NEW IDEAS IN FALL PLANTING

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ABSTRACT: Tests of early fall planting of seedlings from Lava Nursery, Oregon, showed average survival rates better than those for spring planting. For successful early fall plantings, seedlings must not be lifted until soil moisture on the outplanting site is at acceptable risk levels. It is extremely important that seedlings be in perfect physiological synchronization with the planting site environment. A unified approach between the nursery and outplanting crews is necessary for successful early fall outplanting.

INTRODUCTION

Long-lasting snow packs in the high mountain forests of the western U.S. have caused great problems to the managers of those lands. Frequently, planting is delayed until June or July by snow on the units or in the roads leading to them. Seedlings for these units have generally been lifted in January or February, meaning long storage periods of 4 months or more. When these weakened seedlings are finally planted they are immediately exposed to severe heat and low humidity before they can initiate critical root growth necessary to survive. As a result severe outplanting losses have occurred.

These problems have become extremely important in recent years because of the greater dependence upon high-elevation forest lands in the evolution of managed forests in the West. Early efforts at fall planting were not successful because they were too late in the season. These failures came from a lack of knowledge about the growth dynamics of conifers native to these high lands where severe cold persisted for long winter periods alternating with severe heat and dryness in the summer periods. These trees are very different from the Douglasfir and ponderosa pine grown for lower elevations.

Recent research by Dr. Edward Stone at the University of California, Berkeley, revealed that significant root growth potential in the early fall period was a feature of the true fir species native to the high mountains of California. This fact was confirmed by our observations at Lava Nursery, which is located in an identical climatic regime at 2,000-feet (600 m) elevation in the northern Oregon Cascades, an elevation equivalent to about 4,000 feet (1200 m) in northern California and 5,000 feet (1500 m) in the southern Sierra Nevada. At Lava, summer drought causes root and shoot growth to cease about the middle of July when buds are formed. .+s the environment modifies in September with shorter days and cooler nights, these high-elevation true firs initiate root activity with elongation appearing about mid October.

In other research, Dr. Steven Radosevich, then of the University of California and now at Oregon State University, found high levels of photosynthesis in these same species in the period from October to December. This fact triggered my curiosity in 1981 to try to plant some of these species on some test plots in areas of known past difficulty due to late snow packs. Could I successfully transplant trees in early October?

METHODS AND PROCEDURE.

Discussions with other scientists and foresters in Oregon and California brought out additional information and I was encouraged to give the test a try. Three California companies with considerable high-elevation true fir forest land agreed to cooperate by furnishing areas of machinecleared brush field conversion land for the plots. These companies were International Paper Company (now Fruit Growers Supply Company), Southern Pacific Land Company, and Beaty and Associates who administer the old Red River Company lands.

Plots were located in three separate areas ranging from north of Mt. Shasta between the Shasta and Butte Valleys, east of Mt. Shasta toward the Modoc lava country, and north of Chester California on Swain Mt. All of these locations were above 5,500feet (1675 m) elevation in volcanic-origin soils. Annual precipitation averages between 4U and 60 inches (101.6 and 152.4 cm), most of which is snow that persists until July in many years.

The plots were planted during the fall of 1981 in 33.3-foot (9.14 m) squares with 100 trees on a 3.3ft. (1 m) grid with corners and rows staked. Trees were planted as close to these grid points as possible so that they could be found again for survival inventories. Three plots were planted at each location to test exposure effects: open southern exposure, partially shaded southern exposure, and open northern exposure. Trees for the plots were lifted at the nursery in late September and transported on ice directly to the planting locations. Three trees were root pruned to 9 inches (22.9 cm) before being packed in the normal manner in three-layer bags. On the plots, the trees were planted with hoedad or shovel and

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all planting was completed within 4 days after lifting. The plots were revisited several times later in the fall to check on root growth on extra seedlings that had been planted outside the plots for that purpose. Root growth was observed in about 3 weeks, which was late October, and continued until early December when snow covered the plots. These evaluations have been repeated each fall since then.

In order to compare the test technique with the normal spring planting, plots were established the following spring (1982) adjacent to the fall plantings whenever possible.

RESULTS AND DISCUSSION

When checked in the late summer of 1983, the fall plantings had a mean survival of 86.1 percent compared to 81.7 percent for the spring-planted stock (Table 1).

Table 1.--Comparison of survival rates of fall vs spring-planted red fir seedlings.

Land Ownership	Fall Planting 1 (Pct. survival)	Spring Planting 2 (Pct. survival)	Aspect
Beaty & Assoc.	88	67	North
Beaty & Assoc.	92	72	South
Beaty & Assoc.	93	85	South w/shade
S.P.L. Co.	90	100	North
S.P.L. Co.	94	91	South
S.P.L. Co.	95	65	South w/shade
I.P.-F.G.S Co.	84	78	North
I.P.-F.G.S. Co.	64	88	South
I.P.-F.G.S. Co.	75	89	South w/shade
Average	86.1	81.7	

[1]Fall plots were established in Oct. 1981 and evaluated 21 months later.

[2]Spring plots were established in May-June, 1982 and evaluated 15 months later.

Taken altogether, the fall planting is doing better than spring planting. Spring planting survival is much better than would normally be expected because the summers of 1982 and 1983 were exceptionally mild with periodic rains that reduced stress levels on the seedlings and allowed them to develop roots before temperatures and humidities became severe. More typical California summers would not have permitted these survival results. Fall-planted trees that have root development before winter emerge from the snow pack under far less stress than newly planted trees that have been exposed to the whole series of negative experiences from lifting through planting. The fall trees can initiate root growth in their normal sequence at the proper time in the spring. This activity can be observed as early as February under snow cover at Lava Nursery. With far less stress and a functioning root system, early fall-planted seedlings can be expected to survive much better than those with inactive roots and suffering from handling and storage stresses incidental to spring planting activity.

The preliminary results of this test program have been discussed with many forest land managers in the West. The USDA Forest Service is beginning operational tests on the Shasta Trinity National Forest in California and on the Mt. Hood National Forest in Oregon. I expect that more interest in early fall planting will develop as a result of the current tests and as others become more well known. I am becoming more confident that this approach offers a dependable alternative for successful artificial regeneration of high elevation forest lands, particularly with the true fir species.

SOIL MOISTURE ON PLANTING SITE

Two very important factors must be considered in any application of this technique. I am sure that you have all thought about soil moisture while reading up to here.

You're right. Soil moisture on the outplanting site must be adequate to supply growing water for the seedlings for a sufficient period after planting so that root growth can actually occur. If there is inadequate moisture available, root growth will not initiate and the whole point of the fall planting concept is lost. Larry Ballew, forest consultant in Redding, California, has developed a system that very accurately defines soil moisture status and predicts the period of growing water availability. This allows the forester to time his fall planting precisely and minimize his risk. He can also determine whether the risk is too high and delay planting until spring and take his risks then. Since this early fall planting technique uses the "hot lifting" approach, the seedlings are not lifted until the soil moisture determination indicates acceptable risk levels. You also don't have to worry about seedling storage with this procedure.

PHYSIOLOGICAL CONDITION OF SEEDLINGS

Another extremely important factor to consider is that seedlings used for early fall planting must be in perfect physiological synchronization with their intended environment. There is a very small "window" of opportunity to get the seedlings out of the nursery before they awaken fully from their summer drought-induced quiescence and into the plantation before root growth initiates. This means that early fall-plant seedlings must be grown in a cold climate nursery where the annual environmental cycle closely matches that of the plantations where they will be planted. If this sounds like a pitch for Lava Nursery---it is. Physiological preconditioning of seedlings to stressful environments is one reason why we established our nursery. Results from the last

7 years support this theory. Early fall planting success is one of those results.

Early fall planting should be an added benefit for tree planters. This puts more work into a generally low activity period of the tree planter's year. It allows him to plant in usually good weather in the beautiful high-elevation environment. At the nursery, fall is a very inactive time ordinarily. If we can lift a part of our crop in the fall it reduces the workload in the spring. This is particularly important in cold-climate nurseries where hustle, hassle, and chaos reign after long winters.

UNIFIED APPROACH

To be consistently successful I feel that this approach to planting must be done as a unified or full-service contract. This means that the nursery must coordinate directly with the planting contractor in order to properly time the critical activities. I don't think that the traditional, fractionated approach to planting where the land owner goes for lowest cost seedlings, low-bid planting, and low-bid everything will work. Last fall (1983) Lava Nursery sold 12,000 white and Shasta firs to the Shasta Trinity National Forest and contracted to plant them; payment was to be made upon final acceptance of the seedlings and the planting by the Forest Service. The project was located at 6,300-feet (1900 m) elevation on the southwest face of Mt. Sopris where snows often reach 20-foot (6 m) depths. Three previous unsuccessful efforts had been made to plant this brush field conversion.

Lava hired a highly regarded contractor, Mike Brash's Highland Timber Services of Mt. Shasta, California, to do the planting. Mike negotiated the price per acre after looking at the site and discussing it with the Forest Service silviculturist, Dave Trevisan. Mike was also given sample seedlings to provide him with an idea of what production problems he might have with them.

It is important to note here that we were specifying that these seedlings were to be planted with unpruned roots, some of which were laterals of 20 inches (50.8 cm). This specification was recommended by Lava on the basis that root elongation had begun in mid September so we did not want to destroy the delicate physiological balance of the seedlings by cutting off all of the root system "goodies". The Forest Service agreed and we mutually worded the spec's to allow some distortion of lateral roots in planting. "L" laterals were acceptable but not "J's". I might also note that Lava undercuts its seedlings in the beds at about 9 inches (22.9 cm). This reduced tap root length and that is the root element that must be prevented from being distorted in planting. Distorted lateral roots are not nearly as serious as "L" or "J" tap roots.

The Highland crew used 16-inch (40.6 cm) planting shovels, planted 700 trees per man per day in 7 hours working time, and made a 98 percent performance rating in the rigorous Forest Service inspection. Lava Nursery and the Forest Service closely monitored the seedlings during lifting and planting with a PMS moisture stress "bomb" to determine stress levels. Readings were continued after planting for several weeks. The net observation was that the trees apparently became adapted to the plantation environment 4 days after planting. Moisture stress readings after that showed little difference from natural seedlings in adjacent forest stands. By early December, when snow finally covered the site, no stressed seedlings were observed.

What this shows is that coordinated, careful control of planting with all parties committed and paid to do the best job possible will yield top-quality results. We must wait until next September to see for certain what the survival results will be, but one thing certain is that another spring plant would have been doomed. There was still 4 feet of snow on the location in early May, 1984.

Lava Nursery is trying to obtain more fall planting projects and will continue its tests if research funds can be obtained through the Small Business Innovative Research Program. We hope to be working with some of you folks in the future. If you have questions, comments, or help to offer, we would be pleased to hear from you at the following address:

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