Have you ever wondered if alfalfa will respond to lime applications on low pH soils and will alfalfa respond to phosphorus applications if phosphorus soil test levels are high?

A 3-year study was established at the North Central Experiment Field near Belleville, KS to address these two questions. The trial site was a Crete silt loam soil with an initial soil pH of 5.1 and a soil test phosphorus level of 30 ppm. Six thousand pounds ECC lime per acre was recommended. The study included three lime treatments, 0 lime, 3,000 pounds ECC per acre, and 6,000 pounds ECC per acre, and four phosphorus rates, 0, 40, 80, and 120 pounds P_2O_5 per acre. Lime applications were applied and disk incorporated to a depth of 3-4 inches in late summer 1990 and alfalfa was seeded in the spring 1991 at 15 pounds per acre. The initial phosphorus treatments were applied with the lime in the fall, but the yearly applications were made during late winter.

The three-year total forage yield for the 0 lime rate was 15.7 tons per acre, while the total forage yields for the 3,000 and 6,000 pounds ECC per acre rates were 19.5 and 20.0 tons per acre, respectively. Thus, there was a 3.8 tons per acre or 24 percent advantage for the initial lime application. There was only a 0.5 ton per acre increase as the lime rate increased to the 6,000 pounds ECC per acre rate. Interestingly, forage yields for every cutting with the two lime treatments were significantly higher than the 0 lime treatment. There were no differences in forage yields for each of the cuttings between the two lime treatments.

Total forage yields for the 0, 40, 80, and 120 pounds P_2O_5 per acre treatments were 17.4, 18.4, 18.8, and 18.8 tons per acre. Thus, there was only a 1 ton per acre difference in total forage yields between the 0 P_2O_5 rate and 40 pounds P_2O_5 per acre rate (17.4 vs 18.4 tons per acre). As a side note, soil pH levels increased with lime applications. By March 1993, the soil pH levels for the 0 lime, 3,000 and 6,000 pounds ECC per acre treatments were 5.0, 6.1, and 6.5, respectively. And the soil test P level at the 0 P_2O_5 rate was reduced from 30 ppm to 20 ppm.

What's the bottom line?

Alfalfa responds well to lime applications when the soil pH is low. And while application of the full recommended lime rate will raise the soil pH and maintain the pH level for a longer period of time, a one-half lime rate application can raise the soil pH and increase forage yields to the levels produced by the full recommended lime rate. "Why, you ask?" Well, the nitrogen-fixing bacteria perform better at higher soil pH levels, but they don't require the soil pH to be raised all the way to 7.0 or neutral for optimal performance. Also, plant nutrients are not as available to plants at lower pH's and as the pH is raised these nutrients become available.

One must remember the soil pH will not be raised as high as the recommended rate and future lime applications will need to be made sooner. Most lime recommendations are for the applications to be made prior to planting and the lime incorporated into the soil for the best response. However, if it becomes apparent the soil pH is low in an existing alfalfa stand, it is common wisdom to make a lime application as soon as possible. But the response may not be as dramatic as if it had been made prior to planting and incorporated. Always take a soil test before alfalfa planting so that lime applications can be made if necessary.

When soil test phosphorus levels are high, as in this study, alfalfa does not respond or only slightly responds to phosphorus applications. Because alfalfa removes high levels of phosphorus in every ton, after several years the alfalfa could dramatically lower soil P levels.

For more details about this research see:
Kansas Fertilizer Research-1992. Report of Progress 670. P. 65-66. K-State Research and Extension.
Kansas Fertilizer Research-1993. Report of Progress 697. P. 62-63. K-State Research and Extension.

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