EFFECT OF PHOSPHORUS RATES ON BERMUDAGRASS YIELDS IN THREE SOUTHERN OKLAHOMA LOCATIONS IN 2002-2003

Eddie Funderburg and David Annis
Samuel Roberts Noble Foundation, Ardmore, OK
erfunderburg@noble.org (580)224-6445

ABSTRACT

Small plot research tests were established on cooperating farmers' fields in three south central Oklahoma locations in 2002 and continued in 2003. These included a Weatherford soil testing low in extractable P (Mehlich 3), a Port soil testing low in P and a Lela soil testing high in P. Rates of applied P fertilizer were 0, 25, 50, 75, 100 and 200 lbs of P_2O_5 per acre. There were 4 replications of each rate. All plots received 200 lbs N and 120 lbs of K_2O per acre. Plots were clipped on an as needed basis throughout the growing season. Total dry matter yields were obtained and statistical analyses performed. On the Weatherford soil with low soil test extractable P, first harvest and total yields were increased with P fertilizer additions of at least 50 lbs of P_2O_5 per acre in both years tested. On the Port soil with low extractable P, yields were significantly only increased at the 2nd harvest in 2002 with 25 and 100 lbs of P_2O_5 per acre. Yields were not significantly affected at any other harvest date or fertilizer rate in 2002 or in 2003 at any rate or harvest date. Yields were not significantly affected on the Lela soil with high soil test extractable P in either year at any fertilizer rate or harvest date.

INTRODUCTION

Bermudagrass (Cynodon dactylon) is the dominant introduced warm-season perennial forage grass in southern Oklahoma and northern Texas. It has many characteristics that make it a desirable forage base for cattle. It responds well to fertilizer, thrives in a variety of soil conditions, tolerates heavy grazing pressure and persists through adverse environmental conditions.

Many, if not most, of the soils in the service area of the Noble Foundation are inherently deficient in phosphorus. While many studies have explored the response of bermudagrass to nitrogen (Eichhorn, et al 1989, Osborn, et al 1999, Westerman, et al 1983), fewer have examined the effect of P fertilization (Hillard, et al, 1990). The purpose of these tests was to determine if P fertilization of bermudagrass is needed at different soil test levels.

MATERIALS AND METHODS

On-farm small plot research tests were conducted at 3 sites. The first was at the farm of Mr. Donald Schroeder near Tribbee, OK on a Weatherford fine sandy loam (fine-loamy, siliceous, active, thermic Ultic Haplustalf). The Weatherford soil is a shallow, often eroded upland soil, with low-medium productivity. This site had a Mehlich 3 extractable soil test P level of 5 ppm, which is considered deficient.

The second site was a Port silt loam, located at the farm of Mr. Paul Robbins near Pauls Valley, OK. The Port soil (fine-silty, mixed, superactive, thermic Cumulic Haplustoll) is a highly

productive alluvial soil. It had a Mehlich 3 extractable soil test P level of 8 ppm, which is considered deficient.

The 3rd site was a Lela clay on the Harrison Investment farm. The Lela (fine, mixed, superactive, thermic Udic Haplustert) is an alluvial clay with good productivity. This site had a Mehlich 3 extractable soil test P level of 50 ppm, which is considered sufficient.

Permanent plots measuring 4' X 6' were established on the farms. Phosphorus fertilizer was applied at each site at rates of 0, 25, 50, 75, 100 and 200 lbs of P_2O_5 per acre. All plots received 200 lbs of N and 120 lbs of K_2O per acre. Treatments were replicated 4 times each in a RCB design. Plots were harvested by cutting a 2.5' X 5' section from the center of each plot on an as-needed basis, leaving a stubble height of 4 inches. Total dry matter yield was measured.

RESULTS AND DISCUSSION

Yield results are shown in Tables 1-6. Significant yield increases at the first harvest and total yields were noted in both years on the very low P testing Weatherford soil at Tribbee (Tables 1-2). Most of the increase in yield was observed at the first harvest. Soil test recommendations for P on bermudagrass were accurate on this site.

Table 1. Effect of P fertilization on a low P (5 ppm) testing Weatherford soil (2002)

P_2O_5 Rate (lbs/A)	1st harvest	2nd harvest	3rd harvest	Total
	----------Dry matter yield, lb/acre ----------			
0	1740 B	969	271	2980 C
25	1703 B	1447	302	3452 BC
50	2405 AB	1441	424	4270 AB
75	2812 A	1369	376	4557 A
100	2166 AB	1491	420	4077 AB
200	2966 A	1604	355	4925 A
LSD	901 (P=0.03)	NS (P=0.12)	NS (P=0.46)	1034 (P=0.009)

Table 2. Effect of P fertilization on a low P (5 ppm) testing Weatherford soil (2003)

P_2O_5 Rate (lbs/A)	1st harvest	2nd harvest	Total
	----------Dry matter yield, lb/acre ---------		
0	1872 C	718	2590 C
25	3235 B	939	4174 B
50	3825 AB	676	4501 AB
75	3998 AB	962	4960 AB
100	3705 AB	653	4358 AB
200	4228 A	1031	5259 A
LSD	909 (P=0.0005)	NS (P=0.40)	1084 (P=0.0013)

Bermudagrass grown on the Port soil near Pauls Valley did not respond to P fertilizer on a consistent basis, although soil test P was considered deficient (Tables 3-4). A possible reason for this is that the Port soil is a deep bottomland soil and the roots of a perennial plant like

bermudagrass were able to explore a greater volume of soil and scavenge more P than in a shallow soil like the Weatherford.

Table 3. Effect of P fertilization on a low P (8 ppm) testing Port soil (2002)

P_2O_5 Rate (lbs/A)	1st harvest	2nd harvest	3rd harvest	Total
	----------Dry matter yield, lb/acre ----------			
0	2406	1209	2197	5812
25	2577	2127	2628	7332
50	2531	1428	2505	6464
75	2475	1282	2304	6061
100	2556	2100	3204	7860
200	2612	1591	2759	6962
LSD	NS (P=0.98)	697 (P=0.04)	NS (P=0.25)	NS (P=0.11)

Table 4. Effect of P fertilization on a low P (8 ppm) testing Port soil (2003)

P_2O_5 Rate (lbs/A)	1st harvest	2nd harvest	Total
	----------Dry matter yield, lb/acre ----------		
0	3318	1242	4560
25	3905	1622	5527
50	3550	1274	4824
75	3729	1720	5449
100	3763	1913	5676
200	3880	1537	5417
LSD	NS (P=0.35)	NS (P=0.73)	NS (P=0.45)

The Lela soil near Lindsey, OK, tested very high in extractable P and did not respond to any rate of P fertilizer additions (Tables 5-6). This agreed with the soil test recommendation of no P fertilizer on this site.

Table 5. Effect of P fertilization on a high P (50 ppm) testing Lela soil (2002)

P_2O_5 Rate (lbs/A)	1st harvest	2nd harvest	3rd harvest	Total
	----------Dry matter yield, lb/acre ----------			
0	2808	1071	961	4840
25	2506	1255	1124	4885
50	2871	1232	1086	5189
75	2393	946	1132	4471
100	3120	1303	1132	5555
200	2930	1213	1149	5275
LSD	NS (P=0.34)	NS (P=0.77)	NS (P=0.92)	NS (P=0.30)

Table 6. Effect of P fertilization on a high P (50 ppm) testing Lela soil (2003).

P_2O_5 Rate (lbs/A)	1st harvest	2nd harvest	Total
	----------Dry matter yield, lb/acre ----------		
0	3650	888	4538
25	3838	1196	5034
50	3865	1063	4928
75	3276	1480	4756
100	3449	1190	4639
200	3274	1125	4399
LSD	NS (P=0.86)	NS (P=0.19)	NS (P=0.94)

Limited research on these 3 on-farm sites showed that s7oil test recommendations for phosphorus on bermudagrass were correct in 4 of 6 site years. They were correct both years on a high P testing soil where no P fertilizer was recommended, and on a low productivity, low P testing soil. The soil test recommendation was incorrect both years on a highly productive, low P testing soil.

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