Size-controlling Fruit-tree Rootstock Production: Methods Used at Traas Nursery

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INTRODUCTION

At Traas Nursery our primary product is dwarfing and semidwarfing fruit-tree rootstock. We currently raise 12 different cultivars of *Malus* for apple rootstock, *Prunus avium* F12/1 for cherry rootstock, *Cydonia* A (often called Quince A) for pear rootstock, and *Prunus insititia* Saint Julien A for plum and large stone fruit such as peaches and nectarines. The range of size control available in our *Malus* line varies from approximately 25% to 80% of standard. All our stock is vegetatively produced from clonal selections, either by mound-layering, stooling, or hardwood cuttings. No seedling stock is raised at all. The advantages of clonal production as opposed to seedling production is well known. Uniformity is critical when planning new orchards of high density plantings. With some plantings as high as 3500 trees to the acre, there is no place for trees that do not develop to a uniform size, particularly if they grow larger than anticipated. Our main markets are nurseries that custom-bud or graft for orchard renewal and/or garden center sales and the actual orchardists who in some cases prefer to raise their own young trees.

Most of our early plant material came from European sources, primarily East Malling Research Station in England; well known for its work in developing and testing fruit tree rootstock. Stock was also obtained from Poland, The Netherlands, and Germany. Some of our more recent mother stock came from a tissue culture lab in B.C., as we are not set up to do our own tissue-culture work. Our findings were that in the initial years of production, the rootability of the tissue cultured stock seemed to be better than the same cultivars but of a non-tissue cultured origin.

Our annual production of understock fluctuates from 900,000 to 1.1 million trees. All trees are harvested annually. Of this number, approximately 20% are trees transplanted for a second year to develop a more abundant root system. After grading, stock is kept in cold storage at 33 to 36F and can be kept dormant for up to 6 months if necessary. There are similarities in production in all species, and where they are different it will be noted.

MALUS, *PRUNUS AVIUM* (CHERRY) AND *CYDONIA*

Once the parent stock has been obtained and planted, we allow them to grow for 1 year to establish a well anchored tree. Typically our plant spacing in the row is 20 to 25 cm (8 to 10 inches) apart, with row spacing being 1.25 m (50 inches). During the first year we maintain good growing conditions by timely weed control, pest management by regular spray program, and irrigation as necessary. Our weed control is all done mechanically, with hand weeding between plants in the row. The trees are layered the spring after planting. The method we use can best be described as a running braid down the length of the row. To

accomplish this we remove approximately 1 to 1½ inches of the soil from between the trees in the row so as to lower the bed level. We then bend the tree horizontally and weave each adjacent tree with the next. These are secured horizontally by a wooden peg with a nail inserted.

As the stock starts to grow, we cultivate the beds every 7 to 10 days, weather permitting. The shoots being positively phototropic, grow vertically, regardless of initial placement of buds on the layered mother plants. Once the shoots reach 10 to 12 inches in length, we begin mounding on the 7 to 10 day cycle. In the early stages of mounding, care must be taken not to damage the shoots as they are quite herbaceous for the first 6 to 8 weeks. Damage can occur by breaking the shoot off at the base or by burying the shoot too deeply, effectively smothering the plant. Each time we mound up, we add approximately ½ to 1 inch of soil to the base of the shoots or the top of the existing mound. This is repeated until there is about 10 inches of soil above the mother plant. Not only does this process add rooting medium (soil in most cases), it also doubles as effective weed control since any germinating weeds do not get very large with the short interval cultivation. By the end of September it is no longer possible to add any more height to the mound as the angle is too steep and the soil rolls off. By the middle of October, most of the needed caliper has been attained but there can be too much top growth for ease of handling. Stock is therefore topped to an overall length of 28 to 30 inches. At times 12 to 18 inches can be removed. This is done by a modified corn chopper which returns the chips back to the field in small enough pieces so as not to interfere with later harvest or cultivation. As we grade the cherry rootstock by length over 3 ft this part of the preharvest operation is not done with our F12/1.

Our harvesting methods are also different between the *Prunus* and some of the *Malus*. As the cherries do not root as easily as some of the apple clones, they must be hand-harvested to ensure a good supply of well rooted plants. Since the roots have a tendency to develop quite low on the shoot, it is more advantageous to cut them with loppers rather than our mechanical harvester. This same method of harvesting also applies to those of apple that are not as rootable as others. Of the 12 cultivars that are produced at our nursery, the rootability percentages range from 40% to 50% for the poorest rooting to 90% to 95% for the best rooting. Unfortunately, not all the high-demand understock have high rooting percentages. The poor rooting of the stock most in demand is of great concern to us, as our harvest window during the winter can be restricted by weather, which in our area is usually in the form of rain. As most of our rows are between 400 and 450 ft in length, the time difference between mechanical harvesting (10 to 12 min per row) and hand harvesting (2.75 to 3.5 h per row) manifests itself the most in the amount of gradeable stock inside the warehouse when the wet periods do come. We have done some mounding with sawdust (hemlock/fir mix) in some of our heavier fields where the clay content is high. In the summer months when the fields are drier, it is difficult in these fields to break up the soil into a friable texture that will incorporate well around the developing shoots. It is essential that there is good soil-to-shoot contact for roots to develop. One of the benefits of using sawdust, that we had not expected, was that even when the soil-based fields were wet, and the clay-based fields without sawdust all but impassable, harvesting from sawdust-based fields could still continue as there was little or no mud.

During grading, the poorly rooted or rootless stock is discarded, unless there is a higher demand than 1-year production capability for that particular cultivar. In those cases they are rough-graded to size and dipped in 2500 ppm IBA for apples and smaller cherry stock. Cherry stock larger than 5/16-inch caliper are treated to an increased concentration of IBA (5000 ppm). In all cases the trees receive a 5-sec dip. We have found that this stock roots more readily than a hardwood cutting, as the base has already been etiolated during the first year's development on the stool bed. These "rootless" shoots in the case of *Malus* are stored horizontally in square piles with the bases facing out to enable us to water as necessary to prevent drying. This is done in a root cellar with a uniform temperature of approximately 45 to 50F. Humidity is also quite high although no readings have been taken with a hygrometer. The *Prunus* rootless stock is heeled in sawdust in a cooler with a heated floor as this method has been successful for us in the past.

Cydonia A had been grown by hardwood cuttings prior to 1992. We now produce these from a true stool bed. We switched from cuttings to stooled production purely by accident. The mother block had not had the cuttings removed in the fall of 1991 and as the shoots were already starting to flush before late cuttings could be taken, we felt we could not grow any quince that year. Being pressed for time, we cut the whole mother plant down to ground level. Shortly thereafter, the abundant new shoot development that manifested itself was too inviting to ignore. We mounded with sawdust and to our surprise found these new shoots were readily rootable. The quality of plants harvested were also better as the shank was straight as opposed to the former hardwood cutting method which usually had a dog-leg from the top of the cutting where the new growth started.

PRUNUS (PLUMS)

In the past we attempted to raise our plums from layer beds and found this to be impossible. Although there was excellent shoot development, none rooted. We have, therefore, grown all our plum rootstock from hardwood cuttings. Cuttings were taken in the fall (late October) and cut into 14 to 16 inches in length.

Our experience has shown that the base cutting always rooted the best with marked decrease in rooting with the second and third cutting from the base. Any growth over the third cut is discarded. All Saint Julien A cuttings are dipped for 5 sec in 5000 ppm IBA with the medium temperature maintained at 68 to 70F for 4 weeks. By taking the cuttings in late October we could capitalize on our available time before actual layer-bed harvesting commenced in early November. Sadly, this convenience has not been to our advantage. We have struggled with inconsistent stands of cuttings and have always done small experimentation each year to improve the production. This past season's experiments included different media types. In the past we have used damp sawdust (hemlock/fir mix). For our trials we used milled coconut husk (coir), coir/sawdust (1 : 1, v/v), coir/sand (1 : 1, v/v), sand/sawdust (1 : 1, v/v), sand, and sand/coir/sawdust (1 : 1 : 1, by volume). Results were varied but no one trial was remarkably different than any other. Another experiment involved timing. It is here that the most dramatic difference showed up. Having made most of our cuttings at the "normal" time of late October, we left some of the cutting bank untouched to provide a source for early spring cuttings. These later cuttings

were taken and stuck on 1 March. Hormone treatment and bottom heat were identical to fall cuttings. The rooting was more spontaneous and after planting established much quicker with a more uniform stand. Both cutting times were planted within 2 days into the field. We will repeat this procedure in the coming year to determine if it is consistent year after year. We will undoubtedly reduce the number of fall cuttings considerably and concentrate on early spring. Although making cuttings in the spring may not be as convenient for us as in the fall, the extra effort will result in extra stock that establishes and grows better.

These are the methods we use for fruit tree rootstock production and they have served us well. We will continue to strive for increased production efficiencies both in numbers and labor in the future to continue to supply the understock necessary for the trees of the future.

Sanitation for Clean Liner Production

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HISTORY

Briggs Nursery produces 7 million plantlets from tissue culture on an annual basis. At any given time 2 to 4 million plants are either in rooting or in a production phase.

At Briggs Nursery plants are always being sold or moved and by utilizing facilities and personnel on a year-round basis the empty houses are continuously being refilled.

The threat or potential for diseases, weeds, liverwort, and/or mosses is always present. Some of the disease organisms that are a concern are: *Botrytis, Fusarium, Rhizoctonia, Cylindrocladium, Phytophthora, Theiophis*, powdery mildew, downy mildew, rusts, leaf spots, and mushrooms.

Where disease organisms originate, how they spread, and what causes flare-ups remains a mystery. The nursery has used consultants and research people to help pinpoint sources of contamination. Their recommendation is always the same: maintain cleanliness and use good water management.

WHY SANITATION IS IMPORTANT

Without good sanitation procedures disease problems are unavoidable. Sanitation needs to start at the beginning of the crop growing cycle and to be carried through to the end. Sanitation steps should be practiced on benches, flats, containers, soils, propagation areas, trailers, and all growing structures. All of the above, if not monitored for cleanliness, can cause the spread of disease and liverwort.

METHODS

All growing/propagation flats and pots should either be new or cleaned and sanitized thoroughly. Any soil particles left in flats or pots have the potential to harbor disease spores. At Briggs Nursery flats are reused only after being washed and sanitized. Pots are never reused because the possibility of leaving behind soil particles is too great.