
Effect of Fall Planting Date on Survival and Growth of Three Coniferous Species of Container Seedlings in Northern Idaho

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Timing of fall planting was evaluated in terms of effect on survival and growth of Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco), western white pine (*Pinus monticola* Dougl.), and ponderosa pine (*P. ponderosa* Laws.). First-year data indicate that container seedlings can be planted early in the fall season if soil moisture conditions permit. *Tree Planters' Notes* 42(2):52-55; 1991.

The success of fall planting of conifers in the northern Rocky Mountains varies widely compared to spring planting. Spring planting has therefore been preferred, despite important constraints. The planting window is limited, because the snowpack often covers the site or the roads. Thus planting is concentrated into short periods, often creating a severe work load for planting crews and their supervisory personnel. These constraints lead to increased costs and reduce the opportunities for accomplishing large annual regeneration programs.

Fall planting lengthens the planting season, allows easier site

access, reduces storage costs, and spreads the work load. These advantages can result in significant cost reductions (2).

Although the relative merits and reasons for increased variability of fall planting have long been debated, information is lacking on the biological response and reasons for variation in survival of fall-planted conifers in the northern Rocky Mountains. Studies comparing survival of spring and fall plantings of bareroot seedlings in the region have indicated higher first-year survival of spring-planted seedlings and greater variability in the survival of fall-planted seedlings (3, 4). Miller's (2) comparison of fall and spring plantings of container seedlings indicated that survival varied by species, and that fall planting resulted in reduced first-year height growth. Specific reasons for the lower and variable success in the fall have not been defined.

This study was designed to evaluate the effect that timing of fall planting has on the performance of three species. First-year survival and growth were evaluated for container-grown

seedlings of Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco.), western white pine (*Pinus monticola* Dougl.), and ponderosa pine (*Pinus ponderosa* Laws.) planted on six dates in northern Idaho.

Methods

Two identical studies were established. A long-term study will eventually evaluate fall planting over a 5-year period and was also used for determining first-year survival. The short-term study reported here evaluates fall planting for the first growing season.

Seedlings were planted at six different dates from late August to early November 1988, at intervals of 2 weeks at the Priest River Experimental Forest in northern Idaho. The site is on a *Thuja plicata/Clintonia uniflora* habitat type (1) and has a well drained, coarse loamy, mixed frigid typic xerochrept soil. The study site is very uniform and was located so that moisture could be controlled as a variable. Before planting, the area was entirely cleared of competing vegetation, mechanically

tilled, and fenced to prevent animal damage.

One-year-old Douglas-fir, western white pine, and ponderosa pine seedlings were grown in 4-cubic-inch (62.5-cm³) containers at the University of Idaho Research Nursery at Moscow, Idaho. Bud set occurred in July, before planting.

The seedlings were planted with a container-shaped dibble to reduce planting variability, and the site was irrigated to field capacity before and after the first planting in late August to minimize soil moisture stress. No additional watering was necessary due to fall rains.

The experiment was established in a randomized complete block design with 4 replications and 6 treatments for each of the 3 species. Each block-treatment combination consisted of a 16-tree row plot. Rows were 1 m apart and trees were outplanted at 0.5-m spacing within rows.

Height and stem diameter 1 cm above root collar were measured on all seedlings immediately after planting. Seedlings were excavated for analysis at 6-week intervals through the first (1989) growing season (4/14, 6/01, 7/15, 8/29). At each excavation, one-fourth of the trees were selected by randomly identifying 4 trees of each species from each row, for a total of 288 seedlings. These excavations provided data on seedlings at different

growth stages during the first growing season after fall planting.

Measurements on each excavated seedling included length of root system, distance from root collar to tip of longest lateral, root weight, shoot height, top weight, and stem caliper 1 cm above the root collar (all weights oven-dry).

An analysis of variance was used to detect any differences due to the planting dates on survival, height, root length, stem diameter, and dry weight for each species. Scheffe's procedure was used to compare means and to detect significant differences between fall planting dates in survival and growth. Initial height and initial stem diameter were investigated as covariates but were not statistically significant at the .05 level of probability.

Results

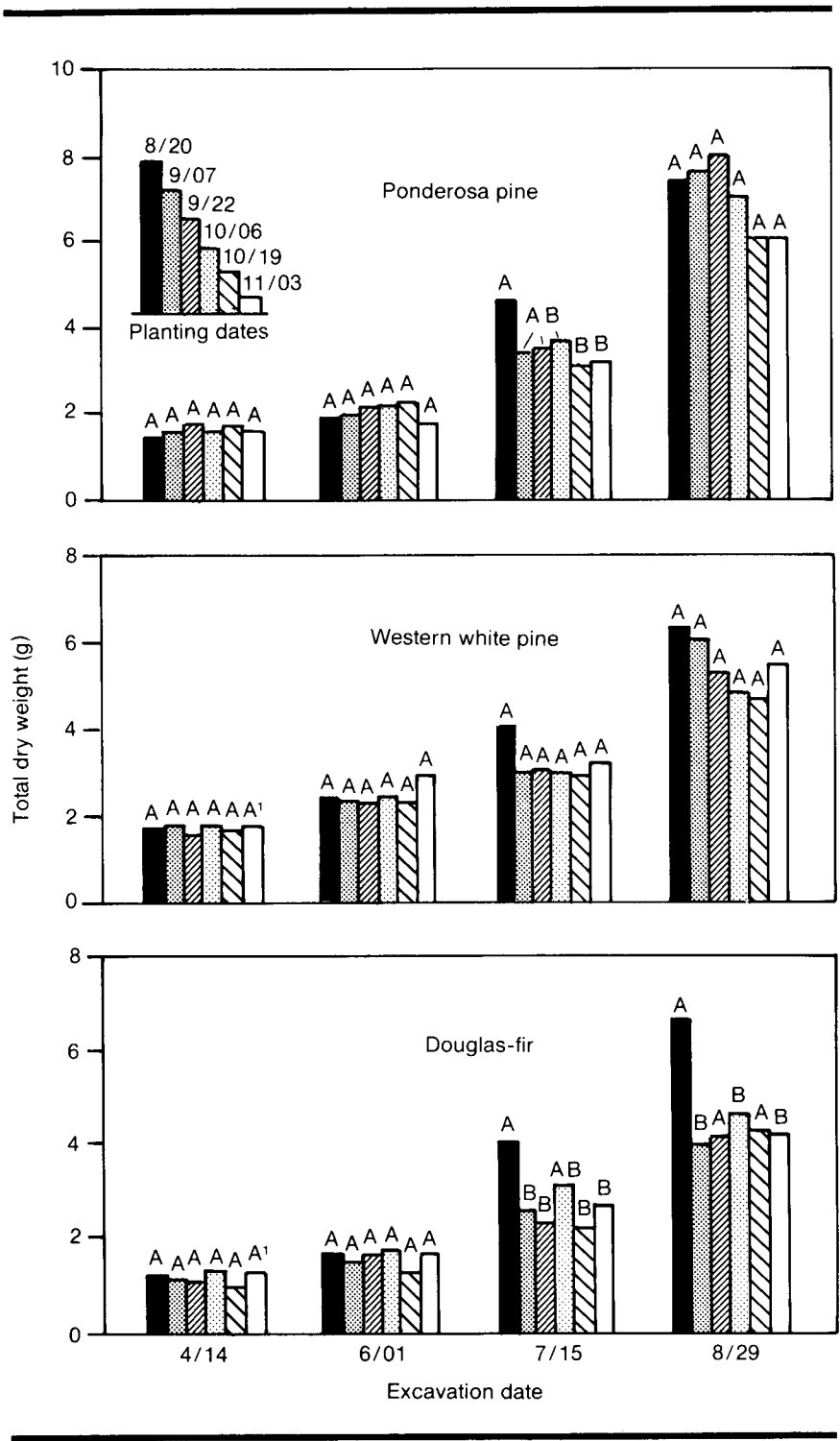
First-year survival did not vary significantly between fall planting dates for the three species tested. Survival ranged from 95 to 100% for Douglas-fir, 99 to 100% for western white pine, and 98 to 100% for ponderosa pine. High survival on this uniform nursery site is due, in part, to protection from rodents, lack of vegetative competition, and adequate soil moisture. However, planting date accounted for significant differences for certain excavation dates, in shoot height, stem diameter, total-dry weight, shoot and root dry

weight, and root length. Differences were most evident for the July and August excavations. The first two excavations were too early in the season to show much differentiation.

For the last excavation date, the earliest planting produced the tallest seedlings, largest stem diameter, and heaviest seedlings for Douglas-fir and western white pine, although most differences were not significant (fig. 1). The response of ponderosa pine to fall planting time was less pronounced. However, a pattern that early planting is better than late planting is evident for ponderosa pine; the first three planting dates all have greater total dry weights than the last three planting dates when observed on the final excavation date (first-year total dry weight results for the three species are shown in figure 1). Seedling height, caliper, and root length had similar patterns.

Discussion

Why did the August and September plantings, in most cases, produce the largest seedlings? With plenty of available soil moisture and warm soil temperatures, one can expect prompt root growth and contact with the soil providing a source of nutrients and moisture. The early planted seedlings responded with the growth patterns shown; they were taller with larger



stem diameters and had longer roots and more total dry weight. As the planting period progressed into the fall, photoperiod decreased, air and soil temperatures declined, and environmental conditions gradually became less favorable for growth. With a shorter fall period for root establishment, the seedlings with less extensive root systems or low carbohydrate reserves were unable to utilize nutrients for growth promptly the next season and were therefore smaller when observed at the end of the season. Also, seedlings planted later in the fall are more prone to over-winter stress and may not grow as well as seedlings planted earlier in the fall.

One year is a small climatic sample from which to draw valid general conclusions. However, the climatic conditions that were recorded during this study period were close to the averages of the long-term weather records of northern Idaho. In addition to the study reported here, a long-term study was established concurrently that will be monitored for 5 seasons, and similar fall planting trials will be established in subsequent years.

Conclusions

First-year survival and growth data indicate that container-grown Douglas-fir, western white pine, and ponderosa pine can be planted early in the fall season if soil moisture conditions permit. The

Figure 1—Total dry weight means by planting and excavation dates. Bars labeled by different letters are significantly different at the 5% level (using Scheffe's procedure).

earliest (August 20) planting appears to favor height growth, root growth, stem diameter growth, and total biomass (dry weight) growth for Douglas-fir and western white pine for seedlings excavated on July 15 and August 29. Ponderosa pine seems to be more flexible in that it responds less to time of fall planting.

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