

**Timing When Bench Grafting.** If the understock roots are inactive, even if the scion is healthy and the graft was made technically correct, the chances for failure are good. Again, it is important to look for 1/4-in. white tips on the roots or indications of buds swelling.

## Propagation Stock Orchard Management and Wood Selection of Fruit and Ornamental Plants

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Propagation stock sources at L.E. Cooke Co. vary from purchased liners, seedlings, budwood, grafting wood, seed, tissue culture, and unrooted cuttings from seedsmen and commercial suppliers in the U.S., arboretums, and government repositories, to our own 60 acres of seed orchards, bud-scionwood orchards, 5 acres of cutting beds, and 20 acres of field division blocks and berry tipping beds. Because we practice a foundation stock plant program, L.E. Cooke also has Foundation screen houses, a registered mother block, and registered scion and seed tree blocks. These sources provide the 1300 cultivars in our production of 7 million trees per year and over 3500 cultivars in our total collection, many under evaluation from plant breeders and our own customers.

In any discussion of management of these sources, the use of their products controls the stock plant treatment.

<u>Source</u>	<u>Harvest Time</u>	<u>Product</u>
Berry-tipping beds	Mid fall	Rooted tips
Shrub-cutting beds	Winter	Hardwood cuttings
	Spring-summer	Softwood cuttings
Field division blocks	Fall	Division planters
Seed trees	Summer-fall	Seed for rootstocks, ornamentals
Cutting stock trees	Fall-winter	Hardwood cuttings
	Mid summer	Softwood cuttings
		scion/budwood trees
	Winter	Graftwood, bench-grafting scions, spring budwood
	Late spring	June budwood
	Summer	Summer-dormant budwood
Registered increase rows	Fall	Fall budwood
	All	All types, new clones
Screenhouse foundation virus-free trees		New mother blocks, budwood for new mother blocks

## NUTRITION

All cutting, scion, and budwood sources receive what we estimate to be their optimum fertilization in mid-March. Trees for June budding are fertilized at half-rate to help mature wood for early May budding. Medium-density plantings receive single applications of 120 lb per acre N, P, and K on legume and fescue orchard middles. Seed tree plantings are fertilized in fall and spring. Cutting blocks are on continual fertilization with irrigation and division and cane-tipping blocks are fertilized according to growth and temperature so they are at the correct size for division and tipping in the fall. Fertilization rates are not adjusted to size the wood. Dormant pruning and pinching of terminals are used to get the desired wood size.

## PESTS AND DISEASE

Good pruning and diseased wood removal is important as is timely sprays for fire blight, various blossom blights, brown rot, and mildew. Pest control measures are primarily directed at dormant scale sprays and the occasional aphid infestation. Most notable in using an orchard cover of grasses and legumes is the absence of mites and lepidoptera pests due to the high number of predacious insects and the attractant of lush orchard floor growth. This is not true in our mother blocks, which must be kept weed free for potential vector control by state law. There, we have significant control costs.

## VIRUS ELIMINATION AND REINFECTION CONTROLS

In California, there is a pome and stone fruit registration program for nurseries producing certified nursery stock. Funding for the program is via acreage fees. Also supporting the virus elimination and tree improvement is a California Department of Agriculture Assessment via a tree sales tax of 1% on most *Prunus*, pome, and nut tree sales. This assessment is allocated by the state through an Improvement Advisory Board that evaluates research proposals on virus and other crop limiting factors. It is through this board's program of virus elimination via heat treatment at Prosser and virus index program called the 10-Step program that L.E. Cooke Co. and other participating nurseries have used to eliminate virus and virus-like diseases from our stock plants. After treatment and testing at IR-2/NRSP-5, a U.S.D.A. Program located at the University of Washington-Prosser, these clones are returned to the participants. To maintain them in a virus-free state, we place these Foundation Plants in the same type of screen house that exists at Prosser. Since L.E. Cooke Co. has many varieties of fruit and flowering plants that are grown for specific climates, and we have the only foundation grade plants of these clones, we maintain them in our screen house. From this foundation screen house we are able to start new mother blocks at our nursery and provide wood for other nurseries that are starting new mother blocks of these clones.

Regular virus indexing of these foundation screenhouse plants on shirofugen and all of our C.D.F.A. mother blocks and registered blocks ensures control of vectored viruses. Annual ELISA (enzyme-linked immunosorbant assay) tissue testing is also done to detect infection by necrotic ringspot virus and prune dwarf virus. Having certified nursery trees also expedites export to foreign countries. But the main benefit and pay back is in the increase in bud-take percentage and tree vigor.

## TREE IDENTIFICATION AND TAGGING

The importance of identification is critical if you are maintaining clones and following a virus-free protocol. If a graft-transferable virus is detected in a nursery crop then it is necessary to have good records that show the source of buds for the crop and the source tree of the buds of the parent tree of the crop. With this information it is possible to track and test the parent stock and find all infected stock for elimination from registration and prevent further use of infected stock plants. Tagging that assigns unique numbers to each stock plant and is used in the computer records for each individual plant is helpful in keeping track of each stock plant and its progeny for virus and budded stock growth checks. L.E. Cooke Co. uses laser-printed luggage tags that are laminated inside a 10-mil clear plastic pouch and tied to the stock plant with 20-mil green Miracle Garden Tie. The tags have the row, tree number, block number, tree name, planting date, and source printed on one side and the unique plant number in numerals and a three-of-nine bar code on the other side. Using the bar code has reduced our shirofugen index cost by 45% and increased the recording of data reliability by 95%.

Bar code is being tested for future use and should be very useful in budwood collection, budwood packaging, nursery row labeling, and data transfer to the office for inventory updating. Maintaining a cultivar as true to name implies that someone is checking that the cultivar is true to an original description and that those characteristics are the same in the plants that are selected to become the new mother/stock plants. Many things can influence change in the appearance of individual plants or populations of plants that are line bred to reduce variability. The interaction of the genotype with the environment is phenotypic variation that can change with environmental change. The responsibility of the propagator is to achieve a high rate of detection as possible of genotypic change or of "off-type" plants as possible. When a low rate of detection is present with a highly variable cultivar, the production of "off-type" stock is to be expected at a rate of the variation rate multiplied by the inverse of the detection rate. It is best to try to evaluate all new cultivars as they are received from the breeders and check them with a thorough description. All fruit plants should be fruited out and the characteristics checked before that individual plant is used as a stock plant. The progeny of the stock must be checked for trueness to type. This is the only way you can be sure a cultivar is being reproduced true to name and description. Many of the highly variable cultivars exhibit true-to-type mother plants, but have a high variability in the progeny. The cause of this variation is mutation in the genetic basis of the genotype and can be caused by many mutation-inducing factors that affect genetic material in the chromosomes (nuclear mutation) or affect cytoplasmic genes (point mutation). Multiplication of sets of chromosomes or polyploidy and translocations of chromosomes at specific loci can occur. Some of these are persistent at higher rates in some cultivars and must be carefully checked in expression to avoid unexpected performance that is not typical for the cultivar. A good example is bud failure in almond, *Prunus dulcis*. Another is the unstable mericlinal mutation exhibited in *Acer negundo* 'Variegatum' progeny. Not all mutation is bad, many of the great fruit cultivars are bud sport mutations. But careful selection and diligent checking of stock plants is necessary to keep the best true-to-type cultivars and clones growing.

## WOOD SELECTION AND CARE

Size of the required wood is determined by the understocks being budded and grafted. In short, the best size that fits is cut. To get wood that is the proper size and condition for grafting and budding is the difficult part. Some *Wisteria sinensis* and *W. floribunda* buds must be grown on fences or trellis to provide wood that is mature enough to bud and is the correct size. Some of the *P. cerasus* and *P. avium* cultivars require terminal tipping to produce small enough mature wood in the San Joaquin Valley of California. When the bud cutters cut a stock plant and it generally has wood that in their judgment is too small or too big they make a notation on the pruning book that is used at pruning time. One less bud per scaffold or one more bud per scaffold will be left for the next season to push. Some genera grow better budwood if they are only cut every other year for dormant and spring budding. These include *Cercis* and *Alnus* cultivars. Remove leaves as soon as possible for wood that will be used in a few days. Package by wrapping in damp newsprint, wrap in moistened burlap, then into plastic bags, and refrigerate at 34F. During shipment and longer storage I will omit the damp material and just wrap in plastic and refrigerate. For winter storage of fully dormant wood, it is essential to wrap in plastic quickly and to keep wood continually refrigerated at 33 to 36F or some wood will start to break dormancy very quickly (*Juglans*). The main cause of wood deterioration is dehydration; second is infection. Wood cutters must be trained to examine a plant the same way a doctor examines an athlete before an event. The cutters should know what the plant should look like and be familiar with the normal variation due to environmental factors, but be able to detect the slightest change from normal appearance. Standing at a distance from a group of plants and observing their color, reflection, branch habit, terminal coloring and general leaf characteristics will make variants more noticeable. On close inspection a look at leaf glands and stomata, exudates and pubescence, leaf shape and bark pattern are all clues to a good budwood cutter.

Study of diseased trees can improve recognition of disease much better than looking at pictures in books. Visits to disease gardens is helpful. Walking of nursery rows of bareroot stock to check for variants is a good lesson in the recognition of cultivars.