Fertilizing Fruit Crops

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Fertilizers for Fruit Crops

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Proper use of fertilizers contributes to high production of excellent quality fruit. Certain fertilizers may be needed in all fruit plantings, but should be applied according to the needs of each planting. Fertilizer is beneficial only when it provides nutrients that are in short supply. Supplying any nutrient above that amount required is not beneficial and may adversely affect fruit quality. Fortunately, fruit plantings are usually tolerant to excessive fertilizer, except for nitrogen.

Fertilizer requirements in different fruit plantings will vary considerably because of (1) the wide variation in Michigan soil, (2) varied fertilizer and cultural treatments used during previous farming operations, (3) the degree of pruning, (4) cultural practices, and (5) intended market for fruit produced. Fertilizers will not compensate for lack of moisture, inadequate pest control, poor pruning practices, winter injury and adverse weather.

DETERMINING NUTRIENT NEEDS

Leaf analysis is the best way to determine fertilizer needs of established fruit plantings. Leaf analysis can be used to confirm or diagnose a problem associated with a nutrient shortage or excess, or prevent the development of a nutrient disorder in an orchard or vineyard. Usually, it reveals that certain fertilizers being used are not necessary and results in the most economical fertilizer program.

The MSU Department of Horticulture offers a leaf analysis program for Michigan fruit growers. Apple, pear, peach, sweet and tart cherry, plum, grape, and blueberry are included. District extension horticultural agents, county extension offices and the MSU Department of Horticulture provide information and instructions on collecting leaf samples (see MSU Extension Bulletin E-449).

Soil tests are not satisfactory for determining the fertilizer needs of established fruit crops. The plants have large root systems and soil tests do not adequately sample the entire root area. Also, the root systems of established fruit plantings absorb nutrients during the dormant season. Consequently, fruit trees can absorb sufficient nutrients from soils having nutrient levels inadequate for annual or seed crops. Many factors, other than the soil nutrient level (winter injury, girdling, etc.), influence the nutrition of fruit plantings. A soil test prior to planting may be used to indicate the need for lime and/or potash applications prior to planting. However, use leaf analysis to determine the most economical fertilizer program in established fruit plantings.

Deficiency symptoms indicate an acute nutrient shortage. Symptoms do not normally appear until the deficiency is well advanced, resulting in loss of growth, yield, quality, etc. Therefore, maintain nutrients at a level that will prevent visible symptoms. Symptoms are usually expressed on the foliage. A nutrient deficiency may be suspected when an abnormal pattern develops on the leaves. The pattern is characteristic for a specific nutrient. These patterns are usually necrotic (dead) or chlorotic (yellow) tissue between the veins or on margins of leaves. Only nitrogen shortage results in a general yellowing of the leaves. Affected leaves are very much alike in appearance, age and position on the shoots. At first, only a single tree or a few trees may develop the symptom, and the trees may be scattered.

Leaf patterns due to insect or disease infestations may resemble but rarely meet the above descriptions. Girdling, winter injury, poor drainage and pesticide injury may result in leaf symptoms resembling nutrient deficiencies.

Deficiency symptoms are more common in Michigan fruit plantings for nitrogen, potassium and magnesium than for other elements.

FERTILIZER REQUIREMENTS

Michigan fruit trees may have need for any one of the essential nutrient elements: nitrogen, potassium, phosphorus, calcium, magnesium, manganese, iron, copper, boron or zinc. However, acute shortages are rare. Do not apply nutrients that are not needed.

Nitrogen is the most important nutrient in fruit production in Michigan and is more widely needed than any other nutrient. Apply only nitrogen unless the need for other nutrients is known. The amount of nitrogen required varies according to crop load, kind of fruit, variety, age of planting, soil conditions, soil management practices, pruning and other factors. Terminal growth frequently indicates whether an apple or peach tree is receiving too much or too little nitrogen. Mature bearing peach trees should produce 12 to 15 inches of terminal growth per year and mature bearing apple trees about 8 to 12 inches of terminal growth.

Apply nitrogen fertilizer in the fall after a killing frost or as early in the spring as possible. Fruit trees respond similarly to different types of nitrogen. Therefore, select nitrogen fertilizers on the basis of cost per unit of nitrogen. Avoid springtime applications of urea on very light, sandy soils. Because blueberries are sensitive to nitrate nitrogen, apply ammonium sulfate if the soil pH is above 5.0 and urea if the soil pH is below 5.0.

Potassium is second only to nitrogen in the nutritional requirement of Michigan fruit plantings. Generally, stone fruits and grapes are more subject to potassium deficiency than apples or pears. These fruit crops are frequently grown on light, sandy soils that have low supplies of potash.

Phosphorus is used in only small amounts by fruit trees. Phosphorus deficiencies, unlike nitrogen or potassium, have not been encountered under orchard conditions. Fruit trees utilize more nitrogen, potassium, calcium and magnesium than phosphorus. Responses to phosphorus fertilizers are slight and applications not necessary unless a need has been demonstrated.

Calcium is normally present in adequate amounts for satisfactory tree growth. Calcium is often used to regulate soil acidity; however, fruit trees exhibit a wide tolerance to soil acidity. Calcium supplied as dolomitic lime exerts its benefit through the correction of both calcium and magnesium deficiency. Fruit trees are deeply rooted, usually have sensitive roots and obtain adequate amounts of calcium, although a soil test may indicate a very acid condition of the surface soil.

Magnesium deficiency is sometimes a problem in Michigan, especially in apple plantings. This condition can be corrected through dolomitic lime or epsom salt sprays.

Minor element deficiencies are not common in Michigan fruit plantings. Most Michigan fruit growers need not be concerned about minor elements as a necessary part of their fertilizer program.

FERTILIZER RECOMMENDATIONS

Most fertilizer applications, except nitrogen, need not be repeated annually. Often a single application will prevent shortages for several years. The following fertilizer suggestions may be followed when the *need for a specific nutrient element is known:*

Nitrogen — On older trees, vary the previous year's application according to response obtained. Remeber, it is easier to increase than to decrease nitrogen levels.

Apply nitrogen in young fruit plantings at the rate of 1/4 to 1/2 lb. of actual nitrogen per tree per year of age. Increase or decrease the amount applied to obtain desired amount of growth.

A guide for initial nitrogen application in mature fruit plantings: apple and pear -- 50 to 75 lbs. of actual nitrogen per acre; cherry, plum and peach -- 75 to 100 lbs.; blueberry -- 50 to 65 lbs.; grape -- 50 to 100 lbs.

Phosphorus — Apply 800 to 1,000 lbs. of concentrated superphosphate (0-45-0) per acre when a need is known.

Potassium — Apply 150 to 300 lbs. per acre of muriate of potash (KCL). Sulfate of potash (K_2SO_4) is necessary for blueberry, but not for other fruit crops.

Magnesium — Apple dolomitic limestone at the rate of 4 to 6 tons per acre. If shortage is acute, apply epsom salts in the first 2 cover sprays at the rate of 10 lbs. per 100 gallons (dilute) for about 3 years until the limestone becomes effective.

Calcium — Apply dolomitic lime at the rate of 4 to 6 tons per acre.

Manganese — If shortage exists, spray with manganese sulfate at the rate of 5 lbs. per 100 gallons (dilute) in the first 2 cover sprays. If excess exists, apply dolomitic lime at the rate of 4 to 6 tons per acre.

Iron — Apply ferbam in early cover sprays (check the current MSU Fruit Spraying Calendar). Chelated iron may be applied.

Boron — Spray with solubar at the rate of 2 to 3 lbs. per 100 gallons (dilute) in the first 2 cover sprays or at the rate of 5 lbs. per 100 gallons as a post-harvest spray (September).

Copper — No shortages found in Michigan. Where present, copper sulfate (bordeaux) can be applied.

Zinc — Apply zinc sulfate plus lime (equal parts) at the rate of 1 to 2 lbs. per 100 gallons (dilute) each in the first 2 cover sprays or at the rate of 5 lbs. each as a post-harvest spray (September).

FERTILIZERS AT PLANTING TIME

Fertilizers and/or fertilizer solutions in the tree hole at planting time may be of little or no benefit. Soaking the trees prior to planting or thorough watering at transplanting if the soil is dry is much more beneficial than a fertilizer solution.

Soils deficient in potassium or magnesium can benefit from a nutrient solution at planting time. If potassium is deficient, use a solution of 1 lb. muriate of potash (KCL) per 100 gallons and apply one gallon of this solution per tree in the tree hole, after planting. If the soil pH is low, a shortage of magnesium or excess of manganese can be avoided by applying a hydrated dolomitic lime solution. Use 50 lbs. of lime per 100 gallons of water and apply 2 gallons of solution in the tree hole after planting.

Do not increase concentration to reduce water. Use more solution.

SOIL MANAGEMENT

Follow management programs that prevent water or wind soil erosion, furnish maximum amounts of soil moisture and avoid competition. Mulch, herbicides, and cover crops accomplish this more effectively than cultivation. Different grasses used as sods or cover crops show little difference in moisture demands.

Grass sods and cover crops usually do not require applications of fertilizers other than nitrogen. If the cover crop or sod cover grew well, little or no benefit will be derived from any fertilizer application. Applications of potassium, phosphorus and lime suggested above will adequately meet fertilizer needs of cover crops. Application of 15 to 25 lbs. actual nitrogen per acre will provide adequate cover crop growth. Cover crops and orchard sod do not remove nutrients since none of the growth is removed from the orchard. Therefore, nutrient levels to provide satisfactory growth may last several years without annual replacement.

Modifying a soil management program to include mulch, herbicides, or undertree cultivation may result in a response similar to nitrogen application. It may be advisable to reduce or omit nitrogen applications for the first year and then re-establish the amount to use on the basis of tree performance. A hay or straw mulch program can eliminate the need for fertilizers.

PRUNING

Pruning reduces tree size, but also stimulates tree vigor, particularly terminal growth. Heavy pruning may eliminate a fertilizer need, especially on apple trees. High density apple plantings experiencing tree crowding should not be fertilized or only lightly fertilized to avoid stimulating excessive growth.

SMALL FRUITS

Grapes

Grapes require detailed annual pruning but heavy pruning can not substitute for nitrogen application. Nitrogen, potassium and magnesium are most often required nutrients in Michigan vineyards.

Nitrogen — mature plantings require about 50 lbs. actual nitrogen per acre. Plantings trained to a double curtain trellis require 75 to 100 lbs. actual nitrogen per acre, sandy type soils requiring the greater amount.

Potassium — apply 150 to 300 lbs. per acre of muriate of potash. If a potassium deficiency is present, apply 300 to 500 lbs. muriate of potash.

Magnesium — apply 1 ton of dolomitic lime where soil pH is below 5.5 or where magnesium deficiency is present. If leaf chlorosis from magnesium deficiency exists, also apply 10 lbs. of epsom salts per 100 gallons of spray, applying 200 gallons per acre, in two post bloom sprays.

Strawberry

Where original fertilizer and organic matter are low, use a green manure program for one or two years prior to planting. Include fertilizers and lime in the program for best growth of the green manure crops (see Extension Bulletin E-159, Fertilizer Recommendations for Michigan Crops).

If a green manure crop has been grown the previous year and has been heavily fertilized, preplant fertilizer is not required. If no soil building program precedes planting, apply a 1-1-1 ratio fertilizer to supply 30 lbs. actual nitrogen per acre and work it into the soil at least 7 to 10 days prior to planting.

If plant growth is weak, sidedress with a 1-1-1 ratio fertilizer about 2 weeks after transplanting, using enough to supply 30 to 35 lbs. actual nitrogen per acre. If vigor is still low, repeate the application in 3 to 4 weeks. Strawberries require ample nitrogen early the first year to promote strong plant growth necessary to form blossom buds for next year. If vigor is low, apply an

additional 25 lbs. of actual nitrogen per acre in early August.

Commercial fertilizers are seldom needed on strawberries during the spring of the first fruiting year. Excessive nitrogen can result in tall, dark green foliage and soft fruit. If the plants show a need for nitrogen in the spring of the fruit year, apply about 10 lbs. of actual nitrogen per acre. A quick response at this time may be obtained using a urea spray of 5 lbs. in 100 gallons of water at the rate of 200 gallons per acre.

Apply a complete fertilizer of 1-1-1 ratio immediately after harvest to supply 50 to 60 lbs. actual nitrogen per acre when fields are to be fruited the following year. No additional fertilizer should be necessary until after harvest and field rennovation the following season.

Blueberry

Fertilizers containing nitrates and chlorides are sometimes toxic to blueberry plants. Do not apply nitrate forms of nitrogen or chloride forms of potassium. Nitrogen is often the only fertilizer element needed in Michigan blueberry plantings. When nitrogen is needed, apply ammonium sulfate if the soil pH is above 5.0 and urea if the soil pH is below 5.0. An analysis of leaves collected in late summer will readily indicate the need for additional fertilizer elements. Apply fertilizer on newly set plants about 4 weeks after planting. Sprinkle it by hand lightly around each plant, 12 to 18 inches from the crown.

For mature blueberry plantings (over 8-years old), apply about 50 lbs. of actual nitrogen per acre on good soils and 65 lbs. on poor soils. On good soils, this about 250 to 300 lbs. of ammonium sulfate, or 110 to 150 pounds of urea. For younger plantings, apply 12 to 16 lbs. of actual nitrogen per acre for each 2 years of age.

Apply 75 to 100 lbs. of potassium sulfate per acre where there is a deficiency of potassium.

Phosphorus applications are sledom necessary on an annual basis. When necessary, apply concentrated superphosphate (0-46-0) at 200 lbs. per acre.

When leaf analysis indicates low calcium content and soil pH is below 4.5, apply 500 to 1,000 lbs. per acre of pulverized or hydrated dolomitic lime.

When a need for magnesium occurs, apply 16 lbs. of magnesium per acre utilizing a complete fertilizer containing 4% magnesium, or apply an equivalent amount of magnesium sulfate or magnesium oxide.

FOLIAR APPLICATION OF NUTRIENTS

Foliar sprays of urea and some minor elements have been very useful under special conditions. Occasionally, a foliar application of urea to apples in an early cover spray has been beneficial when conditions were not favorable for absorption of nitrogen by the tree roots. Epsom salt sprays have helped correct magnesium deficiencies. When minor element deficiencies have been identified, foliar sprays aid in correcting this difficulty in several fruit crops.

The most efficient and economical way to fertilize fruit plantings is to the ground so that nutrients are absorbed by the tree's root system. Complete nutrient sprays have not been found useful for fruit trees. They are not always absorbed. Also, there is possibility of damage when improperly applied, particularly in combination with pesticides, and frequently it is a very expensive method. Foliar sprays are not suggested as a general 'tonic', but only as a means of correcting known nutrient sortages.

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