The Fluff, The Meat and The Guessin' of Seedling Fertilization in the Forest

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The Fluff

All comments and observations in this presentation are based on operational experiences and experiments located at Starker Forests, Inc. Other geographic locations which grow conifer seedlings may experience results that are different from these.

Our observations and experiences are in the central Coast Range of Oregon. Soil parent material is sandstone in the western portion of the ownership and basalt to the east. Rainfall averages 50 to 120 inches a year east to west respectively. Up to 90 days during the summer has little precipitation.

We have seven years worth of trials, though we have learned the most during the last three years. Several individuals have contributed thoughtfully to our research strategies including George Fenn, Tim Kosderka, Byron Carrier, Reid Carter and Bob Powers.

We are seeing growth response from seedling fertilization and we have killed trees with seedling fertilization.

The Meat

I. We have experimented with various kinds and amounts of polymers with and without fertilizer and have not been able to demonstrate a seedling response in the field to polymers.

2. Weeds can kill newly planted, fertilized seedlings. In particular grasses, forbs, and mega amounts of thistle suck the water out of the ground. A high salt concentration in soil without moisture reduces seedling survival appreciably. When fertilizing newly planted seedlings, be sure to have good weed control.

3. Douglas-fir seedlings respond to fertilization. Operationally, we have noticed ponderosa pine, grand fir, Sitka spruce and western red cedar also respond very well to seedling fertilization.

4. In ten year old plantation trials, we have seen an increase in response to blended fertilizer and an additional gain when 2 tons per acre of calcium was added. We are currently testing blended fertilizers on seedlings with and without the addition of calcium.

5. Transplant seedlings lifted in the first part of January and planted in the first part of January have consistently responded to seedling fertilization. Seedlings lifted in January, stored in a cooler, and planted in March do not generally respond to seedling fertilization. Seedlings lifted in late February or early March and planted in March have not shown much response.
6. Containerized seedlings appear to consistently respond to seedling fertilization. This is in contrast to transplant stock where response seems to be tied to lifting and storage timings.
7. Seedlings planted and fertilized in early January on burned units (and perhaps scarified units) respond better and more consistently than those planted in units with large amounts of logging slash.
8. Our soils and foliage analysis consistently show shortages in potassium, calcium, boron, sulfur, copper and zinc. Nitrogen is occasionally deficient.
9. Seedling fertilization, in combination with vegetation control, can yield three to five times root growth above that of control seedlings.
10. We have observed an extra 30 to 45 days of top growth, mostly through second flushes, when trees are fertilized. We have not experienced frost damage due to the late season growth. This may partly be due to potassium.
11. Results are inconclusive on fertilizer placement. Generally, first year slow release blended fertilizers work best when applied below ground. Second year fertilization programs work well when applied topically.
12. Second year seedling fertilization works well. If seedlings are stressed when planted a good option may be to wait until the second year to fertilize. At that time, root growth potential may be higher so that more fertilizer can be used by the seedlings.

The Guessin'

When reviewing the economics of seedling fertilization, we have made the following evaluation. At 400 trees per acre, fertilizing with slow release balanced fertilizer costs about $100 per acre (labor and materials). Assuming a yield of 40,000 board feet per acre at final harvest (60 years) and $500/MBF stumpage net return on investment is 3% real rate if seedling fertilization shortened rotation length by one year.

Unfortunately, there isn't enough information yet on growth response across enough sites to predict long-term yield changes. We will have better information in three to five years but the economics of seedling fertilization will remain a guessing game due to the uncertainty of rotation age yield changes.

With regards to slow release fertilizer, it appears that soil temperatures plays a crucial role in nutrient release rates. We are measuring soil temperatures on scarified, burned, and unburned sites.

Planted and fertilized unburned sites have had inconsistent growth responses. Soil temperature and/or drafting of nutrients by logging slash may have a role in the inconsistencies of the growth response.

Much seedling fertilization work has yet to be done on conifer species other than Douglas-fir. The Canadians have done some work on western hemlock, western red cedar and Sitka spruce.

We have learned a lot but are not yet achieving consistent growth response across all sites. My guess is seedling physiology, root growth potential, lifting, storing, soil temperature, site preparation, weed control and stock size all play a vital role in seedling fertilization response.