FERTILIZING TREES AND SHRUBS IN THE LANDSCAPE [1]

by Elton M. Smith

The objective of this presentation is to review the results of a number of nutrition research studies we have conducted during the past few years and relate them together with established practices to develop some fertilizer guidelines for trees and shrubs in the landscape. We'll review benefits, formulation, rate and timing, methods of fertilizer application, foliar and soil analysis and discuss the most common fertilizer deficiencies and how to prevent them.

Among the many benefits of fertilizing ornamental plants are: 1) darker green foliage that may be more resistant to attack by insects and diseases, 2) more vigorous growth of shoots and roots that will be more tolerant to drought and other stresses, 3) healthier and larger trunk and stem tissues that are more tolerant to stem splitting in winter, particularly littleleaf linden and 4) perhaps most important, improved appearance, rate of growth and value in the landscape.

Formulations

The question is often asked, "What kind of fertilizer should be applied to ornamental plants in the landscape?" This question, of course, has several implications and could be answered in many ways and in great detail. For this discussion let's over simplify and suggest that the kind or formulation is not as important as applying the proper rate of each element to meet the plants requirements for healthy growth.

Without the benefit of either a soil or leaf analysis, which should be considered annually or biannually in the landscape, a fertilizer ratio of 3-1-2 would be a good starting point. Our experience with soil and leaf analysis reports indicate that many landscape soils can be brought up to a desirable level with a 3-1-2 or 3-1-1 analysis with such formulations as 18-6-12, 18-5-9, 30-10-10, 12-4-4, or comparable fertilizers.

Rates

When leaf and soil reports are unavailable, as is the usual situation in the landscape, an estimate of tree and shrub fertilizer needs must be made by the arborist, landscaper or groundskeeper. The objective of commercial producers is to promote optimum growth of plants and his fertilizer rate is usually higher than that needed by plants in the landscape. Typically, landscape plants, especially after the first few years after transplanting, are fertilized primarily to maintain healthy, vigorous growth and not to markedly increase caliper, height or width.

Since nitrogen is the key mineral element to vegetative growth and the one most often limiting, let's key our recommendations to this element. Apply approximately 3 lbs. actual nitrogen/1000 sq. ft./yr. or 6 lbs. every other year to maintain healthy trees. Trees in poor health as judged by foliage color, annual growth, or general vigor should receive up to 6 lbs. N/1000 sq. ft./yr. These recommendations apply as well to deciduous shrubs and narrowleaf evergreens, however, broadleaf evergreens respond to approximately one-half these amounts for healthy growth.

How much 18-6-12 is needed/1000 sq. ft. to apply 3.0 lbs. actual nitrogen? To determine the rate of fertilizer, divide the % N on the fertilizer bag into 3.0. For example, *(3.0 ÷ 0.18 = 16.6)* dividing 3.0 (the rate of N) by 0.18 (the % of N on the bag with the two decimal places counted off as a percent of 100) equals 16.6 lbs. or approximately 17 lbs. of 18-6-12 needed to apply 3.0 lbs. of actual N/1000/sq. ft. Incidentally, using 16.6 lbs/1000 sq. ft. of 18-6-12 also applies 1 lb. of phosphorus and 2 lbs. of potassium which is typically the proportion we have found that these three elements are required for satisfactory growth of most landscape plants.

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Timing

Often landscapers and arborists will delay fertilizing trees until fall or winter to equalize their work load. Commercial producers may fertilize trees and shrubs 3 or more times per season, with lower rates, each application to optimize growth. Homeowners, however, have their own ideas and one of them is that fall fertilizing is bad. Research completed in New York several years ago indicated the value of fall fertilizing but the word has not been effectively communicated.

Our recommendations are to fertilize as often as is practical. Florists learned long ago that constant fertilization is more effective than periodic fertilization. Thus, a container grower may fertilize ornamentals much more frequently than a field stock producer. In the landscape, however, it's not likely that anyone wants to pay for more than an annual fertilization. In respect to timing, we suggest as first choice — autumn (October-December), second choice — winter or early spring (February-April), and third choice — midsummer (May-July). If the application were split into equal parts and applied in each of the 3 seasons plant response would most likely be slightly better than if applied all in one season.

Method of Application

Most arborists have their own methods for fertilizing trees and shrubs which have been undoubtedly quite satisfactory. Several methods of fertilizing trees exist and time does not allow a detailed examination of each. Thus, a quick overview of the merits of each is worthwhile since our studies have suggested that in general it doesn't really make a great difference how the fertilizer is put down. Growth of trees from surface application has been comparable to growth from liquid soil injection and drill hole placement.

Liquid injection of fertilizer has the advantage of rapid uptake by the root system and would be a logical choice when deficiencies are apparent. The benefits from the water in dry soils are desirable during any season, but particularly during summer.

The drill hole system has one major advantage of opening up heavy, compacted soils to provide a source of air. The use of heavy equipment around construction sites, does not enhance soil aeration, and many trees survive but do not thrive.

Surface application is the quickest, least expensive method and in our trials is just as effective as the above two methods. Avoid heavy surface fertilization to turf areas. Either excessive turf growth occurs, which is undesirable, or turf grasses may be injured. Other methods should be considered in turf areas.

Liquid fertilization is a method of preventing or correcting minor element deficiencies such as iron but should not be considered as the sole source of N, P and K in the landscape. Combining a liquid fertilizer with a regular pest spray program on certain plants is a regular procedure for some spray operators.

Tree trunk injection and implantation are becoming more commonplace as products become available and deficiencies are confirmed through leaf analysis. These methods should be considered only for minor element applications such as for Fe, Mn, Zn, etc. Injection and particularly implantation are the most effective means of correcting minor element deficiencies.

The method of fertilizing should be determined by the fertilizer being used, the rate, and the particular circumstances involved such as dry, compact soils, the presence of turf, etc.

Common Deficiencies

Anything which restricts root growth reduces nutrient uptake such as soil diseases and insects, root pruning, soil compaction, soil temperatures, low oxygen, poor drainage as well as a shortage of soil mineral elements. The foliar symptoms may resemble a deficiency and some investigative work with the root system is often necessary before treating with fertilizers to cure all ills.

The most limiting element with ornamentals is nitrogen and symptoms are usually a fairly uniform yellow-green to yellow foliage color. Shoot growth is usually limited in severe cases of nitrogen shortage.

Potassium is quite often limiting and the margins of the leaves are affected first with a yellow to brown color most noticeable. Nitrogen

and potassium can both be corrected with a complete fertilizer with one of several nitrogen or potassium sources on the market.

Magnesium deficiency of plants in sections of the Connecticut River Valley can be expected since soils are quite acid, often below pH 5.0. Taxus are readily affected and the foliage becomes yellowish to brown with brown spots. The first cold weather turns the plants brown. Correct, where possible, by adjusting the pH closer to the desired 6.0-7.0 depending on plant species. Dolomitic limestone has a higher magnesium content and should be considered for pH adjustment. Magnesium sulfate sold as Epsom salts is used by commercial nurserymen in sandy soil areas according to label rates. Sulfate of potash magnesia is used when potassium is also needed.

Boron deficiency, although not a common deficiency in the landscape has been a problem. Symptoms may resemble iron deficiency with yellow leaf margins and dark green veins. Twenty mule team borax or *Solubar* is used for correction.

Manganese deficiency will turn blue spruce yellow, and red, silver and sugar maple trees yellow with necrotic spots. Symptoms also resemble iron deficiency on the youngest foliage. Correct manganese deficiency with foliar sprays of manganese sulfate or preferably with implants of the same material in a capsule form in early spring.

Iron deficiency is common on most all oak species but especially pin and white oak in alkaline or poorly drained soils. In addition, iron deficiency is to be expected in white pine, sweet gum and magnolia. Correct with 1) chelated iron sprays or 2) implants of ferric ammonium citrate since this treatment remains effective for two to three years especially with oaks. For best results implants should be made before vegetative growth in spring. Capsules should be inserted in a spiral pattern around the trunk of the tree and each insert should definitely be made beneath the cambium to insure proper wound healing. Most wounds of oaks heal completely in one growing season.

Figure 1. White oak. (L) Treated with ferric ammonium citrate capsule implants in March. Photo taken in September. (R) Untreated.

Foliar and Soil Analysis

Plant analysis has become a most valuable tool in the identification of mineral element deficiencies in recent years. Plant or leaf analysis is also used to detect deficiencies prior to symptom expression and permits efficient and economical use of fertilizer, avoiding excessive or inadequate amounts.

Sample foliage that has most recently matured and remove 25 to 50 leaves per sample depending on leaf size. Fill out the form that accompanies the sample and mail both to the plant analysis laboratory. Fertilizer recommendations will be made depending on the laboratory, the

amount of information on the report form and the values of each of the elements tested.

Leaf analysis, although more accurate, should not be considered a substitute for soil analysis but as a supplement. A soil analysis will provide the soil pH which is unavailable from a leaf analysis. Soil pH is important because the availability of mineral elements is dependent upon a suitable range. Generally, a pH of 6.0 to 7.0 is satisfactory because most elements are available to some degree in this range. Plants such as oaks and maples, however, grow much better between 6.0-6.5 than at higher levels due to the greater soil concentration of iron and manganese.

Soil and leaf analysis should be used as a regular procedure in production to serve as a check on the fertilizer program, and used as needed in the landscape to diagnose deficiencies, and to assist in a regular fertilizer maintenance program.

Summary

Fertilize plants in the landscape to promote healthy, vigorous growth with fertilizers determined by a foliar or soil analysis. Typically a 3-1-2 ratio is adequate if the nitrogen is applied at the rate of 3.0 lbs. actual N/1000 sq. ft./yr., or the equivalent, to plants in the landscape. Fertilizer can be applied any time during the year but late fall or late winter-early spring are the best seasons. Justification can be made for fertilizing by any one of several methods, however, where it can be used, surface treatment is equal to other methods in respect to tree growth.

Nitrogen, potassium and magnesium are the major elements most often deficient in landscape

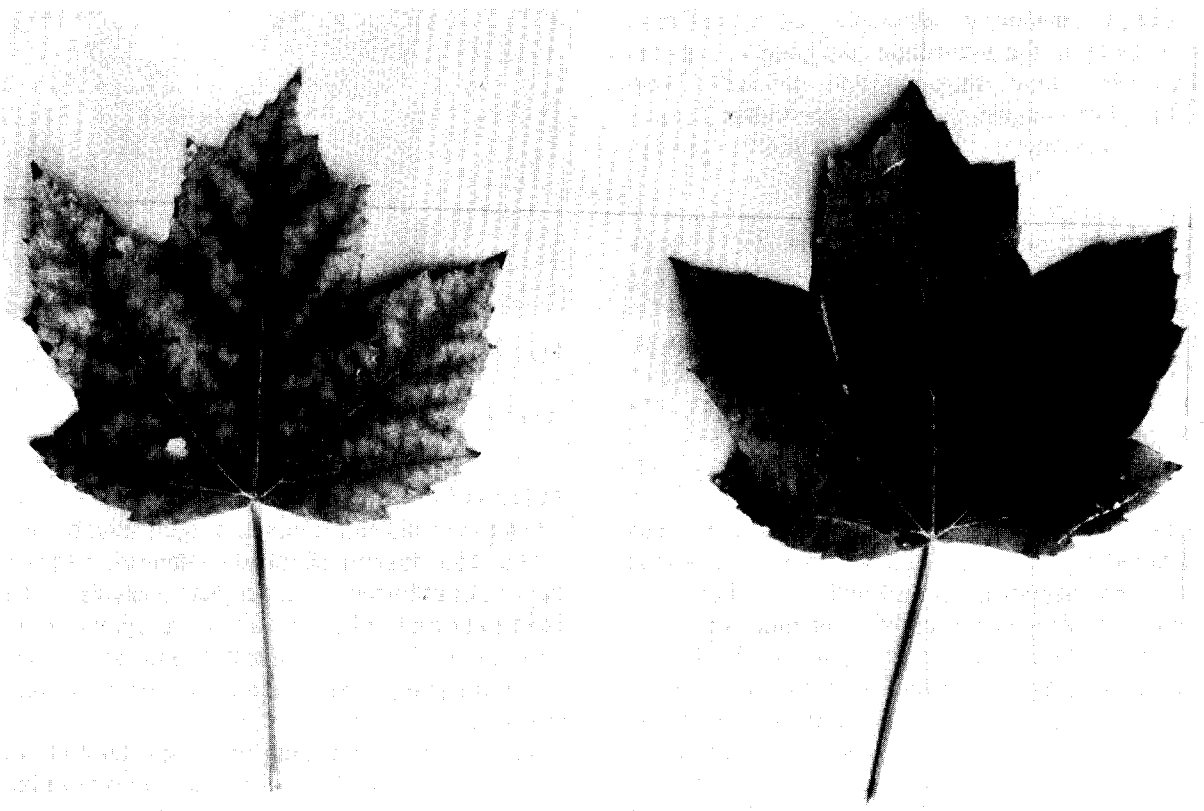

Figure 2. Red maple. (L) Untreated. (R) Treated with magnesium sulfate capsule implants in March. Photo taken in September.

sites. Adjusting the pH or adding magnesium sulfate will control Mg deficiency. Applying a complete fertilizer will usually correct N, P and K problems. The most limiting minor elements are iron and manganese with iron most often limiting. Our studies have shown that iron deficiency of oak, white pine and sweet gum can be corrected with chelated iron or more effectively with trunk implants of ferric ammonium citrate capsules. Manganese deficiency, particularly with maples, can be corrected with sprays of manganese sulfate or prevented by implants of the same material prior to bud break in early spring. For more detailed information on fertilizing landscape plants contact your local Cooperative Extension Service Agricultural Agent. Agents have soil and plant testing information available to assist in obtaining specific recommendations.

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ABSTRACTS

Thomas, G.M. and G.O. Poinar, Jr. 1977. **Diagnostic service identifies insect pathogens.** California Agriculture 31(11): 10-12.

The Department of Entomological Sciences at the University of California in Berkeley offers the only diagnostic service in the United States with equipment and experienced personnel for formal laboratory diagnosis of insect diseases. The Diagnostic Service started in 1944 and as an aid to university entomologists, rapidly grew into a world-wide service. The Diagnostic Service identifies pathogens causing insect diseases, discovers new pathogens, particularly those that are potential biological control agents against crop pests or vectors of plant, animal, and human diseases, assists in controlling diseases affecting beneficial insects, gathers information on the host range and distribution of various pathogens, and maintains a reference collection of insect pathogenic microorganisms.

Beard, J.B. 1977. **Selecting mulch for successful seeding.** Grounds Maintenance 12(7): 21-22, 24, 26.

Successful grass establishment from seed is achieved when a uniform stand of the desired seeded species grows to a mature stable sod without significant loss of soil, seeds, or seedlings from wind and water erosion. Seeding may fail if mulching is not practiced. The following list of criteria for mulch selection is presented as a guide: 1) effectiveness in controlling wind and water erosion; 2) ability to provide a favorable microenvironment for seed germination (moisture and temperature); 3) availability of the mulch in the quantities needed; 4) freedom from weed seeds and compounds that are potentially toxic to seedlings; 5) cost of material (including shipping) and its application; and 6) method and ease of application for a given site condition. Many types of mulching materials are available: straw, hay and grass, excelsior, shredded bark, wood chips, and wood shavings, fibers, woven nets, ground corn cobs, sawdust, and peat moss, burlap, and elastomeric polymer emulsions.