

## Soil Testing for Christmas Trees

Fertilizing Christmas trees can increase growth rate, tree vigor, foliage color, bud set, branch and foliage density, and needle retention. The amount of fertilizer needed is best determined using information gained about the site from a soil test; using foliar analysis; or a combination of both techniques.

Soils can be inexpensively tested at most state universities. The UNH Analytical Services Lab routinely tests for pH, texture, magnesium, calcium, phosphorous and potassium. If deficiencies are suspected, micronutrients (zinc, iron, manganese, copper, boron, molybdenum) can be measured for additional costs. Fertilizer recommendations are based on levels measured.

### What Is A Soil Test and Why Is It Necessary?

A soil test is a chemical procedure used to determine the supply and availability of a particular plant nutrient in a soil. The soil acts as a reservoir for plant nutrients and contains them in various amounts. Before determining the rate at which a particular nutrient should be applied to the soil to assure good plant growth, it is essential to know the current level of available nutrients in the soil. A soil test can provide us with this knowledge.

A soil test includes three basic procedures. The first is the determination of the extractable nutrients in a soil. In New Hampshire, this quantity is reported as low, optimum, and high with each category representing a certain part per million of the nutrient. A second procedure is the determination of soil pH or soil acidity. In effect, pH indicates the general availability of a nutrient, irrespective of the quantity present in the soil. Because of chemical combinations between nutrients and the soil particles, the nutrients are often unavailable to the plant. Most of these adverse combinations occur at either a very low or a very high pH. The pH determination serves as a guide for applying limestone. The third part of a soil test determines soil texture, or the relative amounts of sand, silt, and clay in a soil. The results of this part of the test give an indication of the capacity of a soil to hold nutrients and moisture for future plant use.

When the results of all three components of a soil test are brought together, recommendations may then be developed that will give the best plant growth for the fertilizer dollar.

### How to Take Samples for a Soil Test

- Establish a regular schedule for taking soil samples to determine what may be needed before you plant and to check on the effectiveness of your fertilization management. Two to three soil tests during a rotation should be adequate. The first should be taken prior to plantation establishment; the second mid-way through the rotation; and the third at the end so that fertility recommendations can be formulated for the next planting.
- Taking soil samples in late summer or early fall is recommended for Christmas trees. However, soils can be sampled at any time of the year when a representative sample can be obtained. Sampling should be done at the same time of the year for repeat samples. Samples should be taken six months before planting.

- Treat each unique area as a separate sampling unit. Determine sampling area based on tree species, age, and different cultural treatments, and soil type, if known. If not known, use soil moisture class and texture to differentiate sample areas.
- After determining sampling area, take samples in a random fashion by walking through the sample area in a zigzag pattern and stopping at pre-determined distances. Take twelve sub samples. If the plantation has been fertilized or limed previously in rows, gather soil sub samples from within the previously treated rows.
- Take soil samples when the soil is moderately dry and not immediately after rainfall and not immediately after fertilizing. Remove and discard the top ½ inch of soil before taking the sample.
- Use clean equipment and avoid galvanized containers or those that previously contained fertilizers or similar substances. Select a proper sampling tool. A sampling tube is preferred since it ensures uniform sub sample size. If this is not available, use a clean spade. Cut a soil slice approximately 1 inch wide from the center for the sub sample. Discard the soil on either side of the sample “ribbon.”
- Mix the sub sample ribbons in a clean pail with the other sub samples. The sample may be air-dried prior to submission. A sample placed in a clean brown-paper bag with good air circulation will be properly air-dried in one to two weeks. Samples should not be dried with artificial heat.

While fertilizer recommendations based on soils analysis are far better than a scattershot approach, they are not fool-proof and growers are well-advised to keep records and to observe whether or not desired outcomes occur and to adjust future applications accordingly. Alternating a regular soil testing program with foliar analysis could give the best guidance to proper fertilizer recommendations.

## **Limitations to the Use of Soil Tests**

Before interpreting soil test results, it is important to understand the limitations of the soil test. The complexity of soils and trees provide one limitation. It is far more difficult to gauge the response of a tree to fertilizer than it is to gauge the response of an annual crop. Most formal research on conifer fertility has looked at some form of volume growth for timber production and not at needle length, size and color, bud set, and other characteristics that make a desirable Christmas tree. This means that even with the soil test, growers must carefully monitor tree response, adjust fertilizer levels, and re-test on a regular basis.

Realize that not all labs use the same analytical tests nor do they report the results the same way. The same sample tested at different labs may yield different results. Regard the soil test results as an index of fertility rather than an absolute. Choose a lab and stay with that lab for at least a rotation. You will see changes in soil fertility over time if you do.

Another major limitation to the use of soil tests is the lack of an adequate test of available nitrogen for Christmas trees. Of all the fertilizer elements, nitrogen is used in the greatest amounts by Christmas trees. It is applied without the benefit of a soil test.

## Formulating the Recommendation

The following chart rates the relative fertility levels of soil test results for magnesium, calcium, potassium and phosphorous.

Interpretation of Mehlich III Soil Test Results for Christmas Trees						
Magnesium	ppm	0	21	51	86	>
		*Low	*Optimum	*High	*Very High	*
	lb Mg/acre	0	43	103	172	>
Calcium	ppm	0	86	215	516	>
		*Low	*Optimum	*High	*Very High	*
	lb Ca/acre	0	172	430	1032	>
Potassium	ppm	0	35	53	67	>
		*Low	*Optimum	*High	*Very High	*
	lb K <sub>2</sub> O/acre	0	80	120	150	>
Phosphorous	ppm	0	9	13	22	>
		*Low	*Optimum	*High	*Very High	*
	lb P <sub>2</sub> O <sub>5</sub> /acre	0	40	60	100	>

### Soil Test Interpretation Categories

- Low** The nutrient is probably deficient and will limit tree growth for all Christmas tree species (except Scotch pine). There is a high probability of a profitable return by correcting a low level of the nutrient. The recommendation for a low-testing nutrient should gradually build up the nutrient level to optimum range and maintain it at that level.
- Optimum** The nutrient is probably adequate and is not likely to limit tree growth for Christmas tree species. The recommendation for an optimum-testing nutrient should offset crop removal and maintain the nutrient in the optimum range.
- High** The nutrient is more than adequate and will not limit tree growth of any Christmas tree species. There is a low probability of a profitable return from additional application of the nutrient. The recommendation for a high-testing nutrient should offset crop removal only enough to maintain the nutrient in the optimum range.
- Very High** The nutrient level is very high or excessive for tree growth of all Christmas tree species. This level may cause a nutrient imbalance in the soil, and as a result, in the tree as well. The recommendation should indicate that additional application of fertilizers will not result in satisfactory economic return and may actually be detrimental to the tree.

By comparing actual soil test results to these relative levels, fertilizer needs can be determined. A cautionary note: Do not consider this a simple mathematical procedure. Adjustments must be made based on actual observed tree response. Changes in soil fertility should be reached through a regular soil testing schedule.

## **Additional References:**

Using Fertilizers in the Culture of Christmas Trees (second edition) by Thom J. McEvoy, Racing Dreams LLC, 242 Wentworth Road, Bolton Valley, Vermont, 05477.

Southern New England Christmas Tree Growers' Manual edited by Dr. Mark H. Brand, Cooperative Extension System, The University of Connecticut, (203) 486-3336.

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