Fertilizing Stone Fruit (Peaches, Plums, Nectarines, Apricots, Cherries) and Pears

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Excerpts from Fruit Production Recommendations (Publication 360)

General Soil Fertility

It is important to prepare and test soil before planting trees. To ensure long-term productivity of these perennial crops prepare the soil through tillage and adding organic matter, well in advance of planting.

Prior to planting, ensure that nutrient levels and pH are adequate. Test the soil and apply fertilizer and lime if necessary. Preplant applications of phosphorus, potassium and lime are the most effective.

For more information on Tender Fruit production, please refer to OMAF Publication 360, Fruit Production Recommendations.

| Top of Page |

Manure for Orchards

A spring application of manure can be beneficial in providing nutrients and organic matter to established orchards. Manure is of more benefit in cultivated orchards, compared to those in permanent sod, because manure can be easily worked into the soil, making it available to the tree roots. You can also apply manure in the fall to provide nutrients and organic matter prior to spring planting.

Broadcast manure at no more than 7 tonnes/ha of poultry manure (20 m^3 liquid), 40 t/ha of cattle (100 m^3 liquid), or 35 t/ha hog (65 m^3 liquid). As manure is extremely variable in nutrient content, be sure to analyze it before applying. When using manure, reduce the rate of fertilizer.

Nitrogen in manure becomes available over a long time. Perennial crops that have manure applied continue to be supplied with nitrogen during the year. This can be a disadvantage, resulting in:

- poor fruit colour
- excessive terminal growth
- delayed hardening of the woody tissue
- increased susceptibility to winter injury.

Do not place manure around newly planted trees because of potential winter injury problems.

| Top of Page |

pH Requirements

The pH of a soil is a measure of its acidity. If the pH is not at an acceptable level, nutrient uptake and crop

performance can be hindered. Take a soil sample to determine its pH.

Always take a soil sample before establishing a new planting. If lime is required, incorporate it during soil preparation. In established orchards, a soil sample in the tree row is recommended every 3 yr to ensure the pH is satisfactory. If pH is low (acidic), apply lime to the sod cover in the fall, or before cultivation in the spring. The results will not be immediately evident because lime moves slowly into soil.

The preferred pH before establishing a new orchard is 6.5 on sandy soils and 6.0 on clay soils. If the pH in established orchards is above 5.6, lime is not needed. Apply lime to established orchards when the pH on clay loam soils drops below 5.1, and on sandy soils below 5.6. Applying lime to a soil reduces its acidity by raising the pH. It also supplies calcium. Use dolomitic lime (high in magnesium) on soils low in magnesium

| Top of Page |

Leaf Analysis

In established plantings, leaf analysis for tender fruit is the best method of determining nutrient needs. The nutrient levels in these plant tissues most accurately reflect the uptake of nutrients by the crop. Soil analysis is used in conjunction with leaf analysis to determine the nutrient status of the soil and to monitor soil acidity. A combination of both analyses best evaluates fertilizer and lime needs.

Nutrient uptake is affected by many orchard conditions. Consequently, each year nutrient levels vary slightly depending upon the season. In order to obtain optimum growth and fruit quality, adequate levels of all nutrients must be present in the leaves and relative amounts must be balanced.

Even with optimum levels of nitrogen and potassium, poor growth can be attributed to low levels of magnesium, boron, zinc or other micronutrients. These will be reflected in the leaf analysis. Further information is available in OMAF Factsheet Leaf Analyses for Fruit Crop Nutrition, Order No. 91-012. For leaf analysis to be most effective, sample the same trees each year and make adjustments to the fertilizer program on the basis of this leaf analysis.

Fertilizer requirements are adjusted to the system of soil management, tree age, rootstock, soil type and previous fertilizer applications. Growth, fruit size and colour, and storage quality must also be considered in determining fertilizer required.

| Top of Page |

Fertilizer for Non-Bearing Tender Fruit

Prior to planting is the only time elements such as phosphorus, boron and lime can be effectively worked into the soil. Nutrient levels in the topsoil adequate for orchard establishment are 12-20 ppm phosphorus, 120-150 ppm potassium, 100-250 ppm magnesium, and 1,000-5,000 ppm calcium.

If the soil has been prepared properly, including deep cultivation and addition of organic matter, there should be an adequate supply of other nutrients to sustain the tree in the juvenile years. On coarse-textured, infertile soils, the use of a starter solution at planting time (e.g., 10-52-10 or 20-20-20) may give the trees a needed boost. High nitrogen levels can result in excessive growth and incomplete tree hardening.

Use cover crops to check late season growth in cultivated orchards, especially in new plantings. Cover crops such as Italian ryegrass, sown about July 1, take up much of the available nitrogen in the soil and limit tree growth.

On young trees, broadcast the fertilizer under the spread of the branches at least 15 cm from the trunk, since injury can occur if placed too close.

| Top of Page |

Fertilizing Bearing Tender Fruit Trees

Most bearing orchards require annual applications of both nitrogen and potassium fertilizer. These two elements significantly affect growth and productivity.

Do not apply nitrogen in excessive amounts. Late or excessive applications of nitrogen result in poor fruit

colour and quality. Also, available nitrogen late in the season encourages the tree to grow instead of harden off, potentially leading to winter injury.

Using cover crops in cultivated orchards helps to lower the nitrogen level in the latter part of the season. Cover crops, such as Italian ryegrass, sown about July 1, take up much of the available nitrogen in the soil, thus limiting tree growth. In herbicide-treated strips under trees, weed growth late in the season takes up extra nitrogen, helping to harden off trees and improve fruit quality.

Nitrogen (N)
Nitrogen is necessary for many tree functions including growth, fruit bud formation, fruit set and fruit size. Cultivars differ in their nitrogen requirements. A cultivar grown for processing could receive more nitrogen than one for the fresh market. In some situations, if fruit tends to be small, more nitrogen may be needed. Rootstocks, spacing and pruning also affect application rates. If pruning is to be severe, reduce nitrogen rates or eliminate it for a year. Tree growth, foliage colour and fruit colour, quality and storability, nutrient balance in leaves and soil, are also important considerations. Because of the complexity of nitrogen interactions with quality and production, the best guide for nitrogen rates is leaf analysis.

Do not apply urea (46-0-0) to sod orchards since some nitrogen is lost by volatilization. There are several forms of nitrogen available. If there has been fruit bud damage because of severe winter temperatures, it may be necessary to split applications. Apply the 1st application in mid April and the 2nd, if necessary, after bloom in late May. Excessive spring rains leach spring-applied nitrogen. Apply additional fertilizer or foliar sprays after bloom. During dry springs, irrigate to move the fertilizer into the rooting zone of the soil just before 1st bloom or immediately after petal fall.

For fire blight sensitive pear cultivars, use less than the maximum rate of N suggested.

For pear, peach, plum, and cherry orchards where leaf analysis is not available, the following rates are considered normal.

For each year of tree's age, apply between 30-40 g of N. Thus, a 5-year-old tree in sod culture requires 150-200 g of N. The rate for cultivated orchards can be cut by half, as competition for nutrients is greatly reduced. Trees on dwarfing rootstock generally require more nitrogen/ha (not per tree) than trees on more vigorous stocks. When the tree canopy has covered the space available, nitrogen fertilizer requirements level out and do not increase indefinitely with tree age. Again leaf analysis is the most reliable guide.

For all tree fruits do not exceed the maximum rates of 200 kg actual N/ha per year, even in cases of severe deficiency.

Nitrogen Placement and Timing
Apply nitrogen fertilizer in early April. In cultivated orchards broadcast nitrogen under the tree canopy. In sod orchards place the nitrogen in a band under the drip line or in the herbicide strip.

Foliar Application of Nitrogen for Tender Fruit
When weather or crop conditions create a need for additional nitrogen at a critical time, foliar applications of urea (46% nitrogen) have been successfully used on apples. Late applications adversely affect fruit quality and winter survival of the tree. Do not rely on foliar sprays to completely substitute for soil applications if nitrogen is required. There are several formulations of foliar N. In some years, make applications based on tree performance and leaf analysis.

Phosphorus (P)
Phosphorus is not required in large amounts by fruit trees. With few exceptions, the level of phosphorus in Ontario soils is adequate. Phosphorus does have a place for sod or cover crop maintenance. A soil test is the best way to determine if you need to apply this nutrient to sod cover. Without a soil test, a complete fertilizer (100 kg/ha 10-20-20) could be broadcast and incorporated before seeding a cover crop. If indicated by a soil test, apply phosphorus before planting an orchard when it can be thoroughly incorporated in the soil. Phosphorus soil test values between 12-20 ppm are considered adequate for fruit tree establishment and production.

Potassium (K)
Potassium is important for fruit colour, winter hardiness, tree growth and disease resistance (fire blight in pears). An excess amount of potassium can lead to deficiency of magnesium (Mg), so take care when deciding upon potassium rates. Potassium soil test values between 120-150 ppm are adequate when planting fruit trees. Muriate of potash (0-0-60) is the most common form of potassium. If leaf analysis data is not available the following rates can be considered normal.

Trees 1-6 Years of Age Regardless of Density
Apply 50 g K_2O (80 g muriate of potash) per 2.5 cm of trunk cross-section (diameter).

Trees 7 Years of Age or Older
Apply no more than 3 kg of K_2O (5 kg muriate of potash) per mature standard tree in a year, regardless of how severe the deficiency. When the tree canopy has covered the space available, potassium fertilizer requirements level out and do not increase indefinitely with tree age. Again leaf analysis is the most reliable guide.

Placement and Timing
You can apply potassium separately or combined with nitrogen in early spring. Some growers make fall applications because of time constraints in the spring. However, some of the potassium may be lost by leaching over winter. For this reason, apply in spring if possible. In sod orchards, apply potash in a band around the dripline or in the herbicide strip.

Foliar Application of Potassium for Tender Fruit
In dry growing seasons potassium is not readily available to the plant. Foliar applications of potassium may help where potassium deficiency is confirmed.

Magnesium (Mg)
Magnesium deficiency is becoming more evident in orchards, particularly when high rates of potash are used.

Magnesium deficiency can lead to premature drop of fruit at harvest.

Trees deficient in magnesium have older leaves that are pale in colour, as magnesium is a part of the chlorophyll molecule. Leaf analysis is the best way to evaluate magnesium needs.

Foliar sprays of magnesium are effective in correcting this deficiency for the current year only. For more permanent correction, soil applications of magnesium are required. Magnesium soil test values between 100-250 ppm are considered adequate when planting fruit trees.

Fruit or foliage injury is possible from a mixture of pesticides with magnesium sulfate; therefore, apply magnesium sulfate separately or try it on a few trees first. Check manufacturer's label regarding mixing magnesium chelates with pesticides.

For long-term corrections, apply magnesium to the soil, but the response will not likely be immediate. On some soil types a single early spring application of soil-applied magnesium has not worked well. A 2nd or 3rd application the following spring may be required before the magnesium level in the tree improves. To be sure that fruit drop is not a problem during this waiting period, foliar sprays are recommended for the first 2 yr, in addition to soil applications.

For soil corrections, apply 5-7 kg/mature standard tree, and 3-4 kg/mature dwarf tree of sulphate of potash magnesia. This is a granular fertilizer known by several trade names. It contains approximately 21% potash and 11% magnesium. This material is applied in early spring in a band under the tree dripline. It contains potassium (K) and the rate of application depends on potash needs. No further potash (e.g. 0-0-60) is needed, but apply nitrogen at recommended rates. Other sources of magnesium also work well as a soil application. If magnesium is being blended with the fertilizer, apply at least 80 kg of available magnesium/ha when the fertilizer is spread. Use dolomitic limestone on acidic soils to raise the soil pH and to supply magnesium.

Calcium (Ca)
Lack of calcium is associated with fruit problems in pear, and gummosis in European plums and prunes. Some formulations of calcium chloride ($CaCl_2$) result in poor fruit finish if applied too close to harvest.

Calcium sprays must contact the fruit for uptake to be effective; therefore water volumes capable of wetting the entire tree are required. The more calcium applied, the better the control; however excessive calcium can cause foliar burning. Use ($CaCl_2$) (77% flakes) at 4 kg/1,000 L of water from early July to mid-Aug. Apply 3 sprays, 10-12 days apart. Do not apply calcium formulations containing nitrogen after the end of July or fruit quality and storability may suffer.

For all formulations consult label directions for concentrations to use and compatibility with pesticides. The product used is not as important as the total amount of actual (elemental) calcium applied. For example, calcium chloride (77% flakes) contains 28% actual calcium. For acceptable results up to 12 kg/ha of actual calcium is often required in a total of 4 or more sprays. Calcium sprays may injure foliage and fruit if applied during low temperature and wet weather. These conditions delay the drying of the spray. Injury can also occur if calcium is applied in hot (over 25 C) or humid weather.
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| Top of Page |

Micronutrients for Tender Fruits

Deficiencies of micronutrients or trace elements are not widespread in Ontario fruit plantings. The desirable range for micronutrients is quite narrow. More damage is possible if micronutrients are applied in excess rather than from deficiencies. For this reason, do not apply micronutrients to fruit crops unless leaf analysis or visible symptoms confirm a deficiency. Only apply the nutrient that is deficient in sufficient quantities to correct the problem.

Boron (B)
Boron deficiency is perhaps the most common of micronutrient deficiencies. It occurs mainly on alkaline soils (pH greater than 6.5), acid soils (pH 3.5-4.5), dry soils, soils low in organic matter, or on sandy knolls. Boron deficiency has an effect on growth and fruiting.

There is currently no accredited soil test for boron in Ontario. Use a foliar analysis to check for boron deficiencies. Boron levels should be 20-60 ppm. Where a boron deficiency is confirmed, apply boron to soil or in foliar applications of boron to improve boron in plant tissues. There are several sources of boron. Check the manufacturer's recommended rates and timing of applications.

Manganese (Mn)
Manganese deficiency occurs occasionally in fruit growing areas of Ontario. Its occurrence is closely related to weather conditions, particularly rainfall and soil moisture, as well as soil pH. It is most prevalent in wet seasons or with high soil pH (alkaline conditions). In mild cases of deficiency, there is a yellowing of the interveinal leaf areas of young leaves near the shoot-tip. In addition to leaf analysis, use soil tests to determine the status of manganese in the soil. OMAF soil manganese index values greater than 8 should provide adequate manganese to the crop. If manganese is required, apply as a foliar spray of manganese sulphate or chelate. Use manganese sulphate with a spreader sticker. Soil applications of manganese are not effective. Consult manufacturer's label for complete information on rates and timing.

Manganese toxicity
On some peach cultivars manganese toxicity can occur on coarse-textured soils when the soil is very acid (pH below 5.0). The symptoms known as "measles" are raised pimples on the bark underlain by dark brown spots. Other symptoms that may be observed are leaf chlorosis, tip dieback, early leaf abscission, reduced flower bud development and shoot growth. Correction is sometimes possible by adding lime to raise the soil pH. If possible, work into the soil. Prior to orchard planting, sample the soil and add lime if pH is low.

Iron (Fe)
Iron deficiency is also called lime-induced chlorosis. As the soil pH rises over 7, or in heavily-limed soils, iron becomes unavailable to plants. Occasionally, a few plants may exhibit iron-deficiency symptoms. These are often located near the site of previous lime or building plaster storage where the soil pH is abnormally high. Iron deficiency may also occur in isolated parts of the field or on a few individual plants. Iron deficiency causes interveinal chlorosis of new leaves. As the condition becomes more severe, the whole leaf becomes pale yellow. Quite often only one side or one branch of the tree is affected.

Currently there is no accredited soil test for iron in Ontario. Confirm a suspected deficiency with a foliar analysis. Generally, soil applications of inorganic iron sources are not effective in supplying iron to the crop. Iron chelates1 have made correction of iron deficiency relatively easy. These materials can be applied safely as foliar sprays. Consult manufacturer's label for information on rates and timing.

Zinc (Zn)
Zinc deficiency symptoms include short internodes, small narrow leaves, and interveinal chlorosis with shoot and branch dieback. In advanced stages, small, narrow terminal leaves are arranged in whorls or "rosettes." This results in the typical "rosette" and "little leaf" description for zinc deficiency. In addition to leaf analysis, soil tests can be used to determine the status of zinc in the soil. An OMAF soil zinc index value greater than 8 should provide adequate zinc to the crop. Where a zinc deficiency has been confirmed, check manufacturer's recommended rates and timing of applications of zinc products.

Warning: Do Not Concentrate Nutrient Sprays

Related Links

- OMAF Horticulture Crops Newsletters
- Publication 360, Fruit Production Recommendations
- Pub.811 Agronomy Guide for Field Crops: Chapter 2 - Soil Management and Fertilizer Use
- The Phosphorus (P) and Potassium (K) Soil Testing and Fertilizer Recommendation System in

Ontario
- Soil Management and Fertilizer Use: Fertilizer Recommendations: Soil Acidity & Liming
- Sources of Agricultural Limestone
- Publication 611, Soil Fertility Handbook
- Soil Testing
- Soil Management
- Soil and Water Management
- Best Management Practices Order Form
- Micronutrients for Berry Crops
- Lead and Petiole Tissue Analysis

| Top of Page |

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