

E-Media and Crop Nutrition Monitoring

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Abstract: Modifying media through the addition of slow-release fertilizers and other amendments is a beneficial tool in optimizing seedling performance. At our container reforestation nursery in southwest Washington, we have been enhancing our media through the incorporation of slow-release fertilizers and other amendments in our culturing of native conifers. The concept behind enhanced media is the modification of media components to optimize seedling performance. Enhancing the media allows for growing seedlings outside and supports the development of well-balanced seedlings, both morphologically and physiologically. The incorporation of slow-release fertilizers also allows seedlings to be delivered to the planting site in a nutrient-loaded state.

Keywords: slow-release fertilizer, container nursery, seedling nutrient status, tissue sampling

While conifers benefit from being grown outside in conditions similar to those that will be experienced upon outplanting, other factors associated with outside growing further support the use of slow-release fertilizers. Trees grown outside in containers are susceptible to drought stress, and therefore need an abundant water supply. Likewise, they are also subject to rain. This precludes the solitary use of liquid fertilization due to leaching, either through rain or irrigation. The incorporation of slow-release fertilizers ensures an almost continuous nutrient supply.

Creating the perfect recipe for a given species and stocktype, however, can be a challenging task. The actual release rates of major and minor elements contained within slow-release fertilizers have been observed to vary widely based on coating type, thickness of coating, prill size, and temperature.

E-Media Components

In a 2001 study conducted jointly between Microseed Nursery and the Oregon State University Nursery Technology Cooperative (NTC 2002), the primary objectives were to evaluate the relationships between temperature and fertilizer release rate, and to evaluate seedling responses to fertilizer and media components. This study analyzed the release rates of Apex® 19-5-12 (19N:5P₂O₅:12K₂O) (3–4 month) Flower and Foliage formulation and Apex® 19-6-12 (19N:6P₂O₅:12K₂O) (5–6 month) Flower and Foliage formulation separately and in combination with each other. These formulations were also tested with the addition of Premix 2000 (Marion Ag Service Inc., St. Paul, OR) and Actino-Iron® (Natural Industries Inc., Houston, TX).

The release rates of the fertilizers were analyzed by filling blocks with medium and adding a specified amount of fertilizer prills. For each of the treatments, the prills were separated from a given number of blocks at 2-week intervals. The prills were dried, weighed, and ground for analysis to determine how much fertilizer had been released up to that point. At the same time, greenhouse thermal graphs were used to record “heat hours.” The data was examined to determine the relationship between temperature and fertilizer release over time.

We learned three things from the NTC study:

1. More than one formulation of fertilizer is needed, as release rates overlap. Individually, the release rates of specific elements (nitrogen [N], specifically) do spike, but blending formulations and tailoring the recipe to the length of the growing period of a particular stocktype can minimize the spikes.
2. In regular formulations, phosphorus (P) does not release at the rates needed by conifers. We now regularly add 0-45-0 to boost P to adequate levels.
3. It is better to separate the minor elements. We now add Apex® Micro-Mix separately in addition to the major formulation.

Operationally, we have now been incorporating slow-release fertilizers into our media for several years (table 1, for example). This requires calculating material needs in advance and having them available. We color code each formulation for

added control. As soon as a shipment is received, all the bags are spray-painted the appropriate color. We have a measuring station where each fertilizer formulation or other amendment is weighed and individually bagged based on the current recipe. The bags are then assembled into a crate and delivered to the soil mixing station. The amendments are incorporated slowly as the hopper mixes the media.

Tissue Monitoring

Throughout the growing season, we monitor nutrient levels within the plants by weekly tissue sampling and compare them to sufficiency ranges. The sufficiency ranges we use

are a combination of accepted industry levels and our own experience, supported by extensive tissue sampling, of the levels required to achieve the elusive “target” seedling. If levels appear to be below optimum, we supplement with liquid fertilizers. The results of the tissue testing we conducted in 2005 are displayed in figures 1 through 14.

From the 2005 tissue sampling, we learned the following: (1) we needed to elevate copper (Cu) and boron (B) levels throughout the growing season; (2) not enough liquid supplements were being applied; and (3) calcium (Ca) (and possibly manganese [Mn]), while being diluted during the “rapid rate” growing phase, were adequate at the end of the growing season.

Table 1—E-Media: 2005 Douglas-fir/ plug-to-plug/ IPL 350 / outside.

Base media: SunGrow #57

50% “coarse” Orange Peat
20% Perlite
30% “coarse” Vermiculite

Materials added per yd³:

4 lb (1.8 kg) Gypsum
10 lb (4.5 kg) Zeolite clay
1 lb (0.45 kg) Apex® 19-5-12 (3-4 month)
1 lb (0.45 kg) Apex® 19-6-12 (5-6 month)
8 lb (3.6 kg) Apex® 16-4-11 (18 month)
2 lb (0.9 kg) 0-45-0
1 lb (0.45 kg) Apex® Micro-Mix
2 lb (0.9 kg) SPF 20% Iron

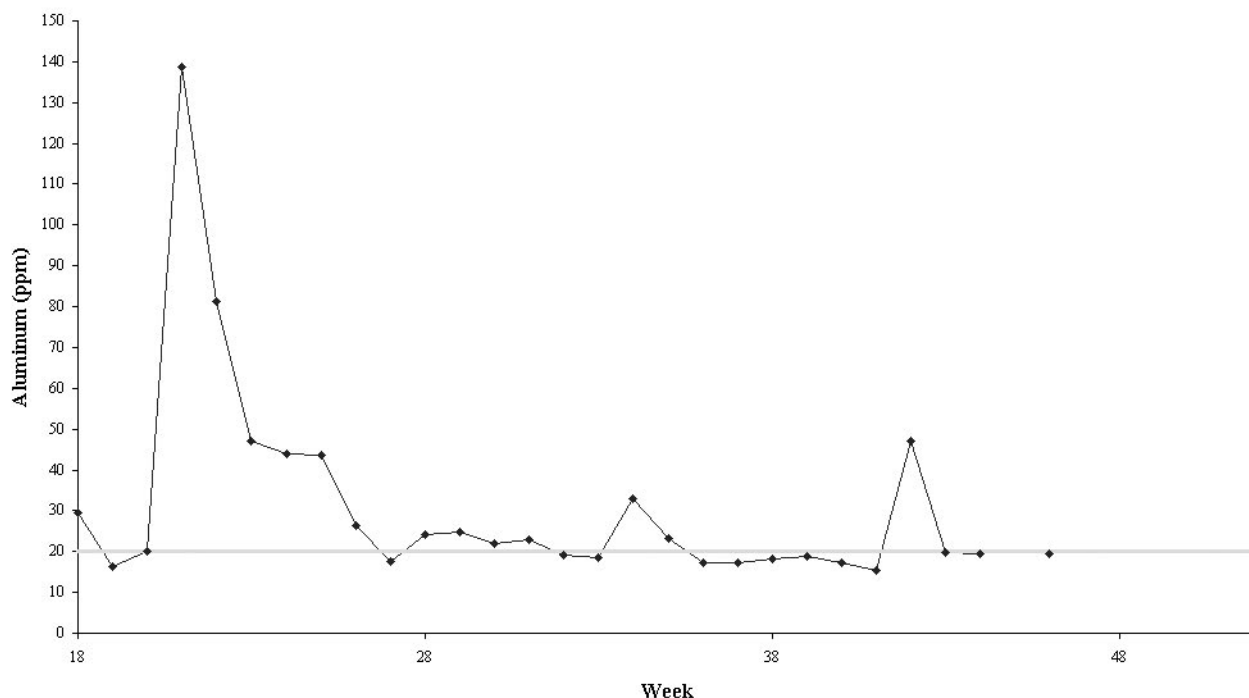


Figure 1—Tissue analysis for aluminum (Al) for Douglas-fir plugs cultured during the 2005 growing season.

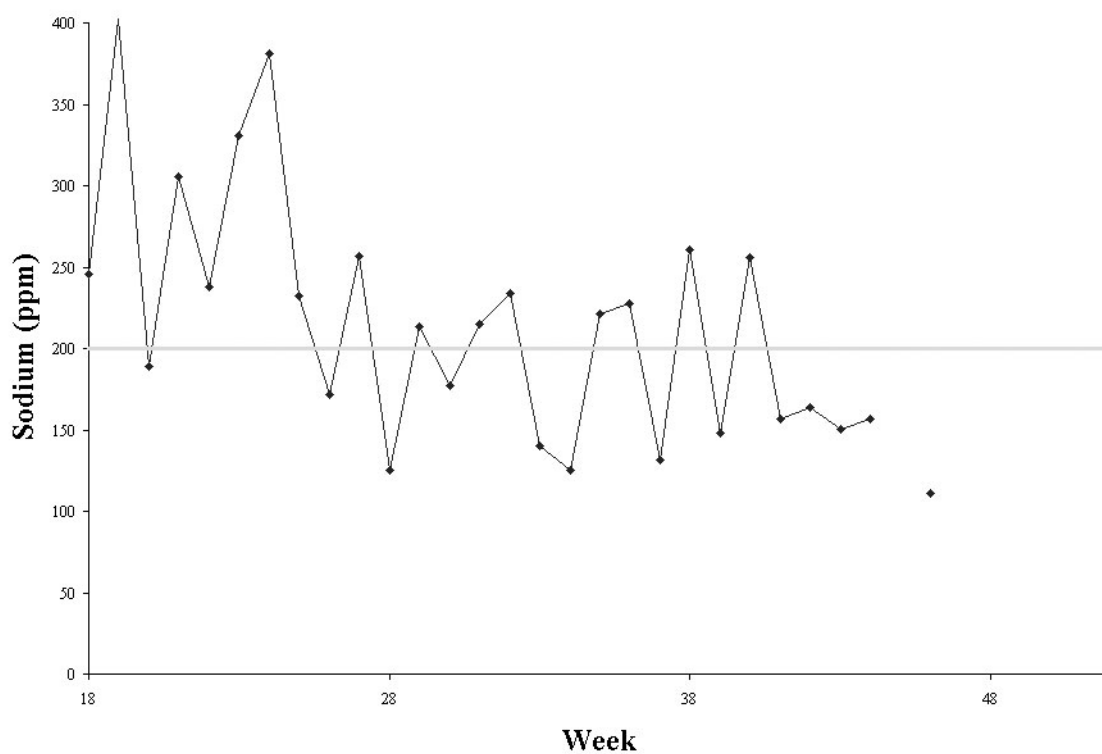


Figure 2—Tissue analysis for sodium (Na) for Douglas-fir plugs cultured during the 2005 growing season.

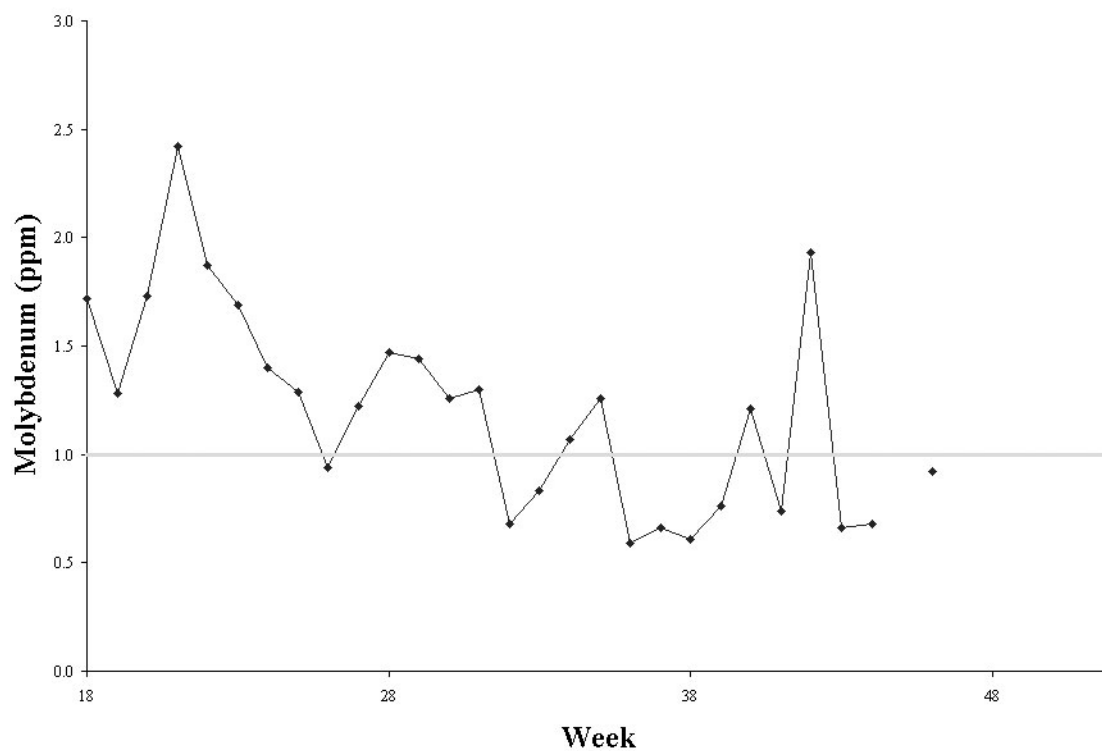


Figure 3—Tissue analysis for molybdenum (Mo) for Douglas-fir plugs cultured during the 2005 growing season.

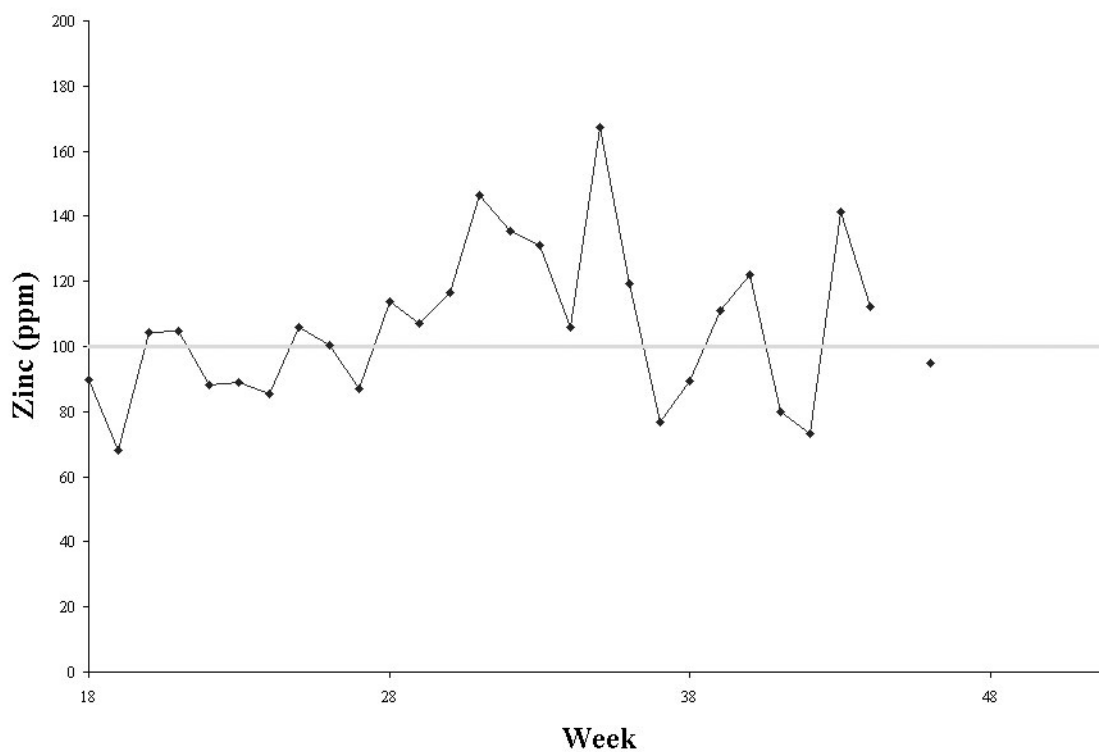


Figure 4—Tissue analysis for zinc (Zn) for Douglas-fir plugs cultured during the 2005 growing season.

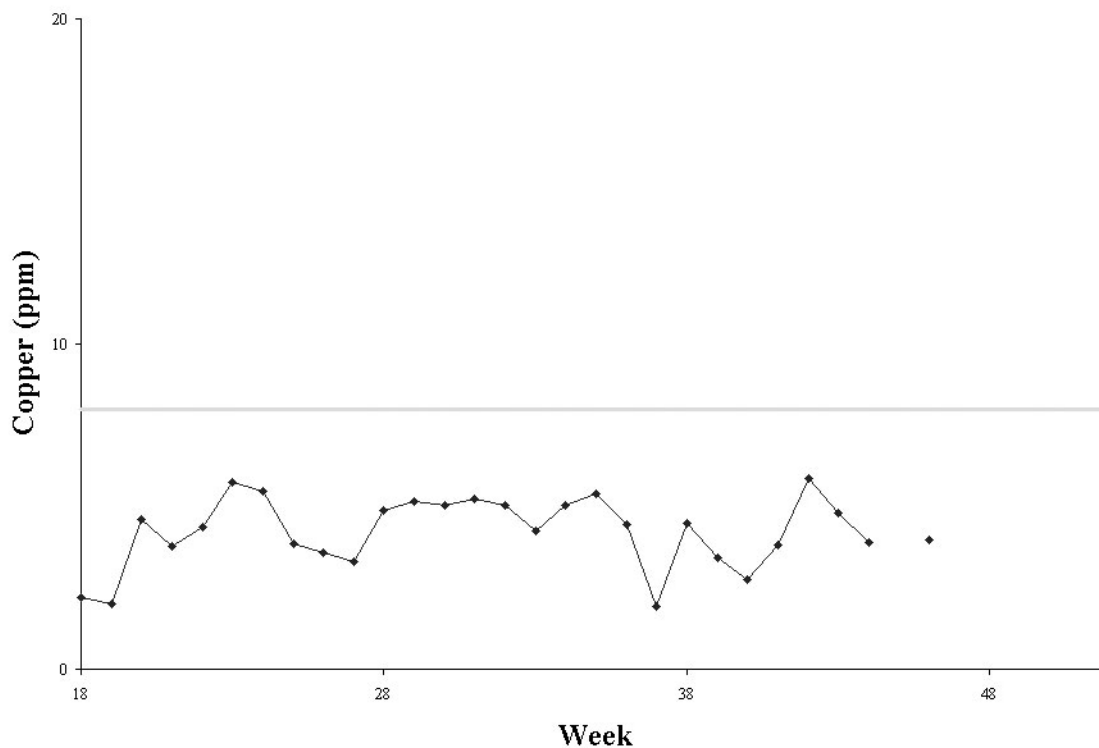


Figure 5—Tissue analysis for copper (Cu) for Douglas-fir plugs cultured during the 2005 growing season.

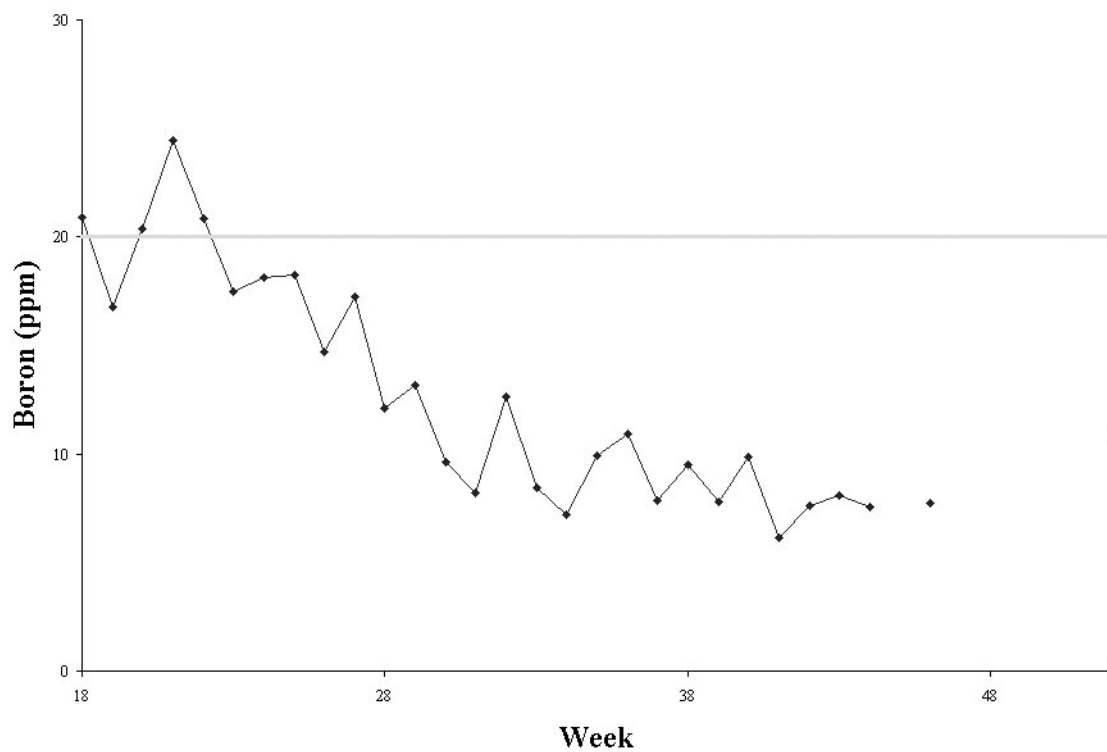


Figure 6—Tissue analysis for boron (B) for Douglas-fir plugs cultured during the 2005 growing season.

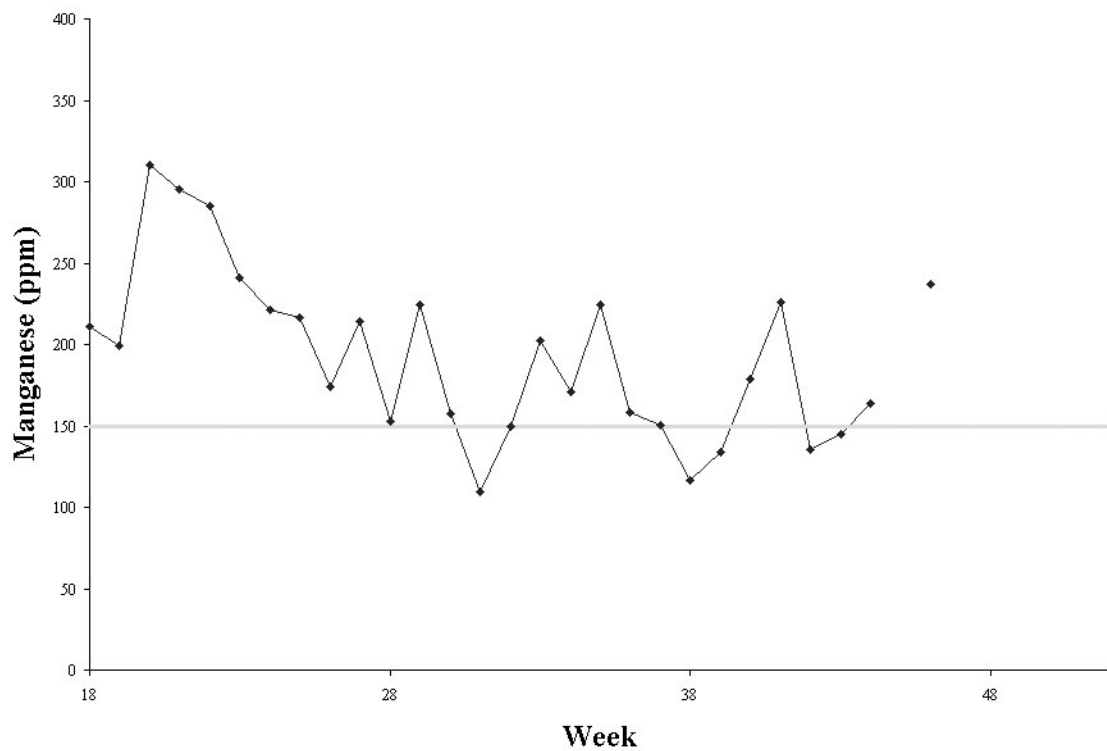


Figure 7—Tissue analysis for manganese (Mn) for Douglas-fir plugs cultured during the 2005 growing season.

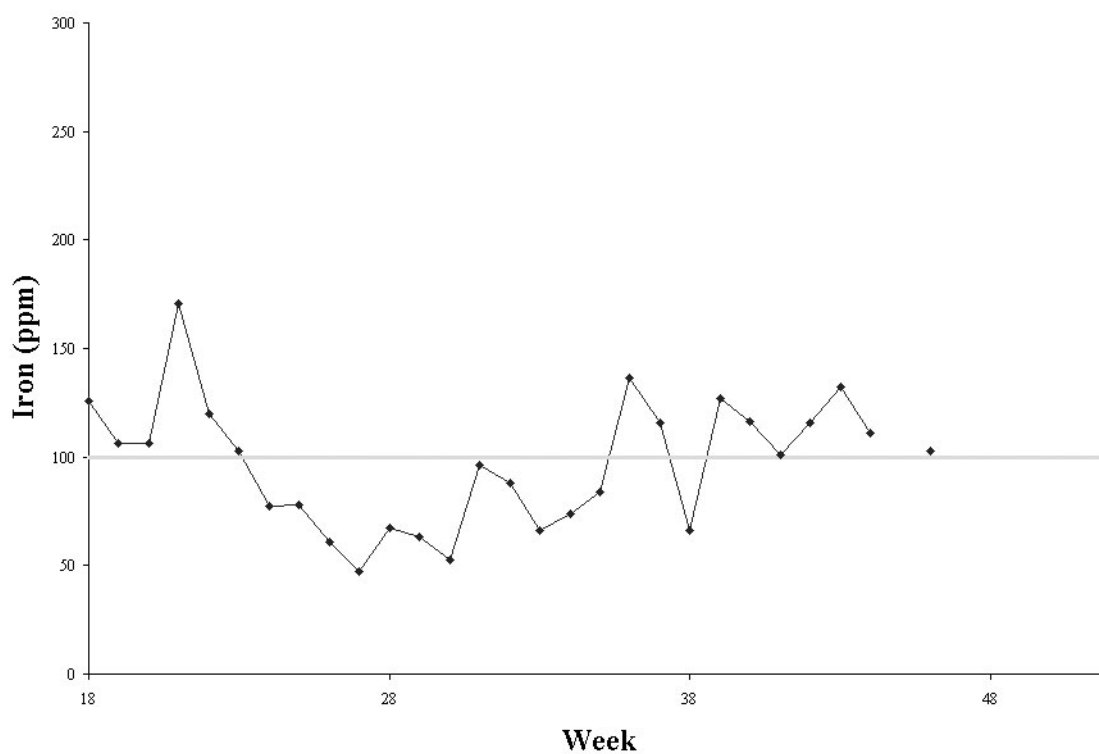


Figure 8—Tissue analysis for iron (Fe) for Douglas-fir plugs cultured during the 2005 growing season.

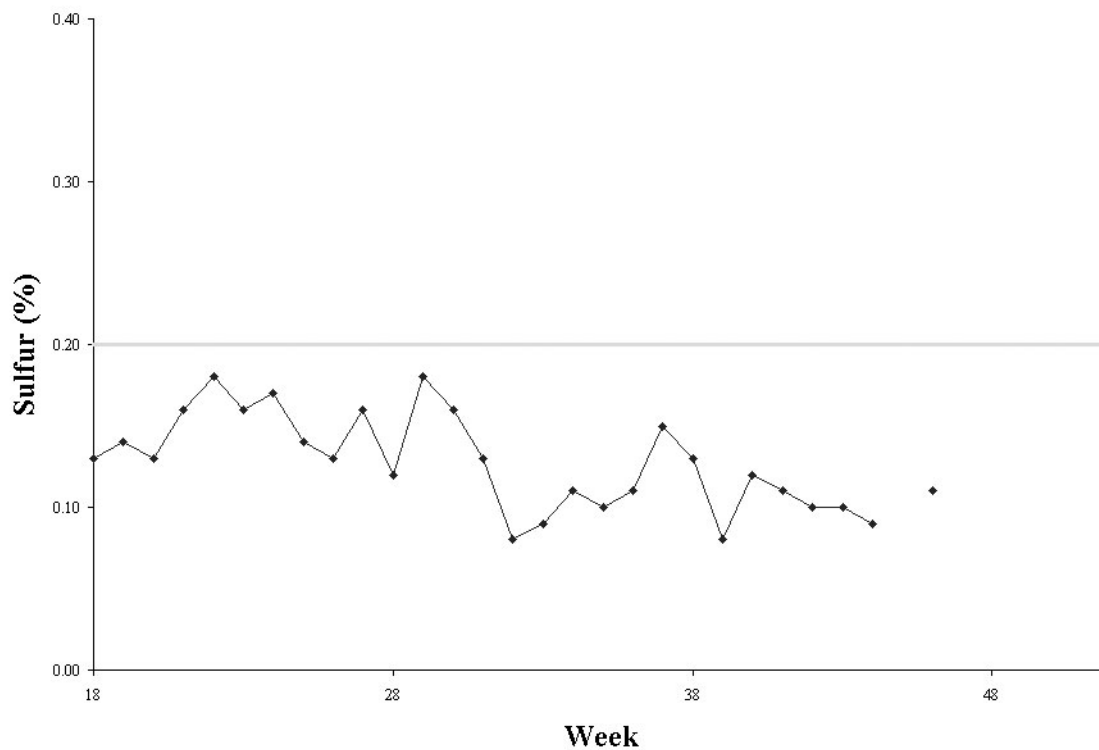


Figure 9—Tissue analysis for sulfur (S) for Douglas-fir plugs cultured during the 2005 growing season.

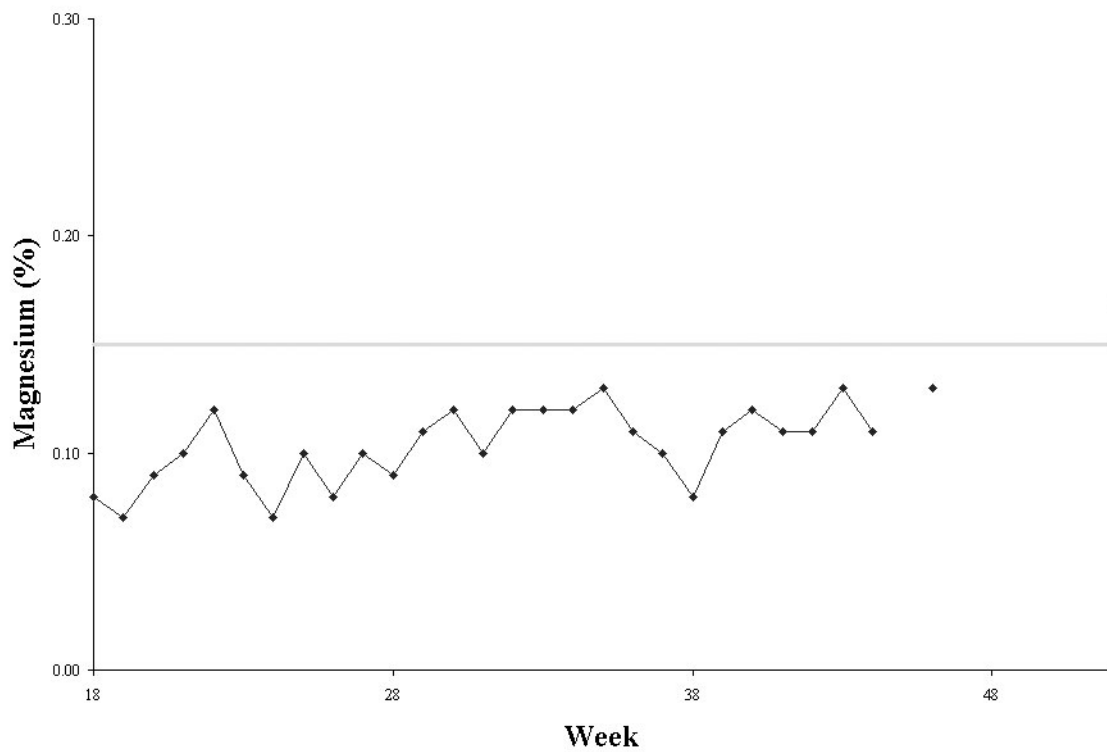


Figure 10—Tissue analysis for magnesium (Mg) for Douglas-fir plugs cultured during the 2005 growing season.

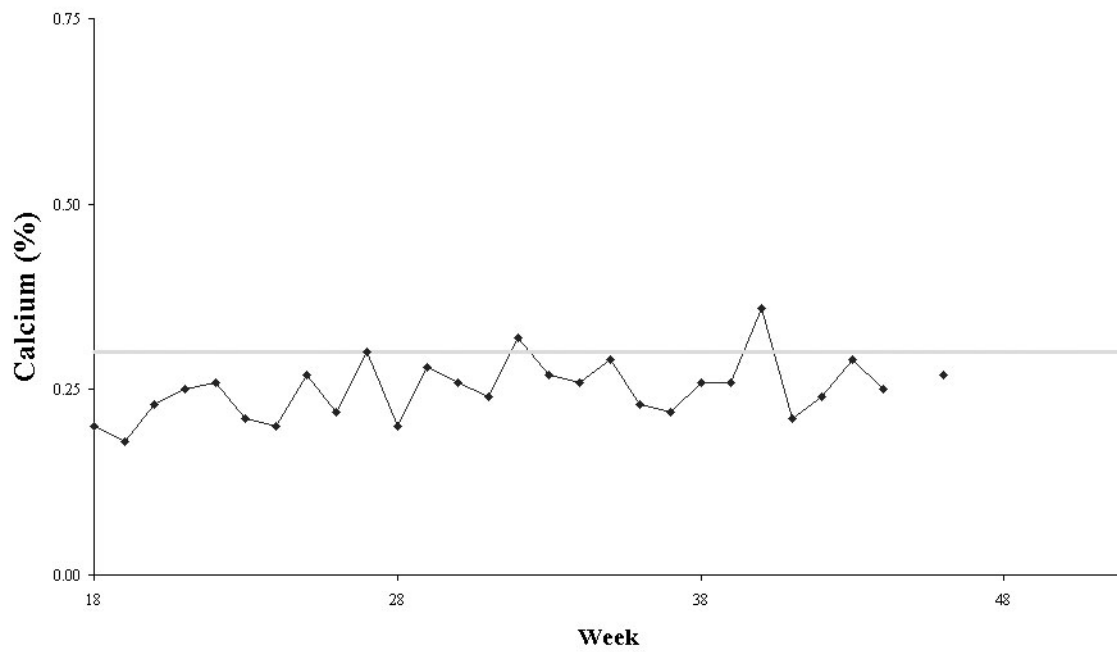


Figure 11—Tissue analysis for calcium (Ca) for Douglas-fir plugs cultured during the 2005 growing season.

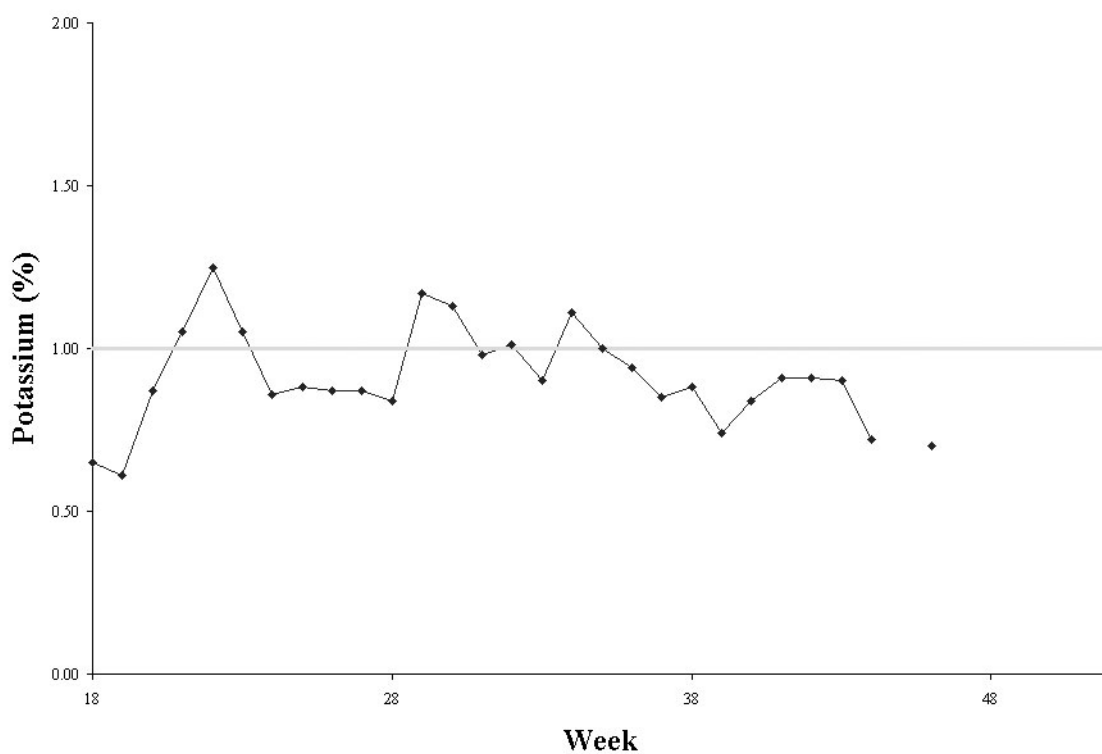


Figure 12—Tissue analysis for potassium (K) for Douglas-fir plugs cultured during the 2005 growing season.

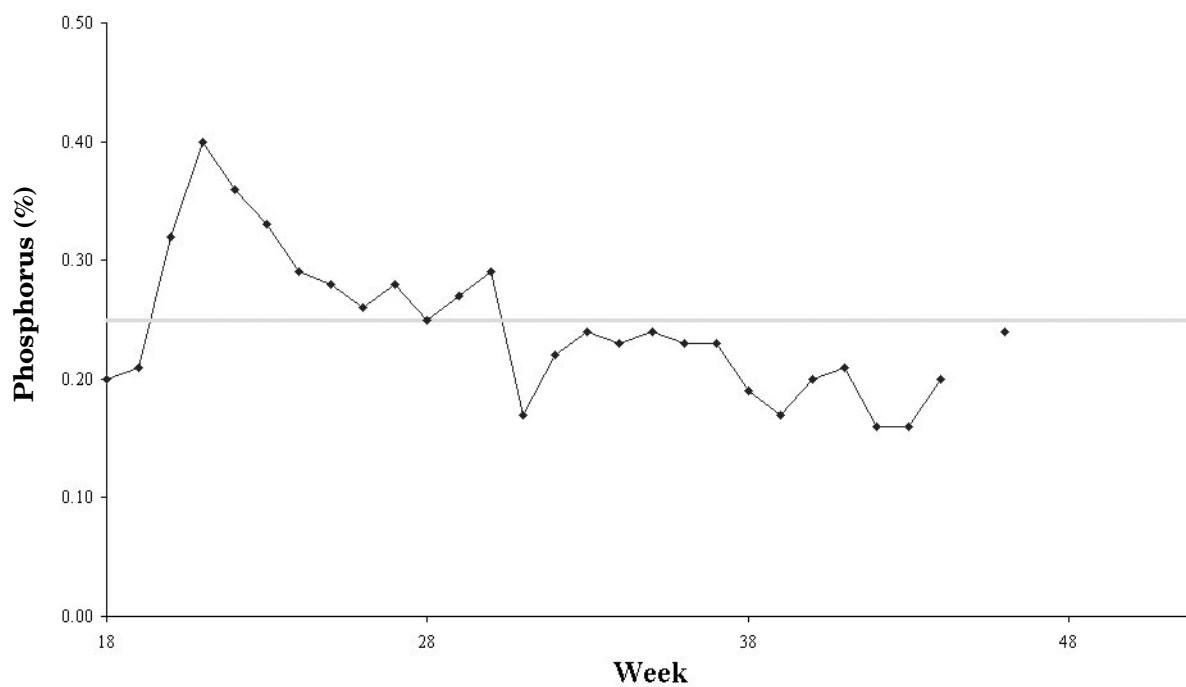


Figure 13—Tissue analysis for phosphorus (P) for Douglas-fir plugs cultured during the 2005 growing season.

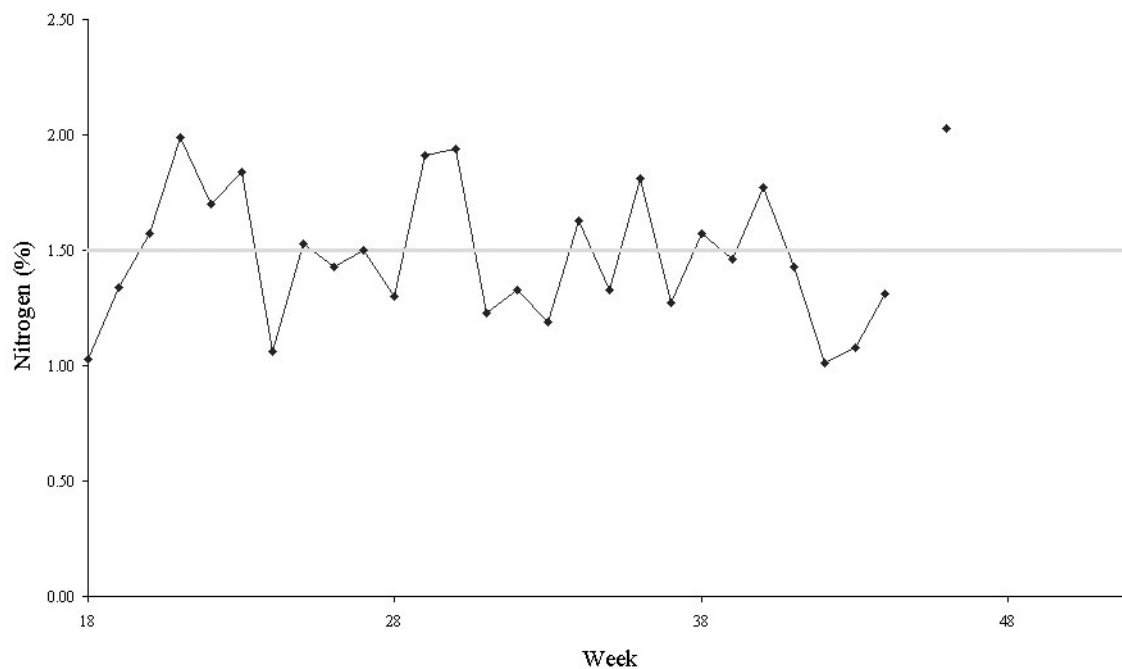


Figure 14—Tissue analysis for nitrogen (N) for Douglas-fir plugs cultured during the 2005 growing season.

For the 2006 growing season, we have, in some cases, added Actino-Iron® and ZEBA® to the soil mix and created a liquid blend of SeQuestar® 14% copper chelate (CuNa₂EDTA), BioGain® WSP® + Sprint 330®, and Solubor. We continue to gather tissue samples weekly and will continue modifying the formulations based on those analyses as well as observed crop performance.

Conclusion

Through the use of enhanced media and outside growing conditions, we are producing morphologically and physiologically well-balanced seedlings. Intensive height and caliper measurements are taken throughout the growing

cycle, and extensive tissue sampling is done. Physiologically, preliminary studies are beginning to show that Microseed's outside-grown, nutrient-loaded seedlings are achieving cold-hardiness at either the same rate, or more rapidly than, bareroot stock (NTC 2006).

References

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