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# Liming Needs of Kentucky Soils

William O. Thom

University of Kentucky, [wthom@uky.edu](mailto:wthom@uky.edu)

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Department of Agronomy

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## Liming Needs of Kentucky Soils William O. Thom

A sound liming program is the first step in building and maintaining soil fertility. Lime lowers the acidity (raises pH) of soil and prevents the adverse effects of high concentrations of soluble aluminum, iron, and manganese on crop growth--effects often associated with acid soils. Maintaining a suitable pH assures adequate levels of calcium and magnesium. Liming an acid soil increases the availability of most essential plant nutrients, increases the efficiency of fertilizers, improves the effectiveness of some herbicides, and makes beneficial soil organisms more active.

### Why Soils Become Acid

It is a natural tendency of most Kentucky soils to become more acid with time due to losses of bases (calcium, magnesium, potassium, and sodium), which are removed by leaching, soil erosion, and crop removal. These bases are replaced by the acid elements, hydrogen and aluminum. In some areas, erosion of the surface soil exposes the underlying subsoil, which may be more acid. Use of nitrogen fertilizers, particularly high rates of ammonium fertilizer or any material that forms ammonium in the soil, contributes to soil acidity when converted to nitrate by nitrifying bacteria. The amount of pH decrease will depend on amount of ammonium applied from fertilizers, manures, or organic wastes.

### Measuring Soil Acidity

Soil acidity is an indication of the amount of hydrogen present. pH is a measure of hydrogen, and each unit change represents a 10-fold change in hydrogen concentrations. Hydrogen occurs in the soil solution and in an exchangeable form on the cation exchange complex. Soil water pH is measured from a slurry of distilled water and soil. This reflects the hydrogen in solution surrounding plant roots and soil particles but does not measure that held on the cation exchange complex. In the past few years a "buffer pH" test has been developed to measure both soil solution hydrogen and exchangeable hydrogen. The buffer pH value should not be confused with the water pH value since they represent two entirely different things. Water pH represents the acidity of soil water surrounding plant roots, while "buffer pH" is an index of the amount of acidity which can be released from the cation exchange complex when the acidity in soil solution is neutralized. The "buffer pH" is used to more accurately estimate lime recommendations. The UK soil testing laboratory determines "buffer pH" on all soil samples that have a water pH below 6.0.

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### Soil Sampling for Lime Needs

The first step in determining lime needs is to take a good, representative soil sample. In sampling, one should divide the fields into uniform areas according to past management and soil type. Sample problem areas separately from the rest of the field since combining problem areas with more normal areas will result in erroneous lime recommendations. Severely eroded areas should be sampled separately from uneroded areas. In no-till fields or on permanent pastures where an acidic soil surface layer may develop, the sample should be taken only from the upper 3 to 4 inches. All other cropping conditions should be sampled to a depth of 7 inches.

### Lime Application

For conventional tillage, lime should be applied ahead of primary tillage and soil sampling should be done far enough in advance to allow this. Usually, this allows ample time for the lime to react with the acid soil before the crop begins to grow, especially when it is thoroughly mixed with the soil. Topdressing with lime for forages, pastures, or continuous no-till can be done any time following the soil test. Action of the lime may be slower than if mixed with the soil; but, in no-till, most of the acidity is located near the soil surface and will be neutralized adequately by topdressing.

### Lime Quality in Kentucky

Lime quality is based on its effective calcium carbonate equivalent (ECCE) and its fineness. Kentucky law requires that agricultural limestone have 80% ECCE and 90% of the material must pass through a 10-mesh screen and 35% must pass through a 50-mesh screen. The Kentucky Department of Agriculture's Division of Weights and Measures is responsible for sampling lime and regulating the state's lime law. A lime suspension (liquid lime) is fast acting but usually of shorter duration than ground limestone (ag lime). Ground limestone lasts for 3 to 5 years but more frequent applications may be required if a lime suspension is used.

### Lime Needs in Kentucky

Soil samples sent to the University of Kentucky soil testing laboratory indicate that about 50% need lime with an average recommendation of 2.75 tons per acre. Total lime needs for the state are about 5 million tons annually while currently only about 2 million tons are being applied each year to agricultural land. Economic analysis indicates that lime is one of the best investments a farmer can make to increase soil productivity.