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CLAY, PLASTIC AND OTHER CONTAINERS FOR PLANT CULTURE

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When we compare the merits of the various kinds of pots available today, it becomes apparent that no one is best for all purposes. The clay pot still is the most generally adapted for plant culture and has the greatest number of points in its favor. It is difficult to produce better plants in any container than can be produced in the regular clay pot. Indeed, by most comparisons the clay pot is conducive to maximum quality of plant growth when compared on a similar basis with other containers.

Root Binding

Work studies conducted by Knight (Michigan Agriculture Experiment Station, 1944) showed that the roots of container-grown plants tend to develop around the inner surface of a container because they cannot go through it. Roots, because of their natural tropic responses, tend to grow out and downward from their main axis. When they strike the wall of a container which they cannot penetrate, they develop along the surface of it, for it is abnormal for a root to turn from the container surface and to grow back into the soil ball. Knight put plants in double containers and in triple containers with layers of soil between them. In this manner he demonstrated that in time some roots found their way through the drain hole in the original pot and extended into the second pot where they again develop around the inner surface of that pot but never around the outer surface of the original pot. Where triple pots were used the same observations were made with respect to root development in the outermost containers, i.e., roots develop around the inner surface of the outer container without growing around the outer surface of the second container.

The results of these studies by Knight dispel the idea that roots develop around the inside of the container and produce a root-bound condition because they received oxygen through the surface of the pot. Instead, the root-bound condition develops because the roots cannot grow in any other fashion.

There have been claims to the effect that while clay pots are porous, oxygen will not move from the outside surface of a clay pot to the roots inside a pot. In general, oxygen is absorbed by roots by diffusion through the soil from the upper surface. This dissolved oxygen should be expected to move from inside the soil ball to the outer surface of the pot. The loss of water from the surface of the pot should facilitate this process. Nevertheless, when the soil in a clay pot becomes moderately dry it should be possible for oxygen to move from the outer surface of the pot to the soil inside it. Many clay pots require only 3 to 5 pounds of pressure to force air through them rather freely. This is considerably less tension than is developed by a moderately dry soil.

The advantages and disadvantages of various containers used for plant culture in our greenhouses may be summarized as follows:

Clay Pots

Advantages. Mechanical development in the manufacture of these containers has reduced their material costs to a point far below that of any type of containers. They are strong. They keep soils cooler than other rigid containers. Plants in them are not likely to be over-watered. Salts leach out of them readily. They are particularly good for summer culture. When placed firmly on a bench of moist fine cinders, they require but little more water than plastic containers.

Disadvantages. They are heavy. Salts and algae may accumulate on the surface to the extent that the containers may appear unattractive. Under winter conditions these pots may keep the roots of some crops too cool. In general, they require 50-100 percent more labor for watering than nonporous containers.

Nonporous or Plastic Containers

Advantages. They are light in weight. Special sizes and shapes are available. They keep roots warmer than clay pots. They require 25-50 percent less time and labor for watering than porous clay pots. The pots remain clean. These containers are available in a wide selection of colors.

Disadvantages. Large sizes are expensive. Plastic containers larger than 6 inches are usually not so strong as corresponding clay pots; indeed, they are usually not strong enough. These containers keep soils too hot during the late spring, summer and early fall seasons in well lighted greenhouses. Clear plastic glass containers or containers of light-colored materials which transmit light may develop an unreasonable growth of algae on the inner surface of the container. Shapes are not always standard and therefore they may not be convenient for shifting to or from other pots. The rims often interfere with insertion of labels. Drainage may not be adequate.

Peat Pots (Peat and Pulp)

Advantages. They are inexpensive. They are permeable to roots. These containers are expendable in that transplanting is done without their removal.

Disadvantages. They are not durable - sometimes not sufficiently durable for the given application. Container plus plant is often too light in weight for convenient support. Because of this, special watering techniques are often required. Roots grow readily through the containers and into the bench.

Soil Pots, Sod Pots, Soil Cubes, etc.

These containers have been used in Europe for the growing of bedding plants and transplants for many years, and considerable progress has been made in their formulation and use.

Advantages. They are inexpensive. Relatively little labor and soil are required for filling. They give no root binding effects and thus transplanting is accomplished with little or no check to plants. Fertilizing is simple and standard.

Disadvantages. Containers before use are relatively heavy. Because of sizes and shapes commonly used no change in spacing is permitted.

Al-G-Proof

This is a silicone treatment which, when properly used, causes a clay pot to resist wetting. Neither algae nor salts, therefore, will accumulate on the surface of Al-G-Proof-treated pots. The material is neither toxic to algae nor to plant roots. The control of algae growth is accomplised entirely by virtue of the water repellent nature of the treated pots, and is effective for some applications for 6 months to a year. In orchid culture, these pots remain clean for several years. Al-G-Proof treated pots require approximately half as much water or labor for watering as standard clay pots. In this respect they correspond to plastic and other nonporous containers. By virtue of this fact, however, they keep the soil in them approximately 3-5 degrees warmer than similar porous clay pots. Here again they correspond to plastic or nonporous containers. The treatment is inexpensive, and is best applied by the manufacturer rather than the grower.

Copper Naphthenate

This treatment when applied properly will keep pots clean for at least 6 months, but it should be emphasized that this treatment functions by virtue of the toxicity of copper to algae. The treated pots also are toxic to the roots of plants growing in them but since the copper does not migrate significantly from the pot to the soil ball, there is usually little or no difference in the size of the tops produced by plants grown in copper naphthenate pots as compared to similar tops grown in standard clay pots. Nevertheless, it has not been definitely established that the reduction in root development imposed by this treatment will not adversely affect the growth of plants maintained over a period of several months in a home. The treatment definitely renders the pots toxic to plant roots as well as to algae.

Temperature Comparisons

During the summer of 1960 a number of temperature comparisons were made to determine the effects of the different containers used on the temperatures of soils in them. The following results were made with Hydrangea plants grown in various containers:

Three thermocouples were placed in each pot - one against the inner surface of the pot midway between the top and the bottom of the container. The second was approximately midway between the outer portion of the root ball and the middle and midway between the top and bottom of the root ball. The third thermocouple was placed approximately in the center of the pot with respect to all dimensions.

It was found that the temperatures observed varied with the surface on which the pots were placed. When grown out of doors on a simulated bench coated with fine cinders as compared to being placed on a white or light colored concrete, the following results were obtained:

Soil Temperatures of Potted Plants

Kind of Container Used	On Bench Outside	On White Outside
Standard Clay	75.7	78
Varnished Clay	83.3	88
Al-G-Proof-Clay	84	88
Green Plastic	85	95

It is evident that under extreme conditions there may be nearly 20°F. difference between the temperatures of soil in clay pots as compared to dark-colored plastic or nonporous pots. The clay remains coolest in all instances.

Summary

Various containers used for different types of plant culture have particular merits of their own. Where there is an application for a special pot, plants usually can be grown satisfactorily in those containers if sufficient care is devoted to the techniques of watering and fertilizing.

A word of caution is warranted at this point - if one has a particular application for a certain kind of pot, then, when conducting trials, do not mix plants in the various containers on a given bench. Keep the blocks of different containers in separate groups. In a relatively short time one will learn to develop the proper cultural techniques for growing good plants in any container. On the other hand, where plants in different containers are intermixed throughout a bench, one may never learn the proper technique to be applied for best growth in any one container.