



Fertilizing Shade and Ornamental Trees

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Young trees (those with a trunk diameter of less than 6 inches) can benefit greatly from regular applications of fertilizer. Research has shown that when these trees receive nitrogen fertilizer, they grow faster, develop a denser canopy, and stay green longer into the fall (Figure 1).

It might not be necessary to fertilize large, established trees growing in or near lawns, groundcovers, or shrub beds that are fertilized regularly. Trees' root systems extend for a long distance and they absorb nutrients when the area above them is fertilized. Additionally, as trees mature, their roots develop associations with fungi called mycorrhizae. These beneficial fungi help the tree absorb phosphorus and other elements from the soil.

Before you fertilize, take a look at your trees. Look for the following:

- How much annual growth do you see? Most young trees average about a foot of new shoot growth each year; older trees have significantly less. Is your tree growing less than expected?
- Has the color, size, or amount of foliage changed?
- Has the tree recently had disease or insect problems?

If you answered yes to any of these questions, the tree might benefit from fertilization.

Despite extensive research about how trees respond to fertilizer, scientists and arborists have not reached specific conclusions regarding what type of fertilizer to use, when to apply it, or how much to apply. Factors such as the type and age of the tree, the purpose of the fertilizer application (e.g., increased vertical growth or trunk diameter, increased canopy density, etc.), and soil conditions must be considered when determining how to fertilize a tree. Below are some of the most common and agreed-upon recommendations.

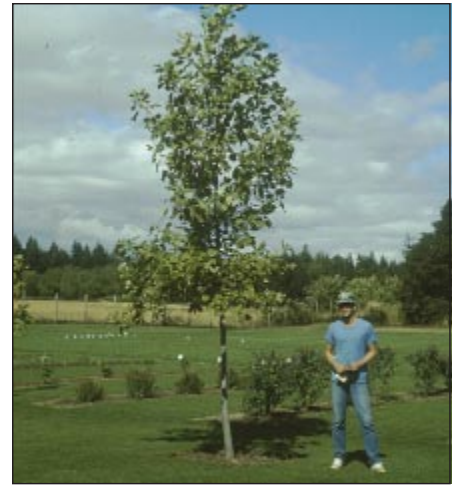


Figure 1—Two 5-year-old tulip trees (*Liriodendron tulipifera*). Left: Tree was fertilized annually for 3 consecutive years. Right: Unfertilized tree.

What type of fertilizer to use

If fertilization is needed, nitrogen generally is the key nutrient required. Nitrogen stimulates new growth and keeps leaves green. A lack of nitrogen often results in less foliage and leaves that are small and yellowish (chlorotic). Nitrogen is water-soluble and can be carried deep into the soil beyond the root zone by rain and irrigation. Thus, you might need to apply nitrogen every year when trees are young.

Phosphorus and potassium also are essential to tree growth. However, neither is used at the same rate as nitrogen, and most soils contain enough of these nutrients. A laboratory soil test will indicate if either element is needed. Once applied, these nutrients generally stay in the root zone, so a single application should last for several years.

Although any complete fertilizer with nitrogen, phosphorus, and potassium (N-P-K) can be used, trees respond best to fertilizers with a higher percentage of nitrogen. If you use a complete fertilizer, select one with approximately a 3-1-2 ratio of nitrogen, phosphorus, and potassium. Examples include 10-4-6 and

20-5-10. A fertilizer labeled 20-5-10 contains 20% nitrogen, 5% phosphorus (in the form of phosphate), and 10% potassium (in the form of potash).

A number of minor elements also are required by plants, but ample amounts usually are present in the soil. Again, a laboratory soil test will tell you whether your soil lacks sufficient amounts of any of the minor elements. Iron is the minor element most likely to be deficient in high-pH (basic) Oregon soils. In these soils, nutrients such as iron are not readily available to plants. Thus, specialty fertilizers might be necessary, especially for plants that prefer acid soils such as rhododendrons and camellias. (See EC 1503, *Fertilizing Your Garden*, for more information.)

Trees respond equally well to organic fertilizers (manure, liquid fish, or blood meal) or “chemical” fertilizers. When fertilizing trees, chemical fertilizers tend to be easier to apply because they contain higher concentrations of nutrients and therefore require less volume. Plants can absorb most chemical fertilizers as soon as they are applied, while soil bacteria and fungi



must act on most organic fertilizers to change them into a usable form.

When to fertilize

Many trees make their spring growth, flower, and set fruit using the mineral reserves they stored during the previous year. It's best to fertilize either in late summer or fall, or in early spring as growth begins. If you fertilize in late summer or fall, use an insoluble, slow-release fertilizer. A soluble fertilizer high in nitrogen might stimulate a late-season flush of growth that could be damaged by an early freeze. Also, nitrogen remaining in the soil at the end of the growing season might be washed below the root zone and into the groundwater by winter rain.

If you fertilize in the spring, use a soluble fertilizer.

Deficiencies of minor elements such as iron can be corrected by foliar or soil applications in early summer.

How much fertilizer to use

Take a good look at your tree before you decide how much fertilizer to apply. Start with a low rate and evaluate the tree during the spring. You can fertilize again in early summer if needed.

A common recommendation is to apply ¼ pound of actual nitrogen per inch of trunk diameter at breast height (4½ feet above ground). This requires 1 to 5 pounds of commercial fertilizer mix per inch of trunk diameter, depending on the formulation. Recent research has shown there is no need to fertilize larger trees at a higher rate than smaller trees. Use Table 1 to determine how much fertilizer to use based on the trunk diameter and the percentage of nitrogen in the fertilizer.

If your tree's trunk is 4 inches in diameter at breast height and you use a 20-5-10 fertilizer, you would apply 5 pounds of fertilizer, or 10 cups.

Table 1.—Amount of fertilizer to use.

Trunk diameter (inches)	Pounds of fertilizer to apply*		
	5% N	10% N	20% N
1	5	2.5	1.25
2	10	5	2.5
4	20	10	5
6	60	30	15

*1 pound of fertilizer = about 2 cups.

How and where to fertilize

Most of a tree's feeder roots (those that take up soil nutrients) are in the top 12 inches of soil within the area from the base of the trunk to 1½ times the canopy diameter (Figure 2). You can broadcast fertilizer over a lawn or mulched surface within this area. Irrigate after the application to move the nitrogen into the root zone. However, this method might cause an undesired flush of grass growth or even burn the lawn if you use a high-nitrogen soluble fertilizer.

Another method is to dig 6- to 12-inch-deep holes around the dripline using a garden trowel or punch bar (Figure 3). As a general rule, dig five holes for each inch of trunk diameter at breast height. Divide the total amount of fertilizer needed by the number of holes. Pour the fertilizer carefully into the holes using a funnel (Figure 4).

For example, Table 1 shows we need 10 cups of 20-5-10 fertilizer for a 4-inch diameter tree. We need 20 holes spaced evenly in the area where the feeder roots are growing, so we'll put ½ cup of fertilizer into each hole.

Tree fertilizer stakes can be pounded into the soil following the same spacing.

Foliar fertilizer applications are an option, but are of limited value for most homeowners. They are difficult to apply and give marginal results. A soluble foliar application of iron or magnesium can rapidly correct deficiencies of these nutrients, but it should be applied by a tree care professional in order to obtain good results. Spray runoff from foliar applications of iron can stain sidewalks, driveways, and buildings.

When fertilizer isn't the answer

Sometimes, reduced shoot growth, leaf discoloration, or disease and insect problems are not due to nutrient deficiencies. Other common problems that affect tree growth include:

- Excessively wet, cold, or poorly aerated soils, which affect oxygen availability and nutrient uptake
- Prolonged periods of dry soil
- High salt content in the soil from overfertilizing, excessive calcium in the soil, or salty irrigation water
- Disease and insect damage, either to the roots or to the upper plant parts
- Damage to the tree trunk

Evaluate your tree and its growing conditions closely to determine what factors might be affecting its growth. You might need to improve soil conditions or even remove the tree and replace it with a species better suited to the growing environment in your yard.

For more information

You can access this publication, EC 1503, *Fertilizing Your Garden*, our Publications and Videos catalog, and additional gardening information through our Web page at eesc.orst.edu

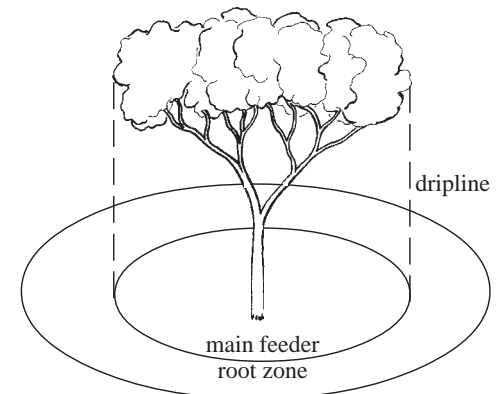


Figure 2.—The feeder roots extend to 1½ times the diameter of the canopy.



Figure 3.—Using a punch bar to dig holes.



Figure 4.—Filling holes with fertilizer.