WATERING PLANTS

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Of all the problems that I observe in visits to container nurseries, the most frequently encountered and the most serious are those related to the plant's root system. We can only make money in container nursery production by achieving accelerated plant growth. To accomplish accelerated plant growth it is necessary that the root system be continuously growing and functioning. Perhaps half of the root system of a shrub can be non-functioning, yet the plant can remain green and appear healthy. However, it will not continue growth at an accelerated rate.

We are attempting to achieve a balance in our potting mixes between the air and water content. Any grower that is producing high quality plants in a short period of time is achieving this balance.

A plant in a container is in a very different environment as compared with the same plant in the ground. In the ground it has a root system covering a larger area; thus it can obtain water and oxygen from a very large soil volume. When the plant is placed in a container, the environment has been changed tremendously by restricting the reservoir of both air and water. When the potting mix is placed in a container, its drainage characteristics are also completely changed.

A major objective in container production is maintaining a "super active" root system. Poor soil aeration and drainage probably affect root growth more than any other factor. We are encountering three problems when there is poor aeration and drainage: (1) reduced soil oxygen; (2) high soil disease organism populations that are caused by the excessively wet conditions; and (3) toxic soil gases that are present under poor soil aeration conditions.

There are a number of variables that can affect the soil-air-water ratio and result in a reduction of plant quality or reduce the growth rate in container production:

Variable 1 – The Potting Mix. Success that growers achieve in accelerated plant production is based to a great extent upon the use of a well-aerated, well-drained potting mix. Much progress has been made by nurserymen in recent years with the advent of well-aerated pine bark mixes. Commercially available pine bark varies tremendously in particle size. It is possible to

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get poor results even with pine bark if it is ground too finely.

Variable 2 – Inadequate mixing of ingredients. We can begin with the proper ingredients in a mix, but if they are poorly mixed we are starting our production cycle with a variable that can result in uneven growth.

Variable 3 – The container size and shape. The soil in deep containers drains better than soil in shallow containers. Nurserymen would all use more of the deeper containers if they did not "topple" over easily.

Variable 4 – The moisture inside the container. The moisture level in the container is not equal throughout the container. There is always more soil water in the lower portion and in the center of the container; therefore there is less oxygen in these areas.

Variable 5 – Container-plant ratios. Wide variations in sizes of container and plants in the containers under the same irrigation system are common in nurseries. This is a variable that is difficult to overcome but is one that we constantly must seek to minimize. Through foliage transpiration larger plants pull water out of the soil much faster than small plants and thus need to be watered more frequently. Organizing plants of the same size and growth rates is important in reducing this variable. The addition of cutoff valves on irrigation risers is also a very useful means of controlling the amount of water to a given block of plants.

Variable 6 – Variation in liner sizes. At canning time if liners of a given kind of plant are not consistent in size another variable has been introduced. A larger liner will pull water out faster and thus you will irrigate when they need water. In the process the smaller size plants will be over-watered.

Variable 7 – Physical changes in the potting mix. Most potting mixes have different air and water holding capacities at the end of the production cycle as compared to the beginning. The organic matter has decomposed somewhat thus causing the mix to compress together. Also much of the open spaces in the mix are gradually replaced by the dense root system that has developed.

Variable 8 – "Shifting up" plants. When a plant is shifted to a larger container and the original soil mix is more compacted than the new mix, then the original mix is usually over-watered and root injury results.

Variable 9 – Rainfall. We don't have control over rainfall. Nurserymen in California do not have the problems with this variable that exists in the East. They can thus grow good plants in a 1/2 soil — 1/2 organic matter mix that would result in problems in the East.

Variable 10 – Poor drainage outside the containers. Containers that sit in puddles of water due to an uneven bed surface will take water up through the drainage holes by capillary action, thus waterlogging the lower portion of the mix. Crowned beds plus a firm surface will eliminate this variable.

Variable 11 – Irregular water application. We assume that an even distribution of water is made when we irrigate. This is often not true. The average rotating sprinkler puts out an uneven amount of water within its circle of distribution. By proper overlapping of these circles we can minimize this variable. Proper reduction in pipe size is also very important in obtaining equal water pressure down a given irrigation line. The design of an irrigation system by someone knowledgeable is of utmost importance in container production.

Variable 12 – The umbrella effect. Assuming that the irrigation system is distributing a uniform amount of water, it is possible that the soil mix in containers is receiving uneven amounts. This variable is caused by the foliage of some plants producing an "umbrella effect" and shedding water. This happens most frequently in older plants that have a dense foliage canopy.

Variable 13 – Position effect. This is most noticeable with container plants under open shade structures. Wind movement and higher light intensity results in the perimeter plants drying out more rapidly.

Variable 14 – Management decisions. The greatest variable is a "person problem" in deciding when to water and how much to apply. We may have uniformity in production, but, unless the correct decisions are made as to when to apply water and how much to apply, then problems will result. We oftentimes assume that a rain is providing adequate water to saturate the container soil but actually it may not be. The only practical way to find out is to knock the plant out of the container in order to look at the soil mix. The most important thing that a grower can do in deciding when to water is to knock plants out of the containers to determine what the soil moisture content is. Over-watering is due to two reasons, either too much is applied at each application or too frequent applications are made.

Variable 15 – Plant tolerance. Tolerance to wet soil conditions varies considerably; therefore, whenever possible, grouping sensitive plants together would be beneficial. Some plants that are easily injured by overwatering include: *Podocarpus*, *Camellia*, *Rhododendron*, (including azaleas), *Pieris*, *Cornus*, *Buxus*, *Juniperus*, *Cleyera* and *Ilex crenata* cultivars.

It is, of course, never possible or practical to completely eliminate the above-mentioned soil moisture related problems.

Efficient producers do reduce these problems to a minimum, however.

SOIL STRUCTURE RELATIONSHIPS . . . SOIL . . . WATER . . . PLANTS . . . IN CONTAINER GROWN ORNAMENTALS

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There are wide and varying types of media that have proven successful in the growing of container ornamentals. If we checked with the many successful nurseries we would find a tremendous range of growing media being utilized. However, three important aspects would have been satisfied. Those are 1) aeration, 2) water holding capacity, and 3) nutrient holding capacity (2,3,6). The key to success is learning to combine proper cultural practices with the particular mix one has chosen. However, there are many factors to consider when selecting a growing medium.

Climatic Conditions. What is the rainfall, temperature (diurnal fluctuation), length of growing season, humidity, wind and day length like in the area where the plants will be grown? California nurseries, for example, are afforded an opportunity to use more native soil in their mixes, due to their low rainfall, than nurseries in the southeastern states (6). Of course, these are variables we have little or no control over, unless we build greenhouses. Therefore, we must consider these factors just as we do when deciding what plants to grow.

Plants to Grow. It is, of course, most practical to grow all of our varieties of plants in the same soil mix. Matkin, *et al.* (3) reported that John Innes Horticultural Institution in England demonstrated that a single soil mixture could, with minor modification, be used for growing a wide range of plants. However, waxleaf ligustrum, azaleas, and bromeliads just cannot be treated alike; but the fewer different formulations of soil mix, the more simplified the growing problems.

SOIL

Things a good soil mix must possess or — the functions of a soil:

1) *Good Soil Aeration.* This will assure that a mix has good drainage, which is so very important in growing plants in containers. Buscher (1) reports a procedure to determine the amount of air-filled pore space. He further states that 15 to 25% air-filled pore space is desirable for container-grown ornamen-