

## Budding and Grafting of Fruit and Nut Trees at Stark Bro's

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As a propagation foreman for Stark Bro's Nurseries & Orchards Co. of Louisiana, Missouri, I would like to give you an overview of my company's general propagation technique and some specific information on a machine bench-graft technique we have recently perfected.

Stark Bro's Nurseries and Orchards Co. is 176 years old and currently produces and markets 1.5 million fruit trees annually. We market many more small fruit, ornamental, and hardgood items through our mail order, wholesale, and commercial-orchard sales operations, but the production and sale of fruit and nut trees is the backbone of our business.

With home offices at Louisiana, Missouri, the company maintains nearly 1,200 acres of field production operations in Missouri, Illinois, and California. We are most noted for the development of the red and golden delicious apple cultivars that together account for 60% of the world's current apple production.

Stark Bro's current product offering includes 207 cultivars of deciduous fruits and nuts. Propagating this number of cultivars to 27 rootstock cultivars results in nearly 1,000 scion/root stock combinations, which must be tracked through our production, storage, and shipping operations. The first step in this long process is the timely placement of the scion cultivar onto the rootstock.

At Stark Bro's, we employ five asexual propagation techniques in combining scions to rootstocks:

- 1) T-budding
- 2) Chip budding
- 3) Bench grafting (whip and tongue)
- 4) Crown grafting (whip and tongue)
- 5) Machine bench grafting

All understocks used by Stark Bro's are purchased as liners from outside vendors except for peach and nut understocks, which are planted as seeds primarily collected from local sources. All of our propagation is conducted by full-time employees.

Scion wood is obtained exclusively from our scion orchard blocks, which are maintained as hedgerow trees. Budsticks are cut and the leaves removed one day prior to being used. Our budding season runs from early July through mid-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.

For the past two years, we have shifted our entire budding operation to chip budding. We find that chip budding provides us with better stands and 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.

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 one-eighth inch at an angle

of 20 degrees to the stem to form the basal lip of the cut. The second cut is made 1 to 1½ in. 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 scion wood 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 and should never be larger. The lip of the receptive cut holds the scion chip in place until it is wrapped.

We use 1/2- × 12-inches strips of clear 2-mil polyethylene to secure the scion chip to the understock. The material we use is slightly elastic, which allows for a more secure wrap. The bud is completely covered in all cases. 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 2,500 to 3,000 chip buds in an eight-hour day. Bud stands often approach 100%, and those buds which fail to "take" are rebudded to fill out the stand.

Historically, the apple bench-grafting program at Stark Bro's was designed around several skilled technicians using the whip-and-tongue method of hand grafting. This system has proven successful over the years and has produced as many as 2.5 millions bench grafts a year during the winter months of January and February. In recent years, however, with the expansion of our operations to the West Coast the ability to maintain the necessary staff of trained grafters has become more difficult. With the addition of our California operation in 1987 our bench-grafting program has increased to include another half million Malling apple grafts. At the time of the acquisition, Agrisun Nursery was making about 200,000 bench grafts a year of both apples and cherries. To accomplish this they had developed a program that incorporated the use of a hand-operated French grafting machine. We found this unit to be too slow, and because of the uneven pressure, the cambial tissue was often torn, or the scion was jammed in the machine. With the help of the California staff, we have developed our new machine.

The pneumatic machine we are currently using was designed in-house and requires 130 to 150 pounds of air pressure to operate efficiently. One large compressor stored in another adjoining building operates the eight machines. We did this to avoid the noise. Each machine has a silencer tube running beneath the table to muffle the noise. The machine cut is a standard cleft-graft cut approximately one inch long. We do like this cut better than some of the smaller notch type or omega cuts made by many of the grafting machines developed for the grape industry. This larger cut allows for more cambial contact and a stronger graft union than others we have tried.

Machine grafting brought a new approach to bench propagation. We have found it to have four advantages:

- 1) Machine grafting does not require a long training period, usually a single full day, if the employee is fairly dexterous.
- 2) We experience fewer injuries related to muscle strains, carpal tunnel syndrome, or other similar problems.
- 3) We can make larger caliper grafts with much less effort than with hand grafting, giving us much more flexibility in matching the scion to the rootstock.
- 4) We waste less material because the machine can use larger scions and rootstocks than we could use with hand grafting. The grafting machine system is an assembly-line approach using eight machines and five teams of employee. The



first group of three to four employees prepares the rootstock by removing all the secondary branch roots from the main tap root, or from clonal rooted cuttings, back to ¼-inch root initials. The second team of two people cut the scion-wood sticks into 5-in. lengths with a bandsaw. The roots and scions are then placed in separate plastic tubs.

The next two teams are the eight grafting-machine operators. The first four machine operators make the point cuts on the basal end of the scions. At the same time the other four grafting-machine operators are making notch cuts on the rootstock sections. We prefer this method of notching the rootstock rather than the scion because we have found that many of the cultivars we currently have in production tend to split when the notch is cut. This reduces the chance of a successful graft. The points and notches are made quickly and transferred from one tub to another for transport to the wrapping line.

When the wrappers receive the tubs of scion points and notched rootstocks, they put the scion and rootstock together, carefully matching the diameter size of each piece. Then starting at the top of the scion and wrapping downward, the wrapper firmly places an air-tight wrap over the graft union. Seedling grafts are wrapped with biodegradable cloth tape. Clonal grafts are wrapped with a very economical light-grade masking tape.

In Missouri the grafts are counted and moved to the packing station where the grafts are dipped in rose wax from the scion end to the taped union of the graft. Then the grafts are packed in damp dog-hair moss in a 16-in. × 16-in. × 4-ft box, lined with kraft paper.

The boxes are moved into our callusing room and allowed to callus at 70°F for about 12 days. Once the grafts have formed sufficient callus, they are moved to our cold storage building and stored at 35°F until planting. Planting is scheduled for the first week in April, when the grafts are removed from storage and machine planted at our Illinois growing site.

At the California plant the bench grafts are taken directly to the field and planted during January and February. Due to the diversity of the many products Stark Bro's produces and the variability in types and sizes of propagation material, growing location, and marketing programs, there will always be a place for some hand grafting. However, as we look toward the future, machine grafting offers a new practical approach to producing economical nursery stock.