

## Tree Seedling Production

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**Seed Pretreatment.** Of the approximate 70 taxa of trees we grow, 80% are started from seed. Seventy-five percent of the seed we propagate requires some form of stratification. A few varieties must be scarified before their stratification. We use warm moist, cold, and cold moist types of treatment for varying time periods—from 30 days to 6 months. Those seeds requiring warm-moist or cold-moist stratification are placed on newspaper and dusted lightly with the fungicide—Thiram WP, and agricultural streptomycin, Agri-Strep, for bacterial control. The seeds are then placed loosely in a fabric netting and packed in a bag containing damp sphagnum moss. We use the netting to eliminate the need to search for loose seeds when it is time to plant. The bags are then labeled and placed either in the office for warm stratification or the cool room for cold stratification.

**Seed Propagation Houses, Trays, Containers, and Media.** All our propagation houses have ground covers on the floor for weed control. We wash the floors and spray with a dormant oil to control insects prior to placing freshly planted seeds on the floor.

Since seed germination percentages vary and our space is limited, we pregerminate about 25% of the taxa we grow in small plug trays. We use a variety of these trays ranging from 68 to 288 cells per tray. We usually get good seed germination. Oak acorns are planted directly into Rootmaker propagation containers (Lacebark, Inc., Stillwater, Oklahoma) or Ropak Mullet-Pot #3 – 96 cells or #6 – 45 cell plug trays (Stuewe & Sons, Inc., Corvallis, Oregon).

We have a 1.5 m<sup>3</sup> (2.0 yd<sup>3</sup>) mixer which also becomes a flat filler with the conveyor belt under it. The conveyor was designed to handle seed trays up to 19-liter (5-gal) containers. This mixer had a dead spot inside its center which did not allow for proper mixing, and we added a V-shaped piece of metal at that spot to help eliminate the problem.

Rootmaker propagation containers are put in an 46 cm (18 in.) square carry-all flat and placed on a conveyor belt. Once the containers are filled they are taken to the planting tables and prepared for planting. We lift the carry-all trays off the table and gently drop them back on the table to settle the media mix. The excess media on the tops of the trays is removed and we are ready to plant.

Our planting mix starts with peat moss, coarse perlite, and extra coarse vermiculite, to which we add 8.9 kg m<sup>-3</sup> (15 lb yd<sup>-3</sup>) of Osmocote 16-6-12 slow-release fertilizer, 3.6 kg m<sup>-3</sup> (6 lb yd<sup>-3</sup>) of dolomite, and 1.2 kg m<sup>-3</sup> (2 lb yd<sup>-3</sup>) of Micromax trace element mix. All seeds are planted in this mix regardless of whether they go into a pregermination tray, a Rootmaker, or a plug tray.

**Positioning Seeds in Containers.** Since all the oaks are directly planted into Rootmaker propagation containers or plug trays—it is extremely important that the seeds be placed properly in these containers. We try to center the seed in the container and at the same time position that seed in a way that when the root radical emerges it goes directly down toward the bottom of the container. We do not want

that root to emerge in an upward or sideways position. Anything other than a straight root will create a weak point as the seedling grows, and it will not be able to stand on its own. We never cover our oak seeds or push them deeply into the container. This gives the maximum space for root development.

The seeds that are planted into the pregermination trays have to be transplanted into either Rootmakers or plugs to become a salable liner. This procedure is time consuming and can create major problems in root development. Plants are carefully selected from the seed trays. Any seedling with a crooked root is immediately discarded and not planted. Seedlings that are to be transplanted have their roots pinched off. This is necessary because roots will spiral in these trays. A dibble is made with the finger in the container and the seedling is carefully placed in that container so as not to create a “J” root. It is vital that the roots are placed straight up and down and the seedling is not “pushed” down into the medium.

The planted seeds or transplanted seedlings are then taken to houses to grow on. Our benches are quite simple. They consist of 2.5 cm × 5.0 cm (1 in. × 2 in.) welded wire set on upright 3.8-liter (1-gal.) containers. This provides air pruning for the bottom of the container.

Most of our propagation houses are 3.7 m × 29 m (12 ft × 96 ft). We like this smaller size house because it is easier to heat and easier to separate water loving seedlings from those that require less water. The majority of our houses no longer have shade cloth on them. We have learned that full sun prevents “stretching” of the stems, increases caliper, and prevents many fungus problems by allowing leaves to dry. Those seedlings that do require shade are grown under 30% shade cloth.

**Irrigation Regimes.** All watering is done without the help of timers. Each crop of seedlings has different water demands at so many different times during its growing season that we feel it important to water only when necessary—and this cannot be done with a timer. Therefore, all houses have manual water valves. Each sprinkler head can be opened or closed manually. This is nice if you have only half a house to water.

**Production of Tree Seedlings.** We feel strongly about good root development in our production of tree seedlings—and are always searching for ways to improve. A large part of our program is producing 3.8- and 11.4-liter (1 and 3 gal) lining-out stock. Our planting mix for these larger containers consists of—2.5 cm (1 in.) screened aged pine bark, sand, and peat (7.5 : 1 : 1.5, by volume), to which we added  $8.9 \text{ kg m}^{-3}$  ( $15 \text{ lb yd}^{-3}$ ) of Osmocote 17-7-12,  $3.6 \text{ kg m}^{-3}$  ( $6 \text{ lb yd}^{-3}$ ) of dolomitic limestone, and  $1.2 \text{ kg m}^{-3}$  ( $2 \text{ lb yd}^{-3}$ ) of Micromax trace element mix.

When potting liners into 1- and 3-gal containers we make every effort to use a seedling produced in the Rootmaker propagation pot. This gives us the greatest number of root tips and will fill the 1- or 3-gal container from top to bottom with roots. The liners produced from these containers give us a faster growing 1- or 3-gal tree than seedlings produced in plug trays. If we have to use seedlings produced in plug trays we cut off the bottom 1/4th of the roots before planting into 1- or 3-gal containers. By doing this we can at least fill up half the container with roots, the top half will be loose soil.

We like to grow in the Rootmaker 1 or 3 gallon containers. We have compared the cooper coated containers to the Rootmaker and still prefer the root system of the Rootmaker. The root development in the conventional containers makes one wonder

why they are still in use for tree seedlings. There is no way to deter root spiraling or encourage secondary root development in conventional containers.

**Preventing Wind Blow Over of Containerized Plants.** In producing large numbers of 3.8- and 11.4-liter (1- and 3-gal) liners, we have the problem of wind blow over when they become large and top heavy. For our 3.8-liter (1 gal) containers, we use remesh wire and T-post hooks. The containers are placed in the wire, skipping a space for better air circulation. The wire is pulled to the top edge of the pots and T-post hooks are attached under the remesh wire and over the top edge of the pots and T-post hooks are attached under the remesh wire and over the top of the pot, holding the wire up to within 1 cm (0.5 in.) from the top of the pot. To prevent blow over on our 11.4-liter (3 gal) containers, we used an idea from Ed and Barbara Ricks, Bushman Plant Farm, Cleveland, Texas. That is, we take 1-cm (3/8-in.) rebar in lengths of 6.1 m (20 ft), crisscross the rebar through the drain holds at the bottom of a 15 and 19 liter (4- or 5-gal) containers and place the 11.4-liter (3 gal) Rootmaker inside. There is no blow over, the roots stay cooler and get less damage from the summer heat. We call this an above-ground pot-in-a-pot system.

**Overwintering Systems.** Because of our overwintering problems with larger containers, we are currently experimenting with containers in the ground. We have placed 11.4-liter (3-gal) containers in the ground and in those containers we have planted seedlings in 23-cm (9-in.) knit fabric. We have also experimented with the 18.9-liter (5-gal) Rootmaker in the ground. This pot is designed to be used in the ground and has already shown us more top growth and better root development in a shorter period of time than with liners positioned on top of the ground. This will allow us to overwinter the slower species outside instead of in taking up space in our larger propagation houses.