PUBLICATIONS

1996

FIELD DAY REPORT - 1996

TEXAS A&M UNIVERSITY AGRICULTURAL RESEARCH and EXTENSION CENTER at OVERTON

Texas Agricultural Experiment Station
Texas Agricultural Extension Service

Overton, Texas

April 18, 1996

Research Center Technical Report 96-1

RESPONSE OF ALFALFA TO SURFACE APPLIED LIMESTONE AND BORON

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Background. Research on alfalfa overseeded into Coastal bermudagrass over the past several years has shown that alfalfa can be produced on the acid, sandy soils common to East Texas. This initial study generated questions concerning the fertility needs of alfalfa growing on limed soils. One of these studies involved the effect that liming a Darco loamy sand to pH 7 has on boron availability. Results of the second year of this research are presented in this report.

Plots were limed with ECCE 62 and 100 limestones at 0, 1, and 2 tons/acre on 9 Nov. 1988, 14 June 1991, and 17 Aug. 1992. The Aug. 1992 treatment was incorporated by light disking. The first two applications were left on the soil surface. A blended fertilizer was applied to provide 125 lb P_2O_5, 166 lb K_2O, 66 lb S, and 33 lb Mg each fall and spring. In fall 1993, individual plots were treated with B at rates equivalent to 0, 2, and 4 lb/acre. Harvests were made approximately each 30 days during the growing season.

Research Findings. Increasing limestone rates and ECCE values elevated soil pH in the 0-6 in. soil depth as expected (Table 1). The 2 ton/ac rate of ECCE 100 limestone raised soil pH approximately 0.4 pH units above the similar rate of ECCE 62 limestone and has maintained that difference over several years. Each year, the 1 ton/ac rate of ECCE 100 limestone maintained soil pH slightly above the one ton/ac rate of ECCE

Table 1. Effect of limestone ECCE and rate on 0-6 in. soil pH in spring 1993, 1994, and 1995.

Limestone	ECCE 62			ECCE 100		
rate (t/ac)	1993	1994	1995	1993	1994	1995
0	5.54 c[1]	5.11 c	5.42 c	5.54 c	5.11 c	5.42 c
1	6.58 b	6.37 b	6.29 b	6.90 b	6.71 b	6.63 b
2	6.81 a	6.68 a	6.70 a	7.24 a	7.21 a	7.12 a

[1]Numbers with similar letters in a column are not different statistically with 95% confidence.

62 limestone. Higher limestone rates, limestone ECCE, and B rates increased alfalfa yields at all harvests. Yield of Coastal bermudagrass declined at all treatments that increased yield of alfalfa due to competition of the alfalfa with the bermudagrass for sunlight and soil water.

Application. The second year (and third -- data not shown) of research on the limestone and B requirements of alfalfa in acid soils verifies improved plant growth as soil pH approaches 7. This research validates our earlier research on clover that showed that liming an acid soil to

pH near 6.2 tied up soil B. With alfalfa needing a soil pH near 7, tie-up of soil B was expected to be even greater than at 6.2. Yield of alfalfa continued to increase as the rate of B was increased from 2 to 4 lb/ac. The higher the soil pH, the greater the rate of B needed to offset this tie-up. Yield data support application of 3 to 4 lb of B/ac for alfalfa when a strongly acid surface soil is limed to pH 7.

Table 2. Effect of limestone rate, ECCE, and boron treatment on yield of Alfagraze alfalfa and Coastal bermudagrass on a Coastal Plain Ultisol. (Alfalfa planted in rows 27" apart)

	Harvest						
Lime rate[1]	Har. 1	Har. 2	Har. 3	Har. 4	Har. 5	Har. 6	Total
t/ac	lb DM/ac						t/ac
				Alfalfa			
0	81 b[2]	42 b	23 b	24 b	0 b	0 b	0.09 b
1	1287 a	873 a	1087 a	813 a	653 a	643 a	2.68 a
2	1473 a	1034 a	1274 a	928 a	811 a	774 a	3.15 a
				Bermudagrass			
0		53	523 a	1073 a	1416 a	1167 a	2.12 a
1		65	322 b	778 b	874 b	827 b	1.43 b
2		55	238 b	617 b	689 b	785 b	1.19 b
Lime ECCE				Alfalfa			
62	1235 b	848 b	991 b	723 b	656 b	633 b	2.54 b
100	1524 a	1059 a	1369 a	1017 a	808 a	784 a	3.28 a
				Bermudagrass			
62		53	352 a	779 a	822	838	1.43 a
100		66	207 b	598 b	741	773	1.19 b
Boron rate lb/ac				Alfalfa			
0	526 b	441	598 c	429 c	306 c	312 c	1.31 c
2	1304 a	872	1001 b	726 b	622 ab	602 ab	2.56 b
4	1530 a	1000	1248 a	949 a	829 a	786 a	3.17 a
				Bermudagrass			
0		64	338	855	1070 a	957	1.64 a
2		55	305	778	888 ab	857	1.44 ab
4		56	341	684	768 b	820	1.33 b

[1]Rates applied 9 Nov. 1988, 14 June 1991, and 17 Aug. 1992. Only the 1992 treatment was incorporated after application, then only by light disking.

[2]Values followed by similar letters within a column are not different statistically at the 95% confidence level.