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Evaluation of Wheat Blended with Corn in Finishing Diets Containing Wet Distillers Grains

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Summary with Implications

An experiment was conducted to evaluate the effect of grain type and wet distillers grains inclusion on finishing cattle performance and carcass characteristics. It was hypothesized that a greater inclusion of wet distillers grains would help mitigate acidosis previously observed with feeding wheat. Treatments were designed as a 2 × 2 factorial arrangement, with the first factor as grain type at either 100% dry rolled corn or a 50:50 blend of dry-rolled wheat and dry-rolled corn, and the second factor as wet distillers grains plus solubles (WDGS) inclusion at either 12 or 30% of diet dry matter. There were no interactions between grain type and WDGS inclusion level. Increasing WDGS in the diet improved average daily gain and feed conversion and increased hot carcass weight. There was no performance or carcass trait response to grain type. Increasing the inclusion of WDGS in the diet improves performance regardless of grain type used. Contrary to the hypothesis, feeding dry-rolled corn or a blend of dry-rolled corn and dry-rolled wheat performed similarly at different WDGS inclusions, and may be an economical replacement for corn during certain times of the year.

Introduction

Feeding dry-rolled wheat as a grain source in finishing diets is not a new concept, but its rapid ruminal fermentation can cause digestive disturbances, such as acidosis. However, in certain regions and months of the year, wheat may become an economically feasible option to replace corn as part of the diet for beef cattle. Much of the previous work on feeding wheat as part of the diet was done prior to the widespread use of distillers grains in the diet. Many Nebraska feedlots are feeding some level of distillers grains, but performance advantages suggest that yards should be feeding at least 12% but no more than 40% WDGS (DM-basis) as part of the diet. Perhaps, feeding more readily fermentable starch from wheat with 30% WDGS will mitigate acidosis concerns and increase performance compared to lower WDGS levels, such as 12%. Therefore, the objective of this experiment was to compare DRC-based or a 50:50 blend of DRC and wheat-based diets with either 12 or 30% WDGS (DM-basis) on finishing cattle performance and carcass characteristics.

Table 1. Diet composition (% of diet DM) of corn or corn and wheat blended diets with two inclusions of WDGS.

Grain Type	DRC	DRC	BLEND[1]	BLEND
WDGS Inclusion	12	30	12	30
DRC	67	49	33.5	24.5
Wheat	0	0	33.5	24.5
WDGS	12	30	12	30
Corn Silage	15	15	15	15
Supplement[2]	6	6	6	6
Urea	1	0	0.5	0
Chemical Composition, %				
Diet DM	69.38	59.88	70.65	60.89
Crude Protein	13.0	14.7	13.0	15.7
Ca	0.76	0.77	0.77	0.78
P	0.30	0.43	0.35	0.47

[1] 50:50 blend of DRC and wheat

[2]Liquid supplement was 68% DM and formulated to provide: 0 or 1% urea, 10.9% calcium, 390 mg/hd/d monensin, and 83 mg/hd/d tylosin.

Procedure

A feedlot study was conducted at the University of Nebraska—Lincoln Panhandle Research and Extension Center (PREC), Scottsbluff, NE. Crossbred steers (n=320; initial BW = 716 ± 50 lb) were used in a 2 × 2 factorial treatment design with factors consisting of two grain types [dry-rolled corn (DRC) or dry-rolled corn/dry-rolled wheat blend (BLEND)] and two inclusions of wet distillers grains (WDGS) levels (12 or 30% DM-basis or 22.1% or 45.8% as-fed). Corn silage was used as the roughage source in all diets (Table 1). A liquid supplement was fed with either 0% or 1% of urea. The 1% urea supplement was used in the dry-rolled corn with 12% WDGS diet. A 50:50 blend of the 0% and 1% urea supplement was used in the corn-wheat blend with 12% WDGS diet to target 0.5% urea in the diet. No urea was added to diets containing 30% WDGS. Wheat was processed on-site using a roller mill (Automatic Ag, Pender, NE) and corn was processed using a commercial roller mill throughout the feeding study. All cattle were limit fed a common diet consisting of 30% alfalfa hay, 40% corn silage, 25% WDGS, and 5% supplement (DM-basis) for 5 consecutive days to minimize BW variation due to gut

Table 2. Effect of feeding DRC or 50:50 blend of DRC on steer performance and carcass characteristics.

Grain Type	DRC	BLEND	SEM	Grain Type P-Value
Initial BW	716	716	0.7	0.95
Live Performance				
Final BW	1352	1357	6.9	0.58
DMI, lb/d	23.9	24.3	0.29	0.29
ADG, lb	4.02	4.06	0.042	0.56
F:G[1]	5.92	5.99	—	0.59
Carcass Adj. Performance				
Final BW[2]	1325	1327	7.6	0.84
ADG, lb/d	3.85	3.87	0.048	0.81
F:G[1]	6.17	6.29	—	0.43
Carcass Characteristics				
HCW, lb	835	836	4.8	0.84
Dressing %	61.8	61.6	1.7	0.53
REA, in^2	13.1	13.5	0.087	0.02
12th rib fat, in.	0.52	0.50	0.012	0.36
Marbling Score[3]	533	511	10.7	0.15
Calculated YG[4]	3.27	3.13	0.049	0.04
Liver Abscess, %	13.3	14.2	3.9	0.61

[1] Analyzed as its reciprocal, G:F

[2] HCW adjusted to a common dressing percent of 63%

[3] 400 = small, 500 = modest, 600 = moderate

[4] Calculated using the following equation: 2.5 + (2.5*12th rib fat thickness, in.)—(0.32*LM area, in^2) + (0.2*2.5 KPH) + (0.0038*HCW, lb) (USDA, 2016)

fill. Cattle were fed once daily and provided ad libitum access to feed and water. All cattle were stepped up to their respective diet over 23 d with concentrate (corn and/or wheat) replacing alfalfa hay and corn silage (25% and 40%, respectively, for alfalfa hay and corn silage initially). The finishing diet is presented in Table 1. Cattle were weighed two consecutive days to establish initial BW. Three blocks were used with two reps in the light block, four reps in the middle block, and two reps in the heavy block for 32 total pens with 8 replications per treatment (10 steers/pen).

Cattle were implanted with Revalor-XS (200 mg trenbolone acetate + 40 mg estradiol; Merck Animal Health) on d 1. Steers were fed for 158 days and harvested at a commercial abattoir (Greater Omaha Packing, Omaha, NE). On the day of shipping, steers were weighed in the morning, loaded, and shipped to be harvested the following morning. Hot carcass weight and liver score were recorded on harvest date, and LM area, USDA marbling score, and 12th rib back fat were collected following a 48-hour chill using camera data. Final live BW was calculated using the pen average final live BW shrunk 4% to adjust for fill. Carcass-adjusted performance was calculated by dividing hot carcass weight by a common dressing percentage of 63%.

Samples of processed corn and wheat were taken throughout the feeding study and composited for analysis of particle size using dry sieving. Samples were measured in duplicate to determine geometric mean diameter and geometric standard deviation.

Data were analyzed using the mixed procedure of SAS as a 2 × 2 factorial design with main effects of grain type and WDGS inclusion and the appropriate interactions. Block, grain type and WDGS inclusion were considered fixed effects. Liver data were analyzed using the GLIMMIX procedure of SAS as a binomial distribution. Alpha values ≤ 0.05 were considered significant and 0.05 ≤ α ≤ 0.10 is considered a tendency.

Results

There were no significant interactions between grain type or WDGS inclusion ($P \geq 0.21$). Average daily gain was 3.80, 3.91, 3.78 and 3.96 lb/d and F:G was 6.29, 6.06, 6.41 and 6.13 for DRC12, DRC30, BLEND12 and BLEND30, respectively. The hypothesis that wheat blended with corn would result in better gain and feed conversion in diets with 30% WDGS compared to 12% WDGS was not correct. Due to the lack of an interaction of grain type and WDGS inclusion, only main effects will be discussed. There were no differences in live or carcass-adjusted final BW, ADG, DMI, or feed conversion ($P \geq 0.29$; Table 2) between 100% DRC or 50:50 blend of DRC and wheat. Geometric mean diameter of DRC was 3814 µm (SD = 1201 µm) and DRW was 2258 µm (SD = 432 µm). These data suggest that up to 50% wheat can be fed as the grain portion of the diet resulting in no change in performance.

Steers that were fed 30% WDGS were 24 lbs heavier ($P = 0.03$; Table 3) at slaughter as compared to steers fed 12% WDGS. Cattle fed 30% WDGS had improved ADG by 3.8% ($P = 0.03$) and were 3.8% more efficient ($P = 0.05$) than steers fed 12% WDGS regardless of grain type.

There were no significant interactions between grain type and WDGS inclusion ($P \geq 0.32$) for carcass characteristics, therefore, only the main effects of grain type and WDGS inclusion will be presented. There was no difference in HCW or dressing percent ($P \geq 0.53$; Table 2) for steers fed 100% DRC or 50:50 blend of DRC and wheat. Longissimus muscle area was significantly greater ($P = 0.02$) for steers fed 50:50 blend of DRC and wheat compared to steers only fed DRC. No differences were observed in 12th rib fat or USDA marbling score between grain type ($P \geq 0.15$), but with the increase in LM area, cattle fed the blended diet had an improved calculated yield grade ($P = 0.04$). It is important to note that this

Table 3. Effect of WDGS inclusion level on performance and carcass characteristics of finishing steers.

WDGS Inclusion	12	30	SEM	WDGS Incl. P-Value
Initial BW	719	719	0.7	0.51
Live Performance				
Final BW	1345	1364	6.9	0.06
DMI, lb	24.1	24.1	0.29	0.93
ADG, lb/d	3.98	4.10	0.043	0.07
F:G[1]	6.02	5.88	—	0.07
Carcass Adj. Performance				
Final BW[2]	1314	1338	7.6	0.03
ADG, lb/d	3.79	3.94	0.048	0.03
F:G[1]	6.37	6.10	—	0.05
Carcass Characteristics				
HCW, lb	828	843	4.8	0.03
Dressing %	61.6	61.8	1.7	0.28
REA, in^2	13.2	13.4	0.09	0.13
12th rib fat, in.	0.49	0.53	0.013	0.02
Marbling Score[3]	531	513	10.7	0.24
Calculated YG[4]	3.14	3.26	0.049	0.09
Liver Abscess, %	11.3	12.7	3.5	0.42

[1] Analyzed as its reciprocal, G:F

[2] HCW adjusted to a common dressing percent of 63%

[3] 400 = small 00; 500 = modest 00; 600 = moderate 00

[4] Calculated using the following equation: 2.5 + (2.5*12th rib fat thickness, in.)—(0.32*LM area, in^2) + (0.2*2.5 KPH) + (0.0038*HCW, lb) (USDA, 2016)

was a heavily replicated study (16 replications per main effect) and therefore, small changes were statistically significant and may not be explained biologically.

Steers fed 30% WDGS had heavier HCW (*P* = 0.03; Table 3), had greater 12th rib fat (*P* = 0.02), and tended to have poorer yield grade (*P* = 0.09) compared to cattle fed 12% WDGS. There were no differences between WDGS inclusions for dressing percent, LM area, or USDA marbling score (*P* ≥ 0.13).

Conclusion

Overall, there was no interaction between grain type (DRC or 50:50 blend DRC and wheat) and WDGS inclusion (12 or 30% DM basis) for cattle performance or carcass characteristics. There was a significant response for cattle fed 30% WDGS compared to 12% WDGS, but there was no performance response for grain type. Feeding a 50:50 blend of DRC and wheat resulted in an increase in LM area and no change in other carcass characteristics, leading to a more desirable calculated YG. Greater inclusions of WDGS (30%) resulted in greater HCW and 12th rib fat but tended to increase calculated YG compared to feeding 12% WDGS. There were minimal effects to feeding DRC compared to a 50:50 blend of DRC and wheat, but there was a performance and carcass response to feeding more WDGS. Therefore, the data suggest that if the price of wheat is competitive or less than that of corn, wheat can replace up to 50% of corn in the diet, regardless of WDGS inclusion, without an effect on performance.

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