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 TAM 90 RYEGRASS TO LIMESTONE AND NITROGEN

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Background. The most important input for ryegrass forage production after planting is water as we have seen this season. When water is available in adequate supply, input of soil-deficient plant-essential nutrient elements becomes critical for optimum forage production. Limestone is needed for efficient ryegrass production on strongly acid soils. After limestone is applied on a strongly acid soil, nitrogen (N) is the plant nutrient most needed for high yields of ryegrass. In 1992, we initiated a study to quantify the effect of limestone and N on ryegrass yield. Five rates of limestone from zero to 4000 lb/ac and five rates of N from zero to 180 lb/ac were applied to experimental plots according to the requirements of a central composite rotatable design study. Ryegrass was seeded on the first of two alternating, duplicate sites beginning in fall 1992. Each plot was 13.3 x 20 feet. Three varieties, two experimentals and 'TAM 90', were evaluated in each plot but only the results of the TAM 90 variety will be discussed in this study. Nitrogen was applied three times each season at one-third of the design rate. The experimental plots had been limed twice with the specified rates. Both experimental sites were acidified by incorporation of elemental sulfur in spring 1988. Three harvests were made each of the three seasons.

Research findings. Soil samples collected from the 0-6 in. depth of these plots during the study were analyzed for pH differences due to limestone and N treatment. Results showed that NH_4^+-N fertilizers applied during six years of research on this site lowered soil pH from 5.4 to 4.5 where no limestone had been applied (Table 1). The highest rate of limestone maintained soil pH at 7.0 or above at all N application rates.

Limestone treatment of this soil appeared to have a nominal effect on ryegrass production compared to the yield response to N (Table 1). Increasing the rate of limestone beyond 1 t/ac at the zero N rate lowered yield to the level produced with no limestone. At the higher rates of N, increasing the limestone rate increased the three-year total yield of ryegrass by almost 2 t/ac over the three years of this study. Without limestone, raising the N rate from zero to 180 lb/ac increased ryegrass dry matter production approximately 5 t/ac for the three years. Over this same time, ryegrass dry matter yield was increased by nearly 7 t/ac with increases in N rate from zero to 180 lb/ac when the soil was adequately limed to raise the pH into the range of 7.0. The significant interactive effect of limestone and nitrogen on ryegrass yield is shown in Fig. 1 which graphically represents the data in Table 1.

Application. Results of this study show the mutually beneficial effect of limestone and

N on ryegrass production. These data indicate that the efficiency of the high N rate for ryegrass production was increased by 46% when lime was applied to raise soil pH above 6.5.

Table 1. Calculated estimates of ryegrass yield responses to limestone and nitrogen rates.

Lime rate	Nitrogen rates, lb/ac							
	0		60		120		180	
lb/ac	lb DM/ac	pH	lb DM/ac	pH	lb DM/ac	pH	lb DM/ac	pH
0	646	5.4	5677	5.1	8854	4.8	10175	4.4
1000	2157	6.3	7600	6.0	11189	5.7	12922	5.5
2000	2470	6.8	8325	6.7	12325	6.5	14471	6.3
3000	1585	7.1	7852	7.0	12264	6.9	14822	6.8
4000	0	7.2	6181	7.1	11005	7.0	13975	7.0

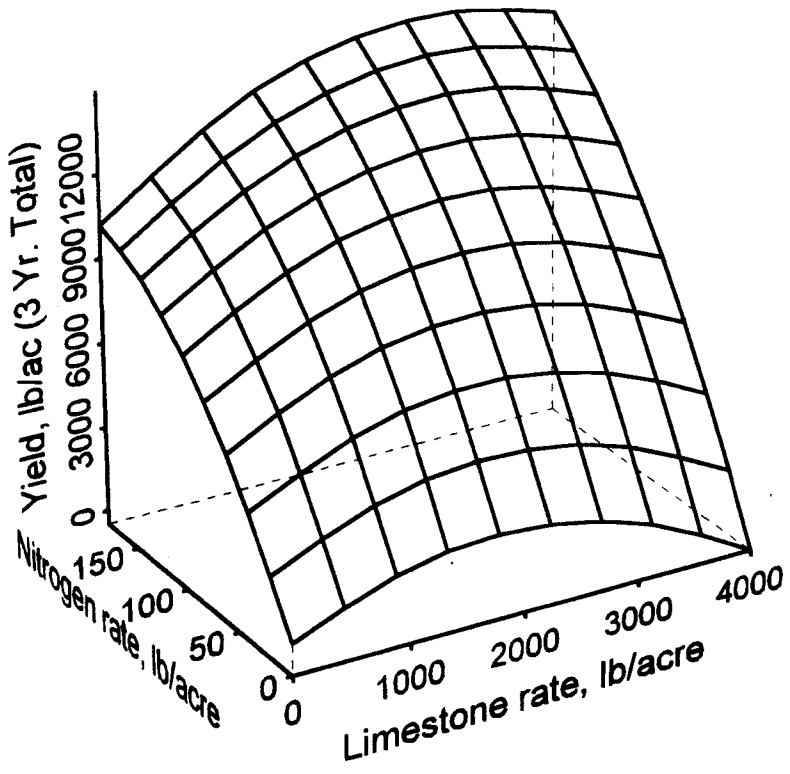

Figure 1. Three-year total TAM 90 ryegrass dry matter yield response to limestone and nitrogen rates.