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PHOSPHORUS CONCENTRATION AND UPTAKE BY TIFTON 85 BERMUDAGRASS IN FIVE CUTTINGS IN 2004

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Background. The Tifton 85 bermudagrass potassium (K) rate and source at two nitrogen (N)-rates study site was fertilized with 180 P₂O₅/ac at initiation of the study in 2001 and this phosphorus (P) was disked into the Darco soil. In 2002, 2003, and 2004, an additional 120 lb of P₂O₅/ac/yr as triple superphosphate (0-46-0) was surface-applied at growth initiation of the Tifton 85 bermudagrass each spring. Potassium sources were potassium chloride (KCl, 0-0-62-47%Cl), potassium sulfate (K₂SO₄, 0-0-50-17S), and KCl plus elemental sulfur (S). Potassium rates as K₂O were 0, 134, 269, and 402 lb/acre split-applied one-third at growth initiation and one-third each following two in-season harvests to 10 x 18-ft plots that received 80 or 160 lb of N/ac for each bermudagrass regrowth during the 2004 growing season. Samples of Tifton 85 plant material were collected from each plot at each harvest for dry matter/chemical analysis using a Swift Machine forage plot harvester (Swift Current, Saskatchewan Canada.) Plant samples were dried at least 48 hours at 60 °C, ground in a Wiley mill to < 20-mesh, digested in sulfuric acid, and the solution was analyzed for P using the vanadomolybdic acid color development method on a Bausch & Lomb Spectronic 2000 spectrophotometer.

Research Findings. Plant P concentration was unaffected by N rate but was significantly lowered by increased bermudagrass dry matter yield in response to increasing N rates and K rates and sources (Table 1). The season total P uptake was significantly increased from 45 to 50 lb P/ac at the highest rate of applied N, but total P uptake was unaffected by increasing K rates or sources (Table 2). Phosphorus uptake for the season varied around 45 to 48 lb of P/acre.

Application. Because P was not applied at increasing rates, we are unable to compute P-uptake efficiency from these data. However, even though P uptake appears to be relatively constant around 45 to 50 lb/ac, the amount of P taken up in a ton of Tifton 85 bermudagrass dry matter declines as yield increases. This occurred as yield increased due to increasing N and K rates, and K sources. At 80 lb N/ac/harvest, dry matter yield was 5.8 t/ac and P uptake was 7.7 lb/ton of dry forage. At 160 lb N/ac/harvest, dry matter yield was 6.9 t/ac and P uptake was 7.2 lb/ton. Similar declines in P uptake of 9.3, 7.7, 7.2, and 7.0 lb/ton of DM occurred with increasing yields due to increasing rates of K₂O, respectively; and 8.1, 7.1, and 6.8 lb P/ton of DM resulted from increased yields due to changing sources of K from KCl to K₂SO₄, and KCl +

S, respectively. This decline in nutrient content with increasing yield is often referred to as the dilution effect. This dilution effect is observed in plant nutrient concentration as seen in Table 1.

Table 1. Tifton 85 bermudagrass P conc. response to N and K rates and K and S sources in 2004.

N rate lb/ac/harv.	Plant P concentration [†]					
	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Season avg.
	-----%					
80	0.45	0.50	0.38	0.37	0.35	0.41
160	0.45	0.50	0.38	0.34	0.32	0.40
K rate						
(lb K ₂ O/ac)						
0	0.50 a	0.60 a	0.49 a	0.44 a	0.42 a	0.49 a
134	0.45 b	0.51 b	0.39 b	0.36 b	0.34 b	0.41 b
268	0.44 b	0.48 c	0.37 bc	0.34 c	0.32 c	0.39 c
402	0.44 b	0.47 c	0.35 c	0.33 c	0.31 c	0.38 c
K Source						
KCl	0.45	0.43 a	0.43 a	0.39 a	0.36 a	0.43 a
K ₂ SO ₄	0.44	0.48 b	0.34 b	0.33 b	0.32 b	0.38 b
KCl + S	0.44	0.46 c	0.33 c	0.32 b	0.30 c	0.37 c
R ²	0.47	0.80	0.86	0.82	0.87	0.89
c.v.	6.80	6.20	8.60	7.90	6.60	4.60

[†]Values in a column/group followed by a dissimilar letter are significantly different statistically ($\alpha = 0.05$).

Table 2. Tifton 85 bermudagrass P uptake response to N and K rates and K and S sources in 2004.

N rate lb/ac/harv.	Plant P uptake [†]					
	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Season total
	-----lb/ac-----					
80	4.6	7.1	9.8	12.3	11.1	45.0 b
160	5.4	8.0	9.6	13.8	13.4	50.2 a
K rate						
(lb K ₂ O /ac)						
0	4.6	6.8	8.9	11.8	12.8	44.9
134	4.9	7.6	9.8	13.3	12.4	48.0
268	5.2	7.7	10.0	13.1	11.9	47.9
402	5.1	7.6	9.7	13.1	12.4	47.9
K Source						
KCl	5.0	7.6	9.8	13.6	12.8 a	48.8
K ₂ SO ₄	5.0	7.8	10.0	12.8	11.6 b	47.2
KCl + S	5.2	7.4	9.6	13.2	12.3 ab	47.8
R ²	0.58	0.54	0.39	0.50	0.57	0.61
c.v.	14.4	11.9	13.8	12.9	13.4	8.0

[†]Values in a column/group followed by a dissimilar letter are significantly different statistically ($\alpha = 0.05$).