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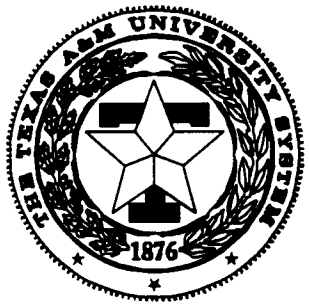

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RESPONSE OF ANNUAL RYEGRASS TO RESIDUAL AND APPLIED PHOSPHORUS

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Background. There is agreement by some scientists that liming acid soils makes residual phosphorus (P) more available to plants. Phosphorus added to a strongly acid soil is not as effective at increasing production of ryegrass as it is when applied to a well-limed soil. A test for P on a strongly acid soil is not effective for prediction of the P fertilizer needs of this soil after it has been properly limed. The most efficient approach is to lime the soil, allow the lime to react, then test the soil to determine the P needs of the crop. Data in this report are from research on ryegrass response to applied P at soil pH levels from 6.4 to 7.0. Results from this research will be used to calibrate the soil test to predict the P needs of ryegrass on limed, acid soils.

Six different soils were selected from eight that had been limed, then fertilized in 1992, 1993, and 1994 with increasing rates of P for alfalfa production in 1993, 1994, and 1995. Annual applied rates of P as P_2O_5 were 0, 50, 100, and 150 lb/acre. Soil pH ranged from 6.4 to 7.1. Ryegrass was grown on these soils in 1995-1996 with no additional P applied. In fall of 1996, the original, 10 by 20-ft plots were split. One-half of each original plot was refertilized with 80 lb of P_2O_5/acre. All plots were drill-seeded to TAM 90 annual ryegrass. Yield data were collected from these split plots in 1997. For this report, the weight per area harvested was projected to yield per acre. Soil samples from the surface 6-inch depth were collected in July 1997. Soils were analyzed for P by the ammonium acetate-acetic acid-EDTA method used in the soil testing laboratory at Texas A&M University.

Research Findings. Residual soil P levels from samples collected in July 1997 are shown in Table 1. Increasing rates of P applied for the earlier research on alfalfa provided a statistically significant range of residual soil P levels in all soils for this ryegrass response study. Plots that received the zero P rate contained a range of P levels from 4.7 ppm in the Darco soil to 13.9 ppm in the Cuthbert soil. The greatest increase in soil P occurred in the Redspring soil. The Lilbert and Bowie soils exhibited the smallest increase in soil P.

Statistically significant ryegrass yield responses to residual soil P occurred only on the Darco and Keithville-Sawtown soils. These soils had residual P levels below 10 ppm. On the Darco soil, increasing the soil test P level from 4.7 to 10.3 ppm increased yield of ryegrass about 1,000 lb/acre. Yield on the Darco soil was not significantly increased at P levels above 10.3 ppm. On the Keithville-Sawtown soil, ryegrass yield continued to increase between the 13.1 and 24.6 ppm soil P levels. The average yield increase to 80 lb of reapplied P as P_2O_5 on the Keithville-Sawtown soil was 1290 lb of dry matter/acre. On the Darco soil, the average yield increase to re-applied P was 1170 lb/acre.

Application. These first-year data indicate that ryegrass yields should be expected to increase in response to fertilizer P when the soil tests below 10 ppm P. The maximum soil test P level on the zero check plots is 13.9 ppm. As the soil P level drops below 10 ppm, all soils in this study are expected to support a yield response to residual and applied soil P over the next two years.

Table 1. Soil series phosphorus levels and TAM 90 annual ryegrass dry matter yields after three years of fertilization with increasing rates of phosphorus.†

Applied P as P_2O_5	Soil Series					
	Bowie fsl		Cuthbert fsl		Darco lfs	
lb/ac	P ppm	Yield lb/ac	P ppm	Yield lb/ac	P ppm	Yield lb/ac
0	10.2 c‡	6355 ns	13.9 ns	2371 ns	4.7 b	5789 b
50	15.5 bc	6420	28.4	2378	10.3 b	6770 ab
100	25.9 ab	6627	42.6	2932	24.2 a	6917 ab
150	30.0 a	6422	45.2	2762	28.5 a	7397 a
Reapplied						
0	19.1 ns	6258	35.0 ns	2683	15.6 ns	6137 b
80	21.7	6654	30.1	2718	18.3	7307 a
R^2	0.94	0.68	0.92	0.90	0.91	0.84
CV	22.0	13.1	30.3	20.5	32.5	13.1
Mean	20.4		32.5		16.9	
Applied P_2O_5	Redsprings gravel l		Keithville-Sawtown fsl		Lilbert lfs	
0	12.7 d	2096 ns	5.9 d	3892 c	10.4 b	7047 ns
50	22.0 c	2316	13.1 c	4980 b	13.0 b	6654
100	35.8 b	2699	24.6 b	5906 a	20.2 ab	6829
150	49.4	1869	38.9 a	6297 a	30.2 a	7327
Reapplied						
0	30.0 ns	2425	17.8 b	4624 b	15.5 b	6859
80	29.9	2065	23.5 a	5913 a	21.4 a	7069
R^2	0.87	0.63	0.98	0.94	0.93	0.38
CV	32.1	37.1	12.0	12.2	23.7	22.17
Mean	29.9		20.6		18.4	

†Sites history - Sites fertilized with 0 to 150 lb of phosphorus as P_2O_5 twice in 1992, and once each in 1993 and 1994. Alfalfa harvested from 1993-1995. Ryegrass grown with residual soil P in 1996. These 10x20 ft plots were split to 10x10 ft, one half receiving P at 80 lb P_2O_5, the other half receiving no P.

‡Within a column, numbers followed by the same letter are statistically equal at an alpha level of 0.05.