PHOSPHORUS UPTAKE BY RYEGRASS-BERMUDAGRASS FERTILIZED WITH BROILER LITTER AND NITROGEN

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Background. A disadvantage of using broiler litter as a plant nutrient source is that more phosphorus is applied than is utilized by forge crops. Although it can vary widely, the average N-P_2O_5-K_2O ratio in broiler litter in East Texas is about 4:4:3. Because about 25% of the nitrogen (N) in broiler litter is lost through volatilization, the available nutrient ratio is about 3:4:3. The N:P_2O_5:K_2O uptake ratio is 4:1:3 for Coastal bermudagrass and 4:1:4 for annual ryegrass to reach 90% of maximum yield. This difference in nutrients applied in the broiler litter vs. crop needs results in the soil buildup of excess nutrients, especially phosphorus (P). As soil P increases, it can move into creeks, rivers, and lakes in runoff during heavy rainfall and cause environmental problems. If broiler litter is the only fertilizer used, N becomes the limiting nutrient. The application of commercial N fertilizer should enhance crop growth to take up some of the excess P. Four tons/acre of broiler litter were applied in October 1998 and 1999 and 2 tons/acre in October 2000 and 2001 to Coastal bermudagrass overseeded with annual ryegrass. Fifty lb N/acre were applied from 1 to 4 times in December, March, May, and/or July. This report will discuss the P uptake from the last 2 years since results of the first 2 years are reported in the 2002 Overton Field Day Report.

Research Findings. The 2 tons/acre of broiler litter contained 81 lb P in 2000 and 225 lb P in 2001 as P_2O_5 (same form of phosphorus used by the fertilizer industry). The least amount of P was removed in the treatment receiving no broiler litter or N fertilizer because of low soil P, forage yields, and P concentration of the forage. In 2001, P uptake by ryegrass was greatest when N fertilizer was applied in December and/or March (Table 1). Phosphorus uptake by bermudagrass was highest in treatments with a May N application. There was a substantial winter weed component in the April harvest in 2001. Nitrogen fertilizer increased P uptake when it was applied in December and March, March and May, and 4 times a year.

Phosphorus uptake in 2002 was slightly higher than in 2001 because of higher forage yields and not because of more P (225 lb/acre) being applied in the broiler litter. Phosphorus uptake by ryegrass was highest when N was applied in December and March and the March, May, and July treatments. Bermudagrass P uptake was usually maximized when N was applied in May. Total P uptake for 2002 was highest when N was applied 3 or 4 times a year. All N fertilizer treatments except the December treatment remove more P than applying broiler litter without N.

Application. Nitrogen fertilizer increased P uptake of ryegrass and bermudagrass. If the objective is to reduce soil P, a May N application is suggested since the forage must be harvested (hay, etc.) and removed. If the objective is to increase utilization of the excess P and other nutrients, N should be applied in December and March to increase ryegrass production for grazing which is more valuable than bermudagrass.

Table 1. Phosphorus uptake by annual ryegrass and Coastal bermudagrass when fertilized with 2 tons/acre broiler litter in October 2000 and 50 lb N/acre from 1 to 4 times during the year in 2001.

Treatment	Ryegrass	Bermuda	Weeds	Total
	lb P/acre			
No BL† or N	1.3 d‡	4.9 e	0.8 d	6.9 c
BL, no N	8.2 bc	16.1 cd	4.1 a-c	28.4 b
BL, Dec.	11.3 a	14.6 d	3.9 a-c	29.7 ab
BL, Mar.	9.4 a-c	17.1 b-d	4.5 a	31.0 ab
BL, May	7.7 bc	19.8 ab	3.8 a-c	31.2 ab
BL, July	8.2 bc	17.1 b-d	4.6 a	29.9 ab
BL, Dec., Mar.	10.3 ab	18.9 a-c	4.1 a-c	33.4 a
BL, May, July	7.4 c	20.2 ab	4.4 ab	31.9 ab
BL, Mar., May	8.9 a-c	21.0 a	4.0 a-c	33.9 a
BL, Mar., May, July	10.3 ab	17.8 a-d	2.8 c	31.0 ab
BL, Dec., Mar., May, July	11.3 a	18.8 a-c	2.9 bc	33.0 a

†Broiler litter.
‡Values in a column followed by the same letter are not significantly different at 0.05 level, Fisher's Protected LSD test.

Table 2. Phosphorus uptake by annual ryegrass and Coastal bermudagrass when fertilized with 2 tons/acre of broiler litter in October 2001 and 50 lb N/acre from 1 to 4 times during the year in 2002.

Treatment	Ryegrass	Bermudagrass	Total
	lb P/acre		
No BL† or N	0.8 g‡	5.8 f	6.6 g
BL, no N	11.6 ef	18.5 e	30.1 f
BL, Dec.	14.3 d	19.1 e	33.4 ef
BL, Mar.	16.5 c	19.9 dc	36.4 c-e
BL, May	12.0 ef	23.2 a-c	35.2 de
BL, July	12.9 de	22.1 b-d	35.0 de
BL, Dec., Mar.	20.7 a	19.1 ed	39.8 bc
BL, May, July	10.4 f	25.3 a	35.7 c-e
BL, Mar., May	17.6 bc	20.3 c-e	37.8 cd
BL, Mar., May, July	18.8 ab	23.8 ab	42.7 ab
BL, Dec., Mar., May, July	20.1 a	25.2 a	45.3 a

†Broiler litter.
‡Values in a column followed by the same letter are not significantly different at the 0.05 level, Fisher's Protected LSD test.