

you don't have excellent hardware that the computer is operating, whether it be mist propagation or drip irrigation or whatever we are working with, we are looking at the uniformity of the complete system. To get an increase in production is possible only when the computer is hooked to a system that is of a level of technology that allows it to do its job. I have seen an application in nursery containerized growing with uniformity of plant materials that is unequaled, but that is because there is a drip irrigation system, in combination with the computer, automating the application of the water, and the application of fertilizer. The savings are there, the real increase in yield comes from the correct and proper program. You have probably all heard the phrase, "garbage in — garbage out", on computers. Eventually, sooner or later, it comes back to the operator running the computer.

## **SOIL MIXING FOR SMALL GROWERS**

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When the current soil mixing systems were reviewed for the preparation of this report, it became readily apparent that very few changes in soil mixing systems have occurred during the past 25 years. The purpose of a soil mixing system should be to achieve a uniform blend of selected dry chemicals, or chemicals which have been placed in aqueous solution with bulk ingredients. Any system which can do this in a reasonable period of time is acceptable and probably has been used at some time in the industry.

The modified concrete mixer is the most common soil mixing machine in use in the medium sized nurseries and greenhouses. With this piece of equipment a batch type system is developed and when the ingredients are added to each batch accurately, the results are quite uniform. Some growers even steam pasteurize or fumigate their soil in these mixers. One of the major disadvantages is the relatively long mixing and unloading time which results in substantial grinding and pulverizing of the bulk ingredients. This is aggravated when either sand, pumice, or lava rock is one of the bulk ingredients.

The second most common mixing system is the use of a tractor with a bucket to blend the ingredients on a hard sur-

faced slab, or even the ground, until the mix is uniform. Usually turning the pile of ingredients three times provides a uniform blend. This system has also proven to be quite efficient and reliable. The major disadvantage is the space involved and, if the mix is to be sterilized, it must be loaded into a trailer and steamed, or covered with a tarp, and treated with gas.

A few growers are using custom built soil mixers which greatly reduce the mixing and unloading time. Their cost is usually quite high compared to the concrete mixer.

The smaller growers are using miniature modifications of these mixing systems or are buying premixed soil from services which custom blend the materials to the growers' specifications.

When the small grower increases to the size where he needs more than several yards of soil per day, he has to decide if he can afford to continue to mix his own soil. At this point, a substantial investment in equipment and machinery is involved. A tractor with a bucket loader is usually purchased and sometimes a forklift is also used to help service the mixing equipment. A mixer of some type must also be purchased, or a hard surfaced slab prepared, so that the soil can be mixed in either a pile or a windrow. In addition to the equipment storage, space for the bulk ingredients must be provided and, in many cases, this area has to be subtracted from the land available for production. In urban areas, where land costs are high, this represents a significant loss.

When all of the costs are given a realistic value, many growers will find that they do not save money by mixing their own soil. At this point, the custom soil mixer can provide a real service to the grower. In some areas we understand the service has been expanded to one of providing custom blended pasteurized soil in nursery flats, or greenhouse pots, which are stacked on a pallet and delivered to the nursery ready for planting. It is anticipated that services of this type will become more common in the future.

In summary, there seems to be no one soil mixing system for the smaller grower that is far superior to all others. Any system that produces a uniform sanitary soil mix is acceptable.