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Effects of Rumensin® and Tylan® in Finishing Diets with Wet Distillers Grains Plus Solubles

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Summary

A total of 3,632 crossbred steers at three different sites (Nebraska, Colorado and Oklahoma) were utilized in a randomized complete block design (RCBD) study. Data were combined for the Colorado and Oklahoma trials. Steers were fed one of five treatments: 1) Traditional corn diet with Rumensin and Tylan (CORN+RT); 2) Wet distillers grains plus solubles (WDGS); 3) WDGS with Rumensin (WDGS+R); 4) WDGS with Rumensin and Tylan (WDGS+RT); and 5) WDGS with expanded dose range of Rumensin (44.4 g/ton) and Tylan (WDGS+HIRT) to evaluate the effects of Rumensin and Tylan in feedlot diets containing WDGS. In WDGS diets, feed-to-gain ratio (F:G) was improved when Rumensin and Tylan were included ($P < 0.05$). With the exception of dressing percentage, there were no differences in performance or carcass characteristics when Rumensin was fed at 33.3 g/ton compared to 44.4 g/ton. Treatments containing Tylan resulted in significantly fewer liver abscesses than other treatments. Cattle fed Rumensin and Tylan diets containing WDGS had improved F:G and decreased liver abscesses compared to those receiving diets with no additives, regardless of corn processing method.

Introduction

Replacing dry-rolled or high-moisture corn grain with wet corn distillers grains with solubles improves cattle F:G and average daily gain (ADG; *2008 Nebraska Beef Report*, pp. 39-40). The effects of Rumensin and Tylan in corn by-product diets have not been studied, and it is possible that reduced starch and increased dietary fiber concentration may alter the effectiveness of Rumensin and/or Tylan in finishing cattle diets.

An interaction between grain processing method (i.e., steam-flaking vs. dry-rolled or high-moisture) and cattle response to wet distillers grains exists (*2007 Nebraska Beef Report*, pp. 33-35.). Regional differences affect preferences in grain processing, with steam flaking (SFC) being a predominant method in the Southern and High Plains, and high moisture ensiling (HMC) and dry rolling (DRC) prevalent in the Midwest. One objective of this study was to evaluate the effects of Rumensin and Tylan in diets containing WDGS on cattle performance, carcass characteristics and liver abscesses. The second objective was to compare the response on a regional basis where corn processing method is the major difference.

Procedure

Three separate trials were conducted at research facilities in Nebraska (University of Nebraska ARDC research feedlot), Colorado (Horton Research) and Oklahoma (Bos-Technica Research). A total of 3,632 steers were utilized in a randomized complete block design. Steers were purchased ranch direct or from regional auction markets and received from October 3, 2006, to March 27, 2007. Cattle were processed at each site according to the site's standard procedures, with all cattle receiving viral and clostridial vaccines and parasiticides. All steers were implanted with Revalor-S® (Intervet, Millsboro, Del.) or Synovex® Choice (Fort Dodge Animal Health) at study initiation. Trials were initiated from January 23, 2007, to April 3, 2007.

At the Nebraska site, five days prior to study initiation, steers were limit fed a diet that consisted of 50% alfalfa and 50% wet corn gluten feed (DM basis) at 2% of BW to minimize variation in gastrointestinal fill. On days 0 and 1, steers were individually weighed and the average weight was used to determine starting BW. Based on day 0 weight, steers were blocked by BW into one of four blocks, stratified by weight within block and assigned to pens, and pens were assigned randomly to treatment. A total of 800 British and British x Continental steers were utilized with 20 steers per pen and eight pens per treatment.

At the Oklahoma site, cattle were pen-weighed for initial and final weights. At the Colorado site, cattle were individually weighed for initial and final weights, following procedures similar to those used at the Nebraska site. At the Colorado and Oklahoma sites, a total of 1,400 British and British x Continental and 1,432 Continental steers were utilized, respectively, with 70 to 72 steers per pen and four pens per treatment.

Five dietary treatments at three different sites (Table 1) were utilized in the study. All sites received common Rumensin and Tylan treatments. Diets at Nebraska used a 50:50 combination of high-moisture (HMC) and dry-rolled corn (DRC); at the Colorado and Oklahoma sites, steam-flaked corn (SFC) was utilized as a common grain source. Treatment 1 (CORN+RT) contained corn grain and Rumensin (Elanco Animal Health, Greenfield, Ind.), formulated at 33.3 g monensin/ton DM basis, and Tylan (Elanco Animal Health, Greenfield, Ind.) formulated to provide 90 mg tylosin/steer daily. Treatments 2, 3, 4 and 5 contained 25% WDGS, replacing corn. Treatment 2 (WDGS) contained no active dietary additives; treatment 3 (WDGS+R) contained Rumensin formulated at 33.3 g monensin/ton DM basis; treatment 4 (WDGS+RT) contained Rumensin formulated at 33.3 g monensin/ton DM basis and Tylan formulated to provide 90 mg tylosin/steer daily; and

Table 1. Composition of dietary treatments and analyzed nutrient composition (DM basis).

	Treatments and sites					
Ingredient	0% WDGS (Neb.)	25% WDGS (Neb.)	0%[1] WDGS (Col.)	25%[2] WDGS (Col.)	0%[1] WDGS (Okla.)	25%[2] WDGS (Okla.)
Steam-flaked corn	—	—	73.8	56.0	85.0	62.6
High-moisture corn	39.75	29.75	—	—	—	—
Dry-rolled corn	39.75	29.75	—	—	—	—
WDGS[3]	—	25.0	—	25.0	—	25.0
Corn silage	7.0	7.0	8.0	8.0	—	—
Soybean meal, 47.5%	—	—	5.0	—	—	—
Alfalfa hay	3.5	3.5	4.0	4.0	5.0	5.0
Molasses	5.0	—	—	—	—	—
Choice white grease	—	—	—	—	4.0	1.4
Tallow	—	—	4.0	1.8	—	—
Supplement, meal[4]	5.0	5.0	—	—	—	—
Supplement, pellet	—	—	—	—	6.0	6.0
Supplement, liquid	—	—	5.2	5.2	—	—
Analyzed Nutrient Composition						
Crude protein, %	13.3	15.2	12.9	16.4	12.8	16.0
Fat, %	4.0	6.7	5.4	4.6	7.5	7.3
Calcium, %	0.63	0.66	0.68	0.80	0.73	0.90
Phosphorus, %	0.27	0.41	0.38	0.44	0.29	0.49
Sulfur, %	0.14	0.26	0.17	0.30	0.20	0.28

[1]Monensin was included at 33.3 g/ton and 90 mg of tylosin phosphate per animal via a flush system with water as a carrier.
[2]Monensin was included at 0, 33.3 or 44.4 g/ton and 0 or 90 mg of tylosin phosphate per animal via a flush system with water as a carrier.
[3]Procured from commercial ethanol plants (Neb. = Abegona Bioenergy, York, Neb; Col. = Pacific Ag Products LLC, Windsor, Col.; Okla. = East Kansas Agri Energy, Garnett, Kan.).
[4]Supplement formulated to provide 0, 33.3 or 44.4 g/ton monensin and 0 or 90 mg of tylosin phosphate per animal. Ground corn was the carrier for the supplement.

Table 2. Site 1 (Nebraska) performance, carcass and liver characteristics of steers fed different diets and amounts of Rumensin and Tylan.

	Treatments[1]						
	CORN +RT	WDGS	WDGS +R	WDGS +RT	WDGS +HIRT	SEM	*P*-value
Pens, n	8	8	8	8	8		
Steers, n [2]	160	160	160	160	160		
Average DOF	153	153	153	153	153		
Performance							
Initial BW, lb	725	725	725	726	725	0	0.72
Final BW, lb[3]	1294^{a}	1317^{b}	1326^{b}	1333^{b}	1317^{b}	6	< 0.01
DMI, lb	23.5^{abc}	23.9^{a}	23.6^{ac}	23.4^{bc}	23.0^{b}	0.2	0.02
ADG, lb[3]	3.72^{a}	3.87^{b}	3.93^{b}	3.97^{b}	3.87^{b}	0.04	< 0.01
F:G[4]	6.29^{a}	6.17^{a}	5.99^{b}	5.88^{b}	5.95^{b}		< 0.01
Carcass Characteristics							
HCW, lb	815^{a}	830^{b}	836^{b}	840^{b}	829^{b}	4	< 0.01
12th rib FT, in	0.47^{a}	0.53^{bc}	0.51^{c}	0.54^{b}	0.51^{bc}	0.01	< 0.01
LM area, in^2	13.1	13.1	13.3	13.1	13.0	0.1	0.68
KPH fat, %	2.0	2.0	2.0	2.0	2.0	0.0	0.43
Marbling score[5]	529	540	540	531	547	6	0.30
Calculated YG[6]	2.6^{a}	2.8^{bc}	2.7^{ab}	2.8^{c}	2.8^{bc}	0.0	< 0.01
Liver Abscesses							
Total, %	17.0^{a}	42.4^{b}	40.8^{b}	8.3^{a}	8.9^{a}	3.0	< 0.01
A+, %	4.4^{a}	16.5^{b}	19.1^{b}	3.8^{a}	7.0^{a}	2.2	< 0.01

[1]CORN = corn control; WDGS = wet distillers grains plus solubles; R = monensin at 33.3 g/ton; HIR = monensin at 44.4 g/ton, T = tylosin phosphate formulated for 90 mg/d.
[2]Number of steers at trial initiation.
[3]Calculated from carcass weight adjusted to a 63% common dressing percentage.
[4]Calculated as total gain divided by total DMI and analyzed as G:F. The reciprocal is presented (F:G).
[5]Where 400 = Slight 0, 500 = Small 0.
[6]Calculated as YG = 2.50 + (2.5*FT, in) – (0.32*LM, in^2) + (0.2*KPH, %) + (0.0038*HCW, lb).
[a,b,c]Within a row means without a common superscript letter differ ($P < 0.05$).

treatment 5 (WDGS+HIRT) contained Rumensin formulated at 44.4 g monensin/ton DM basis and Tylan formulated to provide 90 mg tylosin/steer daily. All diets were formulated to meet or exceed the National Research Council (1996) requirements for CP, Ca, P and K (Table 1).

Steers were adapted to the finishing diet with step-up periods that replaced corn grain with alfalfa. Number of steps ranged from 2 to 4 with total step-up periods lasting 14 to 23 days. Steers were fed once daily at Nebraska and Colorado and three times daily at Oklahoma.

Cattle were slaughtered at commercial packing plants where hot carcass weights (HCW) and liver scores were recorded at slaughter time. Following a 36-48 hour chill period, carcass data were collected, including: 12th rib fat thickness, LM area, KPH percentage, called USDA marbling and YG scores. A calculated yield grade was determined from the equation (YG = 2.50 + (2.5*FT, in.) – (0.32*REA, in^2) + (0.2*KPH, %) + (0.0038*HCW, lb.)). Values for final BW, ADG and F:G were calculated using hot carcass weight divided by an average dressing percentage of 63 to minimize errors associated with gastrointestinal tract fill.

For all experiments, performance, carcass and liver abscess data were analyzed using the MIXED procedures of SAS (Version 9.1, SAS Inc., Cary, N.C.) as a randomized complete block design, with pen as the experimental unit and four weight blocks. Data from Nebraska were analyzed separately; data from the Colorado and Oklahoma studies were combined because of the common corn processing method. Combined trial site data were first checked for a trial site x treatment interaction and combined if there was not a significant interaction. When treatment differences were significant based on a protected F-test, means were separated using the PDIFF option of SAS. Pre-planned contrasts included: CORN+RT vs. WDGS+RT; WDGS vs. WDGS+R; WDGS+R vs. WDGS+RT; and WDGS+RT vs. WDGS+HIRT.

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Table 3. Site 2 (Colorado) and 3 (Oklahoma) combined performance, carcass and liver characteristics of steers fed different diets and amounts of Rumensin and Tylan.

	Treatments[1]							
	CORN +RT	WDGS	WDGS +R	WDGS +RT	WDGS +HIRT	SEM	Int[2]	*P*-value
Pens, n	8	8	8	8	8			
Steers, n[3]	566	567	567	566	566			
Average DOF	186	186	186	186	186			
Performance								
Initial BW, lb	708^{ab}	712^{a}	704^{b}	713^{a}	710^{a}	2	0.20	0.05
Final BW, lb[4]	1406^{a}	1381^{b}	1384^{b}	1402^{a}	1402^{a}	5	0.73	< 0.01
DMI, lb	20.3^{a}	21.0^{b}	20.9^{b}	20.8^{b}	20.8^{b}	0.1	0.29	< 0.001
ADG, lb[4]	3.76^{a}	3.61^{b}	3.66^{bc}	3.71^{ac}	3.73^{ac}	0.02	0.67	< 0.01
F:G[5]	5.40^{a}	5.82^{d}	5.71^{cd}	5.60^{bc}	5.57^{b}		0.61	< 0.001
Carcass Characteristics								
HCW, lb	886^{a}	870^{b}	872^{b}	883^{a}	883^{a}	3	0.73	< 0.01
12th rib FT, in	0.63	0.62	0.62	0.63	0.63	0.01	0.04	0.68
12th rib FT CO, in	0.63^{a}	0.65^{ab}	0.65^{ab}	0.66^{ab}	0.67^{b}	0.01		
12th rib FT OK, in	0.64^{a}	0.59^{b}	0.60^{ab}	0.61^{ab}	0.60^{ab}	0.01		
LM area, in^2	14.0^{a}	13.9^{ab}	13.7^{b}	13.9^{a}	13.9^{ab}	0.1	0.16	0.08
KPH fat, %	2.3	2.2	2.2	2.2	2.2	0.0	0.62	0.62
Marbling score[6]	509^{a}	503^{ab}	503^{ab}	496^{b}	502^{ab}	3	0.62	0.09
Calculated YG[7]	3.5	3.5	3.5	3.5	3.5	0.0	0.06	0.48
Liver Abscesses								
Total, %	15.7^{a}	45.9^{b}	44.3^{b}	17.9^{a}	20.3^{a}	2.9	0.10	< 0.001
A+, %	7.2	25.6	25.0	8.5	10.6	2.1	< 0.01	< 0.01
A+ CO, %	8.2^{a}	35.4^{b}	34.7^{b}	11.5^{a}	12.4^{a}	3.8		
A+ OK, %	6.2^{a}	15.8^{b}	15.4^{b}	5.5^{a}	8.8^{a}	1.7		

[1]CORN = corn control; WDGS = wet distillers grains plus solubles; R = monensin at 33.3 g/ton; HIR = monensin at 44.4 g/ton; T = tylosin phosphate formulated for 90 mg/d.
[2]Interaction *P*-value of site location by treatment.
[3]Number of steers at trial initiation.
[4]Calculated from carcass weight adjusted to a 63% common dressing percentage.
[5]Calculated as total gain divided by total DMI and analyzed as G:F. The reciprocal is presented (F:G).
[6]Where 400 = Slight 0; 500 = Small 0.
[7]Calculated as YG = 2.50 + (2.5*FT, in.) – (0.32*LM, in^2) + (0.2*KPH, %) + (0.0038*HCW, lb.).
[a,b,c,d]Within a row, means without a common superscript letter differ ($P < 0.05$).

Results

Results for Nebraska Trial

Compared to steers fed CORN+RT, steers fed WDGS+RT gained more, were more efficient ($P < 0.05$), and had similar dry matter intake (DMI; Table 2). Wet distillers grains plus solubles fed at 25% (DM basis) had 128% the feeding value of a 50:50 combination of DRC and HMC. Feeding Rumensin increased G:F by 3.1% and feeding Rumensin plus Tylan increased G:F by 4.9% when compared to WDGS without feed additives ($P < 0.05$). With the exception of dressing percentage, there were no differences in performance or carcass characteristics when Rumensin was fed at 33.3 g/ton compared to 44.4 g/ton. Total liver abscesses were significantly greater in steers receiving WDGS (42.4%) and WDGS+R (40.8%), compared to steers receiving treatments containing Tylan, CORN+RT (17.0%), WDGS+RT (8.3%), and WDGS+HIRT (8.9%). Fewer severe liver abscesses also were seen in steers whose diets contained Tylan ($P < 0.05$).

Results for Combined Colorado and Oklahoma Trials

Compared to steers fed CORN+RT, steers fed WDGS+RT were less efficient and had increased DMI (Table 3). Wet distillers grains plus solubles fed at 25% (DM basis) had 87% the feeding value of SFC. Feed efficiency was measured as G:F, which is more statistically valid than F:G. Feeding Rumensin increased G:F numerically by 1.7%, and feeding Rumensin plus Tylan increased G:F by 4.1% compared to WDGS without feed additives ($P < 0.05$). Carcass characteristics, with the exception of HCW, were unaffected by treatment. Hot carcass weight was greatest in steers fed CORN+RT, WDGS+RT and WDGS+HIRT, compared to WDGS and WDGS+R ($P < 0.05$). Total liver abscesses were significantly greater in steers fed WDGS (45.9%) and WDGS+R (44.3%), compared to treatments containing Tylan, CORN+RT (15.7%), WDGS+RT (17.9%) and WDGS+HIRT (20.3%). Additionally, cattle fed Tylan had fewer severe liver abscesses in both the Colorado and Oklahoma studies ($P < 0.01$).

In summary, this study indicates that cattle fed Rumensin and Tylan in diets containing 25% WDGS show improved feed efficiency and decreased liver abscesses compared to those whose diets contain no additives, regardless of corn processing method.

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