UK COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY — COLLEGE OF AGRICULTURE

Determining the Quality of Aglime: Using Relative Neutralizing Values

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Most Kentucky soils need to have lime applied in order to keep the pH in the optimum range for growing crops. Lime applications should always be based on a good soil test that takes into account the existing pH and the buffering capacity of the soil. However, even when all this is done and lime is applied as recommended, the desired change in soil pH may not occur. The problem may be due to the use of low quality lime.

Agricultural limestone in Kentucky is tested by the Department of Agriculture for purity and fineness of grind. This gives three values (one for purity and two for fineness) that make it difficult to compare the relative effectiveness of different sources of lime. This publication discusses the use of Relative Neutralizing Values (RNV), which is a method of combining the three values determined by the Department of Agriculture into a single value that can be used to compare the effectiveness of lime from different sources.

Purity

One factor affecting the ability of lime to neutralize soil acidity is the amount of calcium and magnesium carbonates it contains. The test used in Kentucky combines the two and is expressed as calcium carbonate equivalent (CCE). The minimum CCE to qualify as ground agricultural limestone in Kentucky is 80%. This means that at least 80% of the material could dissolve and neutralize soil acidity. Some limestone that is very pure and contains significant amounts of magnesium carbonate can have a CCE greater than 100%. This is because magnesium carbonate can neutralize more acidity than calcium carbonate. Clay, sand, organic matter, or other minerals present in limestone rock dilute its purity, leading to low CCE lime.

Fineness

Since limestone rock is slow to dissolve, it must be ground very fine to be effective as a liming material for soil. In order to effectively neutralize soil acidity, aglime should be fine enough to dissolve within four years after application. Fineness of aglime is determined by sieving it through screens of known mesh size (mesh is rated according to the number of openings per linear inch of the screen). The Kentucky lime law requires that aglime be ground fine enough that 90% will pass through a 10-mesh sieve and 35% through a 50-mesh sieve.

How quickly lime of different particle sizes dissolves in the soil is illustrated in Table 1. It shows that very little of the particles larger than 8 mesh dissolved in four years, while all of that passing a 60-mesh screen dissolved in one year. Based on this and other data on lime dissolution rates, the effectiveness of Kentucky aglime over a four-year period was estimated as:

Table 1. Solubility of ground limestone based on particle size (% dissolved).[1]

Size of Particles	Years after Application	
	One	Four
Coarser than 8 mesh	5	15
8 to 30 mesh	20	45
30 to 60 mesh	50	100
Finer than 60 mesh	100	100

[1] NCSA Aglime Fact Book

Particle Size	% Effective Material
Larger than 10 mesh	0
Between 10 and 50 mesh	50
Less than 50 mesh	100

Relative Neutralizing Value of Aglime

The percent of effective material in lime based on particle size can be combined with lime purity values to calculate the overall quality of aglime. The term used in Kentucky for this calculated lime quality is Relative Neutralizing Value (RNV). RNV is calculated using the lime purity value (CCE) and fineness values for percent less than 50 mesh and percent between 10 and 50 mesh. The equation used is:

$$RNV = CCE/100 \left[\frac{\%\text{ between 10 and 50 mesh}}{2} + \%\text{ less than 50 mesh}\right]$$

Where CCE is % Calcium Carbonate Equivalent.
The amount of particles between 10 and 50 mesh is divided by two because it is only half as effective as those smaller than 50 mesh.

Since the values reported for lime fineness are the percentage passing 50 mesh and the percentage passing 10 mesh, the equation can be modified as:

RNV = CCE/100 [0.5 (% passing 50 mesh + % passing 10 mesh)]

For aglime with a CCE of 90% and with 95% passing a 10-mesh sieve and 40% passing a 50-mesh sieve, the RNV would be calculated as follows:

RNV = 90/100 [0.5(40 + 95)] = 0.9 [0.5(135)] = 60.75

The RNV of aglime with the minimum requirements of 80% CCE, 90% passing a 10-mesh sieve, and 35% passing a 50-mesh sieve would be:

RNV = 80/100 [0.5(90 + 35)] = 50

Some high quality sources of aglime may have an RNV of 100 or slightly higher. It would take only half as much of the high quality lime to be as effective as the lime with a 50 RNV. Therefore, lime rates should be adjusted based on the quality of lime to be used.

Using RNV to Adjust Lime Rates

The current lime recommendations made by the University of Kentucky College of Agriculture are based on using lime with an RNV of 67. If the source of lime to be used has an RNV substantially different from this, the recommended rates should be adjusted. For practical purposes, adjustments should be made in 1/2-ton increments. The equation to be used is:

Adjusted Rate = (67/Lime RNV)(Lime Recommendation)

Example 1.
A field has a lime recommendation of 3 tons per acre. The lime to be used has an RNV of 85.

Adjusted Rate = (67/85)(3) = 2.36 tons per acre $\Rightarrow$ 2.5 T/ac

Example 2.
This field also has a lime recommendation of 3 tons per acre. However, the lime to be used has an RNV of only 55.

Adjusted Rate = (67/55)(3) = 3.65 tons per acre $\Rightarrow$ 3.5 T/ac

Example 3.
The lime recommendation for a lawn is 150 pounds of lime per 1,000 square feet and the lime to be used has an RNV of 90.

Adjusted Rate = (67/90)(150) $\Rightarrow$ 112 pounds/1000 sq. ft.

Using RNVs to Compare Lime Costs

The first two examples shown above can be used to illustrate the differences in cost to lime a field. The following equation can be used:

Cost of lime per acre = (Lime Price)(Adjusted Rate)

If we assume the price of lime in Example 1 was $12 per ton and Example 2 was $10 per ton, the cost of each would be:

Example 1.
Cost of lime = ($12)(2.5) = $30 per acre

Example 2.
Cost of lime = ($10)(3.5) = $35 per acre

Therefore, the cost per acre of using the lime in Example 2 was $5 more than Example 1 even though the price of lime in Example 1 was $2 more per ton. This was the result of needing 1 ton more of the lime in Example 2 to get the pH change needed.

Where Can RNV Be Found?

County Extension Agents for Agriculture receive reports of aglime quality two times each year. These reports are prepared from the tests conducted by the Kentucky Department of Agriculture, Division of Regulation and Inspection, each spring and fall. County Extension agents can assist in adjusting lime rates based on RNV of the sources of lime available in their area.

Making it Easy!!!

A lime calculator is available on the University of Kentucky Regulatory Services Soils Web page at:

http://www.rs.uky.edu/soils

Select “Calculators” and “Econ Lime” to access the lime calculator. It can be used to calculate an adjusted lime application rate based on RNV of the lime to be used. It will calculate cost per ton of effective lime and cost per acre at the adjusted rate. The most recent lime quality report can also be found at this site.

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