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Effect of Urea and Distillers Inclusion in Dry- Rolled Corn Based Diets on Heifer Performance and Carcass Characteristics

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Summary with Implications

Crossbred heifers (n=96, BW = 810 ± 20) were utilized to evaluate the effects of increasing wet distillers grains plus solubles and urea inclusion in a dry rolled corn based finishing diet on performance and carcass characteristics. Heifers were individually fed using a calan gate system with a 2 × 2 factorial arrangement of treatments. Factors included distillers inclusion at either 10 or 20% of diet DM and urea inclusion at either 0.2 or 1.4% of diet DM. There was no difference for final body weight, average daily gain, and feed conversion on a live or carcass adjusted basis for either urea or distillers inclusion in the diet. Dry matter intake was reduced with increased urea inclusion; however, distillers inclusion did not influence intake. Added distillers and urea in the diet had minimal impact on performance suggesting supplemental urea in a dry rolled corn based finishing diets is of minimal benefit when feeding at least 10% distillers grains.

Introduction

Distillers grains are a good source of protein usually containing approximately 30% crude protein (CP) with 63% of the CP being in the form of rumen undegradable protein (RUP). When metabolizable protein is fed at concentrations above the animal's requirements, the protein is deaminated and the carbon skeleton is used as energy. The nitrogen from the protein is then packaged as urea and enters into circulation where it can be filtered by the kidney and excreted in the urine or recycled back to the rumen. It has long been known that nitrogen (N) is recycled in the ruminant animal. Although some estimates have been established it is still largely unknown how much N recycling takes place when supplying MP in excess of the animal's requirement. Some studies would suggest, that when including wet distillers grains plus solubles (WDGS) at levels between 10 and 20% of the diet, supplemental urea is of minimal benefit to animal performance (*2019 Nebraska Beef Cattle Report*, pp 97–102).

While some previous research has addressed supplementing RDP in diets containing low levels of WDGS (*2018 Nebraska Beef Cattle Report*, pp. 93–95) it remains largely unknown what the optimal level of urea supplementation is in DRC based diets containing 20% or less WDGS. With more feedlots beginning to feed distillers at lower inclusions between 10 and 20% the objective of this study was to determine the amount of urea that needs to be supplemented to meet rumen degradable protein (RDP) requirements of finishing cattle.

Table 1. Treatment Diet Composition and MP balance

	10% Distillers		20% Distillers	
Ingredient Inclusion, % DM	0.2% Urea	1.4% Urea	0.2% Urea	1.4% Urea
DRC, %	71.5	70.3	61.5	60.3
WDGS, %	10	10	20	20
Corn Silage, %	15	15	15	15
Urea, %	0	1.2	0	1.2
Supplement[1], %	3.5	3.5	3.5	3.5
CP, %	11.2	14.6	13.5	16.8
MP Balance[2], g/d	137	125	253	240
RDP Balance[2], g/d	-204	140	-126	218
RDP Corrected MP[3], g/d	6	125	172	240

[1] Purina Steakmaker contained 5.6% urea which contributed to a total dietary urea inclusion of 0.2% of diet DM
[2] Based on the 2000 revised NRC model using cattle initial BW and trial average ADG and DMI.
[3] MP balance calculated taking into account RDP deficiency (MP—|(RDP * 0.64)|)

Procedure

Ninety six crossbred heifers were fed at the United States Meat Animal Research Center (USMARC) near Clay Center, Nebraska. Cattle were housed in a facility with Calan-headgates which allowed for the measurement of individual feed intake. Cattle were all fed a common diet prior to initiation of the trial and BW was measured on two consecutive days using a single-animal scale. Cattle were implanted with a Revalor IH on d 0 followed by a Revalor 200 on d 70.

The experiment was set up as a completely randomized design with a 2 × 2 factorial arrangement of treatments. Factors consisted of WDGS inclusion (10 or 20% of diet DM), and urea inclusion (0.2 or 1.4% of diet DM). There were two basal diets utilized in this trial (Table 1). The supplement fed to all diets contained 5.6% urea which contributed to a total dietary urea inclusion of 0.2% of diet DM. Thus the 1.4% urea treatment had 1.2% additional urea added to the diet.

Performance data (ADG, DMI, F:G, and initial and final BW), carcass characteristics (HCW, LM area, 12th rib fat, marbling score, and USDA yield grade) were analyzed using the MIXED procedure of SAS with treatment as a fixed effect. Individual animal served as the experimental unit.

Results

A tendency was observed ($P = 0.08$) for an interaction between urea and WDGS inclusion for marbling score. Cattle fed 10%

Table 2. Main Effects of WDGS inclusion on animal performance and carcass characteristics.

Measure	10% WDGS	20% WDGS	SEM	*P*-Value
Live Performance				
Initial, lb	809	811	9.3	0.89
Final BW, lb	1197	1194	14.3	0.88
ADG, lb/d	2.79	2.75	0.05	0.62
DMI, lb	19.8	19.4	0.26	0.29
F:G	7.04	6.94	-	0.75
Carcass Adjusted				
Final BW, lb	1195	1191	12.7	0.81
ADG, lb/d	2.78	2.73	0.05	0.47
F:G	7.09	7.04	-	0.83
Dressing, %	63.1	62.9	0.21	0.63
Carcass Characteristics				
HCW, lb	753	750	8.6	0.81
LM Area, in^2	12.6	12.6	0.38	0.79
12th rib fat, in	0.81	0.80	0.03	0.76
Marbling[1]	493	492	11.2	0.97
CYG[2]	3.86	3.80	0.093	0.67

[1] 400 = small^{00}, 450 = Small^{50}, 500 = Modest^{00}.

[2] Calculated as 2.5 + (6.35 × 12th rib fat, in) + (0.2 × 3.0[KPH]) + (.0017 × HCW, lb)—(2.06 × LM Area, in^2) USDA, 1997.

Table 3. Main effects of urea inclusion on animal performance and carcass characteristics

Measure	0.2% Urea	1..4% Urea	SEM	*P*-Value
Live Performance				
Initial, lb	810	810	9.3	0.97
Final BW, lb	1202	1190	14.3	0.55
ADG, lb/d	2.82	2.73	0.05	0.26
DMI, lb	20.0	19.2	0.26	0.03
F:G	7.04	6.94	-	0.71
Carcass Adjusted				
Final BW, lb	1199	1186	8.6	0.51
ADG, lb/d	2.80	2.70	0.05	0.19
F:G	7.09	7.04	-	0.73
Dressing, %	62.9	63.1	0.21	0.65
Carcass Characteristics				
HCW, lb	756	747	8.6	0.51
LM Area, in^2	12.5	12.7	0.15	0.48
12th rib fat, in	0.83	0.78	0.03	0.11
Marbling[1]	499	485	11.2	0.38
CYG[2]	3.94	3.72	0.093	0.10

[1] 400 = small^{00}, 450 = Small^{50}, 500 = Modest^{00}.

[2] Calculated as 2.5 + (6.35× 12th rib fat, in) + (0.2 × 3.0[KPH]) + (.0017 × HCW, lb)—(2.06 × LM Area, in^2) USDA, 1997

WDGS had increased marbling score when urea was included in the diet; however, cattle fed 20% WDGS had decreased marbling score when urea was included in the diet. While a tendency for this interaction was observed it has little biological relevance to this study and is attributed, instead, to random variation in the data. There were no other significant interactions ($P > 0.61$) observed between WDGS and urea inclusion for performance or carcass characteristics. Therefore, only main effects will be presented for performance and carcass characteristics.

Main effects for WDGS inclusion are presented in Table 2. There were no differences ($P \geq 0.29$) observed for WDGS inclusion for initial BW, final live BW, live ADG, DMI, or live G:F. Additionally, no differences were observed ($P \geq 0.47$) for carcass adjusted final BW, ADG, G:F, or dressing %. Carcass characteristics (HCW, LM area, 12th rib fat thickness, marbling score, and USDA calculated yield grade) were not different ($P \geq 0.67$) between the two WDGS inclusions.

Main effects of urea inclusion are presented in Table 3. There were no observed difference ($P \geq 0.26$) between urea inclusions for initial BW, final live BW, live ADG, or live F:G. A difference ($P = 0.03$) was observed for DMI with cattle fed the diet with 1.2% urea having lower DMI than e cattle consuming no added urea. However, even with a lower DMI F:G was not different ($P = 0.73$) between treatments, due to a numerical reduction in ADG. Additionally, there were no observed differences ($P \geq 0.10$) for any carcass parameters measured (HCW, LM area, 12th rib fat thickness, marbling score, and USDA calculated yield grade) in this study between the two urea levels.

Conclusion

In the present study the addition of urea to diets containing either 10 or 20% WDGS had no effect on animal performance or carcass characteristics. These data would suggest that when feeding DRC based diets that added urea is not necessary when at least 10% WDGS is included in the diet. However, with the low urea diets containing 0.2% of diet DM urea a conservative approach would be to include 0.2% urea in diets containing 10% WDGS.

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