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Trees, your "other" Plants:
Fertilizer Application

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Trees in urban and suburban landscapes are often under stress. Low moisture and fertility levels, soil compaction, competition from nearby trees, diseases, insects, damage from vandalism, and other factors can have a negative impact on plant growth. Under stress situations or poor soil conditions, fertility problems may increase. If growth is minimal, then it is necessary to determine the cause, and whether fertilizer will improve plant growth. Stress conditions often predispose trees to other problems; thus with good cultural methods, such as watering and fertilizing, trees are more likely to resist certain insect and disease problems. Fertilizer applications will ameliorate, but may not eliminate environmental stress. As a general guide, terminal twig growth should be six to 24 inches per year on young, healthy, deciduous trees and four to twelve inches per year on conifers. Growth is less on mature trees. A tree under nutrient stress may show a slow or stunted growth rate; reduced leaf, flower, or fruit size; a pale green or yellow green coloration of the foliage, or early fall defoliation. Nutrient stress can also be induced by poor drainage, incorrect pH, and other soil and plant factors. Thus, soil tests should be used to develop a fertilization program.

Soil type is important in determining the need for fertilizer. A fine-textured, clay-loam soil will hold more nutrients than a coarse-textured sandy loam. However, a

tree growing in a heavy, compacted soil may still be stunted because of restricted root growth and lack of soil oxygen to facilitate nutrient uptake. Light, sandy soils will be low in nutrients, and may also restrict growth because of low moisture levels. Soils with a pH greater than 7.0 which is alkaline, may cause deficiencies of micronutrients such as iron and manganese in pin oak, river

birch, red maple, silver maple, and other susceptible species. Deficiencies of these micronutrients, as well as nitrogen deficiencies, produce a condition known as "chlorosis," or a yellowing of the foliage. Nitrogen deficiency is characterized by uniform yellowing of the entire leaf, whereas the area surrounding leaf veins remain green when iron and manganese are deficient, thereby causing interveinal chlorosis. Low soil oxygen caused by excess water from poor drainage, flooding or compaction can also cause chlorosis. Soil tests and/or plant tissue tests should be used to determine the cause of chlorosis in commercial tree and shrub production and in large landscapes. A light fertilizer application can usually be applied to the home landscape without a soil test.

Fertilizer solubilization and subsequent plant absorption requires adequate levels of soil moisture and oxygen. If excess moisture or a lack of oxygen exists, nutrient uptake cannot take place even with adequate nutrients available. Continued fertilization under such conditions will result in excess fertilizer levels. Then, as the soil dries or becomes aerated, excess uptake may occur. Excess uptake will stimulate excessive succulent growth that is structurally weak, less likely to produce flowers, and more susceptible to diseases and insects, such as fire blight or aphids. The high soluble salt concentrations caused by excessive fertilization may also damage the tree causing root or leaf injury. Newly planted trees and shrubs should be fertilized at planting time. Fertilization at this time allows deep placement of phosphorus and potassium. Because these nutrients do not move readily in the soil, deep placement will make them immediately available to the new plant to enhance root and top growth. It is extremely important, however, that the fertilizer be mixed into the bottom of the hole and into the backfill and not placed in direct contact with the roots. A slow release fertilizer is most desirable

for mixing with the backfill. Slow release fertilizers supply only small amounts of nutrients at any one time, so the possibility of root damage is eliminated and a longer-term response is obtained.

When to Fertilize

Most trees in Minnesota have a single flush of growth in the spring, and spring is the time when trees have the greatest need for nutrients. Early spring, consequently, is the time when nutrients must be available. Fall fertilizer applications are easiest and can be the most effective, because the ground is easier to work and nutrients will be available to the tree very early in the spring when growth begins. Fertilizer may be applied from late September until about mid-November. To avoid runoff problems, do not apply fertilizer to frozen soil. Spring applications may be made as soon as the ground is workable until late April or early May. If soil conditions are extremely dry, irrigate prior to and after fertilization. On sandy soils, nitrogen should be applied only in the spring or much of it will be leached out of the soil in the late fall and early spring. If soil is extremely sandy, leaching can be minimized by applying a half rate in early spring and a half rate in late spring. However, this adds to the cost of application.

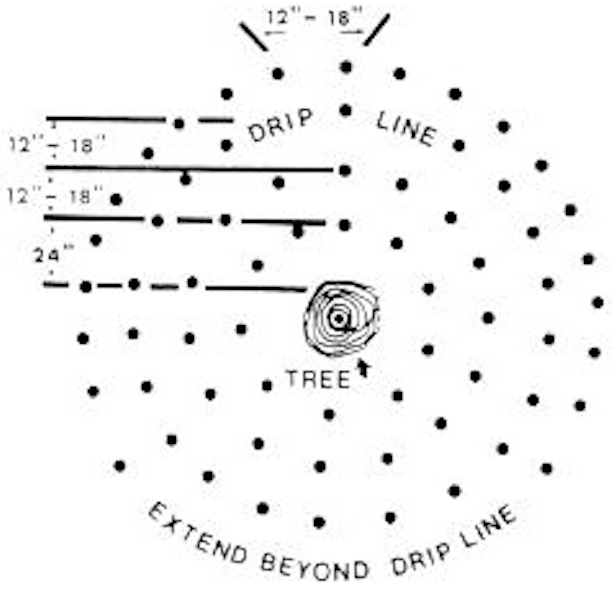
If a plant is showing symptoms of nutrient deficiency, fertilizer may be applied at any time during the growing season to correct the problem. Care must be taken, however, to provide sufficient water for absorption of the nutrients by the plant and prevent fertilizer injury to the roots. During periods of hot, dry weather, two to three inches of water should be applied every two to three weeks to wet the top 12 to 18 inches of an average soil. Heavy clay soils require more water at less frequent intervals,

while light, sandy soils require less water at more frequent intervals. Do not apply fertilizer to non-stressed plants in late August as plants may force a new flush of growth in early September. However, do not allow plants to go into the winter under a nutrient stress, as this will also increase winter injury. A light application of fertilizer may be necessary in late

August or early September to alleviate such stress.

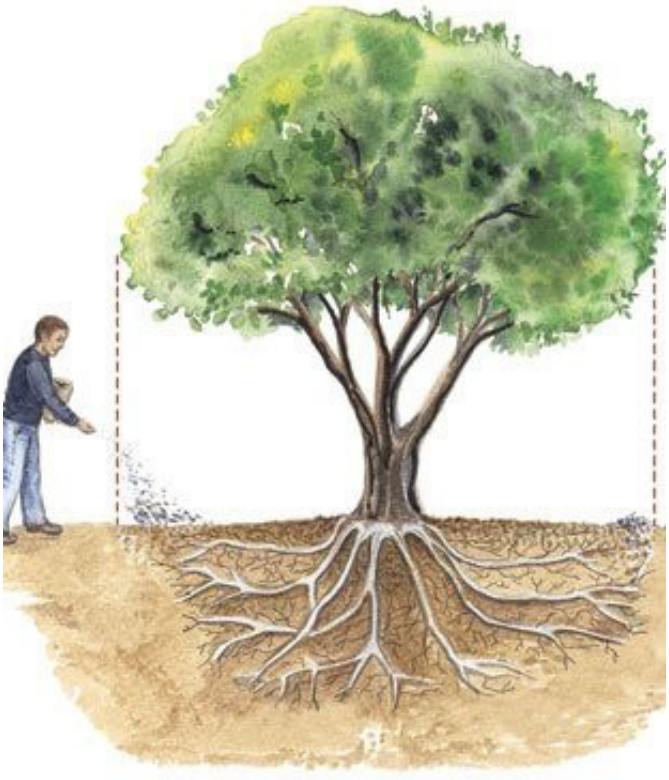
What to Apply

Unless a tree is deficient in some other element, increased nitrogen provides the most pronounced effects on the growth of all plant nutrients. Just because an increase in nitrogen produces a more visible increase in growth, however, does not mean that other elements are not required. Phosphorus, for example, is essential for good root growth. A soil test provides the best indicator of elements that may need to be added to the soil to prevent nutritional problems. High rates of P fertilizer should not be used unless a need is indicated by a soil test. If the soil test is high in phosphorus, then it is best to use fertilizers such as 24-0-15, 32-3-10, 27-3-3, or 16-4-8 with a high rate of N and a low or zero rate of P. High rates of P can negatively affect the environment by causing excessive algae to grow in nearby lakes and streams, which will in time, kill fish and other aquatic life. If phosphorus is needed, an excellent fertilizer to use is 18-18-8 with iron and sulfur. It is 50 percent slow release. Plants in sandy soils will require more fertilizer; however, it is easy to over fertilize in sandy soil as it moves quickly into the root zone. Soils with more organic matter, not only hold more fertilizer, but they also tend to release some nutrients as the organic matter decomposes. Thus, the use of slow release or partially slow release fertilizer is much more critical in a low organic soil containing less than three percent organic matter, compared to a medium or high organic soil containing four percent or greater organic matter. Most soil tests will provide the percent organic matter content of the soil.



For nursery production, the recommended rates of fertilization are three to four pounds of actual nitrogen (N) per 1,000 ft^2 per year. When needed, 3.6 pounds of phosphate (P_2O_5) per 1,000 ft^2 and six pounds of potassium (K_2O) per 1,000 ft^2 should be applied. The above rates must be applied to a non-turf area or placed in holes drilled or punched into the soil under the tree to prevent injury to the turf or a cover crop. Established trees in the landscape require less fertilizer wherein one to three pounds of actual nitrogen will be sufficient. The recommended rate for application over

turf is one lb N/1000 ft^2 at one time. Any rate greater than two pounds of nitrogen per 1,000 ft^2 in one application will result in injury to turf. Table 1 in Chapter 26 of the Manual indicates some common fertilizer analyses and rates of each formulation that will give the recommended rates for application.



Whenever possible, use a slow release or partially slow release fertilizer such as 18-18-8 or 25-3-7 to reduce the amount of fertilizer immediately available and to extend its feeding duration. Products that combine fertilizers and herbicides such as "Weed and Feed" should not be used on or around trees and shrubs. Such products will injure or kill trees, shrubs and perennials in the same way that they kill weeds.

How to Apply

Apply a complete fertilizer (N, P, and K) at the time of planting. Care must be taken to ensure that it is thoroughly mixed with the backfill and it is best to use a slow release or partially slow release product. Do not apply fertilizer of any type directly to the roots.

Fertilization should occur at planting time in the nursery and in the landscape. If the proper amount of fertilizer is thoroughly mixed with the backfill soil, no root injury will occur. The fertilization should be based on results of a soil test to avoid under or over fertilizing any tree or shrub. After planting, the easiest and most convenient method of applying nitrogen fertilizers in the landscape is to spread the fertilizer on the soil under the tree canopy with a standard lawn spreader. Although two pounds of nitrogen per 1,000 ft^2 is the maximum rate that can be applied to turf in this manner, it is better to apply one pound of nitrogen per application and make more applications. Higher rates must be incorporated (drilled) into the soil in a landscape setting. To promote good, healthy, vigorous, rapid growth in a nursery production situation, three to four pounds per 1,000 ft^2 of actual nitrogen can be applied in a band in the nursery row or to individual trees. Surface applications will not readily supply phosphate and potash because these two nutrients do

not readily move down to the tree's root zone. In the landscape, determine the area under the tree to be fertilized by marking off a square that encompasses the spread of the tree several feet past the dripline. Multiply the length by the width to determine the area in square feet. The spreader should be calibrated to deliver the recommended amount of fertilizer per 1,000 square feet. For example, if the area under the tree is 40 feet by 40 feet or 1,600 square feet, 3.2 pounds of nitrogen is needed to provide two pounds of actual nitrogen per 1,000 square feet. Six pounds of ammonium nitrate will supply two pounds of nitrogen (See Table 1 in Chapter 26 of the Manual). Therefore six pounds of ammonium nitrate (2 pounds of nitrogen) should be spread over that 1,600 square foot area. This can be repeated again in three weeks to obtain the four lbs/1,000 ft^2 rate for faster growth rates on younger trees. This surface application should be done when the grass blades are dry and then followed with a deep watering. Note that much of the fertilizer applied to the surface will benefit the grass rather than the tree. If chips or gravel cover the entire area to be treated, the total four pounds can be applied in a single application. For mature landscape trees, the one to two pounds of actual nitrogen may be sufficient.

If higher rates of nitrogen, or if phosphate and potash are to be added, it is best to place the fertilizer in holes drilled or punched in the soil. Drill holes are two feet apart with a soil auger in a series of parallel lines under the spread of the tree and extending two feet past the dripline, or four to six feet if the tree has an upright or columnar form. The holes should be two inches in diameter and 12 to 18 inches deep. No hole should be within three feet of the trunk to prevent damage to the root collar. Avoid damaging major roots when drilling. Too much nitrogen close to the surface of the soil will cause spotty turf growth.

Place the recommended amount of fertilizer (See Table 1 in Chapter 26 of the Manual) in each hole, water it in, and fill the holes with sand, compost, or peat; in heavy soils, leave the holes open to improve soil aeration. In addition to getting phosphorus and potassium down into the root zone, this method has an added advantage because the holes help decrease soil compaction and increase air and water penetration, both of which are essential for nutrient uptake by the tree. Holes may also be made with a punch bar, crowbar, or pipe. However, removing the core of soil with an auger is most beneficial.

Liquid injection root feeders are also acceptable provided that recommended application rates are maintained. This treatment effect may

be less persistent than that of a dry fertilizer and, costs increase with the use of specialized equipment and fertilizers.

Large, slow-release pellets or spikes of fertilizer are available. They do provide nutrients to the tree, but the nutrient distribution may be somewhat limited compared to soil incorporation unless an

abundance of spikes are used. Fertilizer release from spikes is very slow.

Fertilizers may be injected directly into the trunk of the tree either as a liquid or a slow release capsule. This method is commonly used to apply micronutrients. Repeating the injections over many years will cause some damage to the tree trunk.

Micronutrients also may be applied to the soil or foliage using a dilute rate of 200-400 ppm soluble solution or by using a "chelate" formulation. A chelate is a chemical that combines with a nutrient element to make it available to the plant under a wider pH range. Various chelates are available at most landscape supply or fertilizer dealers. Follow label instructions for proper application. Foliar applications of iron chelates are effective, but repeated applications are necessary. Foliar applications of all nutrients are effective for a short term only, and usually have to be repeated several times during the season. Incorporation of iron sulfate, sulfur and/or acid peat into the soil to lower the pH before planting may alleviate most micronutrient problems on high pH soils. The best way to avoid micronutrient deficiency problems is to avoid planting sensitive tree species in high pH soils.

Nursery and landscape plants are easily stressed from fertility deficiencies or excesses. Apply appropriate amounts of the right nutrient at the right time to provide for optimum plant growth and vigor.

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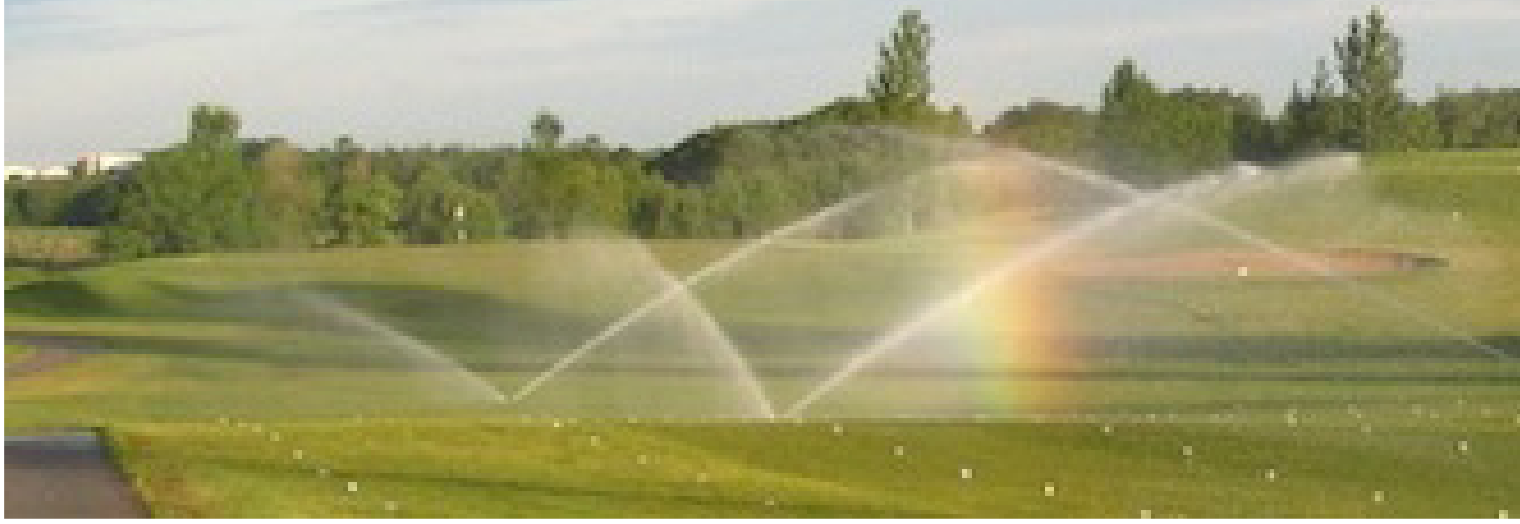

Not That Long Ago ….

Do you remember March 2012? It seems like a long time ago already, but I still remember it well because that month my phone was ringing a whole lot more than it normally rings in March. Spring came early in 2012. Very early. Record early. It went from the "winter that wasn't" to summer in less than a week. The Upper Midwest and Great Lakes regions experienced daytime temperatures in 70, 80 and 90 degree range for almost two weeks straight in the middle of March, and then much above average temperatures until mid April. Since there were almost no irrigation systems up and running yet, many golf course superintendents were trucking water out to their greens and that is why my phone was ringing. These superintendents were seeing the water they were putting on their parched greens puddle up on the surface, and run down slope in ribbons and sheets like it was the middle of a dry spell in July. But this was March, and they wanted to know if I had any recommendations to help them with this problem.

This is not the first time I have seen putting greens act this way in the spring. As a young assistant golf course superintendent in the 1980s, I spent