BARTLETT TREE RESEARCH LABORATORIES
U.K. AND IRELAND
Plant Health Care Program

Bartlett Prescription Fertilisation Programme

Glynn C. Percival

Introduction

It is now widely appreciated that trees require certain essential nutrients to function and grow. A nutrient is an element that is involved in the metabolism of a tree, or necessary for a tree to complete its life cycle. For trees growing on a forest site, these nutrients are normally present in sufficient quantities in the soil. Landscape trees or urban trees, however, may be growing in soils that do not contain sufficient available nutrients for satisfactory growth and development. Topsoil is often removed during construction. Leaves and other plant parts are removed in landscape maintenance, disrupting nutrient cycling, and the return of organic matter to the soil. It may be necessary therefore to fertilise or to adjust the soil pH to increase nutrient availability. For example iron deficiency in Rhododendron (veins remain green while the leaf turns yellow) is a frequent problem found on many properties within the UK, caused by an inappropriate soil pH

Tree fertilisation can increase growth, reduce susceptibility to certain diseases (Fig 1) and insects, and under certain circumstances, help reverse declining health. However, if the fertiliser is not needed or not applied correctly, it may not benefit the tree at all, increasing susceptibility of certain pests and accelerating decline. Trees with satisfactory growth and not showing symptoms of nutrient deficiency may not require fertilisation. Trees growing in turf that is heavily fertilised may also not require additional fertilisation. It is important to recognize when a tree needs fertilisation, what nutrients are needed, and when and how it should be applied.

Fig 1. Fertilised

None Fertilised

Determining Goals and Objectives

The goal of fertilisation is to supply nutrients determined to be deficient in the soil to achieve a clearly defined objective.

Common objectives of fertilisation include:

1) Overcome a visible nutrient deficiency.
2) Eliminate a deficiency not obviously visible that was detected through soil or foliar analysis.
3) Increase tree growth, flowering, or fruiting.
4) Increase the vitality of the tree.
5) Reduce potential injury from disease or insect infestation.

Nutrients and their function

Trees require certain nutrients, known as macronutrients, in relatively large quantities. The most important of these macronutrients is nitrogen. Nitrogen is a constituent of proteins and chlorophyll, and is critical to photosynthesis and other plant processes. Annual raking and removal of leaves typically removes 0.5-1.5kg nitrogen per 100 square metre from soil. Nitrogen deficiency shows up as slow growth, small leaves, and yellowing (chlorosis) of the leaves, especially the older leaves. Since nitrogen is the nutrient most likely to be deficient in trees, fertiliser specifications usually focus on this nutrient.

In addition to nitrogen, the nutrients phosphorus, potassium, and sulphur are also required in relatively large quantities. These nutrients are usually present in the soil in adequate amounts for trees and large shrubs. Deficiency symptoms include sparse, small and distorted foliage. Plants may take on a purple or reddish appearance, especially the undersides of leaves. Sometimes stems also take on this colour. Leaves then turn yellow in the final stages. Other important nutrients include magnesium and calcium, although these are required in moderate quantities. Severe deficiencies of calcium and magnesium result in the veins of the lower leaves discolouring. They first turn yellow, then orange and finally brown. Leaves feel thin, brittle and sometimes cup upward. Older leaves show marginal and interveinal reddening and ultimately plant death.

Other nutrients, known as micronutrients, are required in lesser quantities. Although these nutrients are not required in large amounts, a deficiency of any one can have profound effects on the health of the tree. For example, iron chlorosis is a condition that results when a tree is not absorbing sufficient quantities of iron, usually due to a high soil pH. The young leaves are small and chlorotic (yellow), often with green veins, while the older leaves tend to be darker green. Iron deficiency can eventually kill a tree. Like iron, manganese and zinc may, at times, be deficient in a tree. The remaining nutrients, molybdenum, copper, chlorine, and boron, are less likely to be deficient. Fig 2 demonstrates the symptoms of a range of nutrient deficiencies such as phosphorous, potassium and magnesium in Mahonia growing at the University of Reading.

Fig 2. Symptoms nutrient deficiencies in Mahonia

The F.A. Bartlett Tree Expert Prescription Fertilisation Programme

One of the most accurate ways to determine a tree's nutrient needs is to obtain a laboratory analyses of the soil nutrient concentration. This will ensure that only the correct nutrients are applied to correct the deficiency. By adding only the nutrients required, excess nutrients will not be added to the environment. The process of conducting analyses, setting plant health goals, and selecting a fertiliser to achieve this goal is called Prescription Fertilisation. Prescription fertilisation is a system unique to the F.A. Bartlett Tree Expert Company.

How Prescription Fertilisation Works

1. A range of soil samples are collected throughout a property by one of our arboricultural representatives.
2. The soil samples are sent to our soil analysis laboratory at the University of Reading.
3. Once the soils analysis is complete the Bartlett Tree Research Laboratories develops a prescription based on the plant species, soil type, goals, and nutrient and pH levels.

4. Treatment recommendations are sent to the Bartlett office for presentation to the client.
5. Our fully qualified plant health care technicians select products to mix and apply at each property according to the prescription.

Consequently only those nutrients identified as deficient are identified and remedial measures provided on how to alleviate these deficiencies. In some cases tree decline can be identified as simply an inappropriate soil pH which can be easily rectrified by the application of iron sulphate only. Without a soils analysis a broader approach to fertilisation is normally adopted resulting in widespread application of a range of nutrients in the hope that one of the nutrients provided may halt the symptoms of tree decline. Such an approach is highly undesirable as many of the excess nutrients stimulate weed growth or can be washed away into nearby rivers and streams. Prescription fertilisation therefore provides a environmentally friendly system of providing exactly the right nutrients in exactly the right quantity to ensure optimal tree health.

Fertiliser Application

Fertilisers are applied to the soil, foliage, or even injected directly into the tree trunk. Soil application is the preferred technique via a soil injection system to ensure nutrients are applied direct to the tree root system for maximum uptake. The area in which fertiliser is applied is designed to correspond to the maximum concentration of fine, absorbing roots in the soil. Generally, these roots are in the upper six inches of soil. On open-grown trees, fine roots are found from near the trunk to well beyond the dripline of the tree. Therefore, fertiliser applications are made from near the trunk to near the dripline at 1m spacings.

Before and After

The benefits of prescription fertilization can be quick and dramatic. Trees rapidly green up and overall vigour is markedly improved. In many instances pest and disease resistance can be improved and recovery from environmental damage such as drought or salt damage enhanced. Importantly prescription fertilisation provides a proactive approach to tree care. Nutrient deficiencies are identified prior to visible signs of tree decline such as leaf yellowing and branch dieback. Ultimately trees remain healthier and of greater longevity reducing labour and replacements costs in the future..

Fig 3 fertilised (left) and non fertilised trees (right)