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# Forage Quality and Grazing Performance of Beef Cattle Grazing Brown Midrib Grain Sorghum Residue

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## Summary

Two hybrids of grain sorghum, the AWheatland x RTx430 hybrid (CON) and its near isogenic brown midrib counterpart (BMR), were used in a 65-day residue grazing experiment. Grain sorghum was planted in 4 replications for each treatment within the same field, and grazed with 6 steers/replication. Samples of the sorghum residue were collected on days 1, 31, and 60 for neutral detergent fiber (NDF) and *in vitro* NDF digestibility analysis. Steers grazing the BMR treatment gained 1.55 lb/day while the steers grazing the CON treatment gained 1.32 lb/day ( $P = 0.14$ ). The BMR and CON were similar in NDF (73.5%), but *in vitro* NDF digestibility increased by 9.9 percentage units in the leaf portion.

## Introduction

The brown midrib (BMR) trait has been successfully incorporated into a number of crop species, including corn, pearl millet, and sudangrass. A crop residue with the BMR trait is more digestible due to the lower lignin content, thus improving cattle performance. Until recently, the BMR trait was not available in grain sorghum; however, it has now been developed. Research conducted at the University of Nebraska (Oliver, et al., 2005 *Crop Science*) indicated grain sorghum with the BMR-12 gene was no different in grain yield and residue neutral detergent fiber (NDF) content than

the common grain sorghum hybrid AWheatland x RTx430, but the BMR trait improved *in vitro* NDF digestibility. A study was designed across two years to determine the impact of the BMR trait on gain of cattle grazing grain sorghum residue, as well as the NDF content and digestibility of residue. Year 1 results already have been reported (2008 *Nebraska Beef Report*, pp. 31-33). Year 2 results and performance for both years are reported here.

## Procedure

In year 2, 48 steers ( $492 \pm 50$  lb) were stratified by BW and assigned randomly to 5.75-acre paddocks with six steers in each paddock. Four paddocks contained a conventional grain sorghum hybrid, AWheatland x RTx430 (CON), and four contained its near-isogenic BMR counterpart containing the BMR-12 gene. For 5 days, the steers were limit fed at 2% of BW a diet of 25% alfalfa, 25% grass hay, and 50% wet corn gluten feed to minimize variation in gut fill. Following grazing, steers were limit fed the same diet at a projected 2% of BW to equalize gut fill, as well. Steers were weighed for two consecutive days and those weights averaged for both initial and ending BW. Steers grazed for 65 days from Dec. 2, 2008 until Feb. 5, 2009. Throughout the grazing period, the steers were supplemented daily with 2.5 lb of a distillers grain-based supplement containing 93.8% dry distillers grains, 4.7% limestone, 0.8% tallow, 0.1% Rumensin-80 premix, 0.3% beef trace mineral, 0.2% selenium, and 0.1% vitamin premix.

Residue samples were collected on day 1 (Dec. 2, 2008), day 31 (Jan. 4, 2009), and day 60 (Feb. 4, 2009). Samples were taken from one row (3 ft.) in the grazed portions of each paddock and from one row (3 ft.) in

6x4-ft. grazing enclosures in each paddock for comparison of forage quality between grazed and ungrazed residue over time. The enclosures provided a standard for comparison of residue quality change as the residue was grazed.

Residue samples were separated into stem and leaf portions and dried in a 60°C forced air oven. Samples were ground through a 1-mm screen and analyzed for NDF content and *in vitro* NDF digestibility (IVNDFD). The NDF content was determined by refluxing 0.5 g of each sample in NDF solution for 1 hour (0.5 g of sodium sulfite was added to aid in protein removal). The samples were then filtered and dried for 24 hours. IVNDFD was determined using a 30-hour incubation of 0.3 g of sample in a 1:1 mixture of McDougal's buffer (1 g/L urea) and rumen fluid collected from ruminally fistulated steers. Samples were incubated in a water bath at 39°C and swirled every 12 hours. After incubation, the same reflux technique used to determine NDF content was used to determine the remaining NDF, but only 0.3 g of sodium sulfite was used.

Data were analyzed using the MIXED procedure of SAS (SAS Institute, Cary, N.C.) with paddock as the experimental unit. Performance data also were combined across two years with data from the 2008 *Nebraska Beef Report* (pp. 31-33); the interaction between year and treatment was tested, and years were combined when no interaction was observed. Fiber and digestibility data of residue were analyzed as repeated measures with an auto-regressive (AR-1) covariance structure, with paddock as the experimental unit. Samples were analyzed for the effects of treatment, plant part (i.e., leaves and stems), day of grazing, grazed vs. non-grazed, and their interactions.

(Continued on next page)

**Table 1. Effect of grain sorghum hybrid on steer performance grazing grain sorghum residue for 65 days (Year 2).**

	CON <sup>1</sup>	BMR <sup>2</sup>	SEM	P-value
Initial BW, lb	495	489	2	0.06
Ending BW, lb	575	584	5	0.30
ADG, lb	1.32	1.55	0.10	0.14

<sup>1</sup>CON = treatment in which steers grazed conventional grain sorghum hybrid AWheatland x RTx430.

<sup>2</sup>BMR = treatment in which steers grazed grain sorghum containing the brown midrib gene.

**Table 2. Effect of grain sorghum hybrid on steer performance grazing grain sorghum residue across two years for an average of 69 days.<sup>1</sup>**

	CON <sup>2</sup>	BMR <sup>3</sup>	SEM	P-value		
				Interaction <sup>4</sup>	Year <sup>5</sup>	Hybrid <sup>6</sup>
Initial BW, lb	530	526	2	0.35	< 0.01	0.19
Ending BW, lb	597	618	4	0.07	< 0.01	< 0.01
ADG, lb	1.03	1.39	0.06	0.20	< 0.01	< 0.01

<sup>1</sup>Data from year 1 are presented in 2008 Nebraska Beef Report, pp. 31-33.

<sup>2</sup>CON = treatment in which steers grazed conventional grain sorghum hybrid AWheatland x RTx430.

<sup>3</sup>BMR = treatment in which steers grazed grain sorghum containing the brown midrib gene.

<sup>4</sup>P-value for year x hybrid interaction.

<sup>5</sup>P-value for the main effect of year.

<sup>6</sup>P-value for the main effect of sorghum type.

**Table 3. Effect of grain sorghum hybrid on leaf and stem quality averaged during grazing (Year 2).**

	Leaves			Stems			Interaction
	CON <sup>1</sup>	BMR <sup>2</sup>	P-value	CON <sup>1</sup>	BMR <sup>2</sup>	P-value	
NDF <sup>3</sup> , %	73.2	73.8	0.56	76.3	77.2	0.37	0.82
IVNDFD <sup>4</sup> , %	48.8	58.7	< 0.01	44.8	58.7	< 0.01	< 0.01

<sup>1</sup>CON = conventional grain sorghum hybrid AWheatland x RTx430.

<sup>2</sup>BMR = grain sorghum containing the brown midrib gene.

<sup>3</sup>NDF = neutral detergent fiber represented as percent of the sample.

<sup>4</sup>IVNDFD = *in vitro* neutral detergent fiber digestibility.

**Table 4. Effect of day of grazing on leaf and stem quality averaged across hybrid (Year 2).**

Day	1	31	60	SEM	Linear	Quadratic
NDF <sup>1</sup> , %	73.5	76.1	75.7	0.6	< 0.01	0.04
IVNDFD <sup>2</sup> , %	52.6	54.4	51.2	0.9	0.27	0.03

<sup>1</sup>NDF = neutral detergent fiber represented as percent of the sample.

<sup>2</sup>IVNDFD = *in vitro* neutral detergent fiber digestibility.

## Results

Steer performance is presented in Table 1. Daily gain tended ( $P = 0.14$ ) to be greater for steers grazing BMR compared to CON. When the data from both years were combined, steers grazing BMR gained more ( $P < 0.01$ ) than steers grazing CON, and no interaction between year and treatment was ob-

served for ADG  $P = 0.20$ ; Table 2).

When the data from both years are combined, final BW was greater ( $P < 0.01$ ) for steers grazing BMR compared to steers grazing CON.

In year 2, the BMR gene caused no significant difference in NDF content of either the leaf or stem portion of the sorghum plant as compared to the CON (Table 3). The NDF content was

73.8% and 73.2% for the BMR and CON leaf portions, respectively, while the stem portions contained 77.2% NDF for the BMR and 76.3% for the CON. There was no significant difference in % NDF between grazed residue and residue in the enclosures.

In year 2, there was no significant difference between grazed residue and residue in the enclosures. *In vitro* NDF digestibility of both stems and leaves was impacted by treatment. Leaves from BMR paddocks were 9.9 percentage units more digestible ( $P < 0.01$ ) than CON paddocks, regardless of whether from grazed or ungrazed areas. Stems from BMR paddocks were approximately 13.9% units greater ( $P < 0.01$ ) in IVNDFD compared to CON paddocks. An interesting observation was that the BMR stems and leaves had the same IVNDFD of 58.7%, suggesting that if stems were palatable, cattle would receive a similar amount of energy from either stems or leaves in BMR grain sorghum residue.

In year 2, a quadratic effect of time was observed for the day of sampling with regard to % NDF and IVNDFD for both BMR and CON groups (Table 4). The values for both NDF and IVNDFD were greater at day 31 than at day 1 or day 60. This could have been due to a combination of weather conditions and selective grazing. However, these changes were relatively small in both NDF and *in vitro* NDF digestibility.

This experiment indicates residue from BMR grain sorghum has greater digestibility of NDF compared to conventional hybrids. This increase in digestibility translates into better ADG when calves graze BMR grain sorghum residue following grain harvest.

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