

# Effects of Forage Type, Storage Method, and Moisture Level in Crop Residues Mixed with Modified Distillers Grains

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## Summary

Two growing experiments compared effects of feeding a diet consisting of cornstalks or wheat straw and modified distillers grains when ensiled or mixed fresh daily. Wheat-straw based diets also were compared at different moisture levels (50% and 70%) when ensiled and mixed daily. In Experiment 1, steers fed ensiled diets had greater DMI compared to diets mixed daily. Moisture level and crop residue type had no effect on steer performance. In Experiment 2, steers were offered the supplements and a hay mix to determine palatability and forage replacement. Moisture level had no effect, cornstalks were consumed better than wheat straw, and steers fed freshly mixed diets gained more and were more efficient than those fed ensiled mixes.

## Introduction

Ensiling cornstalks (2009 *Nebraska Beef Cattle Report*, pp. 30-32) or wheat straw (2010 *Nebraska Beef Cattle Report*, pp. 42-43) with WDGS in silo bags resulted in greater ADG and G:F compared to diets mixed fresh daily. A mix of wheat straw and WDGS reduced grazed forage intake without affecting growing steer performance (2008 *Nebraska Beef Cattle Report*, pp. 29-31). By using cornstalks or wheat straw in combination with readily available ethanol byproducts, grazed forage intake may be reduced and growing performance enhanced.

The objectives of these experiments were to 1) evaluate storage method, moisture level, and forage type in crop residue and MDGS diets on growing steer performance; and 2) evaluate growing steer performance and replacement of forage with supplement blends of crop residue and MDGS.

## Procedure

### Experiment 1

Sixty crossbred steers (initial BW = 636 ± 22 lb) were used in a completely randomized design experiment. Steers were received at the University of Nebraska–Lincoln Agricultural Development and Research Center (ARDC), Mead, Neb., during the fall of 2010. Steers were weighed and vaccinated (Bovi-Shield Gold® 5, Somubac®, Dectomax®) on arrival, revaccinated after 14 days (Bovi-Shield Gold 5, Pinkeye, Vision® 7-Somnus) and trained to use individual Calan gates. Prior to initiation of the trial, steers were limit fed a diet of 50% alfalfa hay and 50% wet corn gluten feed at 2% of BW to minimize variation in gastrointestinal fill. Following the limit feeding period, steers were weighed on three consecutive days, with the average BW from day -1 and 0 used to assign steers randomly to treatments. Ten steers were assigned to one of six treatments in two separate 2 x 2 factorials. Forage type (cornstalks or wheat straw) and storage method (ensiled or nonensiled) were compared in the first factorial. Water was added at the time of ensiling or immediately prior to feeding to reach 70% moisture. The second factorial compared wheat straw storage method (ensiled or nonensiled) and moisture level (50% or 70%). Ensiled

treatments were mixed 30 days prior to the initiation of the trial and stored in silo bags. Nonensiled treatments were mixed fresh daily using the same source of forage as their ensiled counterparts. Ensiled and nonensiled blends contained 30% MDGS and 70% crop residue on a DM basis.

Steers were individually fed their respective diets *ad libitum* for 84 days using Calan gates. Feed was adjusted daily based on individual intakes. Feed refusals were collected daily and feed samples were collected weekly. Steers were limit fed for five days at trial completion and weighed three consecutive days to obtain ending BW.

### Experiment 2

Five hundred and ten crossbred steers (initial BW = 696 ± 50 lb) were used in a randomized complete block design experiment to compare forage replacement and growing performance. Steers were received at ARDC during the fall of 2010. Steers were weighed and vaccinated (Bovi-Shield Gold 5, Somubac, Dectomax) on arrival, revaccinated after 14 days (Bovi-Shield Gold 5, Pinkeye, Vision 7-Somnus), and placed onto bromegrass pastures for 30 days. After receiving, steers grazed corn residues and were supplemented with wet corn gluten feed for 90 days. In February 2011, steers were moved to pens and were limit-fed a diet consisting of 50% alfalfa hay and 50% wet corn gluten feed at 2% BW to minimize the effect of gastrointestinal fill prior to initiation of the trial. Following the 5 day limit-feeding period, steers were weighed on two consecutive days, with day 0 weights used to block by BW, stratify within block, and assign

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randomly to pen.

Treatments were supplements containing 70% crop residue and 30% MDGS (DM). The treatments were arranged in two separate 2 x 2 factorials, comparing type of crop residue (cornstalks and wheat straw) and storage method (ensiled or mixed fresh). The second factorial compared storage method and moisture content of the diet (50% or 70%). Four pens were used as a control group and were only offered the 60% grass hay:40% alfalfa hay forage diet. Steers were offered supplements *ad libitum* at 0700 hours. At 1200 hours, prior to feeding the basal forage diet, bunks were evaluated based on supplement intake and adjustments for the subsequent day's supplement offering were made. The basal diet was offered at 1300 hours and adjustments to each afternoon's feeding were made prior to the 0700 hours feeding of the residue and MDGS supplement. Feed refusals were weighed and removed at the time of each bunk evaluation. Steers were limit fed for five days at trial completion and weighed on two consecutive days for ending BW.

## Results

### Experiment 1

Interactions were observed between residue type and storage method for ADG ( $P = 0.02$ , Table 1) and F:G ( $P < 0.01$ ). Steers offered ensiled wheat straw and MDGS mixes had greater DMI and ADG than steers fed diets mixed fresh daily, suggesting an increase in palatability and fiber digestion. However, the positive effect ensiling had on intake of wheat straw was not observed in diets containing cornstalks. Steers fed diets containing cornstalks mixed fresh daily had lower F:G than those

**Table 1. Effects of forage type and storage method on growing steer performance in Experiment 1.**

	Cornstalks		Wheat Straw		SE	Trt	P-Value	
	Fresh	Ensiled	Fresh	Ensiled			Forage	Trt*Forage
Initial BW, lb	635	637	634	638	7	0.83	0.91	0.99
Ending BW, lb	734	729	714	747	11	0.20	0.92	0.08
ADG, lb	1.18 <sup>ab</sup>	1.10 <sup>ab</sup>	0.94 <sup>a</sup>	1.31 <sup>b</sup>	0.09	0.10	0.82	0.02
DMI, lb/day	10.2	11.3	11.1	12.1	0.5	0.03	0.08	0.89
F:G	8.62 <sup>a</sup>	10.31 <sup>bc</sup>	11.90 <sup>c</sup>	9.26 <sup>ab</sup>	0.69	0.76	0.14	<0.01

<sup>abc</sup>Means without common superscript differ ( $P \leq 0.05$ ).

**Table 2. Effects of moisture level and storage method on growing steer performance in Experiment 1.**

	70% Moisture		50% Moisture		SE	Trt	P-Value	
	Fresh	Ensiled	Fresh	Ensiled			Moisture	Trt*Moisture
Initial BW, lb	635	637	634	638	7	0.66	0.97	0.83
Ending BW, lb	714	747	721	733	7	0.03	0.74	0.29
ADG, lb	0.94	1.31	1.05	1.13	0.09	0.01	0.69	0.10
DMI, lb/day	11.1	12.1	11.3	11.6	0.4	0.12	0.75	0.43
F:G	11.76	9.26	10.87	10.31	0.66	0.03	0.76	0.16

fed ensiled cornstalk mixes, but steers fed fresh wheat straw blends gained less and had greater F:G than their counterparts fed ensiled wheat straw blends.

In diets containing only wheat straw, no interactions ( $P \geq 0.05$ , Table 2) were observed between storage method and moisture level, so only main effects are presented. Steers fed ensiled diets had greater ending BW ( $P = 0.03$ ) and ADG ( $P = 0.01$ ), and gained more efficiently ( $P = 0.03$ ) than those fed diets mixed fresh daily. The improvements in gain and efficiency of steers fed ensiled diets are in agreement with previous studies (2009 *Nebraska Beef Cattle Report*, pp. 30-32; 2010 *Nebraska Beef Cattle Report*, pp. 42-43). Performance was not different between steers fed diets at 50% and 70% moisture.

### Experiment 2

This experiment was designed to test the palatability of MDGS

and crop residue mixes, therefore, DMI of the supplements relative to the hay was the important factor. An interaction was observed for supplement (MDGS, residue mix) DMI ( $P < 0.01$ , Table 3) and percentage of total DMI ( $P < 0.01$ ) when comparing storage type and forage. Intakes were lower for steers fed ensiled wheat straw than fresh wheat straw and both cornstalk blends resulting in a lower percentage of forage replacement for the ensiled wheat straw blend.

Interactions between supplement DMI ( $P < 0.01$ , Table 4), forage DMI ( $P = 0.01$ ) total DMI ( $P = 0.01$ ), and percentage of total DMI ( $P < 0.01$ ) were found when moisture level and storage type were analyzed. Steers fed the 70% fresh supplement consumed more pounds of supplement daily, resulting in the greatest percentage of total DMI. Steers offered the 70% ensiled supplement had lower supplement intakes and consequently had the lowest percentage of forage

**Table 3. Growing steer performance when offered fresh or ensiled supplements containing cornstalks or wheat straw and MDGS in Experiment 2.**

	CON	Cornstalks		Wheat Straw		SE	Trt	P-Value	
		Fresh	Ensiled	Fresh	Ensiled			Forage	Trt*Forage
Initial BW, lb	701	697	698	698	697	22	0.99	0.99	0.97
Ending BW, lb	731	755	741	760	729	17	0.18	0.83	0.61
Supplement DMI, lb/day	—	5.3 <sup>a</sup>	5.3 <sup>a</sup>	4.5 <sup>a</sup>	1.4 <sup>b</sup>	0.3	<0.01	<0.01	<0.01
Forage DMI, lb/day	—	10.5 <sup>ab</sup>	9.7 <sup>a</sup>	11.2 <sup>b</sup>	12.6 <sup>c</sup>	0.5	0.50	<0.01	0.03
Total DMI, lb/day	15.5	15.7	15.1	15.7	13.9	0.03	<0.01	0.10	0.09
Percent	100	33.7 <sup>a</sup>	35.4 <sup>ab</sup>	29.0 <sup>b</sup>	9.6 <sup>c</sup>	2.0	<0.01	<0.01	<0.01
ADG, lb	0.59	1.12	0.82	1.20	0.60	0.14	<0.01	0.63	0.32
F:G	27.03	14.08	18.52	13.16	23.26	1.69	0.01	0.71	0.36

<sup>abc</sup>Means without common superscript differ ( $P \leq 0.05$ ).

**Table 4. Growing steer performance when offered fresh or ensiled supplements at differing moisture levels containing wheat straw and MDGS in Experiment 2.**

	CON	70% Moisture		50% Moisture		SE	Trt	P-Value	
		Fresh	Ensiled	Fresh	Ensiled			Moisture	Trt*Moisture
Initial BW, lb	701	698	697	698	699	23	0.99	0.97	0.96
Ending BW, lb	731	760	729	751	740	17	0.21	0.96	0.55
Supplement DMI, lb/day	—	4.5 <sup>a</sup>	1.4 <sup>b</sup>	3.4 <sup>c</sup>	3.6 <sup>c</sup>	0.3	<0.01	0.06	<0.01
Forage DMI, lb/day	—	11.2 <sup>a</sup>	12.6 <sup>b</sup>	12.0 <sup>ab</sup>	11.5 <sup>a</sup>	0.3	0.19	0.58	0.01
Total DMI lb/day	15.5	15.7 <sup>a</sup>	13.9 <sup>b</sup>	15.4 <sup>a</sup>	15.0 <sup>a</sup>	0.3	<0.01	0.14	0.01
Percent	100	29.0 <sup>a</sup>	9.6 <sup>b</sup>	22.2 <sup>c</sup>	23.7 <sup>ac</sup>	1.8	<0.01	0.06	<0.01
ADG, lb	0.59	1.20	0.60	1.03	0.77	0.14	0.01	0.99	0.25
F:G	27.03	13.16	23.26	14.93	19.61	2.70	0.02	0.97	0.36

<sup>abc</sup>Means without common superscript differ ( $P \leq 0.05$ ).

replacement. Slow rates of feeding contributed to spoilage within silo bags, which may have negatively affected the palatability of the 70% ensiled wheat and MDGS blend. There were no interactions when comparing F:G. The main effects of both ADG ( $P = 0.01$ ) and F:G ( $P = 0.02$ ) showed an advantage of diets mixed fresh daily over ensiled diets, which contradicts the results of Experiment 1 and previous studies. However, this experiment presented steers with a choice between supplemented treatment and a basal forage diet rather than offering only the crop residue and MDGS blend. Increased

palatability of fresh diets resulted in greater intakes of supplemented blends and a subsequent increase in amount of MDGS consumed.

With the exception of the 70% moisture ensiled wheat straw supplement, steers showed improved ADG and lower F:G than steers fed the control diet, while effectively replacing 22% to 35% of forage intake. It should be noted that the decreased intakes of the 70% ensiled wheat straw supplement may be attributed to spoilage within the silo bag due to slow rates of feeding. These data suggest that MDGS mixed fresh daily with cornstalks will not only

increase growing steer performance relative to a forage only situation, but the supplement can replace a greater proportion of hay, which was used as a proxy for grazed forage in this experiment.

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