ORNAMENTALS NORTHWEST ARCHIVES

Spring 1985
Vol. 9, Issue 1
Pages 18-19

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NUTRIENT ANALYSIS PROBLEMS IN DOUGLAS-FIR CHRISTMAS TREES

A preliminary study of the nutritional element content of Douglas fir grown in Christmas tree plantations in Oregon has been completed and published (1). The work focused on the elemental variation in twig samples over a two-year period and on the statistical problems of obtaining useful information from any given sample.

Samples were collected near Corvallis every two weeks from June 1 to October 1 and monthly until the next June. Collections took place when the trees were four and five years old. Samples consisted of about one inch of secondary terminal shoot tips gathered from around the tree at all heights and aspects. Each sample was analyzed for nitrogen, potassium, phosphorous, calcium, magnesium, manganese, iron, copper, boron and zinc.

Variation throughout the year can be broken into three basic patterns: 1) elements whose levels increase around bud break and gradually decline through the summer -these include nitrogen and phosphorous; 2) elements whose levels decline around bud break and gradually increase through the summer, fall and winter - these include calcium, magnesium, manganese and iron; and 3) elements that followed no apparent pattern - potassium, copper, boron and zinc.

The most stable period of nutrient content is often recommended as the time to sample evergreen plant species. Usually this occurs during the late fall and winter months when growth is least. We found that this is true for Douglas-fir samples as well. More importantly, however, we found that even within a single population, the values that we can expect from a nutrient analysis will vary considerably from tree to tree and from year to year, as well as throughout the year and among plantations.

The reasons for this variability are several. Genetic variability among seedlings is important. However, we found that even genetically identical trees growing side by side vary in nutrient content, indicating that perhaps soil and microbial factors affect nutrient uptake. Also, there is some variability associated with the methods of analyzing these elements.

Therefore, in order to reliably diagnose the nutrient status of the plantation, thoughtful and thorough sampling must be carried out. Your county agent or a qualified fieldman can help with this.

In addition to the frequent sampling described above, we also collected three samples at each of 12 additional locations in December 1981. Table 1 accompanying this article presents the high

and low values for each element from 13 sampling sites in the Willamette Valley. The sites were selected to represent a range of elevation, aspect and soil type. Trees at all sites were healthy and vigorous. As you can see, a wide range of values could be expected from Douglas-fir twig analysis. If you have a twig analysis substantially below the low-end values reported here and have a problem with your trees, call your county agent. If you would like a free copy of the published paper, write me.

An additional comment. We do not have any evidence that nutritional deficiencies reduce production in Christmas tree plantations, except for occasional nitrogen deficiency which is easily diagnosed and corrected. We do see occasional low reports of some elements, but cases where the problem was corrected by adding fertilizer have not been reported. This suggests that nutrition is generally not a problem in Christmas tree production in Oregon.

TABLE 1. **Low and high values obtained from Douglas-fir twig analysis at 13 Christmas tree plantations in the Willamette Valley.** Sites were selected to represent a wide range of conditions on which healthy trees were being grown. Each figure is the mean (with standard deviation) of 3 samples from a plantation. Each sample consisted of twigs from 20 trees.

ELEMENT	LOW	HIGH
Nitrogen (%)	1.43(.08)	2.30 (.18)
Potassium (%)	.41(.04)	.65 (.01)
Phosphorous (%)	.15(.02)	.29 (.01)
Calcium (%)	.44(.12)	.67 (.05)
Magnesium (%)	.15(.02)	.19 (.04)
Managanese (ppm)	219 (34.0)	1200 (331.0)
Iron (ppm)	44 (8.0)	214 (61.0)
Copper (ppm)	2 (0.6)	5 (0.6)
Boron (ppm)	11 (2.0)	36 (2.0)
Zinc (ppm)	30 (2.0)	60 (5.0)

We have been asked if nutritional deficiencies are the cause of the declines in production reported by .growers after two or three rotations. Again, we have been unable to collect evidence to support this. Perhaps other soil or biological factors are the direct cause of decline. However, we will continue to assess the role of soil and plant nutrition in these problems.

Literature Cited

Proebsting, W.M. and M.H. Chaplin. 1983. Elemental content of Douglas fir shoot tips: sampling and variability. Communications in Soil Science and Plant Analysis. 14:353-362.