FUNDAMENTALS OF ROOTING TISSUE-CULTURED CUTTINGS

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Have you ever noticed that when you mention rooting of tissue-cultured plants, there is a certain "mystique" or "high tech" attitude towards it from nurserymen and growers. I know I felt the same, and still do about new techniques that I hear about.

Well, is there a lot of differences between rooting tissue-cultured shoots and standard cutting propagation? I would like to show that by applying the fundamental principles of propagation very few, if any, changes have to be made. I am going to briefly outline our procedure for rooting stage IV shoots from our Tissue Culture Lab at Briggs Nursery. I am not going to compare different systems, methods, or ideas as each propagator has made adaptations for his own crops, location, and climate. Our primary concern is to provide conditions that meet the requirements of the micro-cuttings until they root. Of course, weather and time of year are the most changeable, especially in sunny weather.

Briggs Nursery roots 95% of its micro cuttings which come from the Tissue Culture Lab right in the greenhouse so the main function of the Lab is acting as a giant stock hedge.

Once a week the Tissue Culture Lab Manager and I meet to discuss what micro shoots will come out from the lab to the greenhouse in the next two weeks. Just as in standard propagation we look to see what the shoots look like—right length, color, and specifically in this case, are the leaves developed fully? Sound familiar? In James Wells' book (1), written 30 years ago, he said, "Condition of the plant (cuttings) is the all important factor in successful propagation from cuttings."

So, by experience, we come to know the right conditions for each plant of when to cut it and bring it out. Obviously, one advantage with tissue culture micro shoots is that the lab can produce cuttings year round so the calendar goes out the "greenhouse window," except that the timing has to be right with conditions in the greenhouse.

The timing for each plant is much the same as for standard cutting propagation. Deciduous items are rooted from March onwards. This includes: *Amelanchier, Syringa, Magnolia,* and *Betula.* Slower growing evergreens are rooted July through September. This includes: *Cornus canadensis* and *Kalmia.* Other evergreens, such as *Pieris* and *Rhododendron* are rooted from September through March. Of course, seasons vary but heat and light are still the main

factors for rooting. We are now doing more work with high pressure sodium vapor lights to give us more flexibility and use our space more efficiently. So far, we have seen that conditions of the wood and timing are very important.

Once the decisions have been made and we can bring the shoots out, they come either pre-cut from the lab in tubs, or still in the sterile jars. These shoots are accustomed to ideal conditions of high humidity, so we must continue this by keeping shoots cool, misted or covered with wet paper towels.

Hartmann and Kester (2), wrote "cuttings should be kept moist, cool, and turgid at all times." Rather obvious, but with shoots this size the error of margin is much less. Our planters keep the cuttings misted with Mister Squirt bottles as they plant. Possible automatic mister lines would work on a larger scale in the future.

Hygiene is very important, as in all propagation methods. We follow strict cleaning of *all* work benches, tweezers, and greenhouse benches with sodium hypochlorite, ammonia, or any other good cleaner, at recommended rates. We plant in 4 in. pots with new flats using a mix of fine perlite, fine peat moss, and sawdust, equal parts of each although we may use an 80/20% mix of perlite/peat for better drainage. As in standard propagation, we know certain plants need higher moisture levels for roots to form.

The first mix mentioned above is for rhododendrons, azaleas and blueberries; for *Daphne* and *Amelanchier* we use a dryer mix. These soil mixes were developed from experience obtained with standard propagation. We continue to learn and record facts from our experiments. It is vitally important to learn from each experiment. One experiment we are looking at is using paper pots as an alternative to our 4 in. pots to help with our breaking out costs at transplanting.

Planting is done in 4 in. pots at a 5 × 5 shoot spacing to give 400 plants per 17 × 17 in. flat. Larger cuttings are at a 4 × 4 spacing.

Grading is very important at this stage as "rubbish in will equal rubbish out." Micro shoots do not change this fact and through experimenting and experience one learns what inferior shoots look like for each plant. Our employees plant around 4 to 5 thousand in a 7½ hour day on piece work. Of course, good training, like any other job, is of the utmost importance.

After being misted-in they go on to the bench with a label to give us the name, stock number, date, quantity, and planter for detailed follow up.

Benches that are waiting to be filled always have mist coming on so new plants get misted when they are on the bench. It is very important to keep the moisture level up. We use biotherm heat cables to heat to around 65°F. (18°C.) at soil level. The first two weeks are important so we keep shoots well misted with mist coming on for 6 sec. every 8 min. Also, shade gives us additional

protection both on the benches and in the greenhouse. We are using a "Remae" material on the benches. After two to three weeks we reduce the mist to prevent decay. This timing is obviously dependent on the current weather conditions. In the summer we use fog with mist and in the winter we use polythene tents to keep moisture levels up. We do not run the mist at night. As the shoots begin to root we give less mist and more air to give good rooting conditions. With 60 benches holding 25,000 plants each we need a full time person to water, change clocks, check nozzles, and give plants their separate needs. Again training that person in the needs of plants is a "must" here, and in any propagation system. As the cuttings root we hand water more and also liquid feed to get the right size shoots.

I walk the benches twice a week with the department supervisor to look at problems, trying to see every batch of plants. Prevention is always better than cure. We put on a fungicide and insecticide bi-weekly. Just like in any normal propagation set up, we use a rotation of chemicals to prevent immunity to buildup. Without doubt, constant watching is important to be able to meet changing conditions of these micro-shoots.

The cuttings take between 8 and 12 weeks to root. Once the cuttings are ready to move out we take them to a similar greenhouse without fog or mist. We maintain similar conditions for a week until they are hardened-off. Then we maintain the plants until transplanting time, which may be 12 weeks or 6 months depending on the time of year.

As one can see, much good basic fundamentals of standard propagation are also required in micropropagation. We do get a better plant through tissue culture, but to put roots on the shoots we still need to use many true and tested principles.

LITERATURE CITED

1. Wells, J. S. 1955. Plant Propagation Practices. Macmillan, New York.
2. Hartmann, H. T. and D. E. Kester. 1975. Plant Propagation: Principles and Practices, 3rd ed. Prentice-Hall, Englewood Cliffs, N.J.