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Optimum Levels of Dry Distillers Grains with Solubles for Finishing Beef Steers

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Summary

A feedlot study was conducted to evaluate increasing levels of dry distillers grains with solubles (DDGS) in corn-based diets on steer performance. Treatments consisted of 0, 10, 20, 30, 40, and 50% (DM basis) DDGS dietary inclusion. Quadratic trends were observed for final BW and ADG with increasing levels of DDGS and 20% inclusion being the most improved. DMI was not changed with DDGS treatment level, while F:G was numerically optimum for 20% inclusion, although all DDGS levels had improved F:G compared to the 0% treatment. No differences in carcass characteristics were observed. Energy value of DDGS at 10 to 40% dietary inclusion remained above 100% in a quadratic trend, with the most improved values at 10 and 20% inclusion. Results showed DDGS can be fed in finishing diets to improve ADG and F:G with optimum level at 20% dietary inclusion.

Introduction

Past research has indicated mixed results from feeding varying dietary inclusion levels of DDGS. Most of these results indicate improved or similar energy values for feeding distillers by-products compared to the corn that is replaced in feedlot diets. However, a response curve resulting from feeding DDGS is needed to generate accurate energy response levels.

The objectives of this trial were to determine the optimum level of DDGS based on steer performance and carcass characteristics and determine the energy value of DDGS at 0 to 40% dietary DM, with 10% increments, relative to a dry-rolled corn diet.

Procedure

A 167-day finishing study used 250 crossbred backgrounded steer calves (676 ± 54.1 lb) in a randomized complete block design experiment. Steers were weighed on two consecutive days (day 0 and day 1) to obtain an initial BW after a five-day limit feeding period at 2.0% of BW. The BW obtained from day 0 were used to block the steers into four weight blocks, stratify the animals by weight within block, and assign steers randomly to pens. Pens were then assigned randomly within block to one of six dietary treatments with five pens per treatment and eight steers per pen.

Dietary treatments (Table 1) consisted of control (CON) with no DDGS, 10% DDGS (10DDGS), 20% DDGS (20DDGS), 30% DDGS (30DDGS), 40% DDGS (40DDGS), and 50% DDGS (50DDGS) replacing dry rolled corn in the diets on a DM basis. All diets contained 10% corn silage and 2.5% ground alfalfa hay to generate a 7.5% roughage level and 6% liquid supplement. The diets were formulated to contain 13% dietary CP, in which urea was provided in a dry supplement and fed in CON and 10DDGS diets at 2 and 1%, respectively. Metabolic adaptation to these finishing diets included a 22-day step-up period in which dry rolled corn replaced alfalfa hay at decreasing levels of 30, 20, and 10% alfalfa hay for 3 ration steps and these were fed for 7, 7, and 8 days, respectively. Inclusion level of DDGS (Dakota Gold Research, Sioux Falls, S.D.) remained the same throughout the step-up period to the finishing diets.

At the end of the 22-day step-up period, sulfur content of DDGS resulted in toxic dietary sulfur levels for the 50DDGS treatment (0.6%) which is higher than threshold sulfur level (0.4%). Some steers experienced polioencephalomalacia (PEM, polio, "brainers") incidences. There were a total of nine steers that either died or were removed from the trial, with two of these due to PEM and four others treated for PEM during the first 22 days; the other trial removals were not due to dietary treatments. Therefore, the 50DDGS treatment was removed from this experiment and the pens of cattle were randomly assigned to one of the other five treatments and finished the trial on those other treatments. Live BW were taken on day 22 and pencil shrunk by 4%, which were used to calculate ADG, DMI, and F:G for all 30 pens on 0-50% DDGS treatments during those 22 days. For the remainder 145 days of the trial (days 22-167), performance was analyzed

Table 1. Composition of dietary treatments for cattle fed increasing levels of DDGS[a] (%DM).

Ingredient	CON	10DDGS	20DDGS	30DDGS	40DDGS
Dry rolled corn	79.5	70.5	61.5	51.5	41.5
Dry distillers grains	0	10	20	30	40
Corn silage	10	10	10	10	10
Alfalfa hay	2.5	2.5	2.5	2.5	2.5
Liquid supplement[b]	6	6	6	6	6
Dry supplement	2	1	0	0	0
Fine ground corn	0.85	0.425	—	—	—
Urea	1.15	0.575	—	—	—

[a]CON = 0% DDGS, 10DDGS = 10% DDGS, 20DDGS = 20% DDGS, 30DDGS = 30% DDGS, 40DDGS = 40% DDGS.
[b]Formulated to provide 320, 150, and 90 mg/ steer daily of Rumensin-80®, Thiamine-40, and Tylan-40®, respectively.

Table 2. **Performance measurements and carcass characteristics for cattle fed increasing levels of DDGS[a].**

							P-value	
Parameter	CON	10DDGS	20DDGS	30DDGS	40DDGS	50DDGS	Lin[b]	Quad[c]
Performance–22 day step-up period								
DMI, lb	19.3	19.5	19.1	19.6	19.1	20.3	0.84	0.75
ADG, lb	3.40	3.54	3.75	3.74	3.12	3.12	0.61	0.06
F:G	5.66	5.55	5.13	5.23	6.06	6.47	0.75	0.10
Performance–145 day finishing period								
Final BW[d], lb	1230	1266	1297	1273	1258	—	0.32	0.04
DMI, lb	20.8	21.8	20.8	21.2	20.7	—	0.69	0.52
ADG, lb	3.29	3.55	3.71	3.56	3.56	—	0.15	0.08
F:G	6.32	6.15	5.60	5.93	5.77	—	0.08	0.29
Diet NE_g [e], Mcal/cwt	61.23	63.66	66.28	63.35	64.02	—	0.37	0.20
DDGS NE_g, %	—	124	126	108	108	—	0.96	0.07
Carcass Characteristics								
Hot carcass weight, lb	782	799	816	804	797	—	0.32	0.07
Marbling score[f]	540	548	550	533	522	—	0.24	0.24
Ribeye area, in^2	12.3	12.5	12.7	12.6	12.6	—	0.68	0.58
12^{th} rib fat thickness, in	0.56	0.55	0.60	0.56	0.57	—	0.72	0.68
Calculated yield grade[g]	3.42	3.41	3.51	3.42	3.39	—	0.86	0.49

[a]CON = 0% DDGS, 10DDGS = 10% DDGS, 20DDGS = 20% DDGS, 30DDGS = 30% DDGS, 40DDGS = 40% DDGS.
[b]Contrast for the linear effect of treatment P-value.
[c]Contrast for the quadratic effect of treatment P-value.
[d]Calculated from carcass weight, adjusted to a 63% common dressing percentage.
[e]Calculated with iteration process for net energy calculation based on performance (Owens et al., 2002).
[f]400 = Slight ^{0}, 500 = Small ^{0}.
[g]Calculated as 2.5 + (2.5*Fat Depth) + (0.2* % KPH) + (0.0038* Hot Carcass Wt.) – (0.32*Ribeye Area) from Meat Evaluation Handbook, 2001.

by removing the pens starting on 50DDGS completely from the trial. However, the summary of carcass characteristics included all 30 pens and assumed the six pens on 50DDGS had been reassigned to each of the other treatments from 0 to 40DDGS throughout the 167 days.

Steers were implanted initially on day 0 with Ralgro and re-implanted on day 56 with Revalor-S® (*Intervet, Millsboro, Del.*) Feed samples were collected bi-weekly and analyzed for DM at 60°C for 48 hours.

Steers were slaughtered on day 168 at Greater Omaha Pack, Omaha, Neb., where liver scores and hot carcass weights were recorded. Fat thickness and LM area were measured, while %kidney, pelvic, and heart fat (%KPH) and USDA marbling scores were recorded after a 48-hour chill. Hot carcass weight, fat thickness, LM area, and %KPH were used to calculate USDA Yield Grade. Final BW, ADG, and F:G during the finishing period were calculated based on hot carcass weights and adjusted to a common dressing percentage (63) in order to obtain an accurate estimate of final BW and to minimize error associated with gut fill.

Performance and carcass data were analyzed using the mixed procedures of SAS as a randomized complete block design, with pen as the experimental unit. Orthogonal contrasts were used to test significance for the highest order polynomial. Feeding behavior data were analyzed with chi-square procedures of SAS.

Results

During the 22-day step-up period, which included 0-50DDGS treatments, ADG (P= 0.06) and F:G (P= 0.10) tended to be quadratic. Steers fed 20DDGS and 30DDGS had the highest ADG, while 20DDGS fed steers had the lowest F:G. DMI was not affected by level of DDGS during this period.

Furthermore, final BW (P= 0.04) and ADG (P= 0.08) followed a quadratic trend similar to the 22-day step-up period. Steers fed 20DDGS had the heaviest final BW and highest ADG, while 30 and 40DDGS fed steers had numerically heavier final BW and gained faster than CON fed steers. DMI was not affected by treatment, but F:G tended (P= 0.08) to linearly decrease as DDGS inclusion increased. Other than HCW, no other carcass characteristics were affected by DDGS inclusion level.

A visual scoring system was used on five selected days during the finishing period as we observed cattle were moving feed in the bunk and some was tossed over the bunk. Scores used were: 0 (no feed movement) to 3 (some feed moved within the bunk and some tossed over the bunk walls onto the feed alley). Feeding scores indicated that cattle fed 10, 20, and 30% DDGS tended to move the feed in the bunk. Interestingly, cattle fed 40% DDGS did not move their feed around as much as intermediate DDGS levels.

Calculated relative energy values for DDGS compared to CON, regardless of inclusion level, were improved above dry rolled corn. The NE_g values as a percentage of corn tended (P= 0.07) to be quadratic. DDGS at 10 and 20% were similar with average relative energy values of 125%, whereas DDGS at 30 and 40% declined to 108% of corn.

Quadratic trends were observed for final BW and ADG both prior to and after the step-up period when feeding

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increasing levels of DDGS. DMI was not affected at any time during the feeding period by DDGS level. However, F:G tended to be quadratic during the step-up period and changed to a linear effect during the finishing period. Relative energy values for DDGS inclusion compared to dry rolled corn were the highest at 10 and 20% inclusion, while 30 and 40% DDGS remained better than cattle fed corn alone.

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