TREE PRODUCTION IN CONTAINERS

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H. J. Judkins and Son Nursery was established in 1940 as a retail, direct-selling firm. Gradually, it evolved into a bare-root, wholesale-only operation. Until 1985, the nursery grew only bare-root stock and marketed most of its stock packaged in poly bags or in "peat balls". The owners had been aware for some time that the trend in the firm's markets was toward an ever-increasing market share for container plants. The company was perceived by the trade to be a producer of high quality bare-root stock, with strong emphasis on fruit trees. Management recognized that if the firm did not move into production of container plants, it would begin to lose market share.

Therefore, in September, 1985, the owners invited me to join the firm to help them establish a container-growing operation. Our basic strategy was to concentrate on production of deciduous trees in 5-gal. containers, for which we believed there was a large, unmet demand. The trees would be sold by the company's well-established sales force, shifting emphasis away from poly-bagged and peat-balled trees, and toward container-grown shade and ornamental trees. To maintain profitability, the firm would continue to keep overhead low, utilizing a small but effective staff of leaders and a core of highly motivated employees. Management planned to set a level of quality, service, and price in the southeastern United States that would be the competition that other firms would have to meet.

Since the company had no facilities for container production, it was a rare opportunity to build a facility and train a staff, starting from scratch. From the outset, the container personnel were trained in the most efficient methods that management could devise, and instructed that only excellence was acceptable. Personnel were instructed in proper procedures, given the reasons for the procedures, and given feedback so that they would know when they were doing the task right. Management operates under the philosophy that if you expect the best from employees, you tend to get their best effort.

Construction was begun in September, 1985, on the first growing beds for the container operation. The initial facility consisted of 2½ acres, with ¼-acre being devoted to production of seedlings in an air root-pruned system. The seedlings were to be used as one source of liners for the container operation. The remainder of the

area had a capacity of approximately 40,000 five-gallon trees. Potting the first year was done by hand. With the completion in October, 1989, of the latest addition to the growing facility, the company has a capacity of approximately 500,000 trees. The addition of mixing and potting machinery makes possible the potting of better than 1,000 five-gallon trees per hour.

Liners for the container operation come from four sources. First is the air root-pruned seedling operation; second, bare-root trees from the field operation; then purchases from other field growers, both local and in the Pacific Northwest; and last, purchases of micropropagated tree liners. Whatever the source of the liners, a rigorous quality standard is maintained A poor quality liner cannot be made into a high quality tree. From the seedling operation, the largest 40 to 50% of the liners are fall-shifted direct into 3- or 5-gal. containers. The next largest, approximately 40%, is shifted to 1-gal. pots to be grown for one more year before being shifted to threes or fives. The remaining 10 to 20% are destroyed as culls. The fall-shifted liners are placed can-to-can on the growing beds and mulched with wheat straw for the winter. Bare-root liners are potted in the spring, roughly from February 1st to May 15th. These liners are graded for straightness, and root-pruned as necessary ahead of potting time. Most bare-root liners are whips or are very lightly branched and vary in size from 3 to 4 ft. up to 5 to 6 ft. Liners are not top pruned until they are set out on the growing beds. At that time they are all topped to a uniform height.

Fall-potted and spring-potted plants are spaced on the beds in the spring on a triangular spacing, in beds 8½ ft. wide, with an 18-in. aisle. This allows four beds to be placed between sprinkler heads, which are 40 ft. apart. Five-gallon trees are given center-to-center spacings of 17½ in., 20 in., or 23 in., depending on the growth habit and density of foliage of each species. Besides the topping of the tree whips, a summer-long program of pruning is carried out. Leaders and side limbs are headed back to develop well-branched, symmetrical tops.

The trees are subjected to a high fertility regimen, with the objective of growing a salable tree after one summer in the 3- or 5-gal. pot. Dogwood and deciduous magnolia are grown in 3-gal. pots, with a goal of at least a 3- to 4-ft. tree with a heavy top. All other trees are grown in 5-gallon pots with an objective of 5 to 6- or 6- to 8-ft. trees with appropriate caliber as set forth in the *American Standard for Nursery Stock* (1).

During the last four years, we have developed three different mix formulas to meet varying needs. All of the mixes contain 80% fine-ground pine bark and 20% concrete sand, the differences being in the nutrients added. For fall-potting most species, we add to each cubic yard 8 lbs. of dolomitic lime containing at least 10% elemental

magnesium, 6 lbs. of gypsum, 1½ lbs. of Micromax, and 5 lbs. of 12-6-6 nursery fertilizer that is compounded by a local supplier. If fall-potting extends past October 1, we eliminate the 12-6-6-fertilizer. Oak species use the same mix except that the dolomitic lime is reduced to 4 lbs. per cubic yard. Dogwood, whether fall-shifted or spring-potted bare-root take the following formula: 8 lbs of dolomitic lime, 6 lbs. of gypsum, 1½ lbs. of Micromax, and 12½ oz. of Subdue 2G per cubic yard. We add no fertilizer of any kind to the dogwood mix. Dogwood trees are hand fertilized after bud break in the spring with Sierra + Minors 17-6-10, at the medium rate recommended on the label. For all other bare-root trees that are spring-potted, we use the formula first listed previously, except that we substitute 8 lbs. of Osmocote 18-6-12 for the 5 lbs. of 12-6-6 nursery fertilizer. All of the trees that are fall-potted and mulched in straw, are uncovered in early spring, spaced, and fertilized by dibbling in Sierra + Minors 17-6-10 at the medium label rate for each pot size.

Beginning about June 1st, all plants receive supplemental feeding through the irrigation system. A solution of 15-3-9 + 5% sulfur is used for this. Initially, plants were fertilized once per week at the rate of 500 ppm N. However, when we began recycling our runoff water, we experienced an excessive build-up of nitrogen in our irrigation water. This necessitated a reduction in frequency of application to prevent nutrient imbalances that caused yellowing of foliage. We also experienced some herbicide damage from using recycled water. We had been using Rout herbicide almost exclusively because it was very effective in controlling our types of weeds. We noticed distorted leaves and stunted growth on some species. Lab testing revealed that enough Goal (one component of Rout) had dissolved in our runoff water to cause this problem. We were forced to revert to using Ronstar and supplementing its use with some hand weeding. Ronstar is applied with a hand-cranked spreader immediately after potting and 6 to 8 weeks thereafter. The label rate for container-grown woody ornamentals is used. Weekly water samples of runoff water and irrigation water, as well as random weekly samples of container medium, are sent to a commercial testing lab for analysis. We make adjustments in our fertility program and other chemicals used, as indicated by the test results.

Pest control materials are applied as needed. This usually means at least weekly application of fungicides, which are rotated to prevent a build-up of resistance by disease organisms. Insecticides must usually be applied about every two weeks unless some specific problem requires immediate attention. Insecticides are also rotated. A log is kept of all pesticides used and the dates applied, so that we may keep track of our materials rotations. All pruning residue is

cleaned up and hauled away each day so that it does not encourage disease organisms. Employees are continually made aware that we require the container beds to be kept neat and orderly at all times.

During the months when the trees are in an active stage of growth, they are watered from one to two hours per day, depending on temperature and wind conditions. The sprinkler system discharges about ¼ in. of water per half-hour. If certain areas show signs of heat stress, these will receive additional five or ten minute periods to cool the foliage.

Wind is also a problem with container trees. To stabilize the trees, we drive a rod through the container and into the ground approximately 12 inches deep. Pots on the perimeter of each bed, as well as every fifth row across the bed, receive stakes. We use a galvanized stake that is 3/8 in. in diameter by 24 in. long for this purpose. Nevertheless, we usually have to stand up the unstaked trees six or seven times each summer.

Winter protection begins after two or three frosts in the fall. Fall-shifted plants are placed can-to-can and mulched with straw. The salable plants are stored in a 2.3 acre over-wintering house. This structure is a gutter-connected unheated greenhouse, and it will hold approximately 340,000 five-gallon trees stacked three deep. The over-flow is heeled-in in sawdust-covered beds outside. As the plants are being moved to winter storage, they are graded and labeled with picture labels. Plants that have light tops and/or light caliber stems, are held over for late spring shifting to seven or ten gallon pots. Crooked, broken, or extremely undersize plants are hauled to the dump.

Throughout the whole production process the staff tries to recognize and remove inferior plants that have no chance of meeting our quality standards.

LITERATURE CITED

1 American Association of Nurserymen 1986 American Standard for Nursery Stock *Am Assoc Nurs.*, Washington, D. C 30 pp

VOICE: Would you give the details of your method of dibbling the fertilizer?

BEN DAVIS: One crew makes three or four holes with a tool purchased from A. M. Leonard. A second crew puts the fertilizer in the holes. The plants get Sierra and minors at the medium label rate.

CHARLES PARKERSON: Why do you change from 18-6-12 to Sierra and minors?

BEN DAVIS: The 17-6-10 formation contains Micromax. In the spring all plants in the nursery that were fall-potted or carried over receive Sierra and minors.