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Summary

A study was repeated over 2 years to determine the effect of feeding different levels of dry distillers grains with solubles (DDGS) and wet distillers grains with solubles (WDGS) on the performance of finishing cattle. In each year, 120 steers (756 ± 22 lb) were weighed, and randomly allocated to 15 pens. The pens were then assigned to one of five treatments: 1) corn-soybean meal (CON); 2) 20% DDGS; 3) 20% WDGS; 4) 40% DDGS; or 5) 40% WDGS. The basal diet consisted of 10% alfalfa hay, 4% molasses, 2% supplement, 10.5% SBM and 73.5% cracked corn. The WDGS and DDGS were added to replace all the SBM and part of the cracked corn. Steers were fed these diets for 138 and 129 days in years 1 and 2, respectively. Body weight was recorded prior to feeding at the start of the trial and every 28 days. Steers were harvested at a commercial facility and carcass data were collected. No treatment x year interactions occurred, thus data were pooled over the 2 years. There was an interaction between wet vs. dry and 20% vs. 40% distillers grains with solubles (DGS) for cumulative DMI. Steers fed 20% and 40% DDGS had the highest DMI, but feeding 40% WDGS significantly depressed ($P < 0.01$) DMI. Cumulative ADG was similar across all treatments; however, steers fed 40% DGS had greater G:F ($P < 0.05$) than those fed 20% DGS, and those fed WDGS were more efficient ($P < 0.01$) than those fed DDGS. Pooled carcass data showed that steers fed DGS had greater ($P < 0.01$) 12th rib fat compared to CON resulting in steers fed DGS having greater ($P < 0.05$) Yield Grades compared to CON steers. Steers fed 20% DDGS and 20% WDGS had numerically higher ($P < 0.05$) marbling scores compared to steers fed CON, 40% DDGS and 40% WDGS. Hot carcass weight, ribeye area, and percent kidney, pelvic, and heart fat were similar across all treatments. In conclusion, feeding DDGS and WDGS at 20 and 40% of the diet DM can be used to replace SBM in finishing diets to achieve similar gains and efficiencies. However, Yield Grades were greater for steers fed DGS compared to those fed the corn-soybean meal diet.

Introduction

Distillers grains with solubles (DGS), a product of the dry milling industry, are excellent feed sources for feedlot cattle. They are normally available for use in feedlot finishing diets in two forms: dried distillers with solubles (DDGS) and wet distillers grains with solubles (WDGS). Previous studies conducted with finishing cattle on the use of WDGS as a replacement of corn as an energy source resulted in consistently improved feed efficiency (Firkins et al., 1985; Larson et al., 1993; Ham et al., 1994; Trenkle, 1997a, 1997b; Fanning et al., 1999). These studies suggested that WDGS contains approximately 40% more energy for gain than dry-rolled corn. The higher energy content could be due to the higher lipid content in DG compared in corn and (or) a reduction in subacute ruminal acidosis.

This study was designed to determine the effect of feeding different levels of DDGS and WDGS (20% vs. 40%) on the intake, performance and carcass characteristics of finishing cattle.

Materials and Methods

One hundred twenty Angus and Angus crossbred steers (756 ± 22 lb) were weighed, stratified by previous treatment and BW, and allocated to 15 pens containing 8 steers/pen for each of the two years. Pens were randomly assigned to one of five treatments

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(3 pens/treatment): 1) cracked corn-soybean meal (CON), 2) 20% DDGS, 3) 20% WDGS, 4) 40% DDGS or 5) 40% WDGS. The basal diet (CON) consisted on a dry matter basis of 10% alfalfa hay, 4% molasses, 2% supplement, 10.5% SBM and 73.5% cracked corn. Wet and dry distillers grains with solubles were used to replace all of the soybean meal and part of the cracked corn in the treatment diets (Table 1). Diets were mixed, fed once daily, and steers were allowed to consume feed ad libitum during the trial. Steers received treatment diets for 138 and 129 days for years 1 and 2, respectively. All steers were implanted on d 28 with Revalor-S and were housed in outdoor pens. Body weight was recorded prior to feeding at the start of the experiment and every 28 d until the end of experimental period. Once cattle reached approximately 0.4 in backfat, they were sent to a commercial packing plant for carcass data collection.

Feed ingredients and treatment diets were sampled weekly, frozen immediately and later analyzed for DM (AOAC, 1995), CP (Macro-Kjeldahl N; AOAC, 1995), NDF, ADF (Goering and Van Soest, 1970), ash (AOAC, 1995; Table 2) and gross energy. Fecal samples were collected by grabbing fecal samples from the rectum of individual steers on d 28 and 113 in yr 1 and d 28 and 84 in yr 2. Samples were frozen immediately and later analyzed for DM, N, NDF and gross energy. Apparent total tract digestibilities of DM, OM, N and NDF were determined using acid insoluble ash (Van Keulen and Young, 1977) as the internal marker.

Performance data were analyzed using the GLM procedure of SAS with pen as the experimental unit. Carcass data were analyzed using the GLM procedure of SAS using steers as the experimental unit. There was no year × treatment interaction, therefore, data for both years were pooled. Orthogonal contrasts were used to determine if there were statistical differences ($P < 0.05$) between CON vs. distillers grains with solubles treatments, wet vs. dry distillers grains with solubles, 20 vs. 40% distillers grains with solubles, and the interaction between wets vs. dry and 20% vs. 40% distillers grains with solubles treatments.

Results and Discussion

For the first 28 d, an interaction ($P < 0.01$) between wet vs. dry and 20% vs. 40% DGS diets was observed wherein steers fed DDGS diets consumed more DM than those fed WDGS ($P < 0.01$), and steers fed 40% WDGS consumed the least DM ($P < 0.01$). Rate of gain was greater ($P < 0.01$) for steers fed DGS than for steers fed CON. Efficiency of gain during the first 28 d was greater ($P < 0.01$) for steers fed DGS compared to those fed CON and those fed WDGS were more efficient ($P < 0.01$) than those fed DDGS (Table 3).

Over the entire trial, ADG did not differ between treatments. However, an interaction ($P < 0.01$) was observed between wet vs. dry and 20% vs. 40% DGS diets for cumulative DMI. Cumulative DMI was significantly depressed ($P < 0.01$) when diets contained 40% WDGS. Steers fed WDGS were most efficient ($P < 0.01$) and those fed 40% DGS had higher G:F than those fed 20% DGS (Table 3).

Apparent total tract digestibility of DM, OM, N, and NDF was not different due to treatment on d 28 or 3 weeks pre-harvest (Table 4). During d 28, DGS diets had higher ($P < 0.01$) NE_m and NE_g compared to the CON. There was also a significant difference ($P < 0.05$) between the NE_m and NE_g content of the 20% and 40% DGS diets. Similarly, 3 weeks pre-harvest, DGS diets had greater NE_m and NE_g compared to the CON and there was also a significant difference ($P < 0.05$) between the NE_m and NE_g content of the 20% and 40% DGS diets. In addition, the WDGS diets had greater NE_m and NE_g compared to the DDGS diets (Table 4).

Carcass data (Table 5) showed that there were no differences between treatments for dressing percentage, hot carcass weights, rib-eye area, and percent kidney pelvic and heart fat. However, steers fed distillers grains with solubles had greater ($P < 0.01$) 12^{th} rib fat compared to steers fed CON (Table 5). This resulted in steers fed distillers grains with solubles having higher ($P < 0.05$) Yield Grades compared to CON steers. There was a 20% vs. 40% effect on marbling, where steers fed 20% DDGS and 20% WDGS had higher ($P < 0.05$)

marbling scores compared to steers fed 40% DDGS and 40% WDGS.

Implications

Results of this study indicate that feeding distiller's grains with solubles (WDGS or DDGS) increased overall DMI, 12th rib fat and Yield Grade but had no effect on overall ADG. Feeding wet distillers grains with solubles decreased overall DMI compared to dry distillers grains with solubles but had no effect on overall ADG, Yield Grade, and Quality Grade. Feeding increasing levels of distillers grains had no overall effect on ADG; however, feeding 40% DGS diets resulted in higher G:F than those fed 20% DGS and steers fed 40% WDGS had the lowest DMI. Additionally, marbling score was greatest for steers fed 20% distillers grains with solubles diets. Therefore, this study shows that distillers grains with solubles (wet or dry) can be used in growing and finishing rations, up to 40% ration DM, to replace SBM and corn without negative effects on efficiency, gain, carcass weight and carcass quality grade.

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Tables

Table 1. Composition of corn-soybean meal based (CON), dried distillers grains with solubles (DDGS) and wet distillers grains with solubles (WDGS) diets fed to finishing steers

Item, % DM	CON	20% DDGS	20% WDGS	40% DDGS	40% WDGS
Alfalfa Hay	10.0	10.0	10.0	10.0	10.0
DDGS	--	20.0	--	40.0	--
WDGS	--	--	20.0	--	40.0
Cracked Corn	73.5	64.0	64.0	43.55	43.55
Soybean Meal	10.5	--	--	--	--
Wet Molasses	4.0	4.0	--	4.0	--
Dried Molasses	--	--	4.0	--	4.0
Limestone	--	--	--	0.45	0.45
Supplement[a]	2.0	2.0	2.0	2.0	2.0

[a]Provided: ground corn, 0.446%; limestone, 0.830%; trace mineralized salt, 0.700%; Rumensin 80, 0.014%; vitamin A, 0.001%; $CuSO_4$, 0.013%; vitamin E, 0.001%.

Table 2. Chemical composition of corn-soybean meal based (CON), dried distillers grains with solubles (DDGS) and wet distillers grains with solubles (WDGS) diets (Year 1 and 2)

Item	CON	20% DDGS	20% WDGS	40% DDGS	40% WDGS
Year 1					
DM, %	88.3	88.4	68.4	88.7	55.4
OM, %	94.8	94.7	95.1	93.9	94.7
CP, %	13.6	13.5	13.9	17.6	18.4
NDF, %	16.7	19.6	28.3	22.4	28.6
ADF, %	7.4	9.8	8.8	12.5	9.4
Fat, %	4.4	6.0	5.0	7.2	5.2
Year 2					
DM, %	87.8	88.0	67.6	88.5	54.5
OM, %	94.3	94.4	94.9	93.7	94.5
CP, %	14.1	13.9	15.1	17.6	20.0
NDF, %	16.0	23.0	26.8	29.8	36.6
ADF, %	6.3	8.5	9.9	11.2	13.2
Fat, %	4.5	6.3	5.6	7.7	6.1

Table 3. Performance of finishing steers fed corn-soybean meal based (CON), dried distillers grains with solubles (DDGS) and wet distillers grains with solubles (WDGS) diets (Year 1 & 2 pooled)

Item	CON	20% DDGS	20% WDGS	40% DDGS	40% WDGS	SEM
Initial Weight, lb	755	756	751	760	755	8
d 0-28						
ADG lb/d[a]	3.32	4.03	4.10	3.88	4.05	0.17
DMI lb/d[bcd]	21.62	22.9	22.17	23.09	20.44	0.25
Gain:Feed[ab]	0.154	0.176	0.185	0.168	0.198	0.007
Feed:Gain[af]	6.56	5.73	5.43	5.98	5.12	0.22
d 28-56						
ADG lb/d	4.48	3.47	4.77	3.93	3.94	0.33
DMI lb/d[bd]	21.22	21.94	21.82	22.46	20.44	0.32
Gain:Feed[f]	0.213	0.159	0.219	0.176	0.194	0.016
Feed:Gain[b]	4.91	6.36	4.88	5.73	5.22	0.28
d 56-84						
ADG lb/d[be]	4.37	4.10	3.50	4.34	3.85	0.16
DMI lb/d[bd]	22.03	22.91	22.24	23.95	20.43	0.49
Gain:Feed[ag]	0.199	0.179	0.158	0.181	0.188	0.007
Feed:Gain[eg]	5.08	5.67	6.43	5.55	5.35	0.22
d 84-112						
ADG lb/d	3.46	3.70	3.60	3.23	3.78	0.20
DMI lb/d[be]	22.67	24.96	23.51	24.68	22.27	0.44
Gain:Feed	0.153	0.148	0.152	0.131	0.170	0.008
Feed:Gain	6.63	6.79	6.78	7.71	6.10	0.42
d 112-end						
ADG lb/d	2.84	2.90	3.15	3.15	3.05	0.21
DMI lb/d[b]	21.63	22.92	21.83	22.77	20.41	0.40
Gain:Feed	0.132	0.128	0.147	0.140	0.152	0.011
Feed:Gain	8.04	8.22	8.13	7.62	7.03	0.63
Final Weight, lb	1255	1268	1264	1282	1278	14
Cumulative (d 0-end)						
ADG, lb/d	3.63	3.65	3.72	3.72	3.74	0.06
DMI, lb/d[bdg]	21.82	23.15	22.37	23.42	20.82	0.27
Gain:Feed[bg]	0.167	0.158	0.167	0.159	0.180	0.003
Feed:Gain[bg]	6.02	6.36	6.03	6.30	5.57	0.11

[a]CON vs. distillers grains with solubles treatments ($P < 0.01$).
[b]Wet vs. dry distillers grains with solubles treatments ($P < 0.01$).
[c]20% vs. 40% distillers grains with solubles ($P < 0.01$).
[d]Interaction between wet vs. dry and 20% vs. 40% distillers grains with solubles treatments ($P < 0.01$).
[e]CON vs. distillers grains with solubles treatments ($P < 0.05$).
[f]Wet vs. dry distillers grains with solubles treatments ($P < 0.05$).
[g]20% vs. 40% distillers grains with solubles ($P < 0.05$).

Table 4. Apparent total tract digestibility and energy concentration of the corn-soybean meal based (CON), dried distillers grains with solubles (DDGS) and wet distillers grains with solubles (WDGS) diets (Year 1 and 2 pooled)

Item	CON	20% DDGS	20% WDGS	40% DDGS	40% WDGS	SEM
			Day 28			
Apparent total tract digestibility						
DM, %	89.8	90.4	86.9	87.7	85.6	1.5
OM, %	90.4	90.9	87.5	88.2	86.3	1.5
N, %	87.2	88.2	85.4	87.8	87.6	1.7
NDF, %	83.8	85.7	83.7	86.4	85.9	2.2
Energy concentration of the diets						
NE_m, Mcal/lb DM[ab]	0.94	0.98	1.00	1.01	1.03	0.01
NE_g, Mcal/lb DM[ab]	0.64	0.68	0.69	0.70	0.71	0.01
			3 Weeks Pre-harvest			
Apparent total tract digestibility						
DM, %	94.6	93.9	94.4	92.8	94.1	1.1
OM, %	95.0	94.2	94.8	93.2	94.5	1.1
N, %	94.1	93.2	94.4	93.5	95.3	1.0
NDF, %	92.7	92.3	93.7	92.0	93.8	1.5
Energy concentration of the diets						
NE_m, Mcal/lb DM[acd]	1.05	1.06	1.09	1.12	1.13	0.00
NE_g, Mcal/lb DM[acd]	0.73	0.74	0.77	0.79	0.80	0.00

[a]CON vs. distillers grains with solubles treatments ($P < 0.01$).
[b]20% vs. 40% distillers grains with solubles treatments ($P < 0.05$).
[c]Wet vs. dry distillers grains with solubles treatments ($P < 0.01$).
[d]20% vs. 40% distillers grains with solubles treatments ($P < 0.01$).

Table 5. Carcass data of finishing steers fed corn-soybean meal based (CON), dried distillers grains with solubles (DDGS) and wet distillers grains with solubles (WDGS) diets (Year 1 and 2 pooled)

Item	CON	20% DDGS	20% WDGS	40% DDGS	40% WDGS	SEM
n	48	47	46	46	46	
Dressing Percentage	60.8	60.9	61.0	60.6	60.9	0.2
HCW, lb	768	773	774	779	775	8
12^{th} rib fat, in[a]	0.51	0.58	0.62	0.56	0.56	0.03
Ribeye area, in^2	13.1	13.0	13.1	12.9	13.1	0.2
KPH, %	2.20	2.43	2.26	2.26	2.29	0.07
Yield Grade[a]	2.94	3.25	3.27	3.24	3.16	0.10
Marbling[bc]	528	544	557	528	520	13

[a]CON vs. distillers ($P < 0.01$).
[c]20% vs. 40% distillers grains with solubles treatments ($P < 0.05$).
[b]$Small^0$=500.