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PHOSPHORUS AND POTASSIUM UPTAKE WHEN COMBINING N FERTILIZER WITH BROILER LITTER

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Background. A disadvantage of using broiler litter as a plant nutrient source is that the nutrient ratio in broiler litter does not match forage crop requirements. Although it can vary widely, the average N-P₂O₅-K₂O ratio in broiler litter in East Texas is about 4:4:3. Because about 25% of the N in broiler litter is lost, the available nutrient ratio is about 3:4:3. The N:P₂O₅:K₂O uptake ratio is 4:1:3.3 for Coastal bermudagrass and 4.4:1:4.3 for annual ryegrass to reach 90% of maximum yield. This difference in nutrients applied vs. crop needs results in the soil buildup of excess nutrients, especially P. If broiler litter was applied at a lower rate where N became 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 to Coastal bermudagrass overseeded with annual ryegrass. Fifty lb N/acre were applied 1, 2, 3, or 4 times/year in December, March, May, and/or July. This practice would not only reduce environmental problems from excess soil P but would also increase the value of a ton of broiler litter since more of the nutrients in the broiler litter would be utilized by the forage crop.

Research Findings. Ryegrass removed about twice as much P as bermudagrass because the P concentration averaged 0.6% in ryegrass and about 0.3% in bermudagrass. More P was removed in 1999 than 2000 because of higher ryegrass yields in 1999 (Table 1). Applying 50 lb N/acre in December, March, or both months increased P uptake in ryegrass by about 5 lb P/N application. Nitrogen fertilizer increased P uptake in bermudagrass by 2 to 3 lb P/N application. Maximum total annual P uptake of 47 to 49 lb/acre occurred when N was applied twice in December, March, or May. Maximum K uptake of about 200 lb/acre by ryegrass occurred in the two treatments containing N applications in December and March (Table 2). Bermudagrass removed as much K with only two N applications in May and July as with three or four applications per year. As with P, total K uptake was primarily influenced by N fertilizer treatments on ryegrass yield. Applying N in December and March or March and May removed as much K as applying 50 lb N/acre three or four times a year.

Application. Combining N fertilizer with broiler litter was an effective method to remove excess nutrients from the soil. Ryegrass had a greater influence on P and K uptake than bermudagrass because it had twice the P and K concentration in the forage.

Table 1. Ryegrass, bermudagrass, and total phosphorus uptake by year and nitrogen fertilizer treatment for two years.

| | Ryegrass | Bermudagrass | Total |
|-----------------------|---------------------|--------------|----------|
| | -----lb P/acre----- | | |
| Year | | | |
| 1999 | 34.9 a† | 13.2 a | 48.0 a |
| 2000 | 23.5 b | 14.7 a | 38.1 b |
| 50 lb N/acre/month | | | |
| none | 25.3 e | 12.5 cd | 37.8 de |
| Dec. | 30.4 bc | 12.6 cd | 43.0 b |
| Mar. | 29.1 cd | 12.7 cd | 41.8 bc |
| May | 23.5 e | 15.3 ab | 38.8 c-e |
| July | 23.2 e | 13.9 bc | 37.1 e |
| Dec., Mar. | 35.1 a | 12.0 d | 47.1 a |
| May, July | 26.0 de | 14.6 b | 40.6 b-d |
| Mar., May | 32.9 ab | 13.7 b-d | 46.6 a |
| Mar., May, July | 32.7 ab | 16.5 a | 49.2 a |
| Dec., Mar., May, July | 33.5 ab | 15.3 ab | 48.8 a |

†Values within a column for year and nitrogen fertilizer treatment followed by the same letter are not significantly different at 0.05 level.

Table 2. Ryegrass, bermudagrass, and total potassium uptake by year and nitrogen fertilizer treatment for two years.

| | Ryegrass | Bermuda | Total |
|-----------------------|---------------------|---------|--------|
| | -----lb K/acre----- | | |
| Year | | | |
| 1999 | 171 a† | 64 b | 235 a |
| 2000 | 155 a | 98 a | 253 a |
| 50 lb N/acre/month | | | |
| none | 129 f | 62 d | 191 e |
| Dec. | 170 cd | 67 d | 237 b |
| Mar. | 160 d | 70 d | 230 bc |
| May | 128 f | 87 bc | 215 cd |
| July | 128 f | 83 c | 211 d |
| Dec., Mar. | 206 a | 67 d | 273 a |
| May, July | 144 e | 92 a-c | 236 b |
| Mar., May | 187 b | 86 bc | 273 a |
| Mar., May, July | 181 bc | 101 a | 282 a |
| Dec., Mar., May, July | 194 ab | 95 ab | 289 a |

†Values within a column for year and nitrogen fertilizer treatment followed by the same letter are not significantly different at the 0.05 level.