



## Soil Test Note No. 2 – Field Crops

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### Lime

Most Virginia soils are acidic and require lime applications at three- to five-year intervals. Maintaining the correct soil pH has several benefits, such as encouraging healthy root development and making sure nutrients in the soil are available to the plant. For example, low pH can cause aluminum toxicity and can decrease phosphorus availability.

### Time of Application

The best time to apply lime is several months ahead of planting. This allows for more complete reaction of the lime with the soil. If this cannot be done, apply the lime as far ahead of planting as possible. Failure to apply lime because it could not be applied at the best time is worse than not applying it at all.

### Tilled Soils

In general, the best method of lime application is one that mixes the lime most completely with the soil to the plow depth.

### Application of 2 Tons or Less per Acre

This entire rate should be applied to the soil in a single application and then disked or plowed into the soil. Lime applied after plowing should be disked into the soil as thoroughly as possible.

### Application of More Than 2 Tons per Acre

For best results, apply one-half of the lime, disk it into the soil or plow it under, and then apply the remaining

amount and disk it into the soil. This method offers the best incorporation of lime into the soil, which is particularly important when the soil pH is very low and large amounts of lime are needed.

### No-Till and Forages

For no-till cropping systems where incorporation of lime is not possible, a greater effort should be made to do frequent small applications of lime, rather than occasional heavy applications. This is because lime moves slowly in soils and primarily neutralizes acidity in the zone where it is applied. Single applications should be limited to no more than 2 tons per acre. Where more than 2 tons per acre are recommended by a soil test (indicating very low soil pH), lime should be incorporated as described above for best results. If incorporation is not feasible, apply one-half the total amount as soon as possible and the other half six to 12 months later.

### Nitrogen

#### Corn, Grain Sorghum

Nitrogen (N) fertilizer should be applied as close as possible to the time when the crop will take it up because the plant-available form (nitrate) is poorly held by soils. Nitrate can be lost from soils by leaching or denitrification. Part of the N should be applied at planting and the remainder applied as a side dressing when the corn is 12 to 24 inches tall. In some instances, the second application to corn may be reduced in soils with a history of manure or biosolids applications or following a legume, such as alfalfa. This can be assessed by the pre-sidedress soil nitrate test (PSNT), as detailed in Virginia Cooperative Extension publication 418-016,

“Nitrogen Soil Testing for Corn in Virginia” (available at [pubs.ext.vt.edu/](http://pubs.ext.vt.edu/)). Alternatively, nitrogen can be applied with the phosphate and potash if done close to planting.

## Phosphate, Potash

The recommended phosphate ( $P_2O_5$ ) and potash ( $K_2O$ ) fertilizer can be broadcast and incorporated into the soil by plowing or disking where possible, or it can be applied in a starter band as detailed below. Application can be made either in the fall or in the spring before planting because neither nutrient is very mobile in the soil (that is, low leaching potential).

For small grain-soybean or small grain-grain sorghum double-crop rotations, phosphate and/or potash fertilizer should be applied before the small-grain crop to permit incorporation of the fertilizer into the soil and to facilitate timely planting of the summer crop. For corn-peanut rotations, the phosphate and potash should be applied and incorporated before the corn crop to avoid high concentrations of potash in the peanut pegging zone.

## Starter Fertilizer

Starter fertilizer is fertilizer placed in a band alongside or in direct contact with the seed. Using a starter fertilizer concentrates the plant nutrients near the seed for easier uptake by young plants with limited roots. Starter fertilizer can be especially beneficial when planting in cold and/or wet soils. Slow root growth in cold and/or wet soils, which occurs when planting early, reduces plant access to the fertilizer nutrients required for optimum growth. Crop response to broadcast fertilizer is unlikely in soils testing very high in phosphate and/or potash. Likewise, research conducted in Virginia demonstrated that no grain yield responses will be expected to starter fertilizer when soil-test phosphorus (P) and potassium (K) levels are in the very high range. On high-, medium-, and low-testing soils, applying P as a starter is a good way of supplying part or all of the P that is needed by the crop.

For band placement, be certain that the fertilizer placement attachment on the planter is properly positioned and that all openers are placing the fertilizer band at least 2 inches from the seed and approximately 2 inches below the seed. Any error in placement must be farther

from the seed rather than closer than 2 x 2 in order to prevent salt injury to the emerging seedlings.

Rates for starter fertilizer applications are 20 to 60 pounds of nitrogen plus (+) potash per acre for band placement or 10 to 15 pounds of nitrogen plus (+) potash per acre for seed contact placement (for example, 50 lbs/A of 6-24-24).

## Trace Elements

Deficiencies of the trace elements listed below have been found in the following field crops in Virginia:

- Zinc – corn, small grains, and grain sorghum.
- Manganese – soybeans and peanuts. (Manganese and copper deficiencies have been documented in small grains, but there are no soil test calibrations for determining these deficiencies.)
- Boron – peanuts and cotton.
- Molybdenum – soybeans.

There is reliable interpretation of soil tests for zinc and manganese. However, soil tests have not been found to be a reliable predictor of field crop response to molybdenum or boron. Experiments conducted with corn throughout Virginia showed that boron fertilizer did not increase yields, although the boron soil test in all locations was low, according to standards being used by some soil testing labs. This indicates that the soil boron test is a poor predictor of corn yield response. Where trace-element deficiencies have been reported but no reliable soil tests are available, a general recommendation is made by the Virginia Tech Soil Test Laboratory for the trace element in question.

## Winter Annual Legumes as a Nitrogen Source

Winter annual legumes can be used to supplement fertilizer N in the crop rotation in addition to their other values as cover crops. Legumes have the ability to fix or utilize N from the atmosphere to supply their nitrogen needs. When they decompose, legumes release this N into the soil, and it becomes available to the next crop in the rotation.

Three winter legumes with high N-supplying potential in Virginia are crimson clover, Austrian winter peas, and hairy vetch. When seeded in August to early September and allowed to grow well into the spring, these legumes will provide about 80 pounds of N per acre to the spring-planted crop. If planted late or killed before spring growth can occur, 40 to 50 pounds of N can be available to the following crop because the legume will produce less N-containing biomass. This option should be considered where a cover crop is needed, but establishing winter legumes for the sole purpose of supplying N may not be economical. Compare the cost of establishing the legume with the expected return in N fertilizer. Mixtures of legume with grasses or other non-legumes can also be expected to supply N to the following crop, but the amount depends on the proportion of the legume in the cover crop stand and the maturity of the cover crop mix.

Several precautions should be taken when growing these legumes as an N source.

- Crimson clover should be planted early (August) because it is susceptible to winterkill if planted late. Severe winters can cause stand reduction even if established early.
- Crimson clover should not be planted on poorly drained soils.
- The range of hairy vetch use is limited because the hard seed may become a volunteer weed in subsequent small-grain crops.
- In areas where few small grains are grown or where this is not a major concern, hairy vetch can be a useful cover crop.
- Some legumes, such as Austrian winter peas, are susceptible to significant damage due to grazing by deer.
- Winter annual legumes should not be used in rotations with peanuts because they can serve as a host for diseases that affect peanuts.