

# Attend to lime

Reduced tillage systems can create new challenges in pH management

By Karl Czymmek and Quirine Ketterings

**Many dairy farmers are shifting** to reduced tillage cropping systems with excellent results. They're seeing long-term benefits through reduced soil erosion, improved soil structure and drainage, and improved soil health.

For farmers who choose not to plow at all and strip- or zone-till corn followed by minimum-till or no-till seedings of hay, pH management is something to keep an eye on. This is particularly true if soils require regular additions of lime. Here's why.

Primary tillage, done by plowing, mixes most or all of the top 6 to 8 inches of soil, and it usually leads to fairly uniform nutrient and pH distribution in that layer. However, farms virtually eliminate this mixing process when they plant corn using strip- or zone-till methods and establish new seedings with little or no tillage.

With shallow, surface mixing in these systems, nutrients and organic matter start to accumulate in the top 1 to 2 inches of soil.

Traditionally, pH adjustments are made in the fall or spring before high pH-loving crops like alfalfa are planted. When a liming material such as calcium carbonate or magnesium carbonate is added to the soil, the carbonate separates from the calcium and magnesium. These replace the hydrogen and aluminum attached to soil particles, releasing them into the soil.

The carbonate then reacts with the hydrogen and aluminum to form neutral compounds, resulting in a higher soil pH. Mixing the lime well within the soil improves the rate of reaction and raises the pH relatively quickly. Here is the basic rule: If the lime has the correct range of particle sizes or fineness, which is regulated by law in many states, pH will be raised from, say, 6.2 to 6.7 in about six months.

Cations like calcium and magnesium will eventually return to the soil solution and move slowly down into the soil profile over time as water percolates. Plowing tends to redistribute the cations through the whole layer.

Under minimum or no-tillage systems, the surface inch of the soil may become acid more rapidly than the original plow layer. Since this is the seed placement zone, you should determine the pH val-

ues of two soil layers: 0 to 1 inch and 0 to 6 inches.

We suggest monitoring pH of the surface zone separately from the 0- to 6-inch sample, recommended for no-till, at least once every three years. Do this especially the year before a new seeding with legumes or other pH-sensitive crops.

You don't necessarily need a separate lab analysis of the two. The Cornell pH test kit is only \$15, simple to use and allows you to determine the pH of the soil within 0.2 pH units.

If the pH of the surface layer is low but the pH of the 0- to 6-inch sample is adequate for the crop, add 1 to 1.5 tons of lime per acre to raise the surface pH. If the surface and the 0- to 6-inch layers are strongly acidic, don't no-till a legume seeding until lime has had six to nine months to react with the soil. If you must establish a stand that year, you can do tillage, but it will set back no-till benefits.

If the surface layer pH is adequate but the 0- to 6-inch layer has a lower pH, you may no-till legume seedings with less waiting time but not without some risk of problems. Ideally, if you plan to rotate from corn to alfalfa in a reduced tillage system, determine lime needs and apply the lime to the last year of corn to ensure proper pH for alfalfa seeding.

## Liming tips

Keep in mind these quality standards used to differentiate liming materials: Calcium Carbonate Equivalence (CCE), fineness and Effective Neutralizing Value (ENV).

- CCE compares the liming material to pure calcium carbonate ( $\text{CaCO}_3$ ). CCE values must be adjusted for the fineness of the material since larger particles take longer to change the pH. In New York, a liming material must have a CCE of 60% or greater. At least 80% must pass a 20-mesh sieve, and 30% must pass a 100-mesh sieve.

- ENV is calculated by multiplying a liming material's CCE and its fineness. Most lime sources are not exactly 100% ENV, so a calculation must be made for your specific lime source to get the correct lime rate. If you're to apply 3 tons of lime and the ENV of your lime source is 85, you need to apply  $3/0.85 = 3.5$  tons per acre. ■

## FYI

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- For the Cornell pH test kit, see this website: [www.css.cornell.edu/soiltest/newindex.asp](http://www.css.cornell.edu/soiltest/newindex.asp) or contact your local Cornell Cooperative Extension office.

- Find Cornell Agronomy Fact Sheets on pH management and liming at <http://nmsp.css.cornell.edu/publications/factsheets.asp>:

- For more information, access "Lime Guidelines for Field Crops in New York" at this website: <http://nmsp.css.cornell.edu/publications/articles/extension/Limedoc2006.pdf>