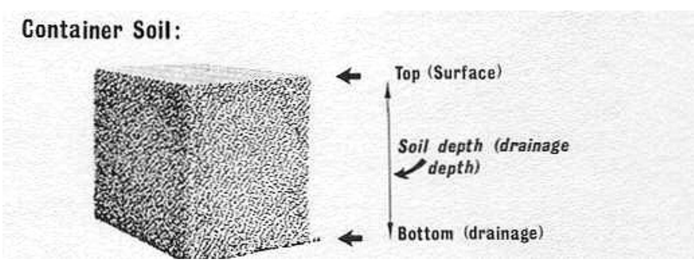


Figure 2. A container soil is isolated from the ground by the container and is usually open at both its top and bottom. The bottom opening usually consists of small drainage holes.

The soil's most important function in relation to plants is to store and supply the water and minerals essential for plant growth and survival. It is not sufficient for soil to merely contain water and minerals; they must be available to the plant.

A number of soil and plant factors affect soil water and mineral availability but one of the most important, as discussed in previous articles, is soil aeration. Soil aeration is the supply of oxygen to and the removal of carbon dioxide from the plant roots. Good aeration is essential for adequate root growth and absorption for plant growth and survival.

All soils consist of a semi-rigid mass of minute solid particles permeated by a network of interconnected pores in which water, mineral nutrients, and air move and are retained. A container soil is isolated from the ground by the container and is usually open to the atmosphere at the top (surface) and bottom (drainage holes). Container soil depth (or height) is the vertical distance between the surface and drainage levels (Figure 2).

Container soils have two important characteristics distinguishing them from ground bed soils; they are (1) small, and (2) shallow (Figure 3). The effect of smallness is obvious. The soil water and mineral reservoir available to container plants is much less than to those growing in ground beds, and this reservoir must therefore be replenished by frequent irrigation and fertilization to maintain equivalent growth in containers.

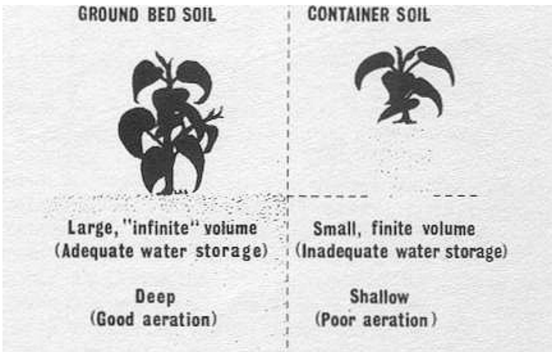


Figure 3. Container soils are smaller and shallower than ground bed soils. Both of these characteristics tend to reduce plant growth in containers.

Because of this "container soil effect," an excellent garden or field soil placed into a container will probably remain saturated following watering and drainage and result in poor soil aeration and poor plant growth. Even if the container is filled with coarse sand or perlite, it may remain saturated following irrigation and be poorly aerated because of its shallowness (Figure 6).

The effect of container shallowness is less obvious; however, it can be easily demonstrated with an ordinary flat cellulose sponge, like the one which you use to scrub the bathroom or car. The sponge is placed flat on the level, (spread fingers of one hand), and saturated by pouring water on it until water drips from its bottom side. The sponge, like the soil, is permeated by pores which are full of water when the sponge is saturated. In other words, the sponge is a good model or analog of a container of soil; it behaves like soil. If, after water ceases to drip from the flat sponge, it is stood on end, more water will drain out of it (its water content decreases) (Figure 4). Merely increasing the height of the sponge by turning it up on end decreases its water content.

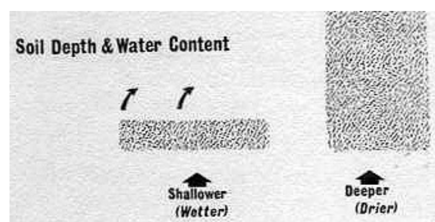


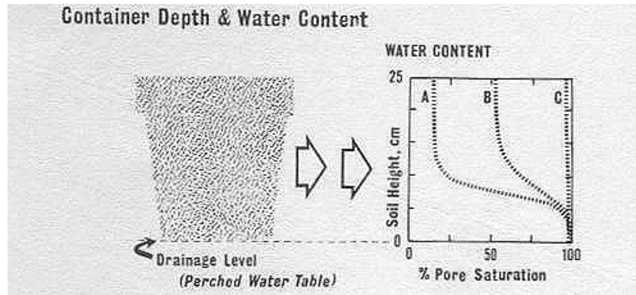
Figure 4. A flat sponge can be used to demonstrate the effect of container soil depth on water content.

A real container soil behaves the same way. Actually, a perched water table forms at the container soil bottom (drainage level), even though it has free drainage (open at bottom (Figure 5). Like any water table, the soil is saturated (pores filled with water) and water content decreases with height above the water table.

The deeper the container soil, the lesser its surface and average water content following watering and drainage.

The effects of container smallness and shallowness create the dilemma of a soil which contains an inadequate supply of water and minerals to maintain growth for more than a short period; yet, this same soil may be too wet for the plant to absorb even this inadequate supply (Figure 7). The effects of smallness can be remedied by frequent watering and fertilization; however, this also increases the frequency of poor aeration (due to shallowness of container soil).

Figure 5. The water content as a function of container soil height for three different soils: A - a very coarse-textured sand; C - a silty clay loam; and B - a mixture of A and C. Even though C is an excellent field soil, it becomes poorly aerated when placed in a container. On the other hand, A has excellent aeration but poor water retention. An ideal soil would be a compromise between A and C.



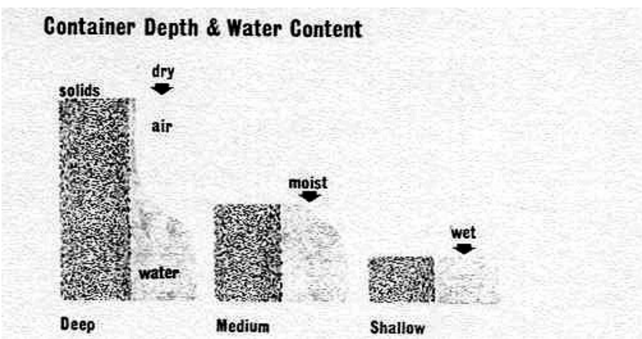


Figure 6. The water and air content as a function of height for the same soil placed in containers of three different heights. The deepest container is likely to be "too dry" and the shallowest container "too wet" following watering and drainage.

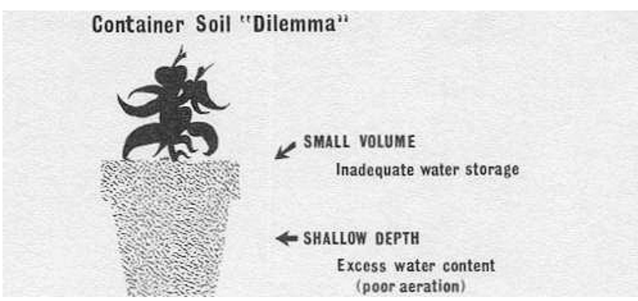


Figure 7. The container soil "dilemma" is reduced in practice through a combination of frequent irrigation (and fertilization) and soil amendment (soil mixes).

The effects of shallowness can be remedied by incorporating coarse-textured amendments (e.g., sand, sawdust, peat, perlite, bark, vermiculite, calcined clay, etc.) into the soil to create large pores which drain following water, despite the perched water table at the container bottom. However, insufficient amendment worsens aeration instead of improving it and excess amendment results in insufficient water retention for growth.

Although container smallness and shallowness create problems for growing plants, these problems can be minimized through proper irrigation, fertilization and use of soil amendments. Remember, CONTAINER SOILS ARE DIFFERENT and therefore require different care than garden or field soils.

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