

Fall Planting Literature Search and Review

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At the January 15, 2001 meeting the co-op membership decided to form a committee to proceed to the next level with the fall planting proposal. The initial efforts had concentrated on a literature search for publications relevant to the subject matter. Hundreds of publications had surfaced as a result of these searches. The next step was to go through these publications and sort out those that had application to the geographical area of interest to the co-op, southern Oregon and northern California. This has been done and references cited in these publications are being gathered and summarized. The library at the University of California at Berkeley has been the source of these latter publications. Thirty-seven publications have been summarized so far from this last search. Plans are to develop two documents on fall planting based on information from the literature searches. One will concern nursery practices, the second will cover the operational aspects of outplanting. The goal is to have these documents finished in 2002.

A secondary phase of research into the fall planting question was initiated while the literature searches were proceeding. Three subject-matter experts were contacted by John Fiske and Gary Fiddler and asked if they would be willing to contribute to our efforts in this proposal. Jim Jenkinson (retired) of the United States Forest Service Pacific Southwest Research Station in Berkeley, CA, Dave Hennemen of the Bureau of Land

Management in Medford, OR, and Tom Landis of the United States Forest Service in Central Point, OR agreed to help us.

Jim was interviewed by John and Gary on February 27th, 2001. The report on the interview can be found at the end of this discussion. Following Jim's advice, Dave and Tom were contacted and reviewed Jim's comments from the interview and contributed their own observations on fall planting. These comments are a part of the report mentioned earlier. In addition, Tom and Dave agreed to be a part of our June 11th & 12th meeting in Mt. Shasta. Their participation in the formal meeting and the field trip is documented in the previous pages dealing with co-op meetings held in 2001.

The following summarizes the results of a 2/27 meeting in the Forest Service Regional Office that Gary Fiddler and John Fiske had with Jim Jenkinson, retired PSW Researcher, and subsequent comments about fall planting by Tom Landis, Forest Service State and Private Forestry National Nursery Specialist and Dave Henneman, Bureau of Land Management, Oregon, reforestation specialist.

Background.

Members of the Sierra Cascade Intensive Forest Management Research cooperative (SCIFMRC) are very interested in the fall-planting option for container stock regeneration on industry lands in Northern California and

Southwestern Oregon. Successful fall planting significantly increases management options. However, fall-planting of container or bare-root stock has failed more often than not. Reasons for failure or success have rarely been documented. At SCIFM request, Gary had done a thorough literature review, but the sparse results were insufficient for SCIFM member use. At the last SCIFM coordination meeting I agreed to set up a meeting with Jim Jenkinson to get his experiences, knowledge, and recommendations to better assess what the forestry community knows about fall planting in the geographic area of interest to SCIFM members.

Jim Jenkinson's Experience.

Jim cautioned that almost all of his fall-planting experience is with bare-root conifer stock in maritime environments, planting 2-0 Douglas-fir from Humboldt Nursery in the Coast Ranges in northern California and southwestern Oregon. Jim's results are available in a General Technical Report: Jenkinson, James L., James A. Nelson, and May E. Huddleston. 1993. *Improving Planting Stock Quality - The Humboldt Experience*. PSW-GTR-13, pp. 170-173. Jim also is generally familiar with fall planting trials of true fir (2-0 Shasta red fir) conducted by Will Ellington, Lava Nursery, Parkdale, Oregon, in the 1980's on true fir sites in the California Cascades. Consequently, Jim has some firm ideas, based on conifer seedling physiology, about the requirements for successful fall planting on both inland and maritime sites in geographic areas of interest to SCIFM members. The following section **Six Principles** summarizes those ideas.

Jim recommended that since his experience was mostly with bare-root, SCIFM should work with Dick Tinus, USFS, Southern Research Station, and Tom Landis, Forest Service State and Private Forestry Nursery Specialist, to get their container expertise.

Tom Landis' comments are included below, followed by those of Dave Henneman.

Six Principles.

Fall planting of conifer stock, whether bare-root or container, succeeds on prepared sites in northern California or southwestern Oregon sites **only if**:

1. **The nursery stock used is capable of growing roots when planted in an environment that can support root growth.** Nursery cultural practices are developed to produce planting stock with this capability.
2. After outplanting, **sufficient root growth must occur to ensure over-winter survival**, so the fall planting environment must be able to support root growth **for a minimum of approximately 2-3 weeks**. This guide reflects Will Ellington's observed minimum fall root-growth period for planted 2-0 red fir seedlings. **The minimum root-growth period may be less for container stock, since this stock can be delivered with intact root tips**, which have the capacity to elongate without delay, a critical advantage where the fall planting window is very narrow.
3. **Soil moisture required for root growth - moisture at near-field-capacity levels to planting depth, 10 to 12 inches.** A general rule of thumb is 2" of rain prior to fall plant. Adequate soil

moisture is essential for both proper planting and sufficient root growth.

4. **Soil temperatures required for sufficient root growth - soil temperature thresholds are: at least 50 degrees F for ponderosa and Jeffrey pines, 47-48 degrees F for Douglas-fir, and 43-45 degrees F for red or white fir. All soil temperature guidelines are at 3-4" depth, measured at 8 am ... the coldest part of the 24-hour day.**
5. **Following fall root-growth, snow covers the seedlings until spring, or**
6. **Where seedlings will *not be covered by snow*, soils are consistently warm enough to permit water uptake during winter. Soil temperatures that limit water uptake are about 32 degrees F (true fir) and about 35 degrees F (ponderosa and Jeffrey pines). In colder soils, root cell membranes become impermeable to water. Where root temperatures often drop to freezing and lower temperatures, uncovered seedlings rapidly desiccate and die.**

Important things we don't know?

1. How does the minimum root-growth period needed for overwinter survival vary with species and seed source?
2. Are the fall planting windows (as specified by the above six principles) valid for other conifer species, such as sugar pine, giant sequoia, or incense-cedar?

Summary of March 5, 2001 Comments Tom Landis

1. He agrees with Jim Jenkinson's comments.
2. Low vs. high-elevation planting windows. The fall-planting window is more often limited by soil moisture at low-elevation sites, but more often by cold soil temperatures at high-elevation sites.
3. Crop scheduling. Because of the unreliability of the fall-planting window opening, nurseries and customers should agree on a schedule with an "escape clause". The seedlings should be ready for fall planting if the window opens, but seedlings can be held over and outplanted the following spring if the window does not open.
4. Stock conditioning. Shoots of seedlings grown for fall outplanting are moderately hardened, but not fully dormant or cold hardy when shipped. However, roots are still active.
5. Reliability of early stock trial results. Early results, suggesting that container stock could be outplanted almost year-round, should be lightly regarded for two reasons. First, most of the stock used in those trials were not properly conditioned (shoots not hardened). Second, most comparisons were invalid because stock of different sizes were used.
6. Strongly recommends doing some operational trials using "target seedling" guidelines.

Summary of March 5, 2001 Comments
Dave Henneman

1. Extensive BLM Oregon fall planting experience indicates wider fall-planting windows for container (vs. bare-root) stock. Greater soil/root contact in container stock means better capabilities to withstand handling stresses and over-winter drought conditions.
2. Following fall planting, want 3-4 weeks when soil temperatures are at least 45 degrees F.
3. Fall vs. spring plantings. Fall plantings (container or bare-root stock) of pine and hardwoods have better average survival and growth rates, compared to spring plantings. However, experience with Douglas-fir and true fir is more variable.
4. Suggest "hot plant" strategy for fall planting. Typically 10 days maximum between nursery "lift" and planting of container stock – but maximum of only 4 days for bare-root stock. Don't cold-store lifted stock (e.g., at 34 degrees F) prior to outplant.
5. Do a realistic assessment of the risks of spring vs. fall planting. (BLM rarely considers fall-planting on most "run-of-the-mill" reforestation units.) Spring planting factors include probabilities of hot or dry conditions the following spring, access to sites, and adequacy of site prep. Other spring planting factors include histories of spring planting results on like sites, likely growth rates of probable competing plants, and the extra seedling caliper and roots if left in the nursery over-winter. Need strong reasons against spring planting to justify taking

on the many significant risks of fall planting.

