Liming Acid Soils Is Essential for Ryegrass Forage Production

By M.M. Eichhorn and Paul Bell

Louisiana field research indicates the importance of liming to correct soil acidity for ryegrass forage production. Substantial differences in varietal responses to soil acidity and liming were recorded.

THE EFFECTS of soil acidity on seven varieties of ryegrass were studied at the Hill Farm Research Station at Homer, LA. Initial soil pH at the test site was 4.2. Exchangeable aluminum (Al) was 118 parts per million (ppm) on the control plots at the outset of the study (**Table 1**).

Table 1. Effects of agricultural limestone on soil pH and soil chemical properties.

Lime rate, tons/A	Before cropping Aug '92	Before harvest Nov '92	After harvest May '93	Prior to planting Aug '93
	---------- Soil pH ----------			
0	4.2	4.0	3.8	3.8
1	4.1	4.4	4.4	4.4
2	3.9	5.2	4.9	4.9
4	3.9	5.9	5.8	5.7
8	4.1	6.6	6.5	6.6
	------- Exchangeable Ca, ppm -------			
0	162	79	82	83
2	81	414	384	424
8	100	1,021	1,051	1,117
	-------- Exchangeable Al, ppm --------			
0	118	106	83	114
2	91	24	24	26
8	91	2	1	3

Fine, high quality agricultural lime (100.2 percent effective calcium carbonate equivalent) was applied at rates of 1, 2, 4 and 8 tons/A in August 1992 and incorporated to a depth of 6 inches. Ryegrass was drill-seeded in October 1992. The crop received nitrogen (N), phosphorus (P), potassium (K) and sulfur (S) fertilization in four applications for total rates of 328 lb/A N, 162 lb/A P_2O_5, 464 lb/A K_2O and 72 lb/A S. The ryegrass was harvested seven times in the October 1992 to May 1993 growing season: December 1, February 1, February 24, March 25, April 13, May 3 and May 26.

Significant Results

Soil pH values were increased by all rates, but lime application at 8 tons/A was required to raise the soil pH to 6.5 (**Table 1**). Liming substantially increased exchangeable calcium (Ca) and lowered exchangeable Al, which contributed to significant forage yield responses at the lowest rate of lime application (**Table 2**).

Table 2. Effects of liming on Marshall ryegrass dry matter yields.

Lime rate,	Dry matter, lb/A --------- Harvest ---------				
tons/A	1	3	5	7	Total of 7 harvests
0	0	124	819	283	2,812
1	658	869	1,519	673	8,723
2	709	936	1,606	719	9,672
4	868	757	1,679	646	8,142
8	793	821	1,678	914	8,828

Low soil pH delayed harvests and reduced yields. None of the seven varieties produced harvestable forage on the acid control plots at the first harvest

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GROWTH of ryegrass was severely limited where no lime was applied (at left). Plot shown at right received 1 ton/A lime application, which increased yield and soil pH.

date. In contrast, Marshall variety produced 658 lb/A dry matter at first harvest on plots receiving 1 ton/A lime and 868 lb/A on the 4 tons/A lime plots. Marshall, Tetragold, Surrey and Jackson varieties produced significantly higher yields with liming than did Gulf, Florida 80 and TXR-91-A7EF.

Summary

Fall applications of good quality agricultural lime to acid soils prior to ryegrass seeding is an important management practice for acceptable forage yields. Liming increased soil pH, increased exchangeable Ca, lowered exchangeable Al, advanced forage harvest and increased yields. ■

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was the most Al-tolerant legume in that it produced 60 percent of the maximum yield at pH 4.4 and 91 ppm Al, while other legumes produced very little growth at that Al level. However, Serala lespedeza produced more growth at 39 and 59 ppm Al than did aeschynomene. Serala also produced more growth than did Interstate 76 lespedeza at all Al levels. Alyce clover was the least Al-tolerant species, producing only 41 and 38 percent of maximum yield at 39 and 59 ppm Al. None of the legumes produced significant growth at pH values above 7.

Summary

Common bermudagrass and Marshall ryegrass were both tolerant of highly acid and alkaline soil, although ryegrass yield was severely depressed at pH 4.6 and 111 ppm of exchangeable Al. Dallisgrass and bahiagrass were highly Al tolerant, but yields were greatly reduced in alkaline soil. None of the legumes grew well at alkaline pH values. Cool-season clovers produced maximum yields at pH 5.2 and 36 ppm exchangeable Al while warm-season legumes, which are generally considered more acid tolerant, produced maximum yields at pH 5.7 and 4 ppm exchangeable Al. Reasons for these differences are being investigated. It is encouraging that legumes can be productive on this highly acid Flatwood soil with as little as 3 tons/A of applied lime. ■