ASEXUAL PROPAGATION OF FRUIT AND NUT TREES AT STARK BROTHERS NURSERIES

ELMER L. KIDD, III

Stark Brothers Nurseries and Orchards Co.
Louisiana, Missouri

Stark Brothers Nurseries is 170 years old and produces 2 million trees on 2000 acres. The company is most noted for its Red and Golden Delicious apples, which account for 60 percent of total production.

At Stark Brothers we employ the following four asexual propagation techniques in combining scions to stocks:

1. T-Budding
2. Chip budding
3. Bench grafting (whip and tongue)
4. Crown grafting (whip and tongue)

All understocks used by Stark Brothers are purchased as liners from outside vendors except for peach and nut understocks, which we propagate as seeds obtained from both in-house and external sources.

Scionwood is obtained exclusively from our in-house scion orchard blocks, which are maintained as non-fruiting, hedgerow trees. Budsticks are cut and de-leafed one day prior to being used. Our budding season runs from early July through late September. Dormant wood to be used in our winter bench grafting and spring crown grafting operations is harvested from the scion orchards in early December.

Table 1 shows the various understocks used by Stark Brothers, the scion types propagated to these understocks, the propagation technique used for the various combinations, and the number of years following propagation that are required to bring the trees to salable size. Salable size is considered to be a branched tree with ½ to ¾ in. caliper in most cases.

Our T-budding technique is fairly standard. As scion sticks are de-leafed, a small portion of the petiole is left attached to the bud base to facilitate the handling of the bud shield as it is removed from the stick and placed in the "T" cut on the rootstock shank. Scion sticks are wrapped in burlap and kept cool and moist. Depending upon the kind of rootstock, the bud shield is placed in the rootstock anywhere from two to six inches above the soil line. T-buds are quickly wrapped with elastic budding rubbers which are left in place for approximately 14 days. A good budder will bud in excess of 1,800 buds in an eight hour day and a 90% bud stand or "take" is considered excellent. The T-budding of peach and nectarine in early July marks the start of our summer budding operation. We do not produce any June-budded trees.

Table 1. Asexual propagation scheme for fruit trees at Stark Brothers Nurseries.

Rootstock	Scion cultivar types	Type of propagation	Years to harvest salable trees
Seedling apple *Malus pumila*	apple	bench graft	2
Clonal apple *M. pumila* 'Mark', 'EMLA 7', 'M 7A', 'EMLA 9', 'EMLA 26', 'EMLA 111', 'EMLA 106'	dwarf apple	chip bud	1
Seedling pear *Pyrus communis* 'Bartlett' *Pyrus calleryana*	common pear Asian pear	chip bud	1
Clonal pear *P. communis* 'OH × F 333', 'OH × F 97'	common pear Asian pear dwarf pear	chip bud	1
Seedling quince *Cydonia oblonga* 'Provence'	dwarf pear	chip bud	1
Seedling peach *Prunus persica* 'Lovell', 'Red Leaf', 'Nemaguard'	peach nectarine	T-bud	1
Seedling prunus *Prunus tomentosa* *Prunus besseyi*	dwarf peach dwarf nectarine dwarf plum dwarf apricot	chip bud	1
Seedling cherry *Prunus mahaleb* *Prunus avium*	sweet cherry sour cherry	chip bud	1
Clonal cherry *P. mahaleb* × *P. avium* 'M × M 14' *P. avium* × *Prunus* *pseudocerasus* 'Colt'	dwarf sweet cherry	chip bud	1
Seedling plum *Prunus americana*	European plum/prune Japanese plum	chip bud	1
Clonal plum *Prunus insititia*, 'St. Julian A', 'St. Julian ×'	dwarf plum dwarf peach dwarf nectarine dwarf apricot	chip bud	1
Seedling apricot *Prunus armeniaca* 'Manchurian'	apricot	chip bud	1

After the peaches are T-budded, the balance of our budding operation shifts to chip budding. We find that, except for peaches, chip budding provides us with better stands and a straighter, more uniform tree growth. In collecting bud sticks for chip budding, it is important to match the caliper of the budstick with the caliper of the rootstock shank. Leaf petioles are completely removed from sticks used for chip budding.

In the chip budding procedure the receptive cut on the rootstock is made first. This requires two cuts. The first is made to a

depth of about ⅛ in. at an angle of 20 degrees to the stem to form the basal lip of the cut. The second cut is made 1½ inches above the first, entering the stem at the same 20 degree angle and then cutting down to meet the base of the first cut. In similar fashion, a chip of matching scionwood is cut from the bud stick and placed in the receptive cut on the understock. The length and width of the scion chip should be slightly less than the chip of understock it replaces. It should never be larger. The lip of the receptive cut holds the scion chip in place until it is wrapped.

We use ½ × 12-in. strips of clear 4 mil polyethylene to secure the scion chip to the understock. The material we use has a slightly elastic quality that allows for a more secure wrap. The bud is completely covered in all cases, except for cherry buds which are allowed to protrude from the wrap. Bud unions are usually sufficiently callused in 30 days, at which time the plastic wraps are removed. A good budding team can place and wrap 1800 chip buds in an eight-hour day. Bud stands often approach 100 percent and those buds that fail to "take" are rebudded to fill out the stand.

Stark Brothers grafters produce 750,000 bench grafts each January. To accomplish this feat, individual grafters are expected to make in excess of 1,600 grafts per day. The grafter first cuts a pile of 100 scion sections containing five buds each. The scion sections are then matched in caliper to a 4½-in. section of seedling root and the two are grafted together via a standard whip-and-tongue graft. Generally, two root sections can be obtained from each seedling rootstock. The grafts are then tightly wrapped with a biodegradable cloth tape, boxed in crates filled with moist excelsior and held at 70°F for 10 to 14 days to complete callusing of the graft and then stored at 34°F until being lined out in the nursery row in April. Success in callusing the graft is almost always better than 98%, but additional losses are incurred when 10 to 15 percent of the grafts fail to transplant successfully.

Our crown grafting procedures are best exemplified by our walnut propagation efforts. Stark Brothers is currently propagating and marketing a total of 15,000 grafted walnuts each year. The species propagated are *Juglans nigra,* (black walnut), *Juglans regia* (English or Persian walnut), and *Juglans cinerea* (butternut or white walnut). All three species are crown-grafted to two-year-old eastern black walnut (*J. nigra*) seedlings which are selected for their vigor, hardiness, and desirable root system.

Our procedure calls for the cutting of the understock three to 10 days prior to grafting the scion cultivar. The timing of the grafting operation is determined by the cessation of sap bleeding and the anticipated weather conditions at and shortly after the time of grafting. When conditions are right for grafting, ⅜ to ⅝-in. caliper scions are grafted to the seedlings, wrapped with masking tape and then tented with aluminum foil for 10 to 20 days, until shoot growth

approaches 1-in. in length. This technique regularly yields a success rate greater than 90 percent and finished trees in the three- to four- (two- to five-) foot range. Recent tests with rose wax indicate that dipping the scions in wax prior to grafting may eliminate the need for the aluminum tenting.

HANDLING TISSUE CULTURE PRODUCED LINERS

JAIME E. LAZARTE and CAL A. FROBERG
Plant Reproduction International, Inc. (PRI)
20835 Broze Road
Humble, Texas 77338

Abstract. Quality, competitive prices, and customer service are a must in the tissue culture industry. Quality includes health, branching, size, true-to-name, labeling, packing, and shipping. Stage II and III plants should be planted as soon as they are received and should follow a 4-week acclimatization procedure. Stage IV plants should be watered and placed in a shaded area as soon as they arrive. Transplant Stage IV plants as soon as possible.

The tissue culture industry started approximately 15 years ago. However, research in tissue culture dates back to the 1890s. Since then advances have been made in improving propagation, increasing production, developing new types of plants, and in producing disease-free plants.

There are a handful of laboratories above 15,000 square feet and many small operations around the country. At Plant Reproduction International, Inc. (PRI) we have an 18,700 ft.^{2} facility, which includes research and production laboratories. Our average capacity is 24 million plants per year. We have occupied our new facility for a year and our present inventory is 800,000 plants. Our goal is to reach 1.5 million plants in production by 1987.

Products and marketing. Tissue culture laboratories have had a non-competitive market for their products until two or three years ago, when two large tissue culture labs were started, one of them PRI. At present there is a market for tissue-cultured plants with better plant quality and competitive prices. Such competition is favorable for the growers and for the labs that know how to do it right. PRI visualizes that in the future the marketing competition will be much like the fashion industry, focusing on new, high quality, and competitive-priced products. It is for these reasons we emphasize research and development.

Our research department is currently working on introducing different types of plants into tissue culture, especially woody plants, and developing procedures for new introductions. PRI's research goals include short, mid- and long-term objectives in areas