

HOW TISSUE CULTURE CAN BE THE ANSWER

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Since 1985 I have been the tissue-culture plant grower at A. McGill & Son Nursery in Fairview, Oregon. In the last few years I have seen quite an increase of interest in tissue-culture plants. Our only supplier of tissue-culture material is Microplant Nurseries which is a joint venture of A. McGill and Son and Knollview Nurseries. After a shaky start we have come a long way. Currently A. McGill and Son grow by tissue culture:

- 15 red maple cultivars
- 15 crab apple cultivars
- 2 ornamental cherry cultivars
- 4 birch cultivars
- 2 linden cultivars
- 1 sugar maple cultivar
- 1 amelanchier cultivar

We have been very successful in producing a field-ready plant for our growing fields and also for outside sales. Motivated by our motto of "Quality from Vigilance" we have worked to ensure a live tree in every hole, the result has been producing material we can be proud of.

HOW CAN TISSUE-CULTURE BE THE ANSWER?

As a tissue-culture plant grower, answering that question automatically puts me in the position of a "biased" authority, though I work to keep as objective a view as I can. There are quite a few advantages to growing trees by tissue culture; here are several examples:

1. Crabapples, less suckering means saving money.
2. Marketing of new cultivars in a much quicker fashion.
3. Solving the problem of incompatibility—think of red maples.
4. Securing the number of trees you want to plant of a certain cultivar when the seed source is not constant—think of linden.

Tissue-culture plants begin in the hospitable environment of the lab; there is plenty of nourishment, the heat source is constant, and the lighting is controlled to meet their demands. But at some point the plants must be exposed to all the elements of Mother Nature. That is where I come in. Those of us in the greenhouse stage of the business act as the transitional stage between the lab and the harsher outdoor environment. I would like to now take you step

by step through the process of getting the plants from the lab to the field.

We receive the plants in large boxes from our lab, Microplant Nurseries (3,000 to 4,000 plants, if rooted, per box—or approximately 10,000, if microcuttings, per box). The plants are then kept at a temperature of 35 to 45 °F. It is very important to plant as soon as possible. Freshness is the key. Always be ready to plant immediately, stay in contact with your lab so as to know exactly when the plants will arrive.

The containers we grow in are 1¾ in. x 1¾ in. x 2 in. plastic pots and are fabricated specifically for us by the McConkey Co. in California; 80 pots fit in an Anderson flat. Some people use plug trays (98 cell); others plant them in 2½ in. x 2½ in. x 5 in. tree pots. Therefore take your pick and make it work for you. I am sold on individual pots because somewhere along the line there is grading involved. Without grading, big-leaf maples will shade out the smaller trees. I feel it is more difficult to grade when using plug trays.

The soil mix must be a well drained soilless greenhouse mix. I use 50% fine composted (aged) hemlock, (fine fir also works well), with a 50% PreMoist, a W. R. Grace product. The PreMoist has some fertilizer value in it. Other people using different mixes have reported satisfactory results.

Flat filling is done with a Gleason flat filler. The flats are then moved to the greenhouse bench. There the flats are watered thoroughly. Make sure the growing medium is very *wet*. For some reason I do the watering myself, mostly because I want to make sure everything is wet through, sometimes this is difficult with bark. If it is not right, I have myself to blame. In the last going over I add 100 ppm calcium nitrate and Benlate, as the label directs as a drench. The calcium nitrate stock mix is prepared as follows: 2 lb calcium nitrate and 2 lb Benlate are mixed in two gal. of water. The stock is run through a 1:200 Smith Injector.

Our planting tool is a modified Grow-Straight, patented by J. Frank Schmidt. The crew stays together during planting, I do not want one person starting one end of the bench and one at another. The reason for this is because this is a critical time for the little plantlet and I have to keep some moisture on them all the time. So keep the crew together so you can do that easily with a fine mist nozzle. On very hot days I use the Baumac fogging machine and we plant in the fog. This makes it possible for us to plant 8 hours a day, as it keeps the plants and crew cool. Put the machine on automatic and set for 85% humidity—it works great. Our benches are tented and as soon as a bench is planted we close the tent tight to keep the humidity in.

A Mistomatic will take over and go off every 20 min. for 4 to 5 sec, just enough to keep the plants from wilting. Adjust when you feel the plants are getting too wet. A warning in this respect is: watch cloudy days, there are more sophisticated devices on market than the Mistomatic, such as the P.R. 2 made in California.

Another very important factor is the effect of chilling. Some plants need a bit of chilling before they get planted, especially crabapples, which need at least 6 weeks of 38 °F before planting. If they do not get that they will not grow. This is very important when you make early spring plantings of crabapples; when making summer plantings of crabapples the chilling is not necessary.

Depending on climatic conditions and plant type, rooted plantlets will need to be tented for 5 to 14 days for weaning. Microcuttings will need 2 to 4 weeks in the tents. As soon as the new growth appears and the plants seem "established", gradually reduce misting and expose plants to normal greenhouse conditions. The sooner the plants are out of the tented environment, the better. After you have gradually cut back on the misting, remove the tenting. This is best done early in the morning on a cloudy day. Be prepared to watch very closely and apply water as needed. Some people continue to use shade cloth for several days after the plants are out of the tents. Bottom heat is still recommended if the weather is cold. Ultimately, the plants should be able to stand regular greenhouse conditions.

As soon as the plants are in the open greenhouse start a liquid fertilizer program. I mix a stock solution in 10 gal. of hot water from the following constituents:

- 6 lb potassium nitrate
- 2²/₃ cup phosphoric acid, 75% industrial strength
- 6 lb ammonium nitrate, 34-0-0
- 5 lb urea, 46-0-0
- 8 lb magnesium sulfate, 9.8%, (epsom salt)
- 1 lb iron chelate
- 2 oz Peter's Special Trace Elements
- 2 oz manganese

This stock solution is injected through a 1:200 Smith Injector. I run the whole thing through a water boom system. Experience has taught me not to use this mix on 'Heritage' and river birch; they are burned. On these two items I use 100 ppm Peter's 20-10-20. I fertilize three times a week depending on the weather, if cloudy I slow it down. Fertilize the plants thoroughly and keep the plants growing!!!

To keep the temperature in the greenhouse tolerable I use 55 to 80% shade. This last summer was difficult for me, because we had so many cloudy days. As the plants start growing we have to do some grading to get those little plants from under the bigger ones.

Otherwise they get shaded out. The bigger plants (8 in.) go outside to harden off for 3 to 4 weeks—the longer the better. The fertilizer is cut off as soon as the plants go outside, where the plants will still grow 4 to 6 in. until all the fertilizer is used up. The plants are clean to start with and disease is not too much of a problem. Keep a bit of Benlate on the plants in the early spring, according to the label. This tends to keep *Botrytis* at bay. In addition to the Benlate, use plenty of ventilation.

Aphids at times infest the crabapples and birches; I usually fumigate 2 or 3 times with nicotine. I do not like to use other sprays like Malathion because the plants are soft and have a tendency to burn easily.

When the plants are hardened-off enough so the mechanical planter can take them, we make a planting. We make 4 to 5 plantings during the spring to fall growing season. Cut-off date for our last planting is usually September 15. This gives the plants enough time to get established for the winter. At the time of planting we bury a "T-tape" under the plants so we can drip irrigate any time we want. By the time the planter is on the end of the row the water is not too far away. The drip system stays with the plants until digging time, 2 to 3 years later. This allows us to economically water and fertilize our fields any time we desire.

The end product, of course, has to compete with a budded tree or seedling. If you compare the different ways of growing with tissue-culture trees, the tissue-culture will match up very favorably. We dig beautiful trees with excellent root systems.

One last word, I believe there is a tremendous opportunity for tissue-culture trees in the future; both in field production and in the container yard.