

PRODUCING QUALITY TRANSPLANT SEEDLINGS: BAREROOT TO BAREROOT AND CONTAINER TO BAREROOT

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Abstract

Webster State Nursery was established in 1957. The stock types and species grown here have changed over the years. Whereas 2+0s were once the main stock type grown, Webster now produces approximately 90% transplanted seedlings. This paper is an overview of the current cultural practices used to grow 1+1 and P+1 seedlings at Webster Nursery.

Key Words

Transplant culture, fertilization, irrigation, *Pseudotsuga menziesii*, *Pinus ponderosa*, *Pinus contorta*

STEPS TAKEN TO PROMOTE SOIL HEALTH

We rotate crops throughout the nursery field system, with a field planted for up to 3 years in a conifer crop, then fallow for 1 or 2 years. The total acreage at the nursery is 274 acres (111 hectares), allowing the flexibility to produce approximately one third of the area in conifer seedlings and the remainder open fallow.

Proper timing of irrigation applications can reduce disease levels by removing the optimum conditions for many diseases to thrive; the conditions include a combination of heat and moisture. We make certain that the soil surface is dry during the hottest hours of the day. This requires irrigation at 5:30 each morning.

We monitor the soil moisture daily, taking a composite of 6 inch (15 cm) core samples from each field location. These samples are weighed moist, dried in an oven for 2 hours, weighed again, and the difference between the two divided by the dry weight to calculate the percentage moisture available to the plants. Comparing these percentages to a calendar table prepared for Webster's soils, we begin the growing season near field capacity and end with moistures that stress the crop appropriately based on stock type and species. The actual amount of irrigation water applied to the plants any given day is based on the soil sample results from the prior afternoon and the temperature forecast for the current day.

We are using farming techniques that promote rapid soil drainage through deep tillage. Recent purchase of a chisel plow gives the nursery the opportunity to rip the ground open 20 inches (51 cm) deep as the first step of soil preparation. We subsoil at the beginning of each rotation to a depth of 30 inches (76 cm).

YEAR ONE OF 1 + 1

Soil preparation is the most important individual process to the final plant, ultimately determining root quality. This is a true statement for all stock types. Site preparation methods and timing are unique to every soil type. Understand your site and investigate and experiment with different soil farming methods and implements.

Sow 1+1 seedlings as early as you can properly prepare the soil. This enables these seedlings to take advantage of as many of the growing weather days as possible. We attempt to sow our 1+1 crop in early to mid April. Our particular region (southwest Washington) provides 90 to 100 growing days per season. Here we don't expect or hope for more time than that.

In order to limit water stress, we maintain a constant range of 12% to 15% for the 1+0 seedlings throughout the entire first growing season. We apply 75 lb of ammonium sulfate per acre (86.6 kg/ha) in 2 separate applications during the growing season: the

first scheduled for early June and the second early July. The first application is made at the first sign of true needles and the second just prior to the second flush. You must monitor the stock and understand their growth patterns and stages of development.

We apply a one-time application of herbicide to the 1+0 for 1+1 crop shortly after sowing. We have not found it necessary to apply fungicide to most of the 1+0 crop for many years. The exception is those species that originate in eastern Washington (pines and larch). These species contract needle diseases due to the extra moisture found here in western Washington. We rotate fungicide chemical families in the treatment of those diseases. We monitor this crop daily in hot periods and at least weekly in cool weather. No insecticides have been applied to 1+0 crops for more than 15 years.

YEAR TWO OF 1+1

Starting in early December, following the chill hours requirement (400 hours < 42 °F [5.5 °C]), the 1+0 plants are lifted, sorted, packaged in bags, and frozen (28 to 32 °F [-2 to 0 °C]) throughout the winter season.

Transplant as early as you can properly prepare the soil. We try to start in April and be finished by mid-May. If you cannot finish consistently within this time frame, consider purchasing more transplant machines to increase your daily production. We average 85,000 seedlings transplanted per day, per 6 row planting machine. Additional growing days increase the likelihood of a seedling reaching a specified size.

We maintain a cultural schedule for each stock type grown. This schedule is updated prior to the current growing season. The schedule is a quick glance guide for all of us at the nursery. What is the next scheduled activity and approximately when are we planning to apply that activity? The cultural schedule also serves as a permanent record verifying that this activity is complete.

The schedule is an excellent tool, but you must monitor your crop and recognize stages of the plant growth cycle. Apply your activities by these observations as well as the calendar. I apply approximately 8 light applications of fertilizer per growing season to the 1+1 crop. Most of them are 100 lb/ac (112 kg/ha). If you are not certain when to apply fertilizer, early is better than late. Once past the growth cycle, they won't be capable of using the fertilizer and thus it is wasted.

We design our irrigation schedule to compliment the unique characteristics of each stock type and species. For example, 1+0s require light watering nearly every day of the growing season; 2+0s require deeper, but less frequent irrigations. In terms of species, Douglas-fir requires water to move through the root zone, followed by drying; western redcedar grows best when maintained near field capacity.

Pesticides currently applied to the 1+1 seedlings include a single application of herbicide following transplanting and prior to bud break. We schedule fungicide applications to the pine and larch species based on the anticipated appearance of needle diseases. No insecticides are currently applied.

PLUGS TO P+1

The soil preparation, transplant timing, and so on, are basically the same as 1+1 plants. There are several things to be aware of when planning for container stock transplanting. Don't assume that the plants grown outside your control will be of the quality you are expecting. Have the size expectations and quality specifications spelled out in a contract. Visit the facility where the plants are to be grown prior to accepting a contract. Examine the greenhouses for cleanliness, determine the soil mix contents, and verify the soil supplier. Ask about their water source and their water-monitoring program. Above all, be aware that when you bring plants from a source outside your facility you also bring the risk of disease and weeds that you may have never encountered before.

As with 1+1 plants, when planning the field location of P+1 species, consider the following: 1) moisture needs are unique for each species; 2) some species will require multiple pesticide applications; and 3) species will have unique fertilizer requirements (both in rate and formula).

FINISHING THE CROP AT WEBSTER NURSERY

Douglas-fir, White Pine, Lodgepole Pine, Ponderosa Pine (2+0 and Transplants)

Once the plants have grown to near the specified target size, we begin culturing to encourage root growth and discourage stem height growth. These activities include: 1) reducing the amount of irrigation water available to the plants in accurately measured increments; 2) root wrenching to 10 to 12 inch (25.4 to

30.5 cm) depth at varying times throughout the middle to late growing season.

All 1+0 Plants

We maintain a moisture stress free growing environment throughout the growing season (keeping soils at a 12% to 15% moisture range). No other activities (no root wrenching, and so on) are performed.

Western Redcedar, Western Hemlock

We maintain the same moisture stress free growing regime as mentioned for the 1+0, but with deeper water applications so the soil always stays near field capacity.

True Firs and Spruce

These species will respond well whether grown with other species with drier or wetter requirements. On our site, however, we do not normally perform any root culturing activities.

For all crops, one of the final activities prior to lifting involves monitoring the number of cumulative chill

hours. Our goal is to attain 400 hours below 42 °F (5.5 °C). We may lift seedlings prior to receiving the required chill hours; we would recommend, however, outplanting them soon (no long-term storage). The chill hour requirement to achieve dormancy is based on research performed by Weyerhaeuser Company.

At the same time that we are monitoring chill hours, we are frost protecting seedlings. We use the same overhead sprinklers that are used to irrigate the crops during the growing season. Crews are called in at approximately 36 °F (2 °C) and turn the water on at 32 °F (0 °C). This forms an ice envelope around the tender foliage and protects it from damage.

IMPROVEMENTS FOR THE FUTURE

1. Scheduled foliar and soil samples to determine any nutrient imbalances.
2. Fertilizer trials throughout the different stock types, for example, looking at slow-release and foliar applications.
3. Scheduled soil sampling to determine disease levels prior to sowing or transplanting.
4. Additional root culturing, with the goal of improving root-to-shoot ratios.