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# Potassium management for brown mid rib sorghum sudangrass: Results of the 2002 Mt Pleasant trial.

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## Introduction

Brown mid rib sorghum sudangrass has shown promise as a replacement for corn in situations where low corn yields are expected due to e.g. a combination of late planting and low fertility soils. However, fertilizer trials need to be conducted to determine best management practices under New York soil and weather conditions. In this article, we report the results of a field trial on the effects of potassium (K) addition on brown mid rib sorghum sudangrass yield and forage feed quality. The trial was conducted on a Bath-Volusia soil at the Mt Pleasant Research farm in Tompkins County, NY. We investigated the effects of K application rate (0, 200, 400 lbs $K_2O$/acre split-applied in two equal applications) and nitrogen (N) application rate (0, 100, 200, 300, 400 and 500 lbs/acre split-applied in two applications) on forage yield and quality. In the previous article we reported on the effects of N rate on yield and quality. In this article, we present and discuss the effects of K application rate.

## Materials and Methods

The pH of the soil at the Mt Pleasant site was 6.2 at the onset of the trial and the soil organic matter content was 3.2%. The site was classified as medium in phosphorus (5 lbs/acre Morgan extractable P), medium in zinc (0.54 lbs Morgan extractable Zn/acre), and high in potassium, calcium and magnesium (142 lbs K/acre, 2355 lbs Ca/acre and 375 lbs Mg/acre). Potassium was applied in the form of muriate of potash (60% $K_2O$). Nitrogen applications were in the form of ammonium sulfate (21% N). All plots received the equivalent of 45 lbs of $P_2O_5$/acre and the entire trial was replicated four times. Planting was done on June 14 using a John Deer grain drill at 60 lbs of seed per acre.

Figure 1: Potassium fertilizer applications to brown mid rib sorghum sudangrass at the Mt. Pleasant farm, NY, took place at seeding and directly following the first cut.

First and second harvest took place on July 30 and September 25, respectively. Both times, cutting height was 3-3.5 inch and harvest was initiated when the plots that received 150 lbs N/acre per cut had reached a height of 38-42 inches. All samples were analyzed for total N, P, K, Ca, Mg, lignin, sugar, non-structural carbohydrates (NSC), neutral detergent fiber (NDF), digestibility of neutral detergent fiber (dNDF at 30 hr), and in vitro total digestibility (IVTD at 30 hr) at the forage laboratory of DairyOne Cooperative Inc. in Ithaca, NY. Soil samples (0-8 inches) were taken at planting and immediately after the first and second harvests. Samples were analyzed for pH, Morgan extractable P, K, Ca, Mg, nitrate and soluble salts.

## Results and Discussion

A significant NxK interaction was observed for several soil and a few forage quality parameters. This resulted from a lack of a response to K application where no or very little N had been applied. There were no NxK interactions at N levels greater than 100 lbs/acre. Because the optimum economic N application rate in this study was likely greater than 100 lbs/acre per cut, we focused our study of the effects of K on yield and quality to plots that had received 150 lbs N/acre per cut or more.

The application of potassium did not significantly increase first or second cut yields (Table 1). The overall yield did show a slight increase from 9.3, without the addition of K, to 10.0 tons/acre (35% dry matter) where 200 lbs of $K_2O$ had been applied. Yields obtained without K addition and those obtained with 400 lbs of $K_2O$/acre applications did not differ significantly. Potassium uptake efficiency showed an increase with N application rate but overall efficiencies were very low suggesting that K may not have been a limiting nutrient at the site (Table 2). Sugar, lignin, NDF, dNDF, and IVTD were unaffected by K application. In the second cut, an application of 400 lbs of $K_2O$ reduced the crude protein concentration of the dry matter by 1.3%. The uptake of $K_2O$ was greatly affected by K application rate. These results support the observation that potassium fertilization often alters elemental concentrations in forage, but generally does not impact forage quality parameters such as CP, IVTD or dNDF (Cherney et al., 2003).

Table 1: Yield, predicted milk production, N uptake, N uptake efficiency, post-harvest soil nitrate and soluble salts as affected by K application rates in a 2-cut brown mid rib sorghum sudangrass trial at Mt Pleasant, NY, 2002.

| Total $K_2O$ applied lbs per acre | Yield (35% dm) tons per acre | Crude protein % of dm | Sugar % of dm | Lignin % of dm | NDF % of dm | dNDF % of NDF | IVTD % of dm | $K_2O$ uptake lbs per acre |
|---|---|---|---|---|---|---|---|---|
| | First cut | | | | | | | |
| 0 | 4.5 a | 16.8 a | 11.1 a | 4.6 a | 62.3 a | 69.3 a | 80.8 a | 91.2 c |
| 200 | 4.8 a | 16.2 a | 9.7 a | 4.6 a | 62.8 a | 69.8 a | 81.2 a | 111.8 b |
| 400 | 4.7 a | 16.3 a | 10.3 a | 4.7 a | 63.0 a | 69.1 a | 80.4a | 125.3 a |
| | Second cut | | | | | | | |
| 0 | 4.8 a | 18.4 a | 13.5 a | 3.6 a | 59.0 a | 69.8 a | 82.0 a | 81.1c |
| 200 | 5.3 a | 17.7 ab | 12.6 a | 3.7 a | 60.6 a | 69.0 a | 81.3 a | 102.5 b |
| 400 | 4.9 a | 17.1 b | 13.0 a | 3.9 a | 59.9 a | 69.0 a | 81.3 a | 112.2 c |

Note 1: Milk yield was predicted using Milk 2000 (http://www.uwex.edu/ces/forage/articles.htm#milk2000).
Note 2: Average values *within columns* with different letters (a,b,c) are statistically different ($\alpha = 0.05$)
Note 3: The initial soil test K was 142 lbs Morgan K/acre. N application was >100 lbs N/acre per cut.

The K concentration in the forage decreased with an increase in N rate where no K had been applied (Table 2). In grasses, K concentration will increase with increasing N rates if there is excess soil K available, but K concentration will decrease with increasing N rates if the soil K level is limiting (Cherney et al., 1998).

This year's results demonstrate that low K forage (<2.5 % K on a dry matter basis) necessary to prevent metabolic disorders in non-lactating cows, was obtained with N rates of just over 50 lbs N per acre per cut. The additions of 200 and 400 lbs $K_2O$ per acre increased soil test K levels from an average of 142 lbs K/acre at the onset of the trial to 176 and 220 lbs K/acre after the second cut, respectively.

Table 2: Effects of N and K application rates on K concentrations in BMR sorghum sudangrass, K fertilizer uptake efficiency and end of season soil available K levels.

| N applied | $K_2O$ applied | K concentration (% of dry matter) | | Morgan soil test K (lbs K per acre) | | K uptake efficiency |
|---|---|---|---|---|---|---|
| lbs per acre per cut | | 1st cut | 2nd cut | At planting | After 2nd cut | % |
| 0 | 0 | 2.60 a | 2.09 a | 144 a | 144 b | - |
| | 100 | 2.74 a | 2.16 a | 152 a | 166 ab | 2 a |
| | 200 | 2.75 a | 2.31 a | 128 a | 246 a | 1 a |
| 50 | 0 | 2.52 b | 1.99 a | 154 a | 132 b | - |
| | 100 | 2.73 ab | 2.17 a | 148 a | 160 b | 8 a |
| | 200 | 2.93 a | 2.31 a | 146 a | 232 a | 7 a |
| 100 | 0 | 2.34 b | 2.16 b | 142 a | 146 b | - |
| | 100 | 2.54 ab | 2.26 b | 140 a | 152 b | 9 a |
| | 200 | 2.98 a | 2.51 a | 144 a | 212 a | 14 a |
| 150 | 0 | 2.34 a | 1.86 c | 138 a | 122 c | - |
| | 100 | 2.68 b | 2.25 b | 130 a | 170 b | 28 a |
| | 200 | 3.03 c | 2.60 a | 136 a | 230 a | 18 a |
| 200 | 0 | 2.14 b | 1.90 b | 138 a | 140 b | - |
| | 100 | 2.50 ab | 2.13 b | 162 a | 162 b | 30 a |
| | 200 | 2.84 a | 2.43 a | 148 a | 238 a | 16 a |
| 250 | 0 | 2.28 b | 1.80 b | 138 a | 106 b | - |
| | 100 | 2.52 ab | 2.09 ab | 134 a | 198 a | 29 a |
| | 200 | 2.89 a | 2.48 a | 136 a | 196 a | 25 a |

Note 1: Average values *within columns and a specific N rate* with different letters (a,b,c) are statistically different ($\alpha = 0.05$)

## Conclusions

The addition of K at this site (high in K) did not significantly increase dry matter yields of the individual first and second cuts but resulted in a slight increase in overall dry matter production. Potassium uptake efficiencies were low suggesting that K was not a limiting nutrient at this site. This was not surprising as the site tested high in K at the onset of the trial. Addition of K may be needed to obtain higher yields on soils testing lower for available K or when soil test K needs to be maintained at high levels.

Feed quality was not affected by K addition with the exception of a slight decrease in crude protein in the second cut which occurred upon addition of 200 lbs of $K_2O$/acre. Low K forage necessary for dry cows to reduce the possibility of metabolic disorders after calving was obtained with N rates of about 50 lbs N per acre per cut.

Although the 2002 results of this trial show that the yield benefits from the addition of 200 lbs $K_2O$ were minimal, recommendations should not be based on the results of one season and one site only. We plan to continue this trial in 2003.

## References

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## For Further Information

For further information on BMR sorghum sudangrass projects in New York contact Thomas Kilcer at the Rensselaer Cooperative Extension Office at tfk1@cornell.edu or 518-272-4210. You could also visit the BMR sorghum sudangrass website at http://nmsp.css.cornell.edu/projects/bmr.asp.