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Homeowner's Guide To Fruit Tree Fertilization

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Fruit trees need regular maintenance, including fertilization, to produce acceptable yields of high-quality fruit. This publication describes procedures and materials for applying nitrogen, phosphorus, potassium and some micronutrient fertilizers to home-garden fruit trees in Idaho.

Fruit trees require the following elements: carbon (C), oxygen (O), hydrogen (H), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), manganese (Mn), copper (Cu), iron (Fe), zinc (Zn), sulfur (S), boron (B) and molybdenum (Mo). The first three elements — C, O and H — are supplied mainly by carbon dioxide (CO_2) in the air and water (H_2O) in the soil. Fruit trees require the macronutrients — N, P and K — in the largest amounts. They require smaller amounts of the secondary macronutrients — Ca, Mg and S — and the minor elements, referred to as micronutrients. Secondary macronutrients and micronutrients are generally sufficiently available in the soil. However, Mg, S and B are deficient in certain northern Idaho soils, and S and Fe may be deficient in some areas of southern Idaho.

Nitrogen

Soil organic matter is the major source of soil N and is important to the soil's ability to store N. Many Idaho soils are naturally low in organic matter. In southern Idaho, high summer soil temperatures, frequent cultivation and abundant soil water from irrigation provide ideal conditions for organic matter decomposition and therefore limit organic matter accumulation. Even in areas where soil organic matter is usually relatively high, soil disturbance during home building often results in the loss of topsoil, which usually contains the highest levels of organic matter.

In most of Idaho, soil N must be supplemented with fertilizer N. Fertilizer N sources include inorganic commercial fertilizers and organic fertilizers such as bloodmeal, fish by-products and animal manures.

Nitrogen-deficient trees lack vigor, have pale-green or yellowish-green leaves and produce small, poor-quality fruit. Older leaves turn yellow before newer leaves. Leaves or fruit may drop early. Peach leaves may be reddish and have a "shot hole" appearance that resembles Coryneum blight or arsenic toxicity. Even though some N-deficient trees may not have pale-green or yellowish-green leaves, they will benefit from an annual N fertilizer application. Sulfur deficiency produces visual symptoms similar to those of N deficiency. Only a tissue sample analysis can distinguish between them.

Nitrogen Fertilizer Application: The First Year

Most Idaho soils do not require N fertilizer the first growing season. If the soil is extremely low in N or very sandy, some fertilizer may be needed. If N fertilizer is necessary, apply at the rates given in Table 1, after planting and before the first irrigation. If trees were not watered in at planting, apply one good irrigation to settle the soil around the tree roots before applying N fertilizers. Refrain from adding inorganic N fertilizer or manure to the planting hole when transplanting young trees because the salts these fertilizers contain can damage young roots.

Nitrogen Fertilizer Application: After the First Year

Apply nitrogen fertilizer in winter or early spring (February or March) at least a month before trees bloom. Broadcast N fertilizer on the soil, inside the

drip line. Nitrogen fertilizer applied during February or March will move into the soil with seasonal precipitation, although in dry climates irrigation may be necessary to dissolve the fertilizer and carry it into the soil. Do not irrigate until moisture is needed for tree growth. When using urea (45-0-0), especially in dry climates, avoid leaving it on the soil surface because it can volatilize (enter the air as a gas), causing severe N losses. Instead, water it in.

Nitrogen fertilizer applied in the fall can leach, especially in coarse-textured soils. If you apply N fertilizer in fall, leaching can be minimized by applying ammonium (NH_4^+) forms of N such as ammonium sulfate (21-0-0) or urea (45-0-0) after the surface soil temperature has dropped to about 50°F or lower. In southwestern Idaho and the Lewiston area this generally occurs about the middle of October. Leaching can also be minimized by applying half the N fertilizer in fall, after the trees are dormant, and the remainder early in spring.

On sandy soils and in regions with high amounts of precipitation, the total N fertilizer may be applied best in a split application, half in late winter (March) and half when active growth begins in mid to late spring (late April to early June). Nitrogen fertilizer should be applied in southwestern Idaho before mid-June. Later or excessive fertilizer applications can result in poor fruit color, delayed maturity and an increased possibility of winter tree injury.

In northern Idaho, delay the application of inorganic N fertilizers until spring (March to April) to reduce leaching losses during the winter.

Adjusting Nitrogen Application Rates

Nitrogen application rates depend on shoot growth — the average length of the previous year's branch growth. Measure branches whose tips approach a 65° angle upward from the horizontal. Shoots on young, non-bearing apple, pear and cherry trees should grow 10 to 20 inches per year, and shoots of mature trees should grow 8 to 12 inches per year. The average N fertilizer rates to accomplish this level of growth are shown in Table 1.

Increase the N rate from that of the previous season if shoot growth was too little, and decrease the N rate if growth was excessive. Heavily pruned trees often require less N fertilizer. Trees with a heavy fruit set have a greater need for N fertilizer than trees with a light fruit set. Nitrogen fertilizer applied to adjacent lawn or garden areas and absorbed by fruit tree roots will also influence fruit tree growth rate and should be considered in the rate of application.

Rates of fertilizer N needed for fruit trees can burn a lawn. When fertilizing fruit trees in a lawn, place the N fertilizer below the surface in 12-inch-deep holes cut through the sod with a bar, pick or other device. Space the holes at 2-foot intervals around the drip line, and divide the fertilizer evenly among the holes.

Heavy summer or fall fertilization of grass under trees may stimulate unwanted summer tree growth and delay fruit maturity. This potential problem is best avoided by removing grass under the drip line.

Manures

Animal manures can be used to satisfy the N needs of fruit trees. The N content of animal manures is generally low and depends on the type of manure and the amount of bedding material mixed with it. Dairy manure may contain only 1 to 2 percent N, and dried poultry manure may contain 3 to 5 percent N.

Manures should be used with caution because they may contain high levels of salts, which can harm trees. Apply manures in fall or early winter so that precipitation can dilute the salts and move them through the root zone when they will damage trees the least.

Repeated, heavy use of manure, especially poultry manure, may cause Zn deficiency. Trees planted in

Table 1. Recommended nitrogen fertilizer rates per tree.

Nitrogen source[1]	Nitrogen content	First-year trees	Young trees (Rate per year of tree age)	Mature trees
	(%)	(oz)	(oz)	(lb)
Ammonium sulfate (21-0-0)	21	2 to 4	2 to 4	5
Ammonium nitrate (34-0-0)	34	1 to 3	1 to 3	3
Urea (45-0-0)	45	1 to 2	1 to 2	2
16-16-16	16	2 to 4	2 to 4	6
Calcium nitrate (15-0-0)	15	2 to 4	2 to 4	6
	(lb)	(lb)		
Dry manure (other than poultry)	1 to 2[2]	4 to 6	4 to 6	100
Dry poultry manure	3 to 5[2]	1 to 2	1 to 2	30

[1]Numbers in parentheses represent percentages of N, P_2O_5 and K_2O in the fertilizer, respectively.

[2]Values apply to animal droppings alone. Inclusion of bedding materials such as sawdust or straw will greatly reduce these values and increase application rates.

old barnyards are especially difficult to grow because of Zn-deficiency problems. Foliar sprays of Zn will correct these problems.

Animal manures are organic materials; they must decompose before the nutrients they contain become available. Don't expect an immediate response to applied manures.

Phosphorus and Potassium

Most Idaho soils have adequate P and K for fruit production. Deficiencies are most likely to occur on sites where the topsoil has been removed and in very sandy soils.

Before planting, P and K fertilizers should be mixed into the soil, preferably by broadcasting and tilling in a complete (N-P-K) fertilizer over the orchard area. A complete fertilizer (such as 16-16-16 or 8-8-8) can be applied at approximately 1 to 2 pounds per 100 square feet.

Soil testing for P and K is available at the University of Idaho Analytical Services Laboratory at Moscow and at several private labs located across the state. A soil test costs $10 to $20 but may be worthwhile for large home orchards prior to establishment and every 4 to 5 years thereafter. However, because even high soil levels of P and K do not usually lead to problems, routine use of a complete fertilizer every 3 to 5 years may be cheaper and preferable to soil testing.

To obtain meaningful numbers from a soil test, start with a good soil sample. For assistance in obtaining a soil sample contact your county Extension office or refer to University of Idaho Extension Bulletin 704, *Soil Sampling*.

When P and K soil test levels are low (Table 2), apply a complete fertilizer such as 16-16-16, 10-10-5, 6-10-4, etc. Regulate the rate of application based on the N need of the trees, and you will apply sufficient P and K to meet their needs.

Zinc

Zinc deficiency is a common problem in home fruit trees. Symptoms typically appear first on younger growth. Leaves near the growing tips are small, narrow and bunched, giving a "rosette" appearance. Leaves are light green and frequently mottled between the veins, which are dark green. Shoots may take on a yellowish cast and have shorter internodes (stem length between nodes). Zinc-deficient trees may have poor, delayed bloom and produce small, low-quality fruit. Deficient levels of Zn must be corrected by foliar Zn applications. Soil applications are not effective unless Zn is incorporated into the soil at planting. For more information on Zn deficiency see University of Idaho CIS 617, *Zinc in Idaho.*

Iron

Fruit trees with an Fe deficiency have striking yellowish-green or yellowish to pale-white leaves with dark-green veins (interveined chlorosis). Leaf size is usually normal or slightly smaller. Fruit tends to ripen early, although fruit quality is often normal. In severely Fe-deficient trees, shoots die back and grow poorly, fruit quality is reduced and overall production is poor. Iron deficiency is usually caused by high lime levels ($CaCO_3$) in soils or extended periods of excessive soil moisture. Neutralizing the excessive lime with elemental S or reducing the amount of soil moisture will usually reduce or eliminate Fe deficiency. Foliar applications of Fe chelates or iron sulfate (Fe_2SO_4) can help, but they are costly and must be repeated each growing season. For more information on Fe deficiency see University of Idaho Extension Bulletin 616, *Fertilizing Shade and Ornamental Trees.*

Calcium and Bitter Pit of Apples

Calcium nutrition of apple trees has often been linked to bitter pit in apples. Ca and bitter pit are undoubtedly related, but management and other factors may be more closely related to bitter bit than are soil Ca levels. Excessive use of N fertilizer, excessive pruning and low fruit set on young trees, conditions that favor strong vegetative growth, can create an induced shortage of Ca in the fruit caused by the demand for Ca by the leaves. For further information on bitter pit see University of Idaho CIS 281, *Bitter Pit of Apples.*

Table 2. Adequate and low soil test levels of P and K[1].

	Sodium acetate extraction		Sodium bicarbonate extraction	
	P	K	P	K
	(ppm)	(ppm)	(ppm)	(ppm)
Adequate	5 or more	100 or more	12 or more	150 or more
Low	less than 5	less than 100	less than 12	less than 150

[1]Soil test levels of P and K vary with the method of extraction used in analyses. Selection is based on soil pH, with sodium acetate used on acid soils (northern Idaho) and sodium bicarbonate used on alkaline soils (southern Idaho).

General Comments

1. Especially in sandy soils, nitrogen leaching losses caused by overirrigation can reduce the N available to trees and may lead to N in groundwater.
2. The amount and type of irrigation, soil type and previous fertilizer applications can influence fertilizer needs.
3. Nitrogen fertilizer application rates should be adjusted to reflect the results obtained from fertilization the previous year as determined by the previous year's shoot growth.
4. "Shotgun" applications of micronutrient mixtures have not been shown to be beneficial and are not recommended.

Contact the University of Idaho Extension agricultural agent in your county for additional information on home orchard management.

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