The Root Production Method (RPM) System for Producing Container Trees

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INTRODUCTION

The RPM system (root production method) is a multi-step system of producing container tree seedlings that places primary emphasis on the root system — which ultimately determines the trees survival and performance in the environment it is transplanted into. This particular container production system has been developed to facilitate mass production of high quality seedling trees with an optimum height-caliper balance. Approximately 80% of our production consists of native trees, many of which have transplanting problems using conventional nursery growing systems. We specialize in *Quercus* (oak) production and currently grow 26 taxa.

SEED SELECTION, COLLECTING, PROCESSING, AND GRADING QUALITY SEED

This is accomplished by selecting superior trees growing on specific sites for seed collection. Experience has taught us that most species have ecotypes that are site specific. We look towards the wetlands or floodplains as a prime seed source for native species that are found growing on both wetland and upland sites. Since they have evolved under stress, we find these ecotypes will consistently out perform their upland counterparts on virtually any site — particularly on highly stressed sites.

Step 1: Processing. After basic cleaning and drying procedures are completed, all seed are graded and sized using aspirators or gravity tables. We find the weight of individual seed to be more important than size. Hence, machines that grade seeds based on specific gravity via air separation give optimal results. This initial step grading seed is of great importance to our subsequent production steps to produce uniformity.

Step 2: Seeding, Timing, Stratification, and First Root Pruning. Seed are placed in a bottomless mesh flat measuring 47 cm × 37 cm × 6 cm (18.5 inches × 14.5 inches × 2.5 inches) with a mesh spacing of 1 cm (⅜ inch). Our standard growing medium consists of composted rice hulls, pine bark, and sand (4 : 4 : 2, by volume), plus slow release fertilizer, micronutrients, and a wetting agent. The medium is also inoculated with mycorrhizal spores. The air space of the medium is of utmost importance in this step. Our medium mix has 35% to 40% air space. Seeded flats requiring stratification are stacked on pallets, wrapped in polyethylene, and placed in cold storage at 1C (34F).

The timing for sufficient stratification is critical since our production system requires moving the seeded, stratified flats to heated greenhouses by 1 Feb. so that seed germination can be initiated. As the seeds germinate, their tap roots penetrate the bottom of the flats and are air-pruned. This allows a more fibrous root system to develop. The grading, selection, and transplanting of the seedlings is done by 1 March. The purpose of shallow root pruning into medium with an approximate depth of 3.8 to 5 cm (1.5 to 2 inches) is to force first lateral roots to develop higher

on the root collar, or crown of the seedling. Since most tree roots grow within the first 30 cm (12 inches) of the soil surface, we find this technique beneficial to all our species. This is of extreme importance for wetland plantings where the lack of air in the soil (anaerobic conditions) becomes a critical limiting factor in survival and future growth. This also allows more even distribution of roots of the containerized seedlings, which is one of the prime objectives of our shallow root-pruning process.

Step 3: Grading, Selection, and Transplanting to Bottomless Band Containers. By 1 March when the tree seedlings have made their initial first flush of growth, the seedlings are transplanted to a plastic square bottomless band container. The band container consists of a standard plastic bottomless liner pot measuring 7.3 cm × 7.3 cm × 14 cm (2.9 inches × 2.9 inches × 5.5 inches), which has been modified and reduced to 9.5 cm (3.75 inches) in depth. Plants are carefully graded and selected at this time. Particular attention is given to height, caliper, and root development. On most species the top 50% are used and the remainder are culled and discarded. The shallower liner pots gives us comparable growth, and improves the root distribution in the production container, including better lateral root distribution higher up in the root collar or crown of the seedling. Transplanted seedling bands are placed on bottomless benches for approximately 60 days. This allows additional air pruning of the secondary lateral roots, further enhancing development of a shallow root system. These first two steps are timed so the bands or liner pots are ready to go outside to the container production area by 1 May, thus avoiding any late frosts and freezes.

Step 4: Hardening-off, Canning, and Growing On. Flats holding 36 tree bands are moved from greenhouses on 1.2 m × 1.8 m (4 ft × 6 ft) pallets and placed outdoors in full sun for hardening-off for 48 h. During the hardening-off period the liners are intermittently misted to relieve stress. After 2 days (48 h) the pallets are moved to container production areas where they are dibbled into larger, existing pre-filled containers. A shallow growing container is preferred, realizing that most of the feeder roots will always remain in the upper 15 to 20 cm (6 to 8 inches) of soil after the tree is outplanted. Our standard growing container is a squat container measuring 25 cm (10 inches) across and 18 cm (7 inches) in depth. The 9.5-liters (2.5-gal) container allows more root mass to develop laterally. This system allows us to produce most native species to a marketable size in one growing season, or approximately 210 days from germination.

SUMMARY

The RPM system is a multi-step seedling production program for producing superior container-grown liners of uniform grade and quality. The two phases of air root pruning, along with careful production planning are the critical components of the RPM system. Air pruning of roots at a shallow depth stimulates initiation and growth of more feeder roots higher on the root collar or seedling crown. This allows for better aeration of the root system, faster growth, and near perfect survival after transplanting to final growing sites. The root system of the RPM-produced trees allow for greater tolerance to wet, low-oxygen transplanting sites. Seedlings produced with the RPM system also have more uniform top growth. Uniformity of both the shoot and root system is important in plantings where uniform plant size is required. Seedlings provide a broad genetic base which will insure longevity and protection against diseases and conditions that might occur with certain clonal, asexually produced and other overused seedling produced taxa.