2018

Impact of Corn Oil Removal from Modified Distillers Grains Plus Solubles and Supplemental Corn Oil on Finishing Cattle Performance

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Summary with Implications

A finishing study was conducted to evaluate removal of corn oil from modified distillers grains plus solubles (MDGS) and replacement of supplemental corn oil on finishing cattle performance. Four treatments were evaluated: a corn control diet, 40% de-oiled MDGS, 38% de-oiled MDGS plus 2% corn oil to equal the fat content of full fat MDGS, or 40% full fat MDGS. There was a significant improvement in ADG and F:G for cattle fed de-oiled MDGS plus oil compared to other treatments. Cattle fed full fat MDGS had numerically lower ADG and numerically poorer F:G (3.7%) compared with cattle fed MDGS plus oil. Cattle fed de-oiled MDGS had greater intake and numerically higher ADG than full fat MDGS, however F:G was similar (1.2%). Even with the improvement in feed conversion, the benefit is too small to make adding corn oil to the diet economical at current prices.

Introduction

Distillers grains are commonly fed in finishing diets as either a protein or energy source depending on inclusion level. The ethanol industry has recently started removing components of distillers grains, such as corn oil, which changes the nutrient composition of distillers grains plus solubles (DGS) that are available to be fed. Some producers are concerned that feeding de-oiled DGS will have a negative impact on finishing cattle performance. When comparing de-oiled versus normal fat MDGS at 40% inclusion level, there was no significant difference in any performance measurement due to the fat content of MDGS (2013 Nebraska Beef Cattle Report, pp. 64–65). Another study compared de-oiled versus normal WDGS at increasing inclusion levels, and a significant increase in DMI was noted when de-oiled WDGS was fed (2014 Nebraska Beef Cattle Report, pp. 81–82). For the main effect of oil content, there were no statistical differences for final BW, ADG, or F:G; however, F:G was improved 2.6% for normal WDGS compared to de-oiled WDGS. Cattle consuming normal MDGS at 30% inclusion level were numerically 3.4% more efficient than cattle consuming de-oiled MDGS; however, at the 15% inclusion level, the difference was only 1.4%. These results suggest that oil removed via centrifugation will have minimal impact

Table 1. Composition (% of diet DM) of dietary treatments fed to yearling steers.

	Treatment[1]			
Ingredient	CON	DO MDGS	MDGS + Oil	FF MDGS
Dry-rolled corn	43.75	23.75	23.75	23.75
High-moisture corn	43.75	23.75	23.75	23.75
MDGS De-oiled[2]	-	40	38	-
MDGS Full Fat[3]	-	-	-	40
Corn Oil	-	-	2	-
Alfalfa hay	3.5	3.5	3.5	3.5
Sorghum Silage	4	4	4	4
Supplement[4]	-	-	-	-
Fine Ground Corn	0.773	2.787	2.787	2.787
Limestone	1.729	1.697	1.697	1.697
Tallow	0.125	0.125	0.125	0.125
Urea	1.517	-	-	-
Potassium Chloride	0.465	-	-	-
Salt	0.3	0.3	0.3	0.3
Beef Trace Minerals	0.05	0.05	0.05	0.05
Vitamin A-D-E	0.015	0.015	0.015	0.015
Rumensin-90®[5]	0.017	0.017	0.017	0.017
Tylan-40®[6]	0.009	0.009	0.009	0.009
Nutrient Composition, % of DM				
OM	96.0	95.2	93.3	95.3
NDF	11.1	22.7	22.0	22.8
Sulfur	0.15	0.45	0.43	0.48
CP	12.1	17.0	16.4	16.7
Fat	3.89	5.96	7.78	7.10

[1]Treatments included CON-control; DO MDGS-40% de-oiled modified distillers grains plus solubles; MDGS + Oil-38% de-oiled modified distillers grains plus solubles plus 2% corn oil; FF MDGS-40% full fat modified distillers grains plus solubles.
[2] DO MDGS: de-oiled modified distillers grains plus solubles containing 8.9% fat.
[3] FF MDGS: full fat modified distillers grains plus solubles containing 11.6% fat.
[4] Supplement fed at 5% of dietary DM
[5] Formulated to supply Rumensin-90® (Elanco Animal Health) at 30 g per ton DM
[6] Formulated to supply Tylan-40® (Elanco Animal Health) at 90 mg per steer daily

on finishing cattle performance. Although corn oil has been added to diets in the past, there has never been a study that evaluated the removal of corn oil from distillers grains compared to adding corn oil back to de-oiled distillers grains. The objective of this study was to determine the effects of the removal of corn oil from modified distillers grains plus solubles and replacement with supplemental corn oil on finishing cattle performance.

Procedure

A finishing experiment conducted at the Eastern Nebraska Research and Extension Center utilized 320 crossbred yearling steers (initial BW = 910 lb ± 55 lb). For 5 days before the start of the trial, cattle were limit-fed a diet of 50% alfalfa hay and 50% Sweet Bran (DM Basis) at 2% of BW to reduce variation in gastrointestinal fill. Cattle were weighed on day 0 and 1 to establish an accurate initial BW. Steers were split into three blocks according to their initial BW. A total of 32 pens were used on the study with 10 steers per pen. Pens were assigned randomly to treatment with four treatments and eight pens per treatment. All cattle were adapted to their respective finishing treatment diet over a five-step adaptation process by replacing alfalfa with dry-rolled-corn (DRC) and high moisture corn (HMC). The three treatments that contained MDGS included it at respective inclusion levels throughout the step-up period and corn oil was included in the MDGS+Oil treatment throughout the step-up period as well.

The four treatments consisted of a corn control diet (CON), 40% de-oiled MDGS (DO MDGS), or 38% de-oiled MDGS plus 2% corn oil (MDGS + Oil) formulated to equal the fat content of FF MDGS, or 40% full fat MDGS (FF MDGS; Table 1). The de-oiled MDGS contained 8.9% fat, while the full fat MDGS contained 11.6% fat. All byproducts utilized in the trial were sourced from the same plant (E Energy Adams, Adams, NE). Although the MDGS + Oil and FF MDGS treatments were formulated to have equal fat content, lab analysis showed the MDGS + Oil treatment contained 7.78% dietary fat and the FF MDGS treatment contained 7.10% dietary fat. On a DM basis, all diets contained 3.5% alfalfa hay, 4% sorghum silage, 5% supplement, and a 50:50 blend of DRC:HMC to make up the remainder of the diet. The control treatment supplement contained 2% Empyreal corn protein concentrate (Cargill, Blair, NE) for days 1–50 then 1% Empyreal for days 51–85 to meet metabolizable protein requirements. Empyreal was removed from the supplement after day 85, as RUP supplementation was not necessary. The supplement also provided Tylan-40® (Elanco Animal Health) at 90 mg per steer daily and Rumensin-90® (Elanco Animal Health) at 30 g per ton DM.

Cattle were implanted with Component TE-200® (Elanco Animal Health) 104 days before harvest and were on feed for a total of 134 days. Steers were shipped to Greater Omaha for slaughter, and carcass data were recorded. On day of harvest, hot carcass weight and liver score were collected. Following a 48-hour chill, USDA marbling score, LM area, and 12th rib fat thickness were recorded. Animal performance and carcass characteristics were analyzed as an unstructured treatment design using a protected F-test, where block was included as a fixed effect. Data were analyzed using the MIXED procedure of SAS (SAS Institute, Inc. Cary, N.C.), where pen was the experimental unit. Treatment differences were declared significant at $P \leq 0.05$. Three steers from the FF MDGS treatment died. One died on day 52 due to lung abscesses from pneumonia, on day 121 due to a rupture of a liver abscess that turned septic, and on day 125 due to heat stress and bad lungs. Additionally, a steer from the MDGS + Oil treatment died on day 130 due to heat stress. One steer from the FF MDGS treatment and one steer from the DO MDGS treatment were removed on day 95 and 101, respectively, due to injuries. These six steers were removed from the performance data.

Table 2. Effect of feeding 40% de-oiled MDGS, 40% full fat MDGS, or 38% de-oiled MDGS plus 2% corn oil on feedlot performance and carcass characteristics

	Treatment[1]					
	CON	DO MDGS	MDGS + Oil	FF MDGS	SEM	F-TEST
Feedlot Performance						
Initial BW, lb	924	926	926	926	1.1	0.43
Final BW, lb[2]	1376[b]	1422[a]	1411[a]	1402[ab]	12.3	0.04
DMI, lb/d	22.7[b]	23.8[a]	22.0[b]	22.5[b]	0.33	0.01
ADG, lb	3.35[b]	3.70[a]	3.64[a]	3.55[ab]	0.09	0.06
F:G	6.76[c]	6.37[b]	6.06[a]	6.29[ab]	-	<0.01
Carcass Characteristics						
HCW, lb	866[b]	895[a]	891[a]	884[ab]	7.7	0.05
LM area, in[2]	13.6	13.7	13.7	13.4	0.20	0.52
Marbling[3]	463	458	446	467	12.9	0.64
12th rib fat, in	0.47[b]	0.56[a]	0.54[a]	0.55[a]	0.020	0.01

[a-c]Means with different subscripts differ (P < 0.05)

[1] Treatments included CON-control; 20MDGS-20% modified distillers grains plus solubles; 40MDGS-40% modified distillers grains plus solubles; 20FIB-fiber fed from concentrated ingredients to mimic fiber provided by 20MDGS; 40FIB-fiber fed from concentrated ingredients to mimic fiber provided by 40MDGS.

[2] Calculated from HCW/common dressing percentage (63%)

[3] Marbling score: 400 = Slight[00], 450 = Slight[50], 500 = Small[00], 550 = Small[50]

Results

Initial BW ($P = 0.43$; Table 2) was not influenced by treatment. Intake was impacted by treatment ($P < 0.01$) with steers fed DO MDGS having the greatest DMI and all other treatments being similar ($P > 0.15$). Dietary treatment impacted ADG ($P < 0.06$), with DO MDGS and MDGS + Oil having the greatest ADG, steers fed the FF MDGS treatment had intermediate ADG, and the CON ADG was least. Feed conversion was numerically the best for MDGS + Oil. The FF MDGS treatment had similar F:G to MDGS + Oil and DO MDGS ($P > 0.15$), while CON was the poorest F:G ($P < 0.03$). There was a numerical improvement in F:G of 1.2% observed for FF MDGS compared to DO MDGS. When 2% corn oil was added to de-oiled MDGS, there was a 4.9% improvement in

F:G compared to DO MDGS. There was a numerical improvement in F:G by 3.7% for MDGS + Oil compared to FF MDGS. Steers on the DO MDGS and MDGS + Oil treatments had the greatest HCW ($P < 0.05$), with FF MDGS being intermediate and CON having the lowest HCW. Cattle on all treatments had similar LM area ($P > 0.52$) and marbling ($P > 0.64$). Fat thickness was greatest ($P < 0.01$) for the MDGS treatments, while CON was lowest.

If corn is $3.36/bushel, MDGS is priced at 90% of the price of corn (currently $127/ton), and corn oil is $600/ton, it is not economical to add corn oil to the diet. The improvement in feed efficiency is not large enough to offset the increased cost of the added corn oil. The price of MDGS would have to increase to 118% of the price of corn or corn oil would have to decrease to less than $0.25/lb to make adding corn oil to the diet logical.

Conclusion

There was a numerical improvement in F:G of 1.2% observed for full fat MDGS compared to de-oiled MDGS, which is consistent with previous observations. When 2% corn oil was added to de-oiled MDGS, there was a 4.9% improvement in F:G compared to de-oiled MDGS. There was a numerical improvement in F:G by 3.7% for MDGS + Oil compared to FF MDGS. This could be partially due to the fact that the MDGS + Oil treatment contained a higher level of fat in the diet. One would expect F:G to decrease because corn oil is considered free oil, so it may negatively impact fiber digestion in the rumen, while the fat in distillers grains is bound in the germ so it may pass through the rumen and not have a negative impact. Even with the improvement in feed conversion, the benefit is too small to make adding corn oil to the diet economical at current prices.

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