

Use leaf analysis in July to monitor boron status. Apply 20 lb of borax/acre to the soil (10% B) every 4 to 5 years if boron deficiency persists.

Soil and Leaf Analyses

Soil samples for determining lime and fertilizer requirements should be taken several months before establishing an orchard and retaken every 3 to 5 years. Samples should be submitted in the fall to allow time for treatment before the next crop. Preplant soil samples should be taken to the depth of 8 inches at random across the orchard for a total of 15 to 20 subsamples/acre. Soil samples on established orchards should be taken to a depth of 4 to 6 inches. Leaf samples should be taken every year from July 15 through August 15.

Records of soil, leaf samples, fertilizer applied and production history should be kept on each orchard. These records provide a means for evaluating fertility practices and a basis for making necessary adjustments. For problem diagnosis submit corresponding soil and plant samples from problem areas. Supplies and information for taking samples can be obtained from local agricultural advisors or the laboratory in Raleigh.

**Additional information
can be obtained
from an
NCDA regional agronomist
or the local
Cooperative Extension office.**

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NOTE 16: Apples

Optimal yields of high quality apples depend on establishing and maintaining the proper soil pH and nutrient balance. Since apple production is a long term investment, lime and nutrient requirements should be addressed before planting. Soil testing provides a means for determining the amount of preplant lime and nutrients required to maintain long term production. Plant tissue analysis also provides a means to monitoring the nutrient status and adjusting nutrient applications during the growing season. Used properly, these tools can provide information necessary for successful apple production.

Lime Requirement

Lime recommendations are designed to raise the soil pH to 6.5 for establishment and 6.0 for maintenance. Before establishing an orchard, broadcast the recommended lime, and mix it into the soil as deep as possible. Deep liming is much more effective in neutralizing soil acidity and distributing calcium and magnesium. Lime also contributes calcium necessary to minimize bitter pit.

On established orchards, surface-applied lime is less beneficial and should not exceed 1.0 ton/acre. Lime recommended above 1.0 ton/acre should be applied the following year. Established orchards should be soil tested every 3 to 5 years to maintain the desired pH and nutrient balance.

Both calcitic and dolomitic lime are used in apple production. Calcitic lime is composed of

calcium carbonate (CaCO_3) and contains little or no magnesium. Dolomitic lime is a mixture of calcium and magnesium carbonate (CaMgCO_3) and contains a minimum of 120 lb of magnesium/ton. Dolomitic lime provides an economical source of the calcium and magnesium required for apple production.

Supplementing Calcium

Supplementing calcium on established orchards is essential for minimizing bitter pit and production of quality fruit when leaf calcium is low. Bitter pit can be caused by low soil moisture, low leaf calcium, or an imbalance between calcium and potassium within the leaves. Additional calcium can be soil or foliar applied.

Soil application of gypsum is the most effective way to supply calcium on established orchards. Broadcast 20 to 25 lb of gypsum (CaSO_4) per tree around the drip line 6 to 8 weeks before harvest. Gypsum provides more available calcium within the root zone or subsoil than surface applied lime. However, gypsum is not a liming agent and cannot be substituted for lime to raise the pH. Moreover, gypsum will not correct bitter pit caused by extended dry weather for the current crop.

Foliar application is the most effective way to increase calcium for the current growing season. Apply 3 lb calcium nitrate (CaNO_3)₂ or 2 lb calcium chloride (CaCl_2)/100 gals. Use calcium chloride when tissue analyses show a high nitrogen content. Foliar treatments should be made at two-week intervals starting at first cover spray and ending two weeks prior to harvest. Do not spray orchards when air temperature exceeds 80 °F. If leaf burn is observed, reduce the rate of calcium applied.

Phosphate (P_2O_5) and Potash (K_2O)

Soil-test data show low phosphorus levels in some mountain soils, particularly where

phosphorus has not been applied. For new orchards phosphorus amendments should be incorporated deeply into the soil before trees are set. Deep incorporation enhances root growth and uptake efficiency. On established orchards, however, where incorporation is not practical, surface applications may be appropriate. Since phosphorus does not leach in soils, it will accumulate with time from fertilizer applications and foliage recycling.

In contrast to phosphorus, potassium levels are generally higher in mountain soils due to the presence of natural potassium-bearing minerals. Potassium applied in excess of soil test recommendations can cause competition with calcium uptake and increase the potential for bitter pit. Therefore, potassium application rates should be based solely on soil and plant analysis. Growers should not make blanket applications of high-potassium fertilizers.

Nitrogen Management

Nitrogen affects apple production more than any other nutrient. Excess nitrogen decreases fruit firmness, delays ripening, color development, and causes premature fruit drop. High nitrogen also promotes water sprout and lateral shoot growth, both of which shade productive fruiting branches. Excess vegetative growth also increases pruning costs.

Length of lateral shoot growth is a good indicator of nitrogen supply. When lateral shoot growth exceeds 10 to 16 inches, nitrogen rates may be too high. Soils high in organic matter contribute to the total nitrogen supply and may require less nitrogen. Other factors that determine nitrogen requirement include tree age, severity of pruning and fruit load.

Nitrogen application on bearing tree should be split to prevent over application when frost damage occurs: apply half in winter and the remainder

when the frost date is past and fruit load is determined.

Plant tissue samples taken in mid-July provide the best means for monitoring nitrogen status and determining future requirements. Guidelines for determining nitrogen rates and time of application are shown below.

Establishment (Nonbearing Trees)

Broadcast 1.0 ounce N/year of tree age (6 to 25 lb N/acre) around the drip line 10 to 12 inches from the base until trees begin to bear fruit (generally 3 to 4 years after transplanting). Apply nitrogen in the spring just prior to bud-swell. Nitrogen rates may be altered depending on growth response of the previous season.

Maintenance (Bearing Trees)

Trees producing 10 to 15 bushels require about 1 lb of nitrogen per tree per year (based on 10 trees/acre). For high-density orchards, apply no more than 80 to 100 lb per acre. However, the final nitrogen rate depends on soil organic matter, production history, current fruit load, severity of pruning and shoot growth.

Apply half the nitrogen during winter dormancy and the remainder after the extent of fruit set is determined. Split applications allow an opportunity to reduce nitrogen rates in years when frost damage reduces fruit set.

Leaf analysis is a useful tool for monitoring nitrogen requirements. When leaf analysis shows excess nitrogen, little can be done for the current year, but adjustments can be made in subsequent years.

Boron (B)

Boron is recommended to reduce cork spot. Make a foliar application of Solubor at 1 lb/100 gallons at petal fall or first cover spray. Make sure boron is compatible with other tank mixes.