Lime cost affects the economics of nitrogen use

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If you are not getting the cool-season forage production that you expect, low pH is a likely culprit. Farmers in the Southern Great Plains typically apply significant quantities of ammonium-based nitrogen (N) on their cool-season cereal forages – forages that are commonly grazed by stocker cattle. This practice has been shown to acidify the soils over time. Lime is typically recommended and used to return the health of the soil back to the ideal pH range (6.0 to 6.5) for optimal production; however, applying lime to the soil is expensive. Recommendations about the optimal levels of N to apply to cereal forages typically ignore the cost of lime. In response to this issue, we conducted an economic study to determine the effect of considering the cost of lime on the current recommendations about the optimal level of N.

A long-term agronomic experiment conducted at the Noble Foundation’s Red River Farm near the community of Burneyville was used to establish the effect of liming, N fertilization rate and timing of application, and soil pH dynamics on mixtures of rye-ryegrass pasture. Mixtures of rye-ryegrass were planted each year in early fall at a seeding rate of 10 pounds per acre. Six treatment levels of N were applied as (1) a single application in the fall at the time of planting; (2) in the spring as a topdress; or (3) in split applications with half in the fall and the other half in the spring. Treatment rates were 0, 100, 150, 200, 300 and 400 pounds per acre per year. Effective calcium carbonate equivalent (ECCE) was applied to half of each plot (split plots) in the study in 1996, 1998 and 2004 to raise soil pH levels to 6.0 to 6.5. Lime rates ranged from 2,000 to 5,000 pounds per acre depending on the year and N treatment level. The split-plot application of lime provided the opportunity to measure forage yield for the six rates of N with and without lime.

Using data from this study, an equation representing the forage yield response to lime and nitrogen was estimated and used along with expected prices for forage, N in the form of urea (46-0-0), and lime in the form of 100% ECCE to evaluate the producer’s expected net return per acre for a typical stocker cattle graze-out enterprise in south-central Oklahoma. For a base-case market scenario, we used 45 cents per pound ($415 per ton) for the price of N and 1.5 cents per pound ($30 per ton) for the price (including application) of lime. The price of forage was determined as the cost of beef gain (dollars per pound) divided by the pounds of
forage required by a typical stocker animal to produce a pound of gain. For a base-case cost of gain of 45 cents per pound, we assumed a price of forage equal to 4.5 cents per pound. When considering the cost of lime, the economical optimal recommended level of N was reduced by about 20 pounds per acre (i.e., from 150 to 130 pounds per acre). The Noble Foundation recommends testing soils each year for nutrient content and pH level. As soil pH levels fall into acidic levels, we recommend applying lime to restore the productive health of the soil. Considering the economics of applying N every year and lime once every three to five years, producers would be better off to reduce their applications of N by about 10 to 15 percent from their normal optimal levels and use the saving each year for anticipated lime applications.