Impact of Brown Midrib Trait on the Decomposition Rate of Sorghum-Sudangrass Residue in Pastures

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Keywords: BMR; brown midrib; sorghum-sudangrass; decomposition; pastures.

Abstract. Sorghum-sudangrass (*Sorghum bicolor* var. bicolor x bicolor var. sudanense) can provide high quality summer grazing. Some varieties possess the brown midrib (BMR) trait which results in reduced lignin resulting in higher digestibility and animal performance. If microbes in the rumen can digest BMR sorghum-sudangrass more completely, then soil macro/micro flora and fauna may do so as well. This could result in nutrients being returned to the soil faster from plants containing the BMR trait. The objective of this study was to determine the decomposition rate of BMR and non-BMR sorghum-sudangrass. The experimental design was a random complete with four replications. Sorghum-sudangrass with and without the BMR trait was placed in litter decomposition bags as whole plants or divided into leaves and stems. A composite sample was taken when bags were loaded to determine initial dry matter. Loaded bags were then placed on the soil surface in a pasture and collected at 1, 2, 3, 4, 6, 8, 10, 12, 14, or 16 weeks after placement. Upon collection plant material was dried for 3-days at 55°C in a forced air oven. Dry weights at each collection date were subtracted from the initial dry weight to determine total DM loss. The BMR trait did not impact dry matter loss in the leaves. Stems possessing the BMR trait lost dry matter at a greater rate resulting in dry matter losses at 14 weeks of 78 and 68% and 59 and 47% for the BMR and non-BMR varieties in trials 1 and 2, respectively. Whole plants showed limited differences in dry matter loss at 14 weeks after placement.

Introduction

Sorghum-Sudangrass (*Sorghum bicolor* var. bicolor x bicolor var. sudanense) is commonly used to provide high quality grazing during the summer months (Ball et al., 2015). Some cultivars possess a single gene mutation called the brown midrib (BMR) trait (Pedersen and Rooney, 2004). This mutation results in lower concentrations of lignin in the plant material resulting in higher digestibility in the rumen of the animal, often culminating in higher animal performance (Cherney et al., 1991). When livestock graze summer annual grasses, utilization rates can range from 40 to 70% (Kyle, 2013). Much of the remaining forage is trampled to the soil surface where it is broken down by macro and micro flora and fauna (Tugel et al., 2000). The impact of the BMR trait on the decomposition rate of residue remaining after grazing is unknown. The objective of this study was to determine the impact of the BMR trait on the decomposition rate of sorghum-sudangrass residue.

Methods and Study Site

This study was conducted at the University of Kentucky Research and Education Center located near Princeton, KY. The experimental design was a random complete block with a factorial treatment arrangement and four replications. The study was repeated. Treatments were sorghum-sudangrass with and without the BMR trait, plant part, and decomposition time. The sorghum-sudangrasses were planted into a prepared seed bed in late-June. The first trial began on 27-Jul-21 and the second on 4-Aug-21. Sorghum-sudangrass was harvested by hand and transported to lab where it was separated into leaves and stems or not separated (whole plant). Leaves, stems, and whole plants were then cut into 25 cm lengths and placed into decomposition bags that were constructed of 30% shade cloth (Figure 1). Filled bags were immediately placed into a grazed pasture. The study area had been clipped closely to facilitate bag placement and a temporary electric fence was used to exclude livestock from the study area (Figure 2). Bags were collected and dried starting at 1 week after placement and ending at 16 weeks after placement for both trials. A composite sample was taken when bags were loaded to determine initial dry matter and

dry matter loss was determined by difference. Data were analyzed using the General Linear Procedure (SAS, Cary, NC) and polynomial regressions were created using SigmaPlot 15.0 (SYSTAT, Palo Alto, CA).

Results and Discussion

Leaves from the BMR and non-BMR plants decreased in dry matter at a similar rate (Figure 3). At 14 weeks after placement, leaves had lost 72 and 62% of their dry matter for trials 1 and 2, respectively. In contrast to the leaves, stems from the BMR sorghum-sudangrass decomposed at a greater rate (Figure 4). Averaged over trials, at 14 weeks after placement, dry matter losses for the stems were 69 and 58% for the BMR and non-BMR plants, respectively. Whole plants with the BMR trait lost slightly more dry matter than non-BMR plants (Figure 5).

When foraging, livestock tend to prefer leaves over stems, resulting in a higher stem to leaf ratio in the residue remaining after grazing. The observed increase stem decomposition for the BMR sorghum-sudangrass could enhance nutrient cycling in summer annual pastures. In addition, the more rapid dry matter decomposition may enhance seed to soil contact when planting the next crop.

Conclusions

Sorghum-sudangrass can provide high quality grazing for livestock during the summer months. The BMR trait and the associated lower lignin levels in the plant tissue not only increase dry matter digestibility in the rumen and associated animal performance but also enhance residue decomposition following grazing. This may speed up nutrient cycling and improve the establishment of subsequent crops. Producers utilizing sorghum-sudangrass should be encouraged to select varieties that contain the BMR trait.

References

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Figure 1. Leaves, stems, and whole plants were placed into 12 x 12-inch litter bags constructed from 30% shade cloth.

Figure 2. Numbered litter bags were placed on the soil surface in a summer annual pasture (crabgrass) (left). An electrified temporary fence was used to exclude cattle from bags (right). Bags were collected starting at 1 week after placement and ending at 16 weeks after placement.

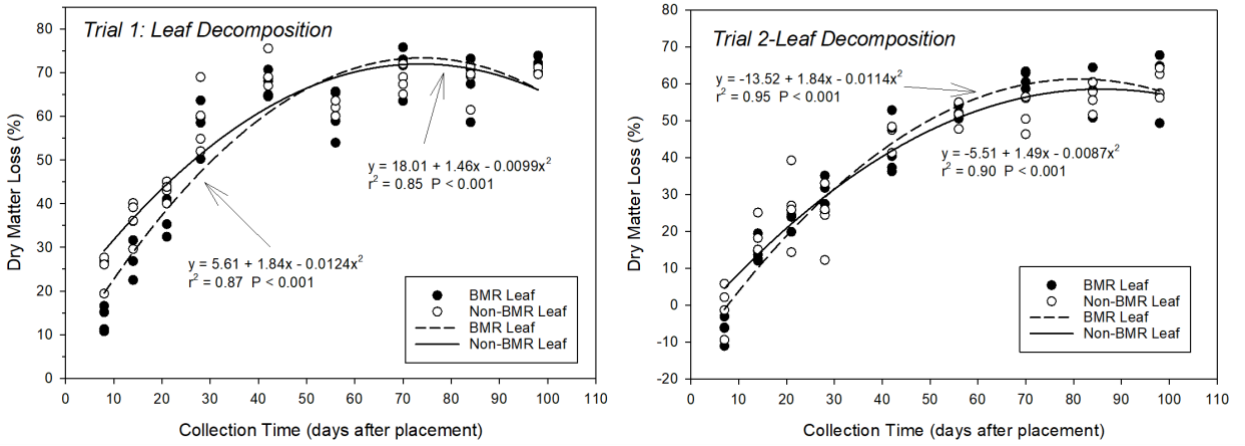

Figure 3. Impact of time and BMR trait on the decomposition of sorghum-sudangrass LEAVES in pastures.

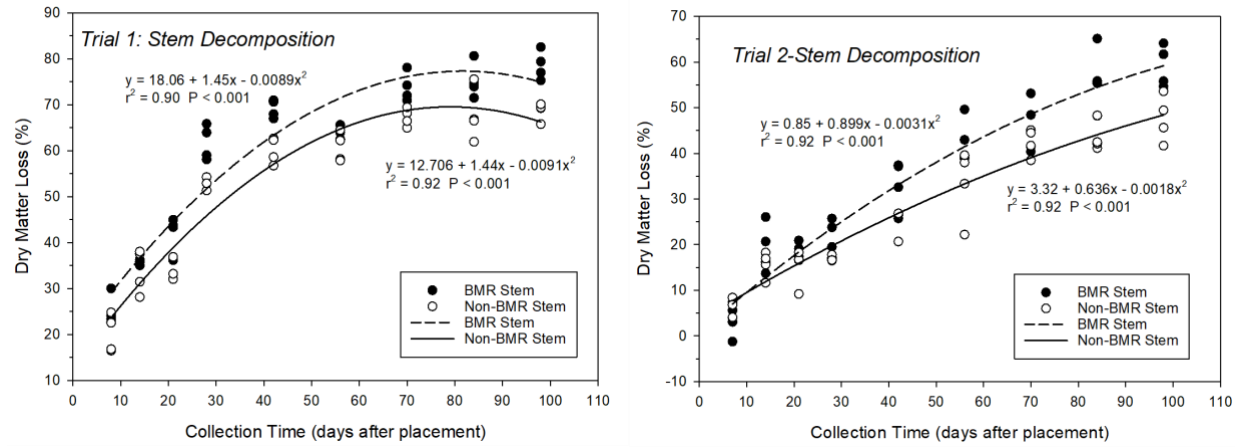

Figure 4. Impact of time and BMR trait on the decomposition of sorghum-sudangrass STEMS in pastures.

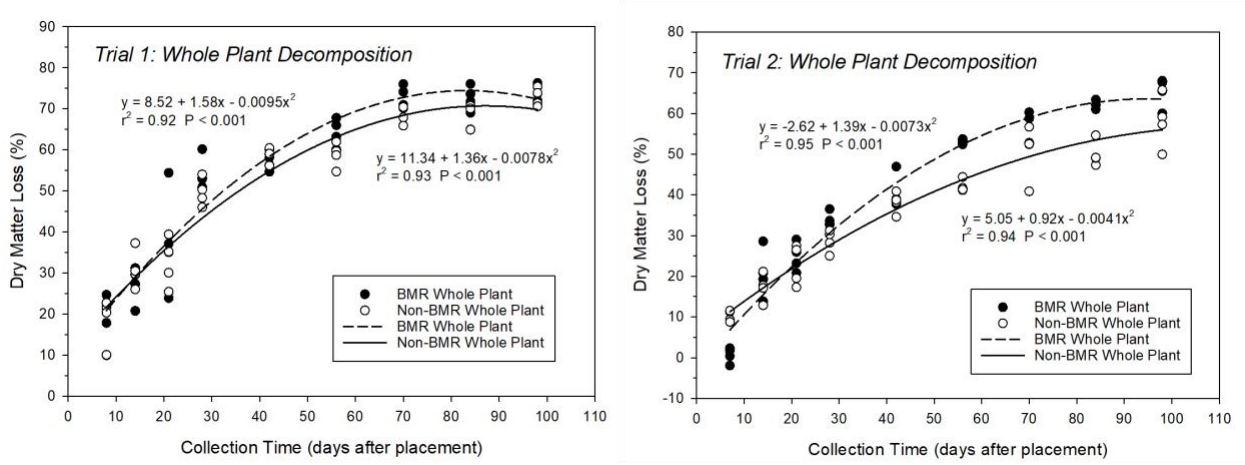

Figure 5. Impact of time and BMR trait on the decomposition of sorghum-sudangrass WHOLE PLANT in pastures.