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Nebraska Beef Cattle Reports | Animal Science Department

2018

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Summary with Implications

A growing study evaluated increasing inclusions of corn distillers solubles (CDS) at 10, 20, 30, and 40%, or increasing wet distillers grains plus solubles (WDGS) at 10, 20, 30, and 40% compared to a corn control. Corn was replaced by CDS or WDGS in each forage-based diet. Increasing CDS resulted in a quadratic increase for both DMI and F:G. Increasing WDGS linearly increased both DMI and ADG with no effect on F:G. The energy value of CDS is less than that of corn, whereas WDGS had an energy value similar to corn in growing diets with 50% brome hay. A 73.7% TDN value was determined for CDS at 40% inclusion in forage-based diets.

Introduction

Forage-based diets containing corn distillers solubles (CDS) have similar F:G with 93% the feeding value compared to corn (*2016 Nebraska Beef Report* pp. 29–30). Whereas, CDS fed in high concentrate diets improve F:G with 147% the feeding value compared to corn (*2018 Nebraska Beef Report* pp. 94–96). Oil removal from CDS, in forage-based diets, minimally impacts F:G at 20% inclusions, with no effect at 40% inclusions (*2013 Nebraska Beef Report* pp. 25–26). Additionally, previous research on forage-based diets containing wet distillers grains plus solubles (WDGS) has suggested a TDN for WDGS of 113%. Using this TDN value, a feeding value was then calculated at 137% the value of corn (*2015 Nebraska Beef Report* pp. 34–35). Similar values are needed for CDS. Therefore, the objective of this trial was to evaluate corn distillers solubles, as well as wet distillers grains plus solubles being fed in forage-based diets and their effects on growing steer performance.

Table 1. Dietary composition (DM basis) of treatments fed to yearling steers[1]

		CDS, % Inclusion				WDGS, % Inclusion			
Ingredient	CON	10	20	30	40	10	20	30	40
DRC	40	30	30	10	-	30	20	10	-
CDS	-	10	20	30	40	-	-	-	-
WDGS	-	-	-	-	-	10	20	30	40
Brome Hay	50	50	50	50	50	50	50	50	50
SoyPass®	3	3	3	3	3	3	3	3	3
CGM	2	2	2	2	2	2	2	2	2
Supplement[2]	5	5	5	5	5	5	5	5	5
Nutrient Composition, %									
CP	13.3	13.8	16.0	18.1	20.3	14.6	17.5	20.4	23.4
Fat	3.16	3.30	3.41	3.51	3.61	4.20	5.20	6.19	7.19

[1]DRC=dry-rolled corn, CDS=corn distillers solubles, WDGS=wet distillers grains plus solubles, CGM=corn gluten meal.
[2]Urea was added at 0.65% for CON diet, 0.33% for 10% CDS diet, and 0.33% for 10% WDGS diet.

Procedure

A 96-d growing study utilizing 120 crossbred steers (BW = 807 lb; SD = 66 lb) was conducted at the Eastern Nebraska Research and Extension Center feedlot, Mead, NE. Steers were limit fed a common diet at 2.0% BW for 5 days and weighed for three consecutive days to account for gut fill at the beginning and end of the trial. Steers were individually fed utilizing Calan gates, blocked by BW, and assigned randomly to treatment. Nine treatments were utilized with 13 steers/treatment, except for the basal control diet, which included 16 steers. Steers were implanted with Ralgro® (Merck Animal Health) on day 1.

Treatments consisted of increasing inclusion of CDS (10, 20, 30, and 40% DM) or WDGS (10, 20, 30, and 40% DM) plus a corn control diet with no by-product (Table 1). By-products (WDGS or CDS) replaced corn in the diets. The nutrient profile of CDS utilized in the study (Aurora Pacific Ethanol, Aurora, NE and Green Plains Ethanol, Wood River, NE) contained 29.7% DM, 30.2% CP, 5.4% fat, and 1.4% S. The nutrient profile of WDGS utilized in the study (Abengoa Ethanol, York, NE) contained 30.6% DM, 37.9% CP, 14.4% fat, and 0.8% S. All diets included 50% brome hay, 3% SoyPass® (LignoTech USA), 2% corn gluten meal (CGM), and 5% dry supplement. SoyPass® and CGM were blended due to their complementarity in amino acid profiles to ensure rumen undegradable protein was sufficient to meet metabolizable protein (MP) requirement. Supplements were formulated to provide 200 mg/hd Rumensin® (Elanco Animal Health). Urea was added at 0.65% diet DM for the control diet and 0.33% diet DM for both 10% inclusion of CDS and WDGS in order to meet rumen degradable protein requirement.

Data were analyzed using the MIXED procedure of SAS as a randomized complete block design. Steer was the experimental unit and BW block was analyzed as a fixed effect. Similar to previous research (*2014 Nebraska Beef Report* pp. 64–66) net energy equations from the NRC (1996) were used to predict energy concentrations of the corn control diet based on observed performance parameters and then replaced using observed performance parameters for each CDS and WDGS diet to determine

Table 2. Effect of CDS inclusion on performance of growing steers

		CDS, % Inclusion					CDS Effect	
Performance	CON	10	20	30	40	SEM	Lin[1]	Quad[2]
Initial BW, lb.	808	805	807	809	808	19	0.95	0.96
Final BW, lb.	1,042	1,023	1,033	1,033	1,034	20	0.92	0.68
DMI, lb./d	20.6[d]	21.4[cd]	23.6[ab]	22.4[abc]	22.2[abcd]	0.6	0.04	0.02
ADG, lb./d	2.44[bc]	2.27[c]	2.36[bc]	2.33[c]	2.36[bc]	0.09	0.72	0.42
F:G	8.43[a]	9.43[abc]	10.00[c]	9.62[bc]	9.41[abc]	-	0.07	0.02
TDN, %[3]	83	51.7	55.2	68.9	73.7	-	-	-

[1]Linear effect of CDS
[2]Quadratic effect of CDS
[3]Predicted TDN values for CDS compared to assumed corn TDN.

Table 3. Effect of WDGS inclusion on performance of growing steers

		WDGS, % Inclusion					WDGS Effect	
Performance	CON	10	20	30	40	SEM	Lin[1]	Quad[2]
Initial BW, lb.	808	808	805	805	808	19	0.96	0.92
Final BW, lb.	1,042	1,046	1,055	1,066	1,058	20	0.39	0.76
DMI, lb./d	20.6[d]	22.0[bcd]	22.6[abc]	23.8[a]	22.7[abc]	0.6	<0.01	0.07
ADG, lb./d	2.44[bc]	2.48[abc]	2.61[ab]	2.72[a]	2.61[ab]	0.09	0.05	0.37
F:G	8.43[a]	8.87[ab]	8.66[ab]	8.75[ab]	8.68[ab]	-	0.71	0.68
TDN, %[3]	83	62.5	73.1	73.6	77.8	-	-	-

[1]Linear effect of WDGS
[2]Quadratic effect of WDGS
[3]Predicted TDN values for WDGS compared to assumed corn TDN.

energy concentration of WDGS and CDS compared to corn for each diet. In order to do so, TDN values were applied for the control diet (DRC=83% and alfalfa=55%) and then NE adjusters were adjusted to match observed animal performance. Corn was then replaced with WDGS or CDS at each respective concentration and their TDN values were adjusted until each diet met their observed performance outcomes, respectively.

Results

Increasing inclusion of CDS quadratically increased DMI and F:G (P = 0.02) up to 20% CDS diet with similar ADG (P = 0.42) (Table 2). Since ADG was not different among CDS inclusions, yet DMI increased quadratically, all inclusions resulted in greater F:G compared to the corn control. Feeding CDS resulted in a 12, 18, 14, and 11% reduction in F:G for the 10, 20, 30, and 40% inclusions of CDS, respectively. Utilizing the NRC model similar to previous research (*2014 Nebraska Beef Report* pp. 64–66), a 51.7, 55.2, 68.9, and 73.7% TDN value was determined for CDS in the 10, 20, 30, and 40% CDS diets, respectively. The quadratic response of F:G indicates a negative associative effect between corn and CDS in forage-based diets. Data would conclude that the energy value of CDS is less than corn in forage-based diets.

As WDGS inclusion increased, DMI (P < 0.01) and ADG (P = 0.05) increased linearly (Table 3). As a result, no differences for F:G were observed as WDGS inclusion increased. The NRC model determined a 77.8% TDN value for the 40% WDGS diet. These data disagree with previous research on distillers grains fed in forage-based diets, which observed a greater energy value for distillers grains compared to corn (*2015 Nebraska Beef Report* pp. 34–35). It is unclear why WDGS did not outperform corn when MP requirement was met in all diets during this trial.

The energy value of CDS is less than corn in forage-based diets with reduction in F:G up to 18%. Feeding 40% CDS was calculated to have a TDN value of 73.7%, which is lower than corn (83%) in forage-based diets. The inclusion of WDGS in forage-based diets resulted in similar performance to corn, which does not agree with previous research indicating distillers grains (wet or dry) has a feeding value of 136% compared to corn.

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