RESIDUAL SOIL PHOSPHORUS AFTER FERTILIZING RYEGRASS-COASTAL BERMUDAGRASS WITH NITROGEN FERTILIZER AND BROILER LITTER

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Background. Approximately 600,000 tons of broiler litter are produced by the poultry industry in Texas each year. Because broiler litter is high in plant nutrients, most of it is used to fertilize pastures instead of using commercial fertilizer. One of the disadvantages of using broiler litter on pastures is that the nitrogen:phosphorus ratio in the broiler litter does not match that of the forage crop. Only about 20 to 25% of the phosphorus in broiler litter is required and utilized. Phosphorus and other nutrients in the broiler litter not used by the crop will build up in the soil and possibly cause environmental problems. High soil phosphorus levels are the main concern since phosphorus can move into streams, rivers, and lakes in runoff with heavy rains. Elevated phosphorus levels increase aquatic plant and phytoplankton (single cell plants) growth which is the beginning of the food chain for fish. However, when this plant material dies and decays, the oxygen level decreases which causes fish to die. Water quality is also reduced because the water has a bad odor and taste. Other reports in this 2004 Overton Field Day handout have shown that combining commercial nitrogen fertilizer with the broiler litter will increase forage production and phosphorus uptake. This report will discuss the soil phosphorus remaining after applying broiler litter at 4 tons/acre in October 1998 and 1999 and 2 tons/acre in 2000 and 2001. Fifty lb N/acre were applied 1, 2, 3, or 4 times during the year in December, March, May, and/or July each year. After 4 years, six 1 in. diameter soil cores were taken to a 24 in. depth from each plot. Soil cores were divided into 0-6, 6-12, and 12-24 in. and similar depths combined for each plot.

Research Findings. Phosphorus moves very slowly in sandy soils so the highest phosphorus concentration was found at the 0-6 in. depth (Table 1). At the 6-12 in. depth soil phosphorus levels were about 75% less than the 0-6 in. depth and the lowest phosphorus concentrations were at the 12-24 in. depth. The no broiler litter or nitrogen fertilizer treatment always had the lowest phosphorus concentrations which is typical of unfertilized sandy East Texas soils.

The highest soil phosphorus levels at all three depths were on plots fertilized with broiler litter but no nitrogen fertilizer which proves that combining nitrogen fertilizer with broiler litter on pastures does reduce soil phosphorus levels. There was no strong relationship between number or timing of nitrogen applications and soil phosphorus level. The 3 and 4 nitrogen applications/year treatments did have some of the lower soil phosphorus levels but so did some of the single nitrogen treatments.

Application. Combining nitrogen fertilizer with broiler litter is an effective method for reducing soil phosphorus buildup and potential environmental problems. The number and timing of nitrogen applications to minimize soil phosphorus levels is not clearly understood. The recommendation is to time nitrogen applications to maximize forage yield.

Table 1. Soil phosphorus levels at 0-6, 6-12, and 12-24 in. depths after fertilizing annual ryegrass – Coastal bermudagrass with broiler litter and 50 lb N/acre from 1 to 4 times during the year.

50 lb N/acre/month	Depth (in.)		
	0-6	6-12	12-24
	P (ppm)		
No BL† or N	6.8 e‡	2.3 d	2.5 c
BL, no N	44.3 a	11.0 a	5.2 a
BL, Dec.	21.1 cd	7.4 b	3.4 bc
BL, Mar.	19.9 cd	5.7 bc	2.7 c
BL, May	32.2 b	7.4 b	2.9 bc
BL, July	21.3 cd	5.5 bc	2.4 c
BL, Dec., March	34.1 b	4.9 c	2.3 c
BL, May, July	21.9 cd	5.5 bc	3.3 bc
BL, Mar., May	23.7 c	5.1 c	4.5 ab
BL, Mar., May, July	22.7 cd	7.4 b	3.8 a-c
BL, Dec., Mar., May, July	19.0 d	5.6 bc	3.3 bc

†Broiler litter.

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