2018

Steer Performance Grazing Corn Residue and Supplemented with Modified Distillers Grains plus Solubles with or without Urea

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Summary with Implications

A growing study was conducted to evaluate the effects of supplementing growing calves grazing corn residue with modified distillers grains plus solubles (MDGS; 3 or 5 lb/d) and with or without urea on growth performance. There were no significant MDGS × urea inclusion interactions observed. Urea inclusion level (0 and 0.12 lb/d) did not affect supplemental intake, ADG, or ending BW. Steers fed 5 lb of MDGS had an increased ADG and a heavier ending BW compared to steers fed 3 lb MDGS daily. Supplemental urea is not necessary when supplementing at least 3 lb MDGS to steers grazing corn residue.

Introduction

Following the increase in corn price in 2006 many rangeland acres were converted to corn and soybean production. An increase in farmland acres has led to an abundance of corn residue, which can be utilized as an inexpensive feed resource for beef cattle. Corn residue is relatively low in protein and energy, especially for growing animals. Thus, it is necessary to provide a supplemental protein and energy source to meet the calves' growth requirements. Modified distillers grains plus solubles (MDGS) are high in energy (108% TDN) and protein (29% CP), which also provides a good source of rumen undegradable protein (RUP). Previous work modeled the metabolizable protein balances of growing calves grazing corn residue and estimated that DGS supplementation results in a deficiency in rumen degradable protein (RDP), but excess metabolizable protein (MP; 2016 Nebraska Beef Report, pp. 31–32). The excess MP can be recycled back to the rumen to meet a RDP deficiency, but it is unclear how efficient recycling occurs. Increasing the amount of supplemental DGS increases the excess MP balance such that a response to supplemental urea may be more likely observed when less DGS is provided. Therefore, the objective of this experiment was to determine the effects of supplementing MDGS with and without urea on the performance of growing calves grazing corn residue.

Table 1. Composition (% of diet DM) of supplements fed to steers grazing corn residue

Supplement	3lb MDGS no Urea	5lb MDGS no Urea	3lb MDGS with Urea	5lb MDGS with Urea
Dried Distillers Grains	2.921	2.274	2.017	1.490
Limestone	1.572	1.572	1.572	1.572
Tallow	0.125	0.108	0.125	0.108
Urea	0	0	0.905	0.784
Salt	0.3	0.3	0.3	0.3
Beef Trace Minerals	0.05	0.05	0.05	0.05
Vitamin A-D-E	0.015	0.015	0.015	0.015
Rumensin-90®	0.017	0.015	0.017	0.015

Procedure

A corn residue grazing study was conducted to determine the effects of feeding either 3 or 5 lb of MDGS with or without urea on growth performance. One hundred and twenty crossbred steers (initial BW = 536; SD = 44 lb) were utilized in a 72-d corn residue grazing experiment at the University of Nebraska–Lincoln Eastern Nebraska Research and Extension Center (ENREC) near Mead, NE. Treatments were arranged in a 2 × 2 factorial treatment design. Factors included MDGS inclusion (3 or 5 lb/d) and urea inclusion (0 or 0.12 lb/d). Steers were received in the feedlot and vaccinated with Bovi-shield Gold One Shot (Zoetis Animal Health) administered at 2 ml/steer, Dectomax® injectable (Zoetis Animal Health) administered at 5.5 ml/steer, and Somubac (Zoetis Animal Health) administered at 2 ml/steer. Steers received a limit fed diet and were trained to the Calan gate system for 27 d prior to trial initiation. During processing on d 0, all steers were individually weighed, and revaccinated with Bovi-shield Gold One Shot (Zoetis Animal Health) administered at 2 ml/steer and Ultrabac® 7 (Zoetis Animal Health) administered at 5 ml/steer. Steers also received a Ralgro® (36 mg Zeranol; Merck Animal Health) implant on d 1.

Prior to initiation of trial, steers were limit fed at 2% of BW a diet consisting of 50% Sweet Bran® (Cargill) and 50% alfalfa hay (DM basis) to minimize variation in gastrointestinal fill. Steers were weighed for 3 consecutive d to establish initial BW. Steers were blocked by d-1 and d 0 BW, stratified by BW within blocks (light and heavy), and assigned randomly to 1 of 4 treatments (n = 30). Block was assigned to field based off d-1 and d 0 weights (irrigated = heavy block, dryland = light block) with 60 steers per field. Steers grazed the same field assigned at initiation for the duration of the trial. All steers were individually supplemented daily via a Calan gate system. Minerals and vitamins were added to supplements to meet nutrient requirements (Table 1). Monensin (Rumensin, Elanco Animal Health) was included in the supplement to provide 200 mg/steer daily. At the

Table 2. Effect of MDGS inclusion on performance of steer calves grazing corn residue

	MDGS, lb			P-Value
	3	5	SEM	MDGS
Initial BW, lb	535	536	3.7	0.84
Ending BW, lb	666	703	4.1	<0.01
ADG, lb	1.83	2.32	0.03	<0.01
Suppl. DMI, lb/d	3.7	5.6	0.01	<0.01

Table 3. Effect of urea inclusion on performance of steer calves grazing corn residue

	Urea, lb			P-Value
	0	0.12	SEM	Urea
Initial BW, lb	534	537	3.7	0.66
Ending BW, lb	685	684	4.1	0.96
ADG, lb	2.09	2.05	0.03	0.41
Suppl. DMI, lb/d	4.6	4.6	0.01	0.59

conclusion of the trial, steers were limit-fed the same diet consisting of 50% Sweet Bran® (Cargill) and 50% alfalfa hay (DM basis) for 5 d at 2% of BW and 3-d weights were collected.

Stocking rate was calculated based on yield of the field at harvest and previous research quantifying the amount of residue available for grazing based on bushel of grain yield (2016 Nebraska Beef Report, pp. 71–73). Estimated forage availability was determined using formulas consistent with UNL grazing recommendations (16 lb of total husk and leaf per bushel of corn, of which 50% is assumed to be ungrazable due to trampling, weathering, and other factors). The amount of residue calculated per acre was multiplied by the number of acres harvested to get an estimate of the total amount of available forage for each field. Total available forage was then divided by estimated forage DMI (10 lb/ steer daily) and multiplied by 60 steers per field to calculate d of available grazing (2015 Nebraska Beef Report, pp. 27–29). Models used to determine RDP and MP balances assumed the following for corn residue nutrient profile: TDN, CP, RDP, RUP, RUP digestibility were 54%, 4.25%, 75%, 25%, and 6%, respectively. Models assumed the following for MDGS nutrient profile: TDN, CP, RDP, RUP, RUP digestibility were 85%, 38%, 37%, 63%, and 96%, respectively. All models assumed a microbial efficiency of 10%. Models for steers receiving 3 lb of MDGS assumed a corn residue DMI of 10 lb, RDP requirement of 357 g/d and a MP requirement of 389 g/d. Models for steers receiving 5 lb of MDGS assumed a corn residue DMI of 8.5 lb, RDP requirement of 392 g/d, and a MP requirement of 451 g/d. The model estimated that steers fed 3 lb/d of MDGS and 10 lb/d of corn residue would have a RDP balance of-46 g/d and a MP balance of 140 g/d. Furthermore, the model estimated that for steers fed 5 lb/d of MDGS and 8.5 lb/d of corn residue would have a RDP balance of 50 g/d and a MP balance of 346 g/d.

To determine changes in forage quality throughout the grazing period, corn residue diet samples were collected at the beginning, middle, and the end of the study utilizing 6 ruminally fistulated steers. Fistulated steers grazed the irrigated corn field throughout the duration of the study and were supplemented MDGS with no urea in a separate pen. Prior to each rumen sample collection, rumen contents were removed from each steer with three steers grazing the irrigated field and 3 steers grazing the dryland field. After approximately 30 minutes of grazing, consumed feed was collected from each steer's rumen and placed in a cooler for analysis. Residue diet samples collected were used to determine in vitro organic matter digestibility (IVOMD). All diet samples were analyzed in two IVOMD runs with 3 tubes per sample.

Growth performance data (BW, supplement DMI, ADG) were analyzed using the MIXED procedure of SAS with individual animal as the experimental unit. All lab data (corn residue diet samples) were analyzed using the MIXED procedure of SAS with run as the experimental unit.

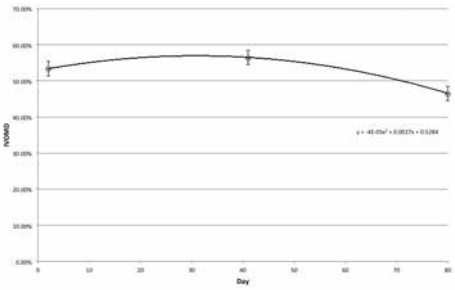

Figure 1. In vitro organic matter digestibility (IVOMD) of corn residue diet samples over time, from 11/3/16 to 1/20/17.

Results

No significant MDGS × urea inclusion interactions ($P > 0.62$) were observed for growth performance, so main effects are presented. Ending BW was 37 lb heavier ($P < 0.01$; Table 2) for steers fed 5 lb of MDGS compared to steers fed 3 lb. Furthermore steers receiving 5 lb of MDGS had greater ($P < 0.01$) ADG compared to steers fed 3 lb. Ending BW was not different ($P = 0.96$; Table 3) between urea inclusion levels, due to no difference ($P = 0.41$) in ADG. There was no difference ($P = 0.59$) in supplement intake between 0 and 0.12 lb of urea treatments. Figure 1 illustrates that the IVOMD of the corn residue decreased quadratically ($P < 0.01$) from 53.4% at the beginning of the grazing period to 46.5% at the end of the period. In vitro organic matter digestibility of the corn residue was not statistically different ($P = 0.76$) between fields. A logical explanation for a decrease in grazed residue quality with time is steers selectively grazed different plant parts and consumed the most digestible components early in the grazing season.

Steers fed 5 lb of MDGS had a 5.3% improvement in ending BW ($P < 0.01$), and a 21.1% improvement in ADG ($P < 0.01$). These results agree with previous research in which steers grazing corn residue were fed either dried distillers grains (DDGS) or MDGS at 0.3, 0.7, or 1.1% of BW (1.4 to 5.4 lb/ steer daily on a DM basis). Gain increased quadratically ($P = 0.01$) gaining 1.55, 2.02, and 2.12 lb/d for steers fed 0.3, 0.7, and 1.1% of BW, respectively, with no

difference between DDGS and MDGS (2014 Nebraska Beef Report, pp. 48–49).

NRC models hypothesized that RDP would be deficient in growing steers grazing corn residue fed 3 lb of MDGS. When modeled, steers fed 5 lb of MDGS had a positive RDP balance of 50 g/d and steers supplemented 3 lb of MDGS had a negative RDP balance of-46 g/d. However, urea inclusion did not affect supplemental intake, gain or ending BW, suggesting that the RDP requirements were met in all treatments.

Conclusion

These findings suggest that additional urea is not needed when steers grazing corn residue are supplemented with 3 or 5 lb/d of MDGS. Supplementing 5 lb of MDGS increased ADG compared to 3 lb.

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