

A major potential use for olivine would seem to be in container production, particularly in warmer climates where long growing seasons and high water use are common. We are currently analyzing data from the 1987 growing season with *Photinia* × *fraseri*, compact Andorra juniper, and 'Hino Crimson' azalea as test subjects. Thanks to support from the Horticultural Research Institute, research into olivine's potential for the nursery industry will continue.

CHIP BUDDING OF MAGNOLIAS

CHARLES E. TUBESING

*The Holden Arboretum
9500 Spelly Road
Mentor, Ohio 44060*

Chip budding is well suited for the propagation of magnolias because it allows great flexibility in the scheduling of propagation. It is often practiced as a bench grafting technique in winter, and again in late summer and early fall. It is also used for outdoor grafting in spring, and in mid-to-late summer. In reality, chip budding is possible throughout the growing season. Highly specialized facilities are not required. If a greenhouse is used, grafts can be placed on an open bench. Grafting cases are not needed.

As a technique, chip budding is simple, easy to learn, and yields a high percentage of successful grafts. Close matching of stock and scion diameters is not necessary, permitting flexibility in rootstock utilization. Callusing of chip buds is rapid, and the graft unions are strong. Growth from the scion is vigorous, strongly upright, and of good form, frequently branching the first season. While these positive inducements apply generally to many species of broadleaved plants, they apply particularly well to magnolias.

PROCEDURE

I chip bud predominately onto established rootstocks in containers in the greenhouse, from late January to early March. Rootstocks are brought into the greenhouse (60°F minimum temperature) in early January, and set on an open bench. The stocks are ready for grafting when the buds swell.

The steps in chip budding are as described by Howard (1) and Macdonald (2). I prefer to collect scionwood the same day as I will use it, but pre-cut, dormant scions can be successfully stored by refrigeration in damp sphagnum moss in polyethylene bags for at

least 3 months. Advance collection and storage of fully dormant scions is necessary for any budding that will occur after buds outdoors have begun to swell.

In setting the bud chip in place, it is important that the cambial layers of stock and scion be aligned on at least one side. If, because of depth of cut or disparity between stock and scion diameters, the distance between the lines of exposed cambium on the stock is greater than that on the bud chip, it will only be possible to line up the cambium on one side. Alignment on both sides will shorten the time necessary for complete knitting of the graft, but alignment on one side is sufficient for union to occur.

For tying the grafts, $\frac{1}{2}$ in. wide polyethylene tape has been recommended, and works well. Being unable to locate a local supplier of polyethylene tape, I have substituted one-half inch, .004 gauge vinyl tape (from A. M. Leonard, Piqua, Ohio) with satisfactory results. Parafilm "M" has also been tried, but does not bind the chip tightly enough to the stock.

At 60°F minimum temperature, magnolias callus quickly. Chip buds with cambium matched on both sides are often completely callused and ready for removal of ties within 10 days after budding. Those grafts that leave exposed part of the cut area of the stock must be left tied until callus totally covers this area and contacts the edge of the bud chip. The advantage of using a clear tie, of course, is that the progress of callusing can be checked periodically, without disturbing the tie.

Once callusing is complete, and the tie has been removed, all or part of the stock above the graft is cut away to force growth from the scion bud. The stock may be cut off directly above the graft, just as you would prune a stem above a bud to redirect growth. If the stock is straight above the graft, I prefer to cut it off 4 to 6 in. above the bud, removing any side shoots or foliage, as well as any subsequent sprouts. Then the growth from the scion is tied to the remaining stub for support and training. Normally, this will be all the training that is necessary. Scion growth is strong and vertical, and apical dominance soon asserts itself, so there is little problem with errant growth, competing leaders, or suckers, such as often follows grafting a scion with more than one bud. The stock stub can be removed in late summer or fall, by which time the graft will be very sturdy.

COMPATIBILITY AND ROOTSTOCK SELECTION

When grafting a cultivar or clone of magnolia, a safe choice for a rootstock is the same species. I know of no case of intraspecific graft incompatibility in the genus *Magnolia*, such as occurs in *Acer rubrum*. When grafting a hybrid between two species that differ in stature, the larger of the parental species is recommended as a root-

stock, unless some restriction in size is desired. For example, *M. acuminata* is the preferred rootstock for its hybrids with *M. denudata* (e.g. 'Elizabeth,' 'Sundance,' and 'Yellow Garland').

Traditionally, seedlings of *M. kobus* and *M. acuminata* have been most often used as rootstocks for those magnolias which bloom prior to or along with leaf emergence. *Magnolia kobus* is a suitable rootstock for any of the early blooming magnolias which do not exceed it in vigor or ultimate size. *Magnolia* × *soulangiana* is also a good rootstock for these small and medium-size magnolias.

When the large Asian magnolia species such as *M. campbellii*, *M. sargentiana*, *M. sprengeri*, *M. dawsoniana*, or their hybrids, (e.g. *M.* × *veitchii*; *M.* Gresham hybrids), are grafted onto *M. kobus* or *M.* × *soulangiana*, the graft union becomes unsightly because the scion grows faster and larger than the stock. This is not a sign of incompatibility, as it does not lead to breakage or other failure of the union, but it does detract from the appearance of the tree. Even when the larger-growing *M. acuminata* is used as the stock, its girth lags behind that of the scion because of its slower growth rate. During my employment at the University of British Columbia Botanical Garden, I found that seedlings of *M. sprengeri* 'Diva' make excellent, comparably vigorous, rootstocks for the large Asian species and their hybrids, and are preferable to *M. acuminata* where they are hardy (U.S.D.A. Zone 6b). *Magnolia sprengeri* seedlings are not available commercially, but can easily be grown from seed to budding size in one season, if grown in a ½ gal. milk carton or container of similar dimensions, filled with a well-aerated medium. First-year growth of magnolia seedlings is severely restricted in containers less than 6 in. deep.

For those species of magnolia which bloom after their foliage is fully expanded, many stock and scion combinations remain to be tried. In my experience, *M. hypoleuca* [syn. *M. obovata*] is compatible as a rootstock for the following: *M. fraseri*, *M. officinalis*, *M. sieboldii*, and *M.* × *wieseneri* [syn. *M.* × *watsonii*].

LITERATURE CITED

1. Howard, B. H. 1977. Chip budding fruit and ornamental trees. *Proc. Inter. Plant Prop. Soc.* 27:357-364.
2. Macdonald, A. B. 1986. *Practical Woody Plant Propagation for Nursery Growers*. Timber Press, Portland, Oregon. pp. 483-486.