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RESIDUAL SOIL NUTRIENT LEVELS AFTER APPLYING FOUR RATES OF BROILER LITTER FOR TWO YEARS

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Background. Approximately 400,000 tons of broiler litter are generated by the poultry industry in East Texas each year. Because broiler litter is high in plant nutrients, most of it is applied to pastures instead of using commercial fertilizer. One of the disadvantages of using broiler litter on pastures is that the nutrient ratio in the broiler litter does not match that of the forage crop. Excess nutrients from the broiler litter not used by the crop will build up in the soil and possibly cause environmental problems. High soil P levels are the main concern since phosphorus can move into streams, rivers, and lakes in runoff with heavy rains. Elevated P levels increase aquatic plant growth and phytoplankton (single cell plants) which is the beginning of the food chain for fish. However, when excess plant material dies and decays, the oxygen level decreases which causes fish die offs.

A 3-year study to evaluate broiler litter as a nutrient source for pastures was conducted at the Texas A&M University Agricultural Research and Extension Center at Overton. Zero, 3, 6, and 12 tons of broiler litter per acre were applied to Coastal bermudagrass and an annual ryegrass-Coastal bermudagrass pasture systems. Forage production and nutrient uptake for the second year of the study are reported elsewhere in this field day handout. This paper will address residual nutrient levels in the soil after two years of broiler litter application. In September 1995, soil samples were taken to a 3 ft depth and divided into 0 to 6, 6 to 12, 12 to 24, and 24 to 36 in. depth samples. Soil samples were analyzed for nitrates, phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg).

Research Findings. There were no differences in nutrient levels at the 12 to 24 and 24 to 36 in. depths due to pasture systems or broiler litter rate. Therefore, only the 0 to 6 and 6 to 12 in. data are reported. Nitrate level increased as broiler litter rate increased at the 0 to 6 in. depth only in the ryegrass-bermudagrass system (Table 1). Nitrates are soluble and will move down into the soil with rainfall. But after 2 years, nitrate level was only 0.5 ppm or less from the 12 to 36 in. depths (data not shown). Phosphorus did increase substantially with broiler litter rate in the 0-6 in. depth because less than 35% of the applied P was taken up. Phosphorus is not very mobile and usually accumulates near the soil surface. In this study, P levels at the 6 to 12 in. depth had also increased at the highest broiler litter rate which indicates some downward movement.

Potassium tended to increase at the 0 to 6 in. depth as broiler litter rate increased for both

pasture systems and for the bermudagrass only system at the 6 to 12 in. depth. Soil K level did not increase in the ryegrass-bermudagrass system because of higher K utilization due to greater forage production. Magnesium level increased with broiler litter rate for both pasture systems at the 0 to 6 in. depth. There were no differences in soil calcium levels due to broiler litter rate or pasture system (data not shown).

Application. After applying broiler litter for 2 years, there was a trend for P, K, and Mg to increase as broiler litter rate increased at the 0 to 6 in. depth for both systems and for nitrates in the ryegrass-bermudagrass system. Soil buildup of these nutrients can be reduced by applying commercial N fertilizer later in the growing season after broiler litter application. The commercial N fertilizer will increase forage growth which in turn will remove more of the other nutrients. Another way to add nitrogen to a pasture system is to overseed the warm-season perennial grass with a cool-season annual legume. Legumes are capable of removing N from the air through N_2-fixation and then transferring this N to the soil through grazing and decomposition of plant parts.

Table 1. Soil phosphorus, potassium, and magnesium levels after two years of four rates of broiler litter.

Broiler litter	Nitrates	Phosphorus		Potassium		Magnesium
	0-6 in.	0-6 in.	6-12 in.	0-6 in.	6-12 in.	0-6 in.
tons/acre	ppm					
Coastal bermudagrass						
0	1.48 a†	12.2 c	3.3 b	64 b	52 b	40 b
3	1.70 a	56.7 b	8.4 b	97 a	50 b	59 ab
6	1.55 a	44.5 bc	4.8 b	71 b	39 c	49 b
12	1.55 a	132.2 a	19.5 a	111 a	65 a	81 a
Ryegrass-Coastal bermudagrass						
0	0.20 b	18.6 c	10.2 a	66 b	34 a	51 bc
3	1.70 ab	53.9 bc	8.2 a	66 b	48 a	46 c
6	2.15 ab	80.9 ab	15.1 a	99 ab	43 a	75 ab
12	2.83 a	116.9 a	32.4 a	111 a	48 a	93 a

†Values within a column in each pasture system followed by the same letter are not significantly different at the 0.05 level Waller-Duncan Multiple Range Test.