

white flowers with a darker pink area at the base of the corolla, and leaves heavily speckled with white. *Cyclamen repandum* var. *peloponnese* has similar splashes of white on the leaves, but flowers which are pink or even a deep magenta-pink. These two varieties of *C. repandum* as well as the pure white form are not hardy.

The beautiful, white-flowered *C. creticum* is one of the rarest of all of the cyclamen. It produces its leaves in the fall, but blooms only in mid-spring. To my surprise it has proven hardy, coming through the Eastern U.S. terrible winter of 1986.

The hardiest species of all is *C. purpurascens*, which blooms throughout the summer and fall and is hardy in Minnesota. It has the shortest dormancy requirement producing new leaves just as the old ones fade in late spring. The fragrant flowers are various shades of rose, and the leaves may be solid green or with varying degrees of variegation; some are even completely silvered. There has been some confusion over the status of a form with solid green leaves from the Fatrense mountains of Czechoslovakia, but botanists agree that there is no basis for giving it either separate species status or a varietal name. The 19th species, *C. somalense*, was discovered in 1986, and I have not yet seen it.

I urge you to get to know this group of plants by growing them from seed yourself or by purchasing nursery propagated, rather than wild-collected specimens.

PROPAGATING AND GROWING CRABAPPLES BY BUDDING

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INTRODUCTION

One thing I have learned in the nursery industry is that there is seldom only one correct way to perform a nursery task. As sure as you think you have perfected a method, someone else will come along with a new technique, an improved product, or a totally different way of thinking that produces equal or even better results.

When I returned in 1978 to the family homestead and business of which I had been a part for 10 years as a school boy, I soon attended my first series of nursery seminars and meetings. At one of them I was amazed to see a friendly but heated debate between two nationally respected propagators on the subject of rooting cuttings. One fought tooth-and-nail for the practice of "wounding the cutting within an inch of its' life"; and the other was equally adamant about not wounding. Both men were highly respected experts in the field.

Each truly believed his method was the best, and each proved his points with excellent yet comparable results. The reason I mention this is because our methods of budding may be totally different from yours. I am not suggesting that ours are the only, or even the best methods, but simply that these are the budding techniques that have proven to work best for us in our location through years of trial and error.

Simpson Nursery Company has been around for 137 years, being started by my great-great grandfather in 1851 when he contracted to grow 12,000 grafts of apples, pears, and grape vines. Through the years the name has changed a few times, and the emphasis has gone from nursery to orchard and back to nursery again, but it has always been owned and operated by the same Simpson family. If my son, Mathew, or daughter, Ann, should choose to continue in the same tradition, they would be the sixth generation. So, you see, we have been propagating trees for a long time.

SCION TREES

In a business where 95% of the products sold are produced by bud grafting, it is extremely important that the scions be of the very best quality, and that they be true to name. To insure this quality and accuracy, we grow and carefully maintain our own blocks of scion trees containing each cultivar of tree we propagate. We try to locate these blocks in areas that are visible, and easily accessible for pruning, spraying, mowing, and for performing other maintenance practices. Each scion tree is paint-coded to match our system of product identification to further insure against any accidental mixture of cultivars. The ideal practice is to keep scion trees of various ages growing in different locations near the rotating budding operations to insure against weather-related damage and old age deterioration of scion quality. Our scion trees are carefully monitored all year for disease, insect and weather damage. Pruning is done in winter or early spring in order to develop vigorous and healthy bud sticks.

UNDERSTOCK

A very important part of growing top quality ornamental trees is to use the best available understock. We do not grow our own, but purchase seedlings each year from nurseries which have consistently provided us with the best quality in past years. From time to time we have tested other special understocks for one reason or another, but now we use only domestic apple seedlings for crabapples, calleryana pear seedlings for ornamental pears and Washington hawthorn seedlings for hawthorn cultivars.

We prefer single-stemmed seedlings of $\frac{1}{4}$ in. caliper. Each seedling is carefully inspected and pruned for producing a good

straight understock in a length to fit our mechanical transplanter. The tops of apple seedlings are dipped in a liquid lime-sulphur mixture of 1 part to 10 parts water for added protection against scab. All seedlings are tied in small bundles and stacked in ricks with good air circulation in controlled refrigerated storage until planting time. They are hand-watered as necessary to maintain proper moisture.

As soon as weather and soil conditions permit in early spring, the seedlings are planted with a 2 row planter in rows spaced 50 in. o.c., and seedlings spaced 12 in. apart in the rows. The seedlings are then packed firmly into the ground by using the same packer my grandfather used years ago. It consists of two large cast iron wheels probably weighing 200 pounds each. Finally, any leaning trees are straightened by foot and all fields are cultivated. It is important at budding time that the seedlings are growing perpendicular to the ground and with a caliper equal to or greater than that of the mature bud sticks.

BUDDING

Prior to 1986, all of our propagation was done by shield budding, or T-budding. On specific cultivars of apples, pears, and hawthorns, which consistently result in poor bud take, we have double-budded to increase the percentage stand. This is done by budding a second time at a later date on the opposite side of the tree just above the height of the first bud.

In 1986 we chip-budded our pears after researching other nurseries that claimed better results by that method. The results for us were substantially better than double T-budding, and so we are now chip budding all of our pears and hawthorns. With crabapples, we are continuing experiments with the two techniques on approximately 50 cultivars. We have found results to be surprisingly varied as some cultivars respond quite differently to one method or the other, while other cultivars seem to show little difference in response. Additional factors, such as budding dates, weather conditions, and maturity of scions and understocks have a great deal to do with the final results.

Our budding season usually begins the first week of August, depending upon maturity of scions and size of rootstocks. The process takes approximately 6 to 8 weeks to complete. Certain cultivars respond well to early season budding and other do not. Every year we keep records of budding dates by cultivar and their results in percentages of successful takes. This gives us a sequential trend over the years to help determine our budding schedule. We use only our own "home-trained" permanent employees for actual budding, and these men have developed a healthy pride in their work.

Fresh scion sticks are collected daily as the budding operation progresses; 50 to 100 sticks are collected at a time and held in 30 gal. plastic containers of fresh water in shaded locations near the areas

being budded. Immediately after collecting scions, the leaves are removed with a knife leaving approximately $\frac{1}{8}$ in. of the petiole remaining. The stipules are then removed.

Meanwhile, the rows of seedlings are being prepared for budding. We use three-men crews composed of the budder, the tyer and a cleaner. The cleaner works ahead of the budder and tyer, and prepares the seedlings by removing any weeds and lower branches of the rootstock that may interfere with budding. The soil is leveled to expose the base of the seedling, and the trunk is wiped clean with a soft cloth. Finally, the soil is lightly raked to provide a smooth path for the budder. The cleaner needs to work at a pace which keeps him well ahead of the budder, but not more than about 100 trees. Cleaned trunks exposed to the sun for very long can cause the bark to tighten, making it more difficult to get a perfect bud union. Each budder carries several budsticks with him in a 2½ gal. bucket with about 6 to 8 in. of water.

In T-budding, the budder holds the scion stick upside down and carefully cuts into the wood below the bud, slicing toward him under the bud with a level cut. He then makes a shallow cross cut into the cambium only, and "shucks" the budshield from the wood. He then uses the end of his knife blade to make a vertical incision in the rootstock trunk and a crosscut at the top of the first cut. While making the crosscut he uses the straight part of his knife in a twisting motion to open the bark as he inserts the bud into the T-pocket between the bark and the wood. Any part of the shield that protrudes above the crosscut is removed.

The tyer then wraps the bud with a $\frac{1}{4} \times 7$ in. budding rubber from bottom to top with a firm pressure allowing 2 or 3 wraps below the handle and 3 or 4 above, leaving the petiole and bud exposed, but tightly in place. These bands are never removed, as eventually the sun rots them and they fall off on their own. After a couple of weeks, the petiole of a healed bud will drop off at a touch. If it is rigidly anchored to the shield, the bud is dead.

In chip budding, the budder holds his scion stick right side up, making an angled crosscut below the base of the bud which will form a wedge at the bottom of the shield. He then inserts his knife above the bud and slices level with firm pressure down to his first cut and removes the bud shield. He then makes a matching cut in the trunk of the rootstock and removes the wood which forms a "pocket" at the bottom of the cut. The wedge shaped end of the bud shield is then inserted into the "pocket" of the rootstock cut which holds it in place for the tyer. Ideally, the bud shield and corresponding wood removed from the rootstock will match exactly. However, if the bud shield is narrower than the corresponding cut in the rootstock, it must be positioned to one side or another so that at least one side of the two cambium edges are aligned.

The tyer then seals the bud with a $\frac{1}{2}$ in. strip of white plastic

budwrap at a length convenient for him. He begins at the top and firmly wraps the tape until all of the shield and incisions are completely covered, tying it off at the bottom. These ties must be removed after the incision begins to callus and the buds are firmly anchored by the healing process. Spot-checking determines the proper timing for removal which could be from two weeks to two months depending upon cultivar and growing conditions. Waiting too long can result in the rootstock callusing completely over the bud, smothering it to death.

After budding is completed, we cultivate between the rows, pulling the soil up around the trees, but not covering the buds. Then a 12 in. band of Surflan is applied to the rows for spring weed control. In past springs, we have had problems with chickweed forming dense mats around the buds, causing them to rot. Surflan controls this problem very well.

The fields are then winterized by sowing winter wheat between the rows for erosion control, since our land is not perfectly level. Finally, we install rabbit fencing around each bud field with 2 ft. chicken wire.

In early spring as the buds begin to push, we cut off the seedling tops about $\frac{1}{4}$ in. above the buds. These cuts are made with hand loppers at a 45° angle, with the bud on the high side. As the buds begin to grow, steel stakes are positioned to the side of each trunk and the newly formed shoots are carefully trained as they develop during the growing season. Summer cultural practices include continual inspection, tying, pruning, suckering, and spraying for insects and diseases. Most cultivars are tipped to promote branching.

All of our budded trees are grown and sold as one-year bareroot liners, developing vigorous growth in height, caliper, and branching, depending upon cultivar characteristics. In 1988, in spite of one of our worst droughts ever, our trees made excellent growth. Some one-year hawthorns and a few crabapples reached a height of 8 ft. without the benefit of irrigation.

In conclusion, I mentioned earlier that there is a great variance in the results of T-budding versus chip budding on crabapples, depending on specific cultivar. We have detailed information on results of one year only, and feel that it is inconclusive at this time. However, when we are able to share the results over a period of two or three years, we will be happy to do so.