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ADDITION OF COMMERCIAL FERTILIZER OR CLOVER WITH BROILER LITTER ON NUTRIENT UPTAKE BY RYEGRASS - COASTAL BERMUDAGRASS

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Background. Because broiler litter (BL) is high in plant nutrients, most of it is applied to pastures instead of using commercial fertilizer. The main disadvantage of using BL as the only plant nutrient source is that the nitrogen:phosphorus:potassium ratio in the litter does not match the pasture's needs. Only about a fourth of the phosphorus (P) is taken up. Continued use of BL as the only nutrient source will result in a P buildup in the soil that may cause environmental problems. Phosphorus can move into creeks and rivers in runoff from heavy rains and cause oxygen depletion which results in fish kills.

A study was conducted at the Texas A&M University Agricultural Research and Extension Center at Overton to evaluate management practices that might reduce the soil P buildup when using BL as the only nutrient source. The objective of these management practices were to provide additional N and K to increase forage production and thereby remove more P. Six tons of BL were applied in the fall (28 October 1994), in the spring (27 April 1995), or split equally between the fall and spring to Coastal bermudagrass overseeded with annual ryegrass in the fall. A duplicate set of treatments received 75 lb N and 50 lb K per acre after each harvest. Two additional treatments were seeding crimson clover with the ryegrass to add N with a spring or fall BL application. Only the second year of the 3 year study will be presented in this report. The study was harvested monthly from January through September 1995, except for July.

Research Findings. Commercial fertilizer and clover influenced nitrogen (N), P, Potassium (K), and magnesium uptake (Mg) but not calcium (Ca; Table 1). Applying BL in spring, fall, or split between spring and fall did not affect uptake of any nutrient. Adding N and K fertilizer did increase the uptake of P and Mg especially when BL was applied in the fall or split between spring and fall. Applying all or half the BL in fall increased ryegrass yields which increased total forage production (data not shown). Ryegrass also had a higher P concentration than bermudagrass. Adding clover to the ryegrass with a spring BL application increased N, K, and Mg uptake over BL alone. At a lower BL rate of 3 to 4 tons/acre and only overseeding with clover should increase P uptake.

Because soil P buildup is the main environmental concern, P uptake by forage species is reported in Table 2. Phosphorus uptake was not influenced by time of BL application. Applying all or half the BL in fall plus the N and K fertilized increased P uptake about 40%. The amount of N and K fertilizer applied in this study is not economical. However, the principle of increasing P

uptake by applying additional N and K did work. Adding clover to the ryegrass did not improve P uptake because the clover production replaced ryegrass and bermudagrass production.

Application. Applying N and K fertilizer with BL did improve P and Mg uptake. This would be an economical practice with BL rates of 3 to 4 tons/acre and only adding 100 to 150 lb N/acre. There is sufficient K in the BL that N is probably the only limiting nutrient. Adding clover to ryegrass did increase N, K, and Mg uptake.

Table 1. Influence of broiler litter (6 tons/acre) application time with and without N and K or clover on nutrient uptake during the 1995 growing season.

| Treatment | N | P | K | Mg |
|-------------------|---------------------|-------|--------|--------|
| | -----lb/acre----- | | | |
| Spring (S) | 209 de ² | 69 bc | 183 e | 26 de |
| S+NK ¹ | 344 b | 77 b | 356 b | 37 b |
| Fall (F) | 211 de | 71 bc | 235 de | 27 cde |
| F+NK | 407 a | 96 a | 478 a | 46 a |
| Split (S,F) | 197 e | 70 bc | 206 e | 25 e |
| S,F+NK | 420 a | 100 a | 445 a | 44 a |
| S + clover | 271 c | 61 c | 288 c | 32 c |
| F + clover | 242 cd | 73 bc | 264 cd | 30 cd |

¹NK = 75 N and 50 lb K₂O/acre after each harvest, annual total 600 lb N and 400 lb K₂O/acre.

²Yields in a column followed by the same letter are not significantly different at the 0.05 level, Waller-Duncan Multiple Range Test.

Table 2. Influence of broiler litter (6 tons/acre) application time with and without N and K fertilizer or clover on phosphorus uptake during the 1995 growing season.

| Treatment | Ryegrass | Clover | Bermudagrass | Total |
|-------------------|---------------------|--------|--------------|---------|
| | -----lb P/acre----- | | | |
| Spring (S) | 17.5 d ² | 0 c | 51.4 ab | 68.9 bc |
| S+NK ¹ | 26.5 c | 0 c | 50.5 ab | 77.1 b |
| Fall (F) | 34.8 b | 0 c | 35.7 b-d | 70.5 bc |
| F+NK | 50.1 a | 0 c | 46.3 a-c | 96.4 a |
| Split (F,S) | 27.5 c | 0 c | 42.2 b-d | 69.7 bc |
| F,S+NK | 45.2 a | 0 c | 54.5 a | 99.7 a |
| S+clover | 19.3 d | 10.1 a | 27.1 d | 60.9 c |
| F+clover | 35.3 b | 4.6 b | 31.2 cd | 72.9 bc |

¹NK=75 lb N and 50 lb K per acre after each harvest, total 600 lb N and 400 lb K/acre.

²Yields in a column followed by the same letter are not significantly different at 0.05 level, Waller-Duncan Multiple Range Test.