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Summary

A finishing study was conducted to assess the effects of feeding increasing amounts of wet distillers grains plus solubles (WDGS) with and without corn oil removal. Oil removal and WDGS inclusion did not interact. Compared to normal oil, de-oiled WDGS did not impact ADG, F:G, or carcass characteristics. Increasing inclusion of WDGS decreased DMI and F:G linearly, with no change in ADG. Regardless of inclusion, oil removal via centrifugation had little impact on finishing cattle performance.

Introduction

The ethanol industry has the ability to remove a portion of corn oil, via centrifugation, from thin stillage to produce de-oiled distillers byproducts that are lower in fat content. A recent study concluded that removal of corn oil via this centrifugation process had no effect on ADG and F:G when 27% inclusion of condensed distillers solubles or 40% inclusion of modified distillers grains plus solubles were fed in finishing diets (*2013 Nebraska Beef Cattle Report*, pp. 64-65). Therefore, the objective of this study was to determine the effects of feeding de-oiled wet distillers grains plus solubles (WDGS) on finishing performance and carcass characteristics when included at greater inclusions in finishing diets. It is plausible that at low inclusions, the oil would have benefits for performance, and at greater inclusions, the de-oiled distillers may actually be better for finishing cattle due to oil inhibiting rumen digestion. This was observed in a previous growing study (*2013 Nebraska Beef Cattle Report*, pp. 25-26).

Procedure

A 147-day finishing experiment was conducted using 336 crossbred, yearling steers (initial BW = 774 ± 42 lb) in a randomized block design, with a 2x3+1 factorial arrangement of treatments. Steers were limit-fed for five days at 2% of BW prior to the initiation of the trial and weighed on two consecutive days (0 and 1) to determine initial BW. Steers were implanted on day1 with Revalor-XS. Steers were blocked by BW, stratified by BW within each block, and assigned randomly to pen. Pens were then assigned randomly to one of seven treatments with six pens per treatment and eight steers per pen.

The control diet contained a 1:1 blend of dry-rolled and high-moisture corn with 12% corn silage (Table 1). The remaining diets contained WDGS with inclusions of 35% de-oiled or normal oil WDGS, 50% de-oiled or normal oil WDGS, and 65% de-oiled or normal WDGS (DM basis). Wet distillers grains plus solubles was sourced from the same plant (KAAPA Ethanol, Minden, Neb.) and received approximately every three weeks throughout the experiment. Samples of WDGS were collected at each delivery as well as monthly composites of weekly feed ingredients and analyzed for DM, fat, CP, and S. Fat concentration was analyzed using the biphasic lipid extraction procedure. All diets contained 5% supplement, which was formulated for 30 g/ton of DM and provided approximately 380 mg/steer daily of Rumensin® as well as formulated to provide 90 mg/steer daily of Tylan®.

All animals were harvested on day 148 at a commercial abattoir (Greater Omaha Packing, Omaha, Neb.) with hot carcass weights (HCW) and liver scores recorded at slaughter. Carcass 12th rib fat, LM area, and USDA marbling score were recorded after a 48-hour carcass chill. Yield grade was calculated using the USDA YG equation [YG = 2.5 + 2.5 (fat thickness, in) – 0.32 (LM area, in^2) + 0.2 (KPH fat, %) + 0.0038 (HCW, lb)]. Final BW, ADG, and F:G were calculated using HCW adjusted to a common dressing percentage of 63%.

Data were analyzed using the GLIMMIX procedure of SAS (SAS Institute, Inc., Cary, N.C.) as a randomized block design with pen as the experimental unit. The PROC IML was used to determine coefficients due to unequal spacing of inclusion level of WDGS. The 2x3 factorial design was analyzed for an oil (de-oiled,

(Continued on next page)

Table 1. Diet Composition on a DM basis fed to finishing steers.

		35% WDGS		50% WDGS		65% WDGS	
	Control	De-Oiled	Normal	De-Oiled	Normal	De-Oiled	Normal
Ingredient, % of DM							
DRC[1]	41.5	24	24	16.5	16.5	9	9
HMC[1]	41.5	24	24	16.5	16.5	9	9
WDGS: De-Oiled[1]	—	35	—	50	—	65	—
WDGS: Normal Fat[1]	—	—	35	—	50	—	65
Corn Silage	12	12	12	12	12	12	12
Supplement [2]	5	5	5	5	5	5	5
Analyzed Composition, %							
Fat	4.5	5.5	7.1	6.0	8.2	6.4	9.3
CP	12.8	16.2	15.8	19.4	18.8	22.6	21.9
Sulfur	0.09	0.32	0.31	0.42	0.41	0.52	0.51
NDF	13.5	26.6	27.8	32.3	34.0	38.0	40.2

[1]DRC = Dry rolled corn; HMC = High moisture corn; WDGS = Wet distillers grains plus solubles.
[2]Formulated to contain 380 mg/head/day of Rumensin and 90 mg/head/day of Tylan.

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Table 2. Nutrient Composition of WDGS.

	De-oiled	Normal
Fat, %	7.9	12.4
CP, %	30.5	29.3
S, %	0.76	0.73
NDF, %	48.0	51.5

[1]All values expressed on a DM basis.

normal) by inclusion level (35%, 50%, 65%) interaction. Using the control as the common intercept, linear and quadratic interactions were evaluated.

Results

The fat concentrations (Table 2) of de-oiled and normal WDGS were 7.9% ± 0.71% and 12.4% ± 0.60%, respectively. Crude protein and sulfur concentration were slightly greater for de-oiled WDGS compared to normal fat WDGS likely due to being more concentrated when a portion of oil is removed. Dietary fat concentrations are included in Table 1.

No linear or quadratic interactions were observed for final BW, ADG, or F:G ($P > 0.31$; Table 3). There was a linear interaction ($P < 0.01$) for DMI producing different slopes for de-oiled and normal oil WDGS (Table 3) suggesting that DMI was different between de-oiled and normal WDGS at different inclusions. For the main effect of oil content, there were no statistical differences ($P > 0.19$) for final BW, ADG, or F:G between de-oiled and normal oil WDGS (Table 4). The effect of oil content was significant ($P < 0.01$) for DMI with cattle fed de-oiled diets having greater DMI than normal fat. There is a numerical difference ($P = 0.19$) between de-oiled and normal oil for F:G with cattle fed normal fat having a 2.6% improvement compared with de-oiled. For the main effect of inclusion, DMI decreased quadratically ($P < 0.01$) and F:G decreased linearly ($P < 0.01$) as the inclusion of WDGS increased in the diet with no response for ADG ($P > 0.17$; Table 5).

There was no linear or quadratic interactions observed for all carcass characteristics ($P > 0.19$). There were no statistical differences for the main effect of oil content ($P > 0.34$) for carcass characteristics (Table 4). For the main effect of level of WDGS, there were no statistical differences ($P > 0.17$) except calculated yield grade tended to increase linearly with increased inclusion of WDGS ($P = 0.08$; Table 5).

Feed conversion decreased linearly which suggests that either de-oiled or normal WDGS could be fed up to 65% of the diet which contradicts our hypothesis of an interaction. We would not recommend feeding WDGS at 65% inclusion, due to availability and economics as well as risk of sulfur toxicity. Regardless of inclusion, the oil content of WDGS had no significant effect on ADG or F:G suggesting that oil removed via centrifugation will have minimal impact on finishing performance.

Table 3. Linear and quadratic interactions for increasing levels of de-oiled and normal oil WDGS on finishing performance.

		35%		50%		65%			*P*-value	
	Control	DO[1]	N[1]	DO[1]	N[1]	DO[1]	N[1]	SEM	Lin Int[2]	Quad Int[2]
Performance										
DMI, lb/day	25.1	25.4	25.3	25.6	24.1	24.2	22.9	0.8	< 0.01	0.48
ADG, lb	3.88	3.99	4.14	4.15	3.92	4.12	4.06	0.12	0.31	0.64
F:G[3]	6.44	6.33	6.09	6.13	6.10	5.83	5.63		0.38	0.89

[1]DO = De-Oiled, N = Normal fat.
[2]Linear and quadratic interaction term.
[3]Analyzed as G:F, the reciprocal of F:G.

Table 4. Main effect of oil concentration on performance and carcass characteristics.

	De-Oiled	Normal	SEM	*P*-value
Performance				
Final BW, lb	1384	1375	9	
DMI, lb/day	25.1	24.1	0.2	0.52
ADG, lb	4.09	4.04	0.07	<0.01
F:G[1]	6.12	5.96	0.19	0.58
Carcass Characteristics				
HCW, lb	870	867	6	0.68
LM area, in	13.1	13.2	0.12	0.58
12th rib fat, in	0.56	0.56	0.01	0.93
Calculated YG	3.46	3.47	0.06	0.91
Marbling score[2]	465	476	8	0.34

[1]Analyzed as G:F, the reciprocal of F:G.
[2]Marbling score: 400 = Small00.

Table 5. Main effect of level of WDGS on performance and carcass characteristics.

	Control	35%	50%	65%	SEM	Linear	Quadratic
Performance							
Final BW, lb	1354	1382	1377	1382	36	0.23	0.46
DMI, lb/day	25.1	25.4	24.8	23.6	0.8	<0.01	<0.01
ADG, lb	3.88	4.07	4.04	4.09	0.12	0.17	0.60
F:G[1]	6.44	6.21	6.12	5.73		<0.01	0.13
Carcass Characteristics							
HCW, lb	850	871	867	867	22	0.25	0.27
LM area, in	13.4	13.2	13.3	13.2	0.20	0.53	0.97
12th rib fat, in	0.52	0.57	0.54	0.56	0.03	0.17	0.37
Calculated YG	3.24	3.49	3.38	3.49	0.12	0.08	0.42
Marbling score[2]	447	473	455	475	19	0.25	0.79

[1]Analyzed as G:F, the reciprocal of F:G
[2]Marbling score: 400 = Small00

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