

## Soil Testing Laboratory

### Soil Test Note 10:

## Commercial Apple Production (Supplement to Soil Test Report)

Your Soil Test Report provides information on the amount of lime required for optimum growth. This Note contains information on apple fertilization as well as a discussion of other factors important in apple production.

### LIME APPLICATION

The best time to adjust the soil pH in new orchards is before the trees are planted. Sufficient lime to bring the pH to 6.0-6.5 can be spread on the surface and plowed under. By plowing the lime down, the soil pH can be adjusted much more rapidly and to a greater depth than by surface application.

### NITROGEN

The optimum amount of nitrogen to be applied is highly dependent on orchard conditions and should be adjusted on the basis of careful orchard observation. Perhaps the best time of year to evaluate the nitrogen status of an orchard is at harvest time. Indications of excessive nitrogen are terminal growth of more than 10-12", delayed and poor coloring of apples, and large, soft apples. Fruit from such blocks will have a reduced storage life, as well as inferior quality at harvest. Some blocks of trees which have not received nitrogen for several years may have these characteristics but that is unusual. Deficient nitrogen will cause reduced

vegetable growth, with small, hard apples which color early for the variety.

A rule of thumb for nitrogen application for mature trees is 20 to 40 pounds of elemental nitrogen per acre. The following amounts of various fertilizer materials will supply these nitrogen rates: calcium nitrate (15.5-0-0), 130-260 lbs; nitrate of soda (16.5-0-0), 120-240 lbs; ammonium nitrate (33-0-0), 60-120 lbs; or urea (45-0-0), 45-90 lbs. If a broadcast application is made for the sod cover, then no additional nitrogen is needed during the year.

Foliar applications of nitrogen may be made to trees which were not fertilized or which show lighter leaf color than is considered desirable. Four lbs or urea per 100 gallons of water is recommended for trees after bloom. This should not be applied after the first or second cover sprays because of the possibility reduced color of fruit.

As various orchard operations are changed, the nitrogen fertilization program should be adjusted accordingly. When herbicides are applied or cultivation is used to control competing vegetation, rates of nitrogen application should be reduced. By eliminating competition for nitrogen, the trees will receive a greater portion of the amount applied.

The increasing use of mechanical pruning has also complicated the nitrogen situation.

When severe pruning of any type is done, there is a decreased need for nitrogen once the top of the tree had been reduced in relation to the root system. Because an apple tree has a sizeable nitrogen storage capacity, the fertilizer application should be reduced or eliminated the year prior to severe pruning as well as the year following. Unless this is done, the symptoms of excessive nitrogen are very likely to occur. It is much more desirable to prevent this situation than to try to alleviate it.

### PHOSPHORUS, POTASSIUM

As a general rule, there is little or nothing to be gained by fertilizing apple trees with either phosphorus or potassium in Virginia. Although no harm is likely to result, beneficial effects are quite unlikely. Phosphorus and potassium may, however, be needed for the sod.

### BORON

Boron, a micronutrient, is necessary in small amounts. Boron-deficiency corking has been common over the years and seems to be worse in dry seasons. The symptoms include corky areas in the flesh of the fruit, often concentrated around the core area. The symptoms vary among varieties but are quite distinct from those of cork spot and bitter pit.

When the symptoms become apparent in a particular year, it is too late to remedy the problem. Therefore, the best procedure is to prevent the disorder by either ground or foliar applications.

- 1. Ground Application of Boron.** (NOTE: To avoid injury, do not use ground application of boron on trees less than 3 years old. Do not apply boron at rates higher than recommended or near the trunk of young trees.) If boron is not applied as a spray it may be applied once every three 3 years. The easiest method of soil application is broadcasting by machine, covering the entire soil surface. Equivalent boron application rates are as follows:

Material	Lbs/Acre*
Agricultural Borax (11.6% B)	30
Borate 46 (14.3% B)	24
Borate 65 (20.2%)	17

\*Rates are designed to give the equivalent of approximately 3.5 pounds of boron per acre.

If boron is applied by hand, apply in about a 4' band at the drip line of the branches on older trees or in a band at a distance of 3 to 6' from the trunk of young trees. Apply on the basis of tree age or trunk diameter if applied by hand. Rates in ounces per tree are:

Tree Age	Trunk Diameter		Ounces of Borate 46	Ounces of Borate 65
	or 1 Ft. Above Ground, Inches			
1-3			0	0
4-6	3 1/2		1 1/2	1
7-9	5		3	2
10-12	7		4	3
13-15	10		6	4
16-25+	14-15+		7-11	5-8

Preferably apply soil applications of boron in November or December. It may be applied in January to March but the later the application, the lower the availability of boron to the tree in the first growing season after application. If a soil application of boron is made in February or March, to help increase boron availability for that growing season, a spray of soluble boron is desirable in the bloom/petal-fall period.

**2. Foliar Application of Boron.** Two early-season soluble boron sprays, applied to trees of any age, may replace the need for a soil application of boron. Do not apply more than one soluble boron spray if boron has been applied to the soil during the previous fall or winter. Use the equivalent of 1.0 pound of Solubor (20% boron) per 100 gallons of dilute spray in each of two sprays applied during the full bloom, petal-fall, or first-cover spray periods. Soluble boron may be added to the spray tank with the regular pesticide spray.

## CALCIUM

Low levels of calcium in apple fruits have been related to certain physiological disorders such as bitter pit and cork spot. Information on calcium application is found under the discussion of each of these disorders below.

## BITTER PIT

Unlike cork spot, which is present in Virginia apple orchards before harvest, bitter pit does not usually develop until after the harvest. Bitter pit is evident as small, brown, soft pits of collapsed tissue. Most of the pitting is just beneath the apple skin and primarily in the blossom half of the apple.

A spray program for bitter pit often will not provide the degree of control desired without a modification of tree condition. Early harvest increases bitter pit. Bitter pit development is largely the result of low calcium in the peel area of apples. It is difficult to increase the calcium supply to the fruit. However, application of calcium sprays before harvest reduces bitter pit.

To reduce bitter pit, use 3.0 to 4.0 pounds of calcium nitrate or 2.0 to 2.5 pounds of calcium chloride per 100 gallons of water, plus a wetting agent. Make four or five applications at 2-week intervals, starting 8 to 10 weeks before picking time. Make certain that each spray coverage is thorough, wetting the entire surface of the apples. Use of concentrate sprays of calcium may reduce response and may cause leaf injury.

Calcium nitrate or calcium chloride has been added to most pesticide mixtures without compatibility problems. To obtain such a spray, add the pesticides first, then the wetting agent, and then the calcium. Keep the tank mixture agitated while adding the calcium. Apply the spray preferably under good drying conditions. Do not apply it when the air temperature is greater than 85°F. Use calcium chloride on Yorks or Mutsu because calcium nitrate may cause fruit surface injury.

## CORK SPOT

Cork spot of apples is occasionally a problem in some blocks of trees. Cork spots are small to large brown spots of dead cells located near the surface or deep in the apple flesh. The spot area is formed than the surrounding flesh. The spot area is firmer than the surrounding flesh. Cork spot forms during the growing season and does not develop after harvest.

An adequate level of boron and calcium in the fruit early in the season helps reduce the severity of cork spot later in the growing season. While adequate boron in the fruit will help reduce cork spot, it cannot control it. Where cork spot has been a problem, use two soluble boron sprays. Follow the recommendations under “Foliar Application of Boron.”

Low calcium levels in apple fruit greatly increase the amount of cork spot. Calcium sprays increase fruit calcium content and aid in the reduction of cork spot. If calcium sprays are needed, apply them in at least the first four cover sprays or, preferably, on all of the cover sprays. Use 2.0 to 2.5 pounds of calcium chloride per 100 gallons. Use a wetting agent to aid on spreading and sticking. Add calcium chloride last to the spray tank. The use of calcium in concentrate sprays has occasionally caused leaf injury and reduced response. Do not apply a calcium spray if air temperature is above 85°F.

In blocks with a history of cork spot, fruit calcium levels may be so low that sprays are ineffective. Cultural practices should then be modified in order to reduce the development of the disorder.

## SOIL MANAGEMENT CONSIDERATIONS

It is desirable to maintain a permanent sod in a bearing apple orchard. Quite commonly, this soil management system may be supplemented by herbicides in the tree row. Because of the somewhat different needs of the sod and trees, it is recommended that they be fertilized separately. A general rule of thumb for maintaining a good sod is to use approximately 300-400 pounds per acre of a 10-10-10 fertilizer broadcast every third year. If the sod cover shows plenty of vigor, this rate can be reduced or the interval between applications extended. Whereas an apple tree will generally not respond to either phosphorus or potassium, a sod cover commonly will. In a year when this broadcast application is made, no additional nitrogen should be applied to the trees.

## ADDITIONAL INFORMATION

For more information, consult *Training and Pruning Apple Trees*, Virginia Cooperative Extension (VCE) publication 422-021 at [www.ext.vt.edu](http://www.ext.vt.edu) or contact your local VCE office.

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