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Impact of Feeding Distillers Grains or Isolated Components in Distillers Grains on Feedlot Performance and Carcass Traits

Brianna B. Conroy
University of Nebraska-Lincoln

Matt K. Luebbe
University of Nebraska-Lincoln, mluebbe2@unl.edu

Galen E. Erickson
University of Nebraska-Lincoln, gerickson4@unl.edu

Jim C. MacDonald
University of Nebraska-Lincoln, jmacdonald2@unl.edu

Jacob A. Hansen
University of Nebraska-Lincoln, jhansen19@unl.edu

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Summary

Six treatments were evaluated to determine the contribution of individual components of distillers grains on finishing performance. Diets were formulated to isolate the contribution of solubles, protein, fat, and fiber compared to a diet containing 40% wet distillers grains or a corn-based control. There was a significant improvement in both feedlot and carcass performance in steers fed the 40% wet distillers grains compared to dry-rolled-corn. Numeric differences between fat, fiber, and protein treatments were observed. However, none of the four component diets alone were able to explain the energy value associated with wet distillers grains.

Introduction

The ethanol industry continues to explore removing nutrients from distillers grains. Previous research indicates that finishing diets containing distillers grains have consistently resulted in higher ADG and improved feed efficiency compared to corn-based rations (2008 *Nebraska Beef Cattle Report*, pp.35–36). However, the contribution of individual nutrients in distillers grains that improve performance of finishing cattle has not been extensively studied. Knowing how fat, fiber, and protein in distillers grains each contribute to the value would allow prediction of impact if components are removed. The objective was to determine the energy contributions for each nutrient component in wet distillers grains plus solubles by isolating protein, fat, and fiber using corn byproducts from the wet milling industry.

Procedure

A finishing experiment utilizing 264 crossbred steers (initial BW = 918 ± 51 lb) was conducted to determine the nutrient values of isolated components of WDGS. The trial was conducted at the Panhandle Research and Extension Center (PREC), near Scottsbluff, NE. Prior to initiating the study, cattle were limit fed for five days at 2% of BW to reduce variation in gastrointestinal fill. Steers were weighed two consecutive days (day 0 and 1) to establish an accurate initial BW. According to the initial BW measurement, steers were separated into four BW blocks (Light, Mid-Light, Mid-Heavy, or Heavy), stratified and assigned randomly to a pen within their BW block. Cattle were placed in 30 pens (24 pens of 9 steers per pen and 6 pens of 8 steers per pen) allowing for 5 replications per treatment. Treatments were assigned randomly to pens, all steers were adapted to one of six dietary treatments over a four step adaptation process. During the adaptation period the percentage of dry-rolled-corn (DRC) included in the diet increased while the amount of wheat straw and corn silage decreased with each step.

Treatments consisted of 1) a corn-based control with no WDGS (CON), 2) WDGS at 40% inclusion (40WDGS), and 3) a diet (SOL) containing 10% condensed distillers solubles. Condensed distillers solubles (CCDS) are a liquid by-product of the ethanol production process which contain, CP, along with yeast cells, and energy. Condensed distillers solubles are commonly added back to dry distillers grains to create

Table 1. Composition of dietary treatments fed to yearling steers

Ingredient[a]	Treatment[e,f]					
	CON	40WDGS	SOL	PROT	FAT	FIB
DRC[b]	75.5	39	68.5	55	64.3	51.5
WDGS[b]	—	40	—	—	—	—
Silage	15	15	15	15	15	15
CCDS[b]	—	—	10	10	10	10
UreaSupp[c,e]	6	—	6	—	6	4
NoUreaSupp[d,e]	—	6	—	6	—	2
SBM[b]	3.5	—	0.5	—	0.5	0.5
Germ	—	—	—	—	4.2	—
Bran	—	—	—	—	—	14
SEM[b]	—	—	—	—	—	3
CGM[b]	—	—	—	14	—	—
Nutrient Composition, %						
CP	13.4	21.7	13.2	22.3	13.4	14.2
NDF	14.7	21.8	13.8	14.1	14.6	22.1
Fat	3.0	4.9	13.4	3.2	4.8	3.3
P	0.26	0.51	0.41	0.44	0.41	0.40
K	0.61	0.95	0.81	0.78	0.80	0.79
S	0.10	0.30	0.15	0.26	0.15	0.17

[a]All values presented on a % DM basis.
[b]DRC: Dry rolled corn, WDGS: Wet distillers grains plus solubles, CCDS: condensed distillers. solubles SBM: Soybean meal, SEM: solvent extracted meal, CGM: Corn gluten meal.
[c]Supplement 137: contained 1.3% urea, 1.34% limestone, 0.3% salt, 0.2% KCL (% of diet DM).
[d]Supplement 2041: contained 0% urea, 1.40% limestone, 0.3% salt, 0% KCL (% of diet DM).
[e]Both supplements contained a trace mineral premix (30% Zn, 50% Fe, 10% Cu, 20% Mn,0.5% I, 0.1% Co, 0.1% Se) and a Vitamin ADE premix (1,000 IU if vitamin A, 125 IU of vitamin D, and 1.5 IU of vitamin E).
[f]Treatments included a corn-based diet with no added WDGS (CON), 40% WDGS with no solubles (40WDGS), 10% solubles no WDGS (SOL), protein component using 20% CGM (PROT), fat component using 4.2% full-oil germ (FAT), and a fiber component diet containing 14% bran and 3% SEM (FIB).

WDGS. In order to accurately mimic the nutrient composition of WDGS all component treatments included CCDS at 10% of the diet DM. An additional three diets were formulated on a DM basis to simulate the nutrient content of each individual component in WDGS. The first (PROT) was formulated to match protein content using 14% corn gluten meal, the second (FAT) replicated fat content utilizing 4.2% full-oil germ, and the last (FIB) isolated fiber using 14% dry corn bran and 3% solvent extracted meal. All component diets contained 15% silage, 10% CCDS and 6% liquid-based supplement on a DM basis (Table 1). Condensed distillers solubles were included at 10% DM across all component treatments (SOL, PROT, FAT, FIB). Tylosin and monensin were distributed from a micro machine; Tylan® was fed at 90 mg/steer/day, and Rumensin® at 360 mg/steer daily. The WDGS (7.9% crude fat, 32.7% crude protein) and CCDS (6.8% crude fat, 19.5% crude protein) were delivered from Bridgeport Ethanol (Bridgeport, NE) as needed.

On d 0, cattle were implanted with Revalor-XS®. On d 113 steers in the Heavy or Mid-Heavy BW blocks were shipped to Cargill Meat Solutions in Fort Morgan, Colo. for slaughter. Cattle blocked into the Light or Mid-Light BW blocks were slaughtered on day 126. Hot carcass weight and liver score were collected on d of harvest. Following a 48 hour chill USDA marbling score, LM area, and 12th rib fat thickness were recorded. Yield grade was calculated as follows: 2.50 + (2.50 * fat thickness, in) + (0.2 * 2.5 [KPH]) + (0.0038 * HCW, lb) – (0.32 * LM area, in²). Animal performance and carcass characteristics were analyzed using the MIXED procedure of SAS (SAS Institute, Inc. Cary, N.C.). Pen was the experimental unit and BW block was a random effect. Treatment differences were declared significant at $P \le 0.05$. One steer died from respiratory complications and one animal was removed from the PROT treatment because of respiratory-related chronic illness. Those two steers were removed from the performance data.

Table 2. Effects of individual nutritional components of WDGS on feedlot performance and carcass characteristics

	Treatment						SEM	*P*-value
	CON	40WDGS	SOL	PROT	FAT	FIB		
Performance								
Initial BW, lb	924	923	923	923	921	921	30.7	0.50
Final BW, lb[a]	1410[gh]	1482[f]	1403[h]	1432[gh]	1411[gh]	1440[g]	15.3	< 0.01
DMI, lb/d	27.95[g]	28.00[g]	27.69[g]	28.75[f]	28.73[f]	28.28[fg]	0.36	0.04
ADG, lb	4.08[h]	4.69[f]	4.02[h]	4.25[gh]	4.12[gh]	4.34[g]	0.13	< 0.01
F:G[b]	6.94[gh]	6.07[f]	7.07[gh]	7.00[gh]	7.09[h]	6.62[g]	0.005	< 0.01
Feeding Value[c]	—	136%	82%	96%	85%	118%	—	—
Carcass Characteristics								
HCW, lb	888[gh]	934[f]	884[h]	902[gh]	889[gh]	907[g]	9.6	< 0.01
LM area, in[b]	13.12	13.55	12.97	13.10	13.29	13.08	0.21	0.13
12th rib fat, in	0.48[g]	0.57[f]	0.51[fg]	0.55[f]	0.48[g]	0.54[f]	0.03	0.02
Marbling[d]	578	586	579	594	571	576	23	0.94
Liver Abscess[e]	7	3	4	6	5	4	—	—

[a]Calculated from HCW/ common dressing percentage (63%).
[b]Originally analyzed as G:F, the reciprocal value of F:G
[c]Calculated as the percent change in the G:F of each treatment and the control, divided by the percentage of corn replaced in each treatment.
[d]Marbling score: 400 = slighto, 500 = smallo, 600 = modesto
[e]Liver abscess score: total number of A or A+ liver scores per treatment (43 or 44 steers per treatment group).
[f–h]Means with different superscripts differ ($P < 0.05$).

Results

According to past research, improved ADG and feed conversions were expected to be observed in cattle fed a diet containing 40% WDGS compared to DRC at similar intakes. In this experiment the energy value of WDGS was 137% that of DRC. As predicted, data showed significant improvement in live performance for cattle fed 40WDGS compared to CON. In this trial, DMI was greater for steers fed PROT and FAT compared with CON, 40WDGS, and SOL ($P = 0.04$) with FIB being intermediate. Daily gain was greater for 40WDGS compared to all other diets ($P < 0.01$). Gains for cattle fed PROT and FAT were intermediate, while FIB was greater than both CON and SOL ($P < 0.01$). Similar to ADG, steers fed 40WDGS had improved F:G compared with all other treatments ($P < 0.01$). Steers fed FIB had improved F:G compared to FAT ($P < 0.01$), while the remaining treatments (CON, SOL, PROT) were intermediate. Final BW was heaviest for cattle fed 40WDGS and lightest for those fed SOL ($P < 0.01$). When compared to SOL, FIB had a greater final BW ($P < 0.01$), while CON, PROT, and FAT were intermediate. Marbling score and LM area were not affected by treatment ($P \ge 0.13$). Greater external fat thickness was observed from steers fed 40WDGS, PROT, and FIB compared to CON or FAT ($P = 0.02$). Similar to final BW, cattle fed 40WDGS had the heaviest hot carcass weights of all dietary treatments.

Data from this experiment did not determine a sole nutritional component that was able to account for the energy value of wet distillers grains, however, we did observe numeric improvements from the fiber component compared to protein and fat.

Brianna B. Conroy, graduate assistant

Matthew K. Luebbe, assistant professor

Galen E. Erickson, professor

Jim C. MacDonald, associate professor

Jacob A. Hansen, research technician, University of Nebraska–Lincoln Department of Animal Science, Lincoln, Neb.