

QUALITY PLANTS START WITH PROPAGATION AND THE MEDIUM

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Production material for a wholesale nursery generally comes from two different propagation sources. One you have control over more directly than the other; in-house production plants provide you with cuttings. But when you are buying seed or cuttings from out-of-house sources, on a regular or as-needed basis, then your control is to continue to buy, or to stop buying from them. Our plant material at Nurserymen's Exchange comes from both of these sources. The production quantities that we work with demand that both sources be used. The cost in maintaining the extra square footage necessary for in-house stock plants, and their maintenance cost, may be a factor in it. The real advantage in the use of both sources is that often an increased demand for the plants in production or an error in stock plant production makes outside sources a good back-up program. An example is when our poinsettia stock program was set back some weeks in an error in the soil mix so that the plants had to be repotted, and thus production was cut back.

In-house Production. Our in-house production from the stock plants maintained in the nursery, and the use of our production plants, carry many programs. As plants need to be shaped, the cuttings are used by the particular department that propagated them. These cuttings are especially readily available on those species that are not sprayed with growth regulators to control their shape. Careful selection is made of cuttings to ensure not only quality plants but that they are true to the species and cultivars we wish to produce. Discarding of plant material has to be done when cuttings are either not true to cultivar or have other characteristics that we do not wish to perpetuate.

By careful planning, the process of shaping plants for sale and having available cuttings from production plants helps to cut the plant production costs.

Stock plants can be an asset if used with the idea that they will eventually be used for plant sales when their usefulness/shape and size meet the needs of the sales. We work for such a program so that we get the use of the cuttings — in many cases from the plant over a long period of time, and then when a full saleable plant has been grown with many lateral

breaks, as an example, the plant is sold on the market-place. The stock plants are routinely replaced with new plants to continue the program, or where a program will be phased out for a period of time, then they are sold with the plans to replace, or even buy in more cuttings prior to the need for the full use of the plants later in another year. Proper care of stock plants is a vital need in any stock plant program. Just as production plants are fertilized, sprayed for insects and diseases, the stock plants must be cared for in the same manner, and with more care, for this is how you keep your production program going.

Out-of House Sources. Out-of-house sources for cutting material requires a careful record keeping system and selective buying. The plants that may leave the source as excellent quality material may reach you as unuseable plants. Test loads of cuttings can be obtained from new sources to see how they hold up and then, by keeping records, you can see what happens to the plants in time. When the plants arrive at Nurserymen's Exchange they are inspected for defoliation, damaged tissue, pests, trueness to species and cultivar, and how it was packed for shipment. The information that is relevant is noted immediately so the shipper can be notified and also, so the purchasing department can be told if what was received did not meet what was ordered.

PLANT PRODUCTION SYSTEM

Plant production programs are set up on paper often a year in advance of the actual growing. This gives time for the program to be fitted into the space that is open for it, or the program (when it is a large one) may have to be planned so that others may plan their crop to finish to give the extra space. Planning on large programs gives the needed room for the quality plants we sell. Prior planning then also gives time for the set up of either system in the nursery for supplying the cutting stock needed; in-house, out-of-house sources, or a combination of both.

Careful planning by each department then allows the maximum use of space and the maximum use of propagation material in an orderly way. Since we use both rooted cuttings (RC) and unrooted cutting (URC) in all the departments in our production programs, the planning gives a weekly schedule for the arrival of the plant material that minimizes the cost of freight in bringing in the out-of-house material on a weekly basis.

Prior preparation by the department must include clean-up of the benches so that we will have clean pots filled with soil for sticking.

When cuttings arrive by motor or air freight they must be logged in by cultivar, quantity, and source.

For in-house sources, when the pots have been readied, then the cuttings are made. The benches are laid out by pot size and as the plant material arrives then it is moved to the benches so the employees can "stick", in the case of URC, or plant the rooted cuttings. The lead person is given a list of how many flats to plant and the size pot to plant; in addition, the number of cuttings per pot size.

As cuttings are either unpacked, received from another department, taken from stock plants, or in the process of planting them up, a quality control here is to teach the employee what you want the cutting to be like. It is at this time that the keen eye of an employee can save you work later on. Loss of turgidity, disease, improperly made cuttings, etc., can be found now and not used, or the problem solved before the plant is stuck in the medium with the problem being harder to solve later on.

A careful check at this early stage in production is made of the actual number of cuttings received, when from an out-of-house source, to check with production numbers and the invoice. Are we getting in more than our production schedule called for, and so perhaps we need to cut back in the weeks to come? Are we getting less than what we ordered? Records for plants from either cutting source will tell us if we are getting the proper rooting, as we have obtained in the past, or is disease occurring from one source or another. This is another quality control that we have to have in our system of producing plants.

We use auxins to stimulate root formation on some of the many kinds of plants we grow. We use both liquid and powder formulations.

ROOTING MEDIA

Propagation media varies with the plants we are growing. Seed is usually grown in a medium that is brought in for that purpose, as are the fern propagation media. For some kinds of cuttings, i.e. *Exacum*, we use rooting cubes. For the majority of the plants that we grow from cuttings the medium used is of our own formulation, and we do our own mixing.

Whether it be the 2¼ in. pots or larger, the cuttings we start are generally in the same medium that they will be "grown on" in (direct sticking). This method not only saves time, but by use of the same medium, cost of later transplanting is saved.

Since the medium is used both for rooting and growing on, aeration is important and a good supply of oxygen and CO₂ is essential. Under good aeration conditions, both gases are supplied at the levels needed to help in root stimulation. More roots will form in darkness than in light, a dark medium provides that. The medium structure is important even after the roots have been initiated, for if we then get a situation of low aeration caused by poor porosity, noncapillary porosity, or waterlogging, due to poor medium structure or poor irrigation management, a reduction in the growth of the new roots will result (1). The medium then must stand the test of time in holding its structure throughout the full cycle from propagation to sale of the plant.

Soil temperature affects rooting also and has a direct influence on the rapidity of root formation. This increased rooting temperature helps up to 90°F but over that can be detrimental.

Soil moisture affects rooting also; roots will not penetrate a dry medium so overhead mist by hand or automated equipment is used. Soil moisture must not be so high as to cut off oxygen penetration. Unrooted cuttings need the proper amounts of both gases and moisture.

Proper soil medium pH is essential to successful rooting — too low a pH and low levels of calcium can inhibit root growth.

The soil medium provides support for the cuttings, moisture, and other essential items. The medium can do its part but if the cutting does not have the proper supply of auxins and carbohydrates to supply the root forming cells and then the elongation of roots and growing tip, the medium is of little use. To maintain turgidity of the cuttings, intermittent mist is most often used, supplied by automation, hand misting or, in some areas, fog such as with the Mee System (2).

Media Preparation Overview. We use most of the standard media: peat, pumice, sand, and topsoil. For our mixes we use "Premix", that contains liming ingredients to give us a starting pH of 5.5 on most crops. Nitrogen, phosphorus, potassium, etc., are added in the "Premix" to get the plants off to a quality start. We have been working with one mix that includes incorporation of micronutrients at the time it is mixed and have seen some promising results with it. One mix that is different from the others included the use of lime plus an organic fertilizer that when "tracked properly" gives excellent results from propagation to the finished plant.

The mixes in greatest use at Nurserymen's Exchange include:

1. peat, bark, pumice, plus Premix
2. peat, bark, pumice, topsoil, plus Premix
3. peat-60%, pumice-40%, plus Premix, micronutrients, and wetting agent.
4. peat-80%, pumice-20% plus lime and organic Premix.

What we are working at now and have been able to do for many crops is to eliminate the topsoil entirely from our mixes. The step after the elimination of the topsoil is to use only a handful of soilless mixes that can be used on all the crops, from propagation through to saleable plant.

CONCLUSIONS

The key to quality in saleable plants in the wholesale nursery starts with the cutting material. You have a check on that quality by the records you keep of the plants, whether from your own stock plants or from sources that you buy-in. The employees are another key to your quality in that they know what quality you want "stuck" in the pots and they continue that process as they care for the plants. The final way that you can get your plants off to a good start is in the type of medium that you use for growing and making sure that it can meet the criteria that you establish that will give quality and quantity of plants.

LITERATURE CITED

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INTEGRATED TECHNIQUES FOR PROPAGATING AND CONVEYING COMPACT GRAFTED TREES UNDER THIRD WORLD CONDITIONS

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Abstract. Weight reduction to about 150 grams of grafted tropical and subtropical nursery trees has been achieved here by multi-directional air root-pruning, thereby moulding the root system into a flat compact mass that substitutes for containerization. This opens up the possibility of supplying genetically improved nursery trees to distant locations, particularly hill and arid regions in the Third World. At destination, the nearly bare roots can be inserted into a mud solution to fill in and protect the fibrous mass. This forms a flat solid rootplate that can be planted very fast by placing against an 18 cm. vertical wall of a small hole, made by a stroke or two of a hoe.