

plants these old methods are still best.

LITERATURE CITED

1. Conner, D. 1985. Propagation of *Mahonia* species and cultivars. *Proc. Inter. Plant Prop. Soc.* 35:279-281.

CAMELLIA GRAFTING AT MONROVIA NURSERY

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Camellias are one of the major crops at Monrovia Nursery. We prepare in the neighborhood of 1,500,000 camellia cuttings per year resulting in the production of over 1,000,000 liners. Approximately 600,000 of these liners are used for the production of larger containers while the rest are sold as liners. Of the 600,000 or so #1 container plants produced each year, only about 5,000 are grafted, (this is only about 0.8%).

We graft camellias for one of three reasons. First some cultivars ('Pink Pagoda' for example) are very poor rooters or grow poorly on their own roots. Second, we can multiply new cultivars faster by utilizing both softer cuttings and heavier scionwood from the plants where cutting wood is limited. Third, when we receive wood of the new cultivars from other nurseries or arboreta the wood is often unsuitable for cuttings, but better suited for scionwood.

Camellias require considerable care during the grafting process. We have had the best results utilizing the following procedure. For understock, we use strong growing cultivars (usually *Debutante*) grown in #1 containers and produced by cuttings. The caliper of the understock should be about $\frac{1}{4}$ in. diameter. To produce a plant of suitable size for understock it takes approximately 2½ years from the time of making the cuttings. Understock is hand selected and must not be too low-branched; it should have a straight base with little or no side branching for the first 4 to 5 in. above the soil. Many times, the best understock are the plants which are a little too "leggy" to be kept for growing on. Selecting them to be grafting understock makes good use of them.

Understock is brought into the greenhouse during the middle of December, about two weeks prior to grafting. Because of winter rains, the understock usually comes into the house quite wet. It often takes two weeks for the understock to dry enough to be suitable for grafting. We have found that if the soil is too wet, the plant will "bleed" heavily, which will interfere with callusing and contribute to disease problems at the graft union.

The greenhouse environment is very important. Camellias should be kept cool; heating is only provided if night temperatures fall below 40°F. Extra shade is provided by draping 55% shade cloth inside the greenhouse over the benches. Since the grafts are covered with clear glass jars, this extra shade is necessary to help prevent heat build-up in jars.

Once the understock has dried to a suitable point, grafting begins. Just prior to grafting all understock is sprayed with a 200 ppm Benlate spray. Since a cleft graft is used, the first step is to cut off the understock at a height of 2½ to 3 in. above the soil with pruning shears. Next, a fresh cut is made on the understock with a sharp grafting knife, removing a thin slice of wood and any damaged tissue resulting from the pruning shears. The first cut on the understock should not be flat, rather it should slope slightly to one side. Then a downward cut is made splitting the understock to a depth of about 1¼ in. This cut is made so that it bisects the angle of the first cut. In this way, one side of the vertical cut is through the high point of the understock. The understock is now ready for the scion.

Scionwood is collected from #1, #5, and #7 containers from last year's wood, although older wood may be used if necessary. Tips, seconds, and thirds are suitable. Scions are 3 to 3½ in. in length, containing 3 or 4 buds; shorter scions with only two buds may also be used if wood is in very short supply. Each scion should have two leaves (with the end ⅓ of the leaf removed). All other lower leaves are removed. Scions are washed in 200 ppm Physan, dipped in 200 ppm Benlate and stored in plastic bags at 40°F until needed. Camellia wood stores well and may be good for three weeks if stored in this manner.

The two cuts on the scion are 1 to 1¼ in. long. They should begin just below and on either side of one of the bottom buds, usually the second or third bud from the top. The bark left between the cuts should be slightly wider on the side below this bottom bud. Thus the scion base is slightly wedge-shaped. The very thin wood at the base of the scion should be removed since it is most susceptible to drying and desiccation.

Once the scion is prepared, it is placed in the understock so that the bottom bud faces out and is placed at the top of the sloping cut of the understock. Care should be taken to match the cambial areas of the scion and understock. Pulling the scion up so that ¼ in. of the cut can be seen above the understock often simplifies the matching process as well as providing a good visual area to check callus formation. The graft is then wrapped with a ¼ × 4 in. grafting rubber; no sealing is required. Lastly the entire graft is sprayed with a 200 ppm Benlate spray.

Wide mouth quart jars are used to cover each grafted plant. They provide each plant with its own mini greenhouse environ-

ment where a clean, high humidity condition can be maintained. Jars are washed and dipped in Physan prior to use.

By the third week after grafting, good callus formation can be seen; by the fourth week the buds on the scions begin to elongate and unfold. This is a critical time to watch for jar removal. At the first sign of bud unfolding, the jar should be tipped to provide some air circulation and start the hardening-off process for the graft. The jar may be completely removed two or three days after tilting. If leaves are allowed to unfold in untilted jars, the new scion will usually wilt badly and sometimes even die when the jar is removed. Light hand misting may be necessary on warm days to prevent wilting. Two to three weeks after jar removal, the plants may be taken outside and placed in a shade house where they again may require hand misting on warm days for awhile.

By the following spring, one year later, the grafted plants are ready for shifting to larger containers.

This method has worked well for us for many years. The most important things to remember are to keep the grafts dark, cool and dry, and to be sure to remove the jars before leaves unfold.

RECENT ADVANCES IN THE PROPAGATION OF WOODY PERENNIALS

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Abstract. Major advances have emerged in methods for cloning, creating new genetic variation (directed and misdirected), and in risk reduction associated with the vegetative propagation of woody perennials. These advances are related mainly to the capturing of specific genetic gains. Advances will be illustrated with wood ornamentals, forest (pine, fir, spruce) and fruit trees (peach, cherry, pistachio).

INTRODUCTION

Apart from classical and traditional methods of plant propagation (8,15), the emphasis in this review will be on more recent cloning procedures based on cell and tissue culture (4,5). Recent advances in propagation reflect three categories of trend. First, for cloning procedures, somatic embryogenesis in cell suspensions for mass propagation is increasingly being considered as an alternative or supplemental method to micropropagation (6). The trend with micropropagation and somatic embryogenesis is to apply these procedures to explants from mature trees. Second, methods are now available to create new genetic variation with long-lived woody