K-STATE Research and Extension | Wildcat District

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The Time to Lime

Fall is a great time to tackle farm tasks, including applying lime to pastures and crop fields. Most farmers understand the importance of maintaining proper soil pH, but what's less understood is the causes of soil acidity, how lime works, and how long it takes to correct acidic soils. Liming isn't an optional extra. Like nitrogen, phosphorus, and potassium, proper soil pH is essential for crop production. Most crops perform best in slightly acidic soils, generally between pH 6.4 and 7.0. Within this range, essential nutrients are readily available to plants. As soil becomes more acidic, nutrient availability declines, and crop yields can suffer.

At a certain point in soil pH the yield loss is not just the reduction of available nutrients, but the aluminum in soil begins to become toxic. When the pH gets into the mid-5s, the aluminum in the soil changes into a form that most plants can't help but adsorb in huge quantities. The aluminum becomes so plant available; it becomes toxic.

In southeast Kansas, K-State has recommendations for lime when soil pH falls below 6.4. Much of the cost of lime is in the hauling and application, rather than just the cost of the lime itself. Application rates vary depending on soil conditions, lime quality, and incorporation depth. A soil test is the best way to determine how much lime is needed. For fields that haven't been limed in several years, I recommend grid sampling or detailed management-zone testing. Soil pH can vary considerably within the same field.

What Causes Soil Acidity?

Soil acidity develops through both farming practices and natural processes. Nitrogen fertilizers, particularly those containing ammonium or those that form ammonium in the soil, gradually increase soil acidity. Other contributors include decomposing organic matter, natural weathering and leaching, and rainfall, which can be slightly acidic as well.

Southeast Kansas soils are naturally prone to acidity because of their age and relatively high rainfall. However, our clay-rich soils also have a high buffering capacity, meaning they resist rapid changes in pH. Think of clay like a microscopic puff pastry, with layers that hold positively charged nutrients and other ions. This gives our soils a high cation exchange capacity (CEC). As a result, they may resist acidification longer than sandy soils, but they also generally require more lime to raise their pH.

How Does Lime Work?

Agricultural lime, primarily calcium carbonate, neutralizes soil acidity through a chemical reaction. The carbonate reacts with acidity to form water and carbon dioxide, while calcium helps replace acidic ions held on soil particles. However, lime doesn't work overnight. Fine particles react within the first couple of weeks, while larger particles may take months or even years to fully react. Moisture, particle size, soil acidity, and incorporation all influence how quickly lime works. This is why fall is an excellent time for lime applications. It allows more time for the material to react before spring planting.

It's also important to understand that soil pH tells us whether lime is needed, while buffer pH helps determine how much lime to apply. Because much of the soil's acidity is held on clay and organic matter rather than in the soil solution, two fields with the same soil pH may require very different lime rates.

Soil pH Changes Throughout the Year

One frustrating aspect of managing soil pH is that it isn't constant throughout the year. As shown in the Cornell research (Figure 1), soil pH can fluctuate with seasonal moisture and temperature conditions. For example, a field testing at pH 6.1 during a wet winter could test closer to 5.8 during a dry summer. Soil sampling at approximately the same time each year helps provide more consistent results. These seasonal fluctuations, along with natural variation across a field, are important when evaluating lime needs.

My Recommendation

If field conditions allow, take soil samples this fall. If it has been 8 to 10 years since your last lime application, particularly on fields with a history of fertilizer use, consider grid sampling or detailed management-zone testing to better identify areas needing attention. Due to our high pH and field variability in this area, I recommend a soil test represent no more than 20 acres. For southeast Kansas, I recommend evaluating fields for lime when pH falls below 6.4, with particular attention to areas below 6.1. Use soil test recommendations to determine application rates rather than relying on a blanket rate for the entire field.

Incorporating lime generally accelerates the reaction and distributes it more deeply into the soil. However, surface applications are still beneficial in established pastures and no-till fields, where lime gradually reacts near the surface and moves downward over time. Remember, liming is a long-term investment in soil fertility, so don't wait until soil acidity is already limiting production.

If you have questions about liming your crop fields or pastures, contact any Wildcat Extension office or call the Girard office at 620-724-8233.

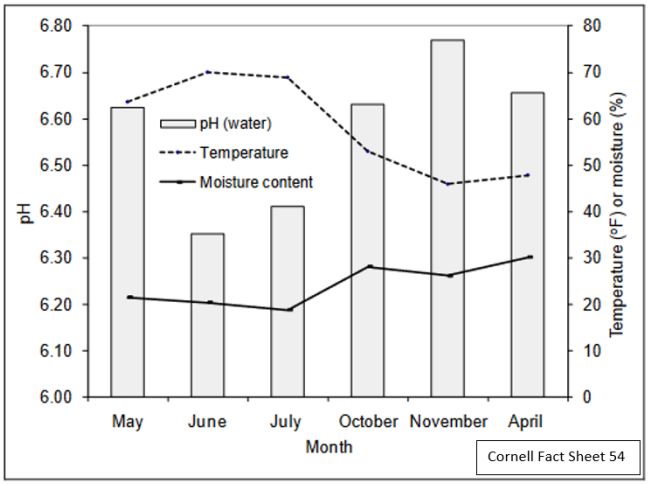


Figure 1: Soil pH tends to be lower in the warmer and drier summer months than in the rest of the year.

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