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FERTILIZING SHADE & ORNAMENTAL TREES

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Shade and ornamental trees can be greatly improved through regular tree care. Fertilizer application is one of a number of practices available to the homeowner.

Many of us are aware of the need for fertilizing our garden and lawn, but we frequently forget that trees also benefit from fertilization. Like all plants, trees depend on sunlight, water, air, and certain mineral nutrients present in the soil for normal growth. Under forest conditions, the annual fall of leaves and twigs, and their eventual decomposition, provides a fresh source of nutrient materials. However, trees in lawns or similar areas are usually denied this source of soil enrichment since most homeowners gather up these leaves. Over a prolonged period of time, this practice can lower the fertility of the soil.

Infertile soils are common around new houses where the soil removed for the basement has been spread during filling and leveling operations. Normally, this soil has poor physical properties and may be lacking in adequate amounts of the necessary minerals. Fertilizer will improve the growth of trees planted on these areas.

Trees growing on good soils will also benefit from fertilization. This is especially true if the soil is compacted or if normal root growth is restricted by sidewalks, driveways or building foundations. Fertilizer also helps develop good leaf color, recovery from insect, disease, or other injury, and stimulates general tree vigor.

How Can I Tell When My Trees Need Fertilizer?

There is no single indicator that trees need fertilization. However, some symptoms may indicate the need for certain fertilizers: leaves of smaller than usual size, light green or off-color foliage, ends of branches containing dead twigs, very short elongation of branches during the growing season, and a general lack of thriftiness or vigor.

Some nutrient deficiencies cause specific discoloration in the foliage. Chlorosis is the most

common condition of this type. It results in the development of a light yellow-green color, especially in the areas between the veins (Figure 1). It is most often associated with a lack of available iron. Other essential nutrients, including nitrogen, phosphorus and potassium also exhibit deficiency symptoms; however, such symptoms are not as apparent as those of iron.

What Kind of Fertilizer is Best?

While many kinds of materials can be added to the soil to improve fertility, some are more effective than others. Organic residues such as peat moss, manure, wood chips, etc., are beneficial in improving the physical properties of the soil, but they will not greatly increase the nutrient content of the soil unless added in large amounts over a number of years.

Most commercial fertilizers consist of inorganic compounds blended together to provide one or more essential nutrients. The three most common ingredients are nitrogen, phosphorus and potassium. Plants, including trees, require larger amounts of these three nutrients. Nitrogen is obtained principally from the atmosphere, phosphorus and potassium by mining rock deposits high in these elements. These nutrients are then converted to an available form, combined with an organic or inorganic carrier and formed into the familiar fertilizer granule.

Manufactured fertilizers differ in the amount of nutrients they contain (Figure 2). This difference is shown in the analysis (grade) on the bag. Fertilizer analyses are commonly expressed with three numbers, e.g., 10-6-4. The first number (10), in this example refers to the percentage of elemental nitrogen (N) present, the second number (6), to the phosphorus (P) content expressed as percentage P_2O_5 (phosphate) and the third number (4), to the percent potassium (K) in the form of K_2O (potash). Since many different analyses are available, it is important to understand that a fertilizer with a grade of 16-8-8 contains 60 percent more nitrogen (N), 33.3 percent more phosphorus (P_2O_5) and 100 percent more potassium (K_2O) per pound of fertilizer than a pound of 10-6-4. This means that 37.5 lb of 16-8-8 or 60 lb of 10-6-4 would be required to apply nitrogen at the rate of 6 lb/1,000 sq ft. This explains why some fertilizers are more expensive than others.

Figure 1. Yellowish-green color between the veins and along the margins (edges) of leaves may be an indication of chlorosis (left and right). This condition is most often associated with a lack of available iron in the soil. Note normal leaf (center).

When Should I Apply Fertilizer?

To be of greatest value to the tree, fertilizer should be applied in the fall, after the growing season. In Michigan, this is usually after the middle of September. Since root growth can continue until early December or later, fertilizers will be available and beneficial to the tree. Any fertil-

Figure 2. The amount and form of nutrient materials in a manufactured fertilizer are given on the package. Other information regarding the effectiveness of the fertilizer is also included.

izer not used at this time will be available when growth resumes in the spring.

Fertilizer can also be applied in the spring as soon as the soil is free of frost. In Michigan, this is usually late March in the southern portion of the state and early to mid-April in northern areas. Fertilizer applied in early spring is available for the tree to use as growth resumes. Since root growth begins before leaf development, apply fertilizers as early as possible.

Trees usually are not fertilized in mid-summer, although some benefit from fertilizing is possible where injury or defoliation has occurred. Do not apply fertilizer in late summer or flushes of new growth may result. Such tissue may not harden-off sufficiently before fall, resulting in winter injury. Apply fertilizers after the middle of September to avoid this danger.

How Should I Apply Fertilizer?

To be effective, nutrient materials in fertilizers must be transferred into the sap stream of the tree. While most transfer occurs through absorption by the roots, some uptake may take place by absorption through the leaves (fertilizer solutions sprayed on foliage) or as a result of direct injection of fertilizer materials into the trunk of the tree.

Because of these several means of uptake by the tree, many different methods of applying fertilizer have been developed. These include (1) application directly to the soil surface, (2) application (dry or liquid form) in holes in the soil, (3) foliar sprays, and (4) injections (dry or liquid) into the trunk of the tree. No one method is best, even though all are available and used by commercial arborists. Often, a combination of methods is used.

The application methods suggested are based on current research and consider the requirements of a tree for nitrogen, phosphorus, and potassium, the size of the tree, and the environment (lawn area) in which it is growing. For the best indicator of fertilizer needs, use a method based on the soil surface area around the tree rather than trunk diameter.

The frequency of fertilizer applications will depend on the material and methods used. For example, nitrogen is required in larger amounts than phosphorus or potassium. And, fertilizer compounds applied to the soil surface or in holes in the soil will provide a longer lasting effect than materials applied as foliar sprays. Due to the differences in tree requirements, apply nitrogen fertilizers annually, and phosphorus and potassium, at intervals of 3 to 5 years.

The recommended method of application will vary according to the amount and type of grass beneath the tree. This is related

to differences in nitrogen requirements between bluegrass (common in sunny lawns) and fescue (frequently planted in heavily shaded areas).

Some Typical Situations

Let's look at the best way to apply nitrogen, phosphorus and potassium for several different situations.

SITUATION I
Small (less than 25 ft high) open-branched tree that casts light shade, or any tree with lowest branches 12 ft or more from ground; bluegrass growing satisfactorily beneath tree.

a) Apply nitrogen to the surface annually, when grass is dry at 6 lb/1,000 sq ft of soil surface beneath the tree. Make 3 applications of 2 lb each at 2-week intervals to avoid damage to lawn. If non-burning fertilizers are used (i.e., urea-formaldehyde), make a single application (6 lb/1,000 sq ft). Or, apply 3 lb nitrogen fertilizer in the fall and an additional 3 lb in early spring. Refer to page 5 for calculation methods. Do not apply fertilizers within 3 ft of the trunk.

b) At 3- to 5-year intervals, apply a complete fertilizer, such as 10-6-4, 16-8-8, or 12-12-12, in holes at a rate equal to 6 lb of nitrogen/1,000 sq ft (see Figure 5).

SITUATION II
Trees that cast heavy shade, or trees in clumps beneath which fescue or other shade-tolerant grasses are growing.

a) Surface application at recommended rate of nitrogen would be harmful to grass. Apply nitrogen annually in soil holes (Figure 5) at 6 lb actual nitrogen/1,000 sq ft (see page 1 for calculations).

b) For phosphorus and potassium, follow same procedures as in Situation I.

SITUATION III
For ornamental flowering trees and other small fruit trees.

Unless definite need of fertilization exists, do not fertilize. Heavy applications of nitrogen may tend to reduce flowering. If fertilization is necessary, apply complete fertilizer such as 10-6-4 or 12-12-12 in soil holes (Figure 5) in the spring at a rate of 3 lb nitrogen/1,000 sq. ft.

SITUATION IV
Evergreen

For large trees, follow recommendations given in Situation I and II. For small trees and shrubs, use complete fertilizer (such as 12-12-12) at 3 lb actual nitrogen/1,000 sq ft.

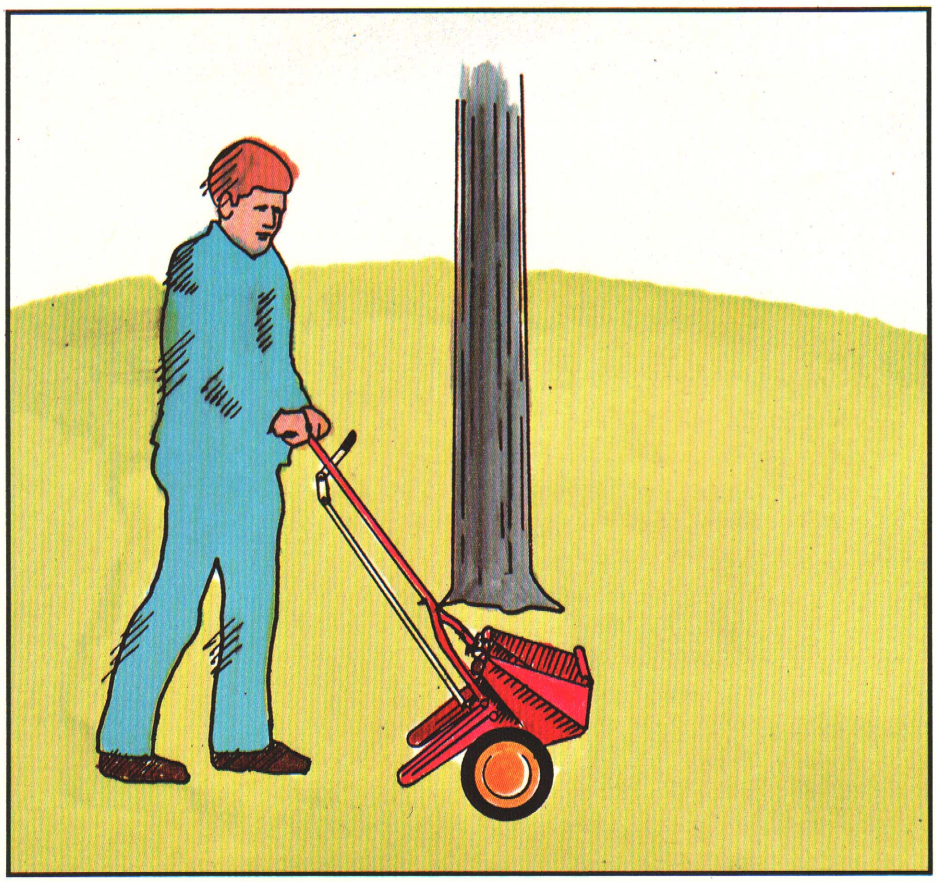

Figure 3. Nitrogen fertilizers can be applied to the soil surface with a lawn fertilizer spreader. Calibrate the spreader to insure accurate delivery.

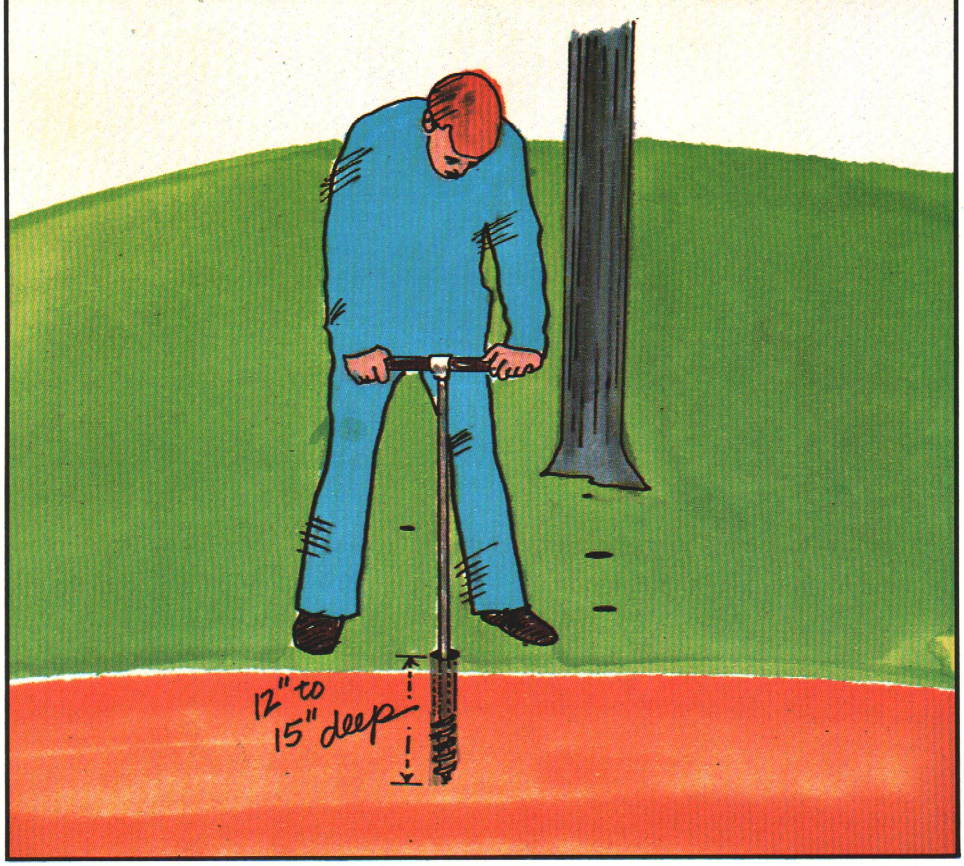

Figure 4. Use a soil auger to make holes beneath the tree for fertilizer. Holes should be approximately 1½ to 2 in. in diameter and about 12 to 18 in. deep.

Application to Soil Surface

Surface application of nitrogen fertilizers to the soil is quick, practical and inexpensive. Nitrogen readily leaches into the root zone and is quickly available to the tree roots. In contrast, potassium, and particularly, phosphorus, do not move readily within the soil and should be placed in the root zone. Nitrogen-containing fertilizers can be conveniently spread on the soil surface with a lawn fertilizer spreader (Figure 3). These spreaders distribute the material evenly, and when properly calibrated, accurately deliver the amount required. (See "How to Calibrate a Sprayer," p. 7.) Apply fertilizer to the surface only when the grass is dry or some burning may occur to the grass. It is usually advisable to water the area thoroughly following application.

Application to Holes in Soil

When fertilizer is placed in the soil, make small holes by using a drill or soil auger (Figure 4). Holes should be 1½ to 2 in. in diameter and about 12 to 18 in. deep. Larger holes are not recommended since the fertilizer will be located at the bottom of the hole rather than distributed more evenly. Make the hole at a slight angle slanted towards the trunk for best distribution.

Make holes in concentric circles around the trunk of the tree. The first circle should be no closer than 3 ft from the trunk and successive circles at 2 ft intervals. Distances between any two holes should be approximately 2 ft (Figure 5). Extend the circular pattern of holes a few feet beyond the drip line or edge of the crown. Determine the amount of fertilizer for each hole by dividing the number of holes into the pounds of fertilizer required (see below).

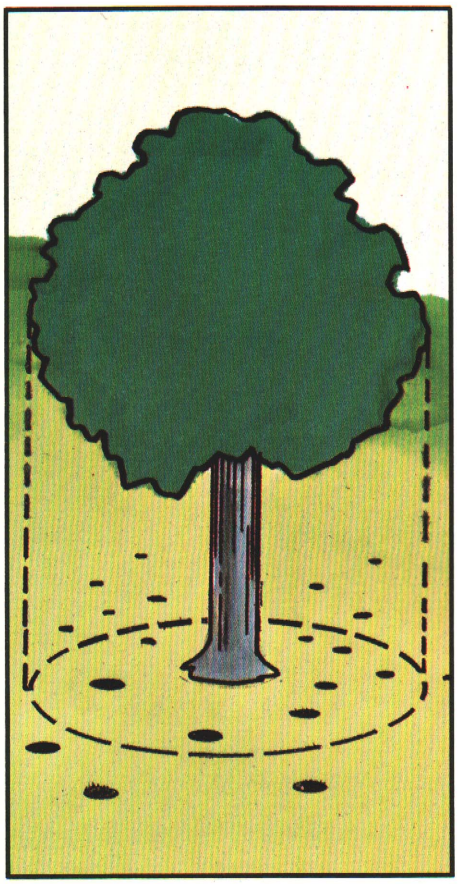

Figure 5. Apply potassium and phosphorus in holes both inside and outside the drip line of the tree. Make holes approximately 2 ft. apart and 12 to 18 in. deep. Do not permit fertilizer to come within 4 in. of the soil surface to minimize adverse effects on grass.

To avoid uneven grass growth, do not place fertilizers within 4 in. of the soil surface. After the prescribed amount of fertilizer is placed in each hole, fill the hole with peat or other organic materials instead of the original soil, unless it is of good quality.

How Do I Calculate the Amount of Fertilizer Needed?

An easy way to do this is to think of the circular area beneath the tree (drip line) as a square or rectangle (Figure 5). Remember to extend the distances for 8 to 10 ft, where possible. If a part of this area is covered by sidewalks, driveways, streets, etc., reduce proportionally the total area and therefore the amount of fertilizer.

How many pounds of 10-6-4 fertilizer will be required to apply nitrogen at the rate of 6 lb/1,000 sq ft to a tree that has crown dimensions of 40 x 50 ft (2,000 sq ft)? We are aware that 10-6-4 contains 10 percent available nitrogen. Since the recommendation is for 6 lb of nitrogen per 1,000 sq ft, we need 2 x 6 or 12 lb of actual nitrogen.

Knowing that 100 lb of 10-6-4 contains 10 lb of actual nitrogen, we can use the proportion 10/100 = 12/X, and find that X = (100 x 12/10) or 120 lb. This relationship may be used for most fertilizers if we remember to change the percentage figures accordingly (i.e., 12-12-12 should be 12/100 = 12/X; 16-8-8 would be 16/100 = 12/X, etc.) If we had made 150 holes in the area to be treated, the amount to be placed in each hole would be 120/150 or 0.8 lb or about 12 oz. A 6-oz can (e.g., frozen fruit juice) makes a convenient measuring container (Figure 6).

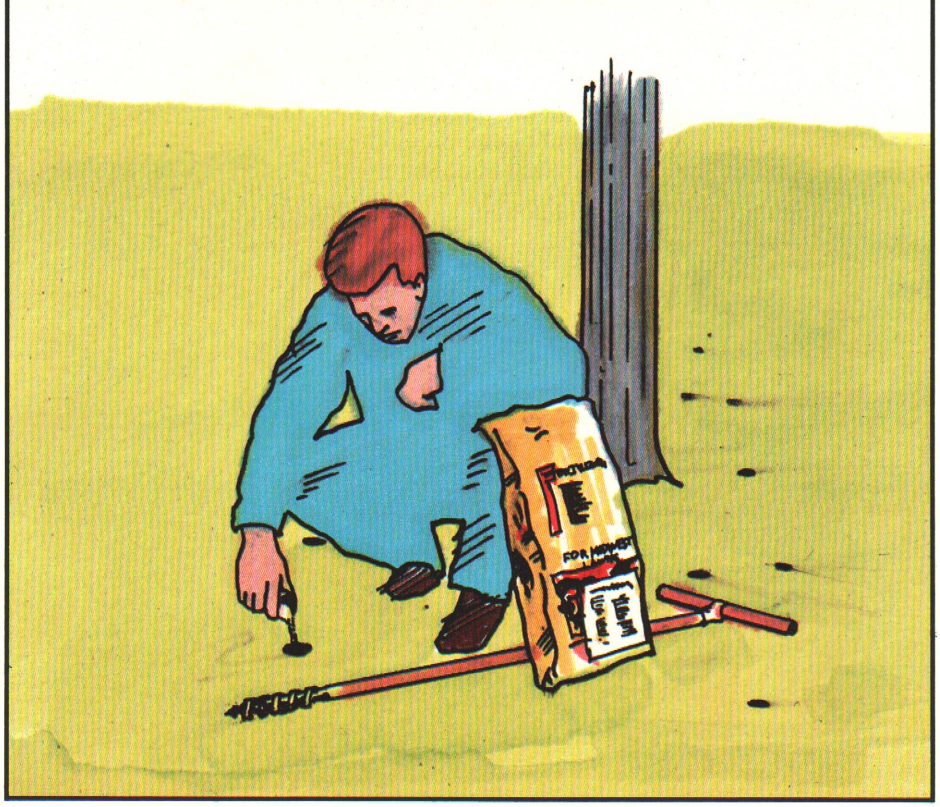

Figure 6. After pouring the fertilizer in the hole, fill the hole with peat or other organic material.

Other fertilizer needs

Thus far, we have considered tree fertilization as related to nitrogen, phosphorus, and potassium requirements. While these nutrients are required in the largest amounts, all green plants require several other mineral nutrients. These include: calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and molybdenum. Most soils contain adequate amounts of these nutrients; however, one or more is occasionally deficient.

Iron deficiency is perhaps most common, especially in alkaline soils or where lime has recently been added. In such soils, iron may indeed be present, but unavailable for absorption by the roots due to the alkaline soil. Lack of iron can cause chlorosis —characterized by light yellow-green color in the foliage. Pin oak is particularly sensitive to iron deficiency.

Chlorotic conditions can be corrected by applying acidic materials to increase the acidity of the soil solution. Powdered sulfur is effective at the rate of 1¾ to 2 lb/100 sq ft of soil surface. Successive treatments may be required.

Iron chelates, a form of iron fertilizer, correct this problem even quicker. These compounds provide an immediate supply of

Figure 7. Foliar sprays containing iron in an available form are often effective in correcting chlorosis. Longer lasting treatments for preventing lime-induced chlorosis require soil applications of iron chelates.

available iron which is unaffected by the soil reaction. They may be applied to the foliage (Figure 7), but soil applications give longer lasting benefits. When using iron chelates, be sure to follow the manufacturer's recommendations.

In some parts of Michigan, manganese deficiency has been observed in maple trees growing on highly alkaline limestone soils. Manganese sulfate or manganese chelate foliar sprays have improved foliage color and general appearance. When using these or similar compounds, be sure to follow manufacturer directions.

Other nutrient deficiencies may be present in your locality. Soil tests and foliar analyses can help identify these conditions. For more information, contact your county Cooperative Extension Service Office.

Commercial Materials

A number of commercial materials (devices) are available for fertilizing shade and ornamental trees. These include root feeders, trunk implants, fertilizer stakes, and other similar products. Although they are convenient, their effectiveness has not been thoroughly documented. Concern exists over apparent variation in results with many of these products. Homeowners should realize that such products may not be as effective as more proven methods.

How to Calibrate a Spreader

To calibrate a spreader, consult the manufacturer's instructions or do as follows. First, determine how much fertilizer is needed to deliver the rate desired. (Refer to page 5 for help in calculating the rate based on the analysis you are using.) Next, convert this amount to that needed to treat a 100 sq ft area. (Divide both numbers by 10.) If a 10-6-4 analysis fertilizer is to be applied at a rate of 6 lb of actual nitrogen/1,000 sq ft, 60 lb of fertilizer will be required per 1,000 sq ft, or 6 lb for 100 sq ft.

Weigh out 6 lb of fertilizer and place in the spreader. On a hard surface, such as the garage floor or driveway, mark out a 10 x 10 ft square (100 sq ft or 1/10 of 1,000 sq ft). Begin spreading the fertilizer within the marked area and make the necessary adjustments until a setting is found that will result in all the fertilizer being uniformly spread over the area. This is a trial and error procedure and will probably require readjustments of the spreader, sweeping up the fertilizer and starting over. When the correct setting has been obtained, multiply the amount spread (6 lb in our example) by 10 to determine the rate/1,000 sq ft. Follow the same procedure for other rates or analyses, remembering to first convert to the amount needed for 100 sq ft.

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