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

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Background. We evaluated magnesium (Mg) in plant tissue from the study of Tifton 85 bermudagrass response to potassium (K) rates and sources at two nitrogen (N) rates on a site that was adequately fertilized with 180 lb P_2O_5/ac at initiation of the study in 2001. Two years before initiation of this study, the site was treated with 3 tons of ECCE 100% calcitic limestone (4% Mg) per acre, surface applied. Two tons additional ECCE 72% calcitic limestone (≈ 1% Mg) were applied and incorporated by disking following the initial phosphorus (P) treatment. In 2002, 2003, and 2004, additional P was surface-applied at the rate of 120 lb of P_2O_5/ac as triple superphosphate (0-46-0) at initiation of bermudagrass re-growth each spring. Potassium sources were potassium chloride (KCl, 0-0-62-47% Cl) and KCl plus elemental sulfur (S) compared to potassium sulfate (K_2SO_4, 0-0-50-17.6 % S). Potassium rates from all sources were 0, 134, 268, and 402 lb/ac as K_2O split-applied one-third at growth initiation and one-third each following an early- and a mid-season harvest to 10 x 18-ft plots that were fertilized with 80 or 160 lb of N/ac for each bermudagrass regrowth during the 2004 growing season. Yield data and samples of Tifton 85 plant material were collected from each plot at each harvest for dry matter and chemical analysis using a Swift Machine forage plot harvester. Plant samples were dried at 60 °C, ground to < 20-mesh, digested in sulfuric acid, and analyzed for Mg using a Perkin-Elmer model 1100-B atomic absorption spectrophotometer.

Research Findings. The season average concentration of Mg in bermudagrass ranged from 0.21% at the high K_2O rate to 0.31% at the zero K_2O rate where yield was lowest (Table 1). Plant Mg concentration was significantly increased in bermudagrass at harvests 3 through 5 at the high rate of applied N and was increased 0.02% in the season average at this high N rate. Plant Mg concentration was significantly increased in harvests 3 and 4 when S was applied as part of the K source but this effect was not evident in the season average of Tifton 85 Mg levels. However, as DM yield increased with increasing K (as K_2O) rate, the Mg concentration in the plant significantly declined. With total yield at 13,856 lb/ac and Mg concentration at 0.25% at the high N rate, total Mg uptake by Tifton 85 bermudagrass was 35 lb/acre. As yield was increased because of higher rates of applied K_2O, Mg concentration was significantly lowered but total Mg uptake was 30, 34, 30, and 29 lb Mg/ac and may indicate that Mg was becoming deficient at the higher production levels. The greatest concentration of Mg occurred in forage from the third harvest where dry matter yield was highest relative to all other harvests.

Application. Magnesium is a constituent of the chlorophyll molecule in green plants and it has an important role in the transport of phosphate in the plant. High rates of potassium fertilizers have been shown to lower the Mg content of plants by competition for uptake, and this may be one reason for the decline in Mg concentration in Tifton 85 as the rate of K_2O was increased. Magnesium contents of herbage plants vary, and are normally higher in legumes than in grasses. Protein supplements of plant origin usually contain 0.3 to 0.6% Mg. Magnesium fertilization usually increases plant Mg content on Mg-deficient soils. Reports indicate the phosphate content of a crop can sometimes be increased by adding Mg instead of P.

The Mg requirements of young calves have been reported to range from 5.4 to 13.6 mg/lb/day. Deficiencies of Mg may occur as a result of simple deficiencies, such as with young calves restricted to milk diets. However, deficiencies are more frequently associated with the metabolic disorder hypomagnesemic tetany, commonly referred to as grass tetany. Grass tetany is most likely to occur with beef cows during initial stages of lactation while grazing pasture forages containing < 0.2% Mg. The Mg levels in Tifton 85 bermudagrass in our study ranged from 0.21% at the high K_2O rate, where increased DM yield and competition for uptake from K lowered Mg, to 0.31% in bermudagrass from plots that received no K. With 7 t/ac dry matter yield and 0.24 % Mg in the forage, Tifton 85 removed about 34 lb Mg/ac, or ≈ 5 lb Mg/t of DM.

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

N rate	**Plant Mg concentration**[†]					
lb/ac/harv.	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Season avg.
	----------%----------					
80	0.24	0.23	0.26 b	0.20 b	0.23 b	0.23 b
160	0.24	0.24	0.28 a	0.23 a	0.28 a	0.25 a
K rate						
lb K_2O/ac						
0	0.29 a	0.28 a	0.35 a	0.29 a	0.33 a	0.31 a
134	0.26 b	0.25 b	0.30 b	0.24 b	0.30 b	0.27 b
268	0.23 c	0.22 c	0.25 c	0.20 c	0.23 c	0.23 c
402	0.22 c	0.21 c	0.24 c	0.19 c	0.21 d	0.21 d
K Source						
KCl	0.24	0.23	0.25 b	0.19 b	0.24	0.23
K_2SO_4	0.23	0.23	0.26 ab	0.21 a	0.24	0.24
KCl + S	0.23	0.23	0.27 a	0.22 a	0.25	0.24
R^2	0.78	0.71	0.82	0.84	0.83	0.88
c.v.	7.5	9.9	9.0	9.6	12.1	6.7

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