

FALL-LIFTED CONIFERS SUCCESSFULLY SPRING PLANTED IN SOUTHWEST IDAHO

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Seedling Lifting, Storage, and Planting

In mid-November 1972, after oscilloscope traces indicated dormancy (1), we lifted and stored seedlings of 1-0 ponderosa pine (*Pinus ponderosa* Laws.), 2-0 lodgepole pine (*Pinus contorta* Dougl.), 2-0 Douglas-fir (*Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco), and 3-0 Engelmann spruce (*Picea engelmannii* Parry) for spring planting on the Boise National Forest, along with 2-0 ponderosa pine and 1-0 western larch (*Larix occidentalis* Nutt.) for the Payette National Forest (4). For each lot, half of the stock was packed in the polyethylene-lined paper bags and the other half in open-ended wooden crates. Half of each package type was then held in cold storage at 28° F (-2.2° C), and the other half at 33° F (0.6° C) until the spring planting season. For a description of the handling and planting procedures on each forest, please refer to Morby and Ryker (4).

For comparison, seedlings of the same lots were lifted, packed, and stored at 33° F (0.6° C) on February 16 (western larch) or March 6 to 28, 1973. Seedlings sampled were immediately adjacent to the seedbed areas sampled in the fall, so that the nursery soil and site characteristics were essentially the same for both fall- and spring-lifted stock.

Survival and growth of outplanted bare-root stock confirm the feasibility of late-fall lifting, cold storage, and spring planting of seedlings at the Lucky Peak Nursery in southwest Idaho.

Seedling Survival and Growth

There were no significant differences in survival between fall- and spring-lifted trees stored at 33° F (0.6° C) (tables 1 and 2). Height growth of Douglas-fir was twice as great for fall-lifted seedlings as for spring-lifted ones. The 1-0 ponderosa pine, which also exhibited more growth with fall lifting the first year (4), lost much of the advantage by the end of the third year. In contrast, spring-lifted western larch seemingly grew more than fall-lifted larch, but the difference was not statistically significant. Lodgepole pine and Engelmann spruce continued to grow about the same for both lifting seasons.

Whether crated or bagged, fall-lifted seedlings stored at 33° F (0.6° C) and bagged seedlings stored at 28° F (-2.2° C) all performed about the same. When fall-lifted seedlings were packaged in crates and stored at 28° F (-2.2° C), the seedling tops dried and survival and growth were significantly reduced for every species except western larch.

Discussion and Conclusions

The depressing effect that spring lifting had on Douglas-fir height growth probably explains an observation frequently made in field plantings. Douglas-fir trees planted on sites in southern

Idaho typically are "bushy" for 3 to 5 years, even when survival is good.

We believe this lack of dominant leader growth indicates a serious delay in plantation establishment. Presumably, improper planting, grazing damage, and genetic makeup do contribute to the undesirable early growth pattern. However, our results indicate that the physiological condition of the planted seedling is the major cause of the problem. Additional testing of selected seed sources of not only Douglasfir but all species is needed to clarify the effects of lifting date, storage period, and planting date on the subsequent height growth of outplanted stock.

The western larch was the only species with spring-lifted seedlings growing more than fall-lifted ones. However, the larch was lifted in mid-February, several weeks earlier than the other species. At this earlier lifting date, the larch was apparently in a physiological condition more suitable for lifting and storage. Had the other species been lifted at the earlier date, they too might have shown greater growth than when fall-lifted. Frozen soils normally prevent lifting prior to early March, but further testing should be done to determine the best lifting period attainable at Lucky Peak for each species grown.

To minimize molding and

Table 1.—Three-year field survival and total height for seedlings lifted and stored in fall and spring at the Lucky Peak Nursery and outplanted May 8 on the Boise National Forest ¹

Lifting date, storage temperature, and package type	Ponderosa pine		Lodgepole pine		Douglas-fir		Engelmann spruce	
	Survival <i>percent</i>	Height <i>cm</i>	Survival <i>percent</i>	Height <i>cm</i>	Survival <i>percent</i>	Height <i>cm</i>	Survival <i>percent</i>	Height <i>cm</i>
November 13, 1972								
28° F (-2.2° C)								
bag	91	35	96	52	84a	39a	93a	44a
crate	81	31	84	49	41b	25b	62b	28b
33° F (0.6° C)								
bag	91	32	100	61	94a	44a	95a	43a
crate	94	34	98	61	75a	41a	93a	44a
March 6 to 28, 1973								
33° F (0.6° C)								
bag	93	30	97	59	91a	22b	96a	40a
crate	93	30	98	67	77a	22b	97a	42a

¹ For a species trait, means followed by unlike letters differ significantly at the 5 percent level. Mean comparisons were made only for those species traits for which an analysis of variance showed a significant difference for treatment.

metabolic activity, many workers have successfully stored trees at temperatures of 26° to 32° F (-3.3° to 0° C) (2, 3). Our results also indicate that 28° F (-2.2° C) is an acceptable storage temperature. In our study, mold did not develop on any stock held at 33° F (0.6° C), but during the winter of 1975-76 some

production stock held at 33° F molded badly. In the spring, the seedlings were repacked and the obviously damaged seedlings discarded. First-year survival of the salvaged Douglas-fir was reduced from 96 to 50 percent and that of lodgepole pine from 95 to 76 percent compared to spring-lifted stock of the

same lots. Height growth of the survivors was also reduced a small amount. In the future, fall-lifted seedlings that are to be stored until spring should be packaged in polyethylene-lined paper bags and the storage temperature should be 28° F (-2.2° C) to minimize the growth of molds.

Table 2.—Three-year field survival and total height for seedlings lifted and stored in fall and spring at the Lucky Peak Nursery and outplanted May 17 and 18 on the Payette National Forest ¹

Lifting date, storage temperature, and package type	Western larch		Ponderosa pine	
	Survival <i>percent</i>	Height <i>cm</i>	Survival <i>percent</i>	Height <i>cm</i>
November 13, 1972				
28° F (-2.2° C)	95	56	99a	34
	97	52	61b	28
33° F (0.6° C)	94	52	97a	35
	91	60	83ab	35
February 16 or March 19, 1973				
33° F (0.6° C)	96	66	99a	29
	94	69	97a	32

¹ For a species trait, means followed by unlike letters differ significantly at the 5 percent level. Mean comparisons were made only for those species traits for which analysis of variance showed a significant difference for treatment.

² Larch was lifted February 16 and pine March 19.

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