INTEGRATING FIELD AND CONTAINER PRODUCTION OF TREES

BETSY S. KENYON

Greenleaf Nursery Company, Inc.
Park Hill, Oklahoma 74451

Prior to the freeze of 1983, tree production at Greenleaf Nursery Co. was a containerized operation with the exception of the seed bed for some shade trees. Our propagation techniques were either by seed, grafting, or rooted cuttings.

Seeds were sown in the fall in raised ground beds, grown for one growing season and dug the following winter. They were healed-in outside storage beds of sawdust until March 15th when they were planted into 1-gal containers. That November the 1-gal trees were then shifted into 5 gal containers and grown for one more year to saleable size.

Grafts were made in January and February as bench grafts, allowed to callus, and then potted into peat pots and placed inside quonset houses heated to 50°F. This allowed the losses to occur in the less expensive propagation space instead of after planting in containers. The grafts were planted directly into 5-gal containers in May or June once they were actively growing. These grafts were then grown for 2 years in a 5-gal container.

A limited number of trees were grown on their own roots. A small number of 'Bradford' pear, all 'Red Sunset' maple, and 'Whitespire' and 'Heritage' birches were propagated by softwood cuttings. The cuttings were taken in late spring or early summer and stuck in ground beds in a quonset house. They remained in the propagation beds until spring when they were planted bareroot directly into 5-gal containers and grown for 2 years.

The severe winter damage we received on our container trees in 1983 prompted Greenleaf Nursery to purchase land in the Arkansas River bottom at Fort Gibson, Oklahoma, to be used for field production of trees. We wanted to keep the advantages of the containerized trees but still benefit from growing and overwintering our trees in the field. During that winter of 1983, we lost 10 to 100% of our grafted trees, depending on taxa and the type of 5-gal container they were grown in. We felt we could significantly reduce these tree losses from freeze damage by growing the trees the first year in the field and then transplanting them into containers the spring of their second and last growing season.

With our new system, we plant the graft, cuttings, or seedlings for budding in the field in early spring while they are still dormant. The grafts and cuttings grow for one year and are dug the following February after going through the winter in the ground, giving the roots more protection than they would have received in a container.

These year-old trees are then planted into 5-gal containers and grown one more growing season and sold in the fall or the following spring. Since the trees grown from seed were not as severely damaged by the cold, only 5 to 30% killed, they remain on the 1983 production cycle except they are shifted from #1's to #5's in the spring instead of the fall.

The results of this change to the field for the first year of the 2-year growing cycle not only improved our winter survivability but also afforded us the opportunity to improve on other problem areas in our tree production.

In the area of propagation we have continued previous techniques that were effective but have been able to add better methods on problem plants. Named cultivars of redbud have an incompatibility problem when they are grafted. By going to the field operation, we can bud the redbud cultivars and get a better take—65 to 75% compared to 30 to 50% for grafting. Not only does our percentage increase, but budding costs are $25/100 less than grafting costs. Budding was not a viable option in the container operation because it would add an extra year in the container to the program at the expense of valuable space. Budding has also increased our stand of 'Aristocrat' pear. In the past, during the grafting procedure we would develop a bacterial disease, cause by *Pseudomonas,* which would kill the scion. By changing to budding of 'Aristocrat' pears we have improved our survival rate from 20–70% to 80%.

Another problem that the change to the field production overcame was the death of grafts when they were transplanted from the propagation bed to the 5-gal container. Since the grafts needed to be actively growing when they were planted, their planting in June correlated with the onset of hot weather in Oklahoma. We would lose anywhere from 5 to 30% of the grafts to heat stress, depending on the type of summer we had. By going directly to the field from propagation, the grafts are dormant when planted in February and so are well established before summer arrives.

Other improvements to our system are being investigated. In the propagation area we are refining our procedure for rooting trees such as 'Bradford' pear, cherries, crabapples, and maples. Even though we can root these trees, we do not increase the number we propagate until we evaluate the hardiness of the own root vs. grafted trees.

In the case of 'Bradford' pears and 'Red Sunset' maples, there was no difference in the hardiness of own-root vs. grafted through the winter of 1983. The other plants we root remain to be tested for hardiness before they go into full production. We are presently propagating ⅓ of our 'Bradford' pears by softwood cuttings and because of the interest in this procedure I will briefly summarize our method. 'Bradford' pear cuttings are taken in early June just as the new growth begins to harden and the leaves begin to change from light green to dark green. The 6 in. cuttings are stripped of their lower leaves, dipped in a Captan/Benlate fungicide solution and then given a quick dip in a 10,000 ppm IBA + 5,000 ppm NAA hormone solution. The cuttings are then stuck in ground beds of pine bark/sand (1:1, v/v) under intermittent mist for 10 seconds every 12 min. during the day. The pear cuttings callus and initiate roots in 6 to 8 weeks. Just as the cuttings start to root, the leaves begin to turn black. At this point, the mist needs to be reduced to 10 seconds every 30 min. and then stopped within 7 days. All the cuttings will not be rooted but if the medium is kept moist and the plants are shaded, they will continue to root.

We have also started a tissue culture lab to allow us to get into new tree cultivars faster, to propagate hard-to-root or hard-to-graft types and to eliminate diseases. We are experimenting with 'Aristocrat' pear and purple leaf smoke tree with limited success.

Finally, we are experimenting with different types of 5-gal containers and how best to overwinter these containers. In the winter of 1983 we had 'Bradford' pear in two container types, round green metal 5 gal and round black plastic 5 gal. Ninety to 100% of the pears in the round black plastic 5 gal were killed, whereas only 10 to 15% of the pears in the round, green metal cans died. To date we can only theorize why. We think one of the major differences between the two types of containers is the shape, straight sides vs. tapered sides. The metal cans are straight sided so when they are placed can-to-can for winter, little air can penetrate through the bed of cans. The plastic containers are tapered so when they are placed can-to-can, air can easily move among the cans in the bed; thus, losing the insulation factor which is the purpose of bunching can-to-can. To overcome this problem we have gone to square plastic cans that are straight sided for at least the top 3 in. and then tapered very gradually. We need another severe winter to prove the benefit of these cans.

Secondly, we think the material the containers are made of and the color of the containers plays a role in winter protection. The black plastic containers absorb heat better than the green metal cans; thus, keeping the roots actively growing later in the fall and start them growing earlier in the spring. Therefore, the root systems are more susceptible to early and late freezes. The metal cans are better conductors of heat and cold than the plastic containers. We feel that the metal cans conduct the cold to the root ball allowing the roots to harden earlier. But, we also wonder if the metal cans do not conduct ground heat up to the root ball once the plants are bunched can-tight and strawed in.

Finally, we are placing the containers can-to-can but staggering the rows to form a wind barrier past the second row of cans. In 1983, our procedure for overwintering trees was to bunch the containers can-tight in straight rows then straw around the top and sides of the bed of trees. In a normal winter straw proved to be a very beneficial insulator. However, in 1983 the cold spell was so long, 15 days below freezing, that the entire root ball froze even under the straw. At that point we feel the straw became detrimental because it did not allow the root ball to thaw as rapidly once the temperature did go above 32°F. Therefore, this year we are testing trees in all three types of containers, square plastic, round plastic and round metal, can-to-can under 3 straw regimes; 1) no straw, 2) straw only on the sides of beds, and 3) straw on top of the containers as well as the sides of the bed. We are recording temperatures in these containers to try and correlate temperature conditions to any possible freeze damage. Unfortunately, to achieve good results, we need an extremely cold winter.

To summarize our new tree production we are:

1) Propagating by seeds, grafting, softwood cuttings, budding, or experimentally by tissue culture.
2) Planting dormant bareroot liners into the field in early spring.
3) Growing and overwintering the trees the first year in the field instead of in containers.
4) Transplanting the one-year-old trees bareroot into 5 gal containers in the spring for sale the following fall or spring which allows for only one winter in the container at most.
5) Constantly evaluating and improving our overwintering practices for the two-year trees by evaluating container types as well as the manner in which the containers are treated for winter.

The primary reasons we made these changes were:

1) To reduce the number of winters the trees are in containers from two to one, thus cutting down our potential overwintering losses.
2) To improve the percent saleability and quality of 5-gal trees. By growing larger numbers of each kind of tree in the field, which is a less expensive production method, we can cull heavily for quality before the trees go to 5 gal containers.
3) To allow us, through grafting and budding, to greatly diversify the cultivars of trees we grow.