Effect of Feeding Wet Distiller Grain Produced From Corn, Sorghum or a Combination of Corn and Sorghum Grain on Finishing Steer Performance: A Two Trial Summary

Submitted to: Conestoga Ethanol Group

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Experimental Procedures:

Experiment 1: One thousand eighty steers, average initial weight 647 pounds, were selected from a larger group of 1200 steers following a 60 day starting and growing period. Steers were sorted by weight into 5 replications and randomly sorted by groups of 5 head into 3 treatment pens within each replication. Following sorting, each treatment group of steers was processed according to feedyard protocol based on the average weight of the entire group and assigned a home pens. Steers were administered a second implant approximately 90 days prior to harvest. All treatments were stepped up to the experimental diets (Table 1) using common transition rations and were placed on the experimental diets 21 days following sorting into treatment groups.

Experimental diets contained 20% wet distiller grain (DM basis) from the fermentation of 100% corn grain (***Corn***) or a 50:50 blend of corn and sorghum grain (***Blend***) and contained 65% moisture (35% DM). The third treatment consisted of drying the 50:50 blend from 35% dry matter to 50% dry matter at the time of production to be fed in the modified form (***Modified***). Wet distiller grains were produced from a common plant and stored in Ag bags. The experiment began April 23, 2009 and was completed October 15, 2009. Steers were fed an average of 174 days.

Experiment 2: Thirty-three hundred twenty steers, average initial weight 747 lb, were blocked by arrival group (6) to the feedyard. Upon arrival steers were sorted by groups of 5 head into 4 treatment groups. The first group of steers arrived on August 16, 2010 and the final group arrived August 25, 2010. Following sorting, each treatment group of steers was processed according to feedyard protocol based on the average weight of the entire group and assigned a home pens. Pens from each arrival group were randomly assigned to one of four treatments. Experimental treatment diets (Table 2) contained 22% wet distiller grain (DM basis) produced from 100% corn (***Corn***), 100% sorghum (***Sorghum***) or a 50:50 combination of corn and sorghum grain (***Blend***). Wet distiller grain in these three treatments contained condensed distiller solubles. The fourth treatment (***Corn(LF)***) consisted of wet distiller grain produced from 100% corn grain without condensed solubles to create a lower crude fat concentration. Finishing diets were formulated to contain similar amounts of forage (corn silage), macro and micro minerals, Rumensin and Tylan (Table 2).

Steers were adapted to finish rations using a common step-up program across all pens. Treatment diets were fed once pens within each replication were ready to be put "on feed", approximately 21 days. Steers were implanted twice according to feedyard protocol for initial weight, and all pens within a replication (block) were reimplanted at the same time on feed. Steers within a replication were harvested at same days on feed. The first replication was harvested on January 18, 2011 and the last replication was harvested on February 23, 2011, averaging 172 days on feed across treatments.

Pooled Analysis:

Finishing diets contained 20 and 22% wet distiller grain in Experiments 1 and 2, respectively. Both experiments contained treatments consisting of wet distiller grain produced from 100% corn grain (**Corn**) or a 50:50 combination of corn and sorghum grain (**Blend**). Finishing performance data from these two treatments were pooled for further analysis.

<u>Experimental Results:</u>

Experiment 1: Analyzed nutrient composition of treatment diets and wet distiller grain types during the conduct of the experiment are presented in Table 1. Dietary dry matter and dietary concentrations of crude protein, NPN, and crude fat were similar to formulated concentrations. Analyzed nutrient content of wet distiller grain was similar across treatments.

Results for finishing performance and carcass characteristics are presented in Table 3. Steers were harvested by treatment group which explains the differences observed for days on feed and final weight. Death loss was similar among treatments, and finishing performance results are presented with death loss removed. Dry matter intake was similar among treatments. Expressed on live or carcass adjusted basis, average daily gain and dry matter conversion were similar among treatments.

Hot carcass weight and dressing percentage (Table 3) were similar among treatments. The percentage of Choice or higher carcasses was higher in steers fed Modified compared with either Corn or Blend. Yield grade 3 carcasses were lower and yield grade 4 and 5 carcasses were higher for steers fed Modified compared with either Corn or Blend. The differences observed in Quality grade are confounded by harvest date as a result of the steers fed the Modified received an additional day of carcass chill. Furthermore, the differences in Quality and Yield Grade are difficult to explain biologically with similar performance and with 360 steers per treatment caution should be exercised with inferences.

Experiment 2: Analyzed nutrient composition of treatment diets and wet distiller grain types during the conduct of the experiment are presented in Table 2. Finish ration dry matters were similar across treatments. Changes in ration crude protein and crude fat concentrations are a reflection of the changes in wet distiller grain type. The change in dietary fat concentration between Corn and Corn(LF) was a result of smaller than expected changes with or without addition of condensed solubles as a fraction of the wet distiller grain. Based on measured difference between Corn and Corn(LF) distiller grain, a 22% dietary inclusion would produce a .28% change in dietary fat. The analyzed difference between Corn and Corn(LF) dietary fat concentration was .2%.

Finishing steer performance for Experiment 2 is presented in Table 4. Death loss was not statistically different among treatments and deads were removed from analysis. Digestive death loss among treatments was similar; 2, 1, 1, 2, respectively for Corn, Sorghum, Blend and CornLF. Most other death loss occurred during the step up period when all cattle were on a common diet. Carcass data was unavailable from this experiment.

Dry matter intake was lower ($P < .05$) for steers fed Corn(LF) compared to Sorghum or Blend. Dry matter intake of steers fed Corn was intermediate. Daily gain was similar among treatments. Dry matter conversion was higher ($P < .10$) for steers fed Sorghum or Blend compared to those fed either Corn or Corn(LF). Dry matter conversion of steers fed Corn and Corn(LF) were similar as result of minimal differences in dietary fat concentration. Dry matter conversion of steers fed Sorghum and Blend were similar. On average, dry matter conversion of steers fed Sorghum or Blend was 2% higher ((6.4-6.27=.13)/6.4*100) compared with those fed either Corn or Corn(LF). With a dietary inclusion of 22%, these differences suggest that Sorghum and Blend had approximately 91% the energy value of Corn (100- (2/.22).

Pooled Analysis:

Results of the pooled analysis of Corn and Blend treatments are presented in Table 5. Final weight, dry matter intake and daily gain were similar between treatments. A significant ($P < .01$) experiment × treatment interaction was observed for dry matter conversion. The variation in response to feeding Corn or Blend on dry matter conversion was low enough among replications within each experiment that pooling data did not result in a different interpretation compared with each individual experiment.

Conclusions:

Experiment 1 demonstrates that the energy value of wet distiller grain produced from 100% corn grain or a 50:50 combination of corn and sorghum grain is similar. Conversely, Experiment 2 demonstrates that wet distiller grain produced from 100% corn has a 9% higher energy value compared with wet distiller grain produced from 50:50 combination of corn and sorghum grain. Differences that may be meaningful in explaining the variation between the two experiments are initial weight and time of year. Steers used in Experiment 2 had an initial weight 100 pounds heavier than those used in Experiment 1. Experiment 1 was conducted through the summer months (April through October) compared to Experiment 2 which began in late summer and concluded during mid-winter (August through February). Heavier steers fed during some adverse winter conditions could have depicted or magnified a difference in wet distiller grain produced from 100% corn or a 50:50 combination of corn and sorghum grain compared with an experiment conducted with less environmental stress and lighter steers. In any case the difference in energy value (0 to 9%) between wet distiller grain produced from 100% corn or a 50:50 blend of corn and sorghum grain is similar to the variation that can be found between individual experiments evaluating the energy value of corn or sorghum as feed grains for finishing cattle.

The fat concentration between wet distiller grain produced from 100% corn grain with or without condensed solubles in Experiment 2 did not result in a final dietary fat concentration large enough to produce measurable differences in animal performance. An experiment completed simultaneously reducing crude fat from 12 to 8% (DM basis) resulted in a 12% reduction in energy content of wet distiller grain.

Table 1. Composition of Experimental Diets and Nutrient Composition of Wet Distiller Grain in Experiment 1 (100% DM basis)

	Treatment [a]		
Diet Composition, %	Corn	Blend	Modified
Flaked Corn	62.7	62.7	62.7
Alfalfa Hay	5.5	5.5	5.5
Corn Silage	3.0	3.0	3.0
Tallow	1.8	1.8	1.8
Protein Pellet	7.0	7.0	7.0
Wet Distiller Gain	20.0	20.0	20.0
Formulated Nutrient Composition			
Dry Matter. %	60.1	60.1	66.6
Crude Protein, %	15.3	15.3	15.3
NPN, %	2.0	2.0	2.0
Forage-NDF, %	4.0	4.0	4.0
Crude Fat, %	6.8	6.8	6.8
Calcium, %	.8	.8	.8
Phosphorus, %	.4	.4	.4
Sulfur, %	.28	.28	.28
Rumensin, g/ton	33	33	33
Tylan, g/ton	8	8	8
Analyzed Diet Nutrient Composition			
Dry Matter, %	60.0	59.9	65.8
Crude Protein, %	15.5	15.8	15.3
NPN, %	1.8	1.8	1.8
Crude Fat, %	6.6	6.5	6.8
ADF, %	10.5	11.0	11.6
Sulfur, %	.23	.22	.22
Analyzed WDG Nutrient Composition			
Dry Matter, %	33.6	34.2	48.1
Crude Protein, %	31.8	32.3	31.1
Crude Fat, %	11.8	11.8	11.1
Sulfur, %	.48	.45	.43

[a] Corn = 100% corn wet distiller gain, 35% dry matter; Blend = 50% corn and 50% sorghum grain blend of wet distiller grain, 35% dry matter; Modified = 50:50 corn sorghum blend of wet distiller grain, 50% dry matter.

Table 2. Composition of Experimental Diets and Nutrient Composition of Wet Distiller Grain in Experiment 2 (100% DM basis)

	Treatment [a]			
Diet Composition, %	Corn	Sorghum	Blend	Corn(LF)
Steam Flaked Corn	61.6	61.6	61.6	61.6
Corn Silage	11.0	11.0	11.0	11.0
Liquid Supplement	5.4	5.4	5.4	5.4
Corn WDG	22.0	--	--	--
Sorghum WDG	--	22.0	--	--
Blend WDG	--	--	22.0	--
Corn(LF) WDG	--	--	--	22.0
Formulated Nutrient Composition				
Dry Matter, %	54.1	54.1	54.1	54.1
Crude Protein, %	15.7	16.2	16.4	16.2
NPN, %	2.5	2.5	2.5	2.5
Forage NDF, %	4.2	4.2	4.2	4.2
Crude Fat, %	5.3	5.2	5.2	4.9
Calcium, %	.85	.85	.85	.85
Phosphorus, %	.5	.5	.5	.5
Sulfur, %	.25	.25	.25	.25
Rumensin, g/ton	33	33	33	33
Tylan, g/ton	8	8	8	8
Analyzed Diet Nutrient Composition				
Dry Matter, %	54.3	54.4	53.9	54.2
Crude Protein, %	15.8	16.6	16.1	16.9
NPN, %	3.0	3.1	3.0	2.9
ADF, %	8.9	10.2	10	9.1
Crude Fat, %	5.4	5.3	5.4	5.2
Sulfur, %	.19	.18	.18	.19
Analyzed WDG Nutrient Composition				
Dry Matter, %	35.1	36.1	35.3	36.1
Crude Protein, %	31.7	33.9	33.6	36.1
Crude Fat, %	12.9	12.2	12.0	11.6
Sulfur, %	.45	.39	.37	.40

[a] Wet distiller produced from: Corn = 100% corn; Sorghum = 100% sorghum; Blend = 50:50 combination of corn and sorghum grain; Corn (LF) = 100% corn with CCDS removed to lower fat concentration.

Table 3. Effect of Wet Distiller Grain Type on Finishing Steer Performance and Carcass Characteristics in Experiment 1.

	Treatment [a]			
Item	Corn	Blend	Modified	SEM
Head Count, n	360	360	360	
Pens, n	5	5	5	
Initial Wt., lb	647	646	648	
Days on Feed	173[b]	174[bc]	175[c]	.8
DM Intake, lb/d	20.6	20.7	20.9	.17
Death Loss, %	.83	1.12	1.11	.58
Live Performance, Final Weight, 4% Shrink				
Final Wt, lb	1300[b]	1307[bc]	1316[c]	5.7
Daily Gain, lb	3.78	3.80	3.82	.041
DM Conversion	5.47	5.45	5.46	.067
Carcass Adjust Performance, Final Weight = Hot Carcass Weight/.635				
Final Wt., lb	1319	1328	1327	7.9
Daily Gain, lb	3.88	3.92	3.88	.053
DM Conversion	5.31	5.29	5.37	.075
Carcass Characteristics				
Hot Carcass Wt., lb	837	843	842	5.1
Dressing Percentage	64.4	64.4	64.0	.24
Heavy Carcasses, %	2.0	1.4	1.4	.95
Light Carcasses, %	.2	.2	0	.21
Quality Grade Distribution, %				
Choice and Prime	57.7[b]	60.4[b]	73.3[c]	3.3
Select	40.3[b]	37.7[b]	26.2[c]	3.7
Standard	2.0	2.0	.5	.96
Yield Grade Distribution, %				
Yield Grade 1	9.5	13.0	9.6	2.4
Yield Grade 2	32.3	32.2	31.0	4.7
Yield Grade 3	45.5[b]	41.0[bc]	38.0[c]	3.7
Yield Grade 4 and 5	12.7[b]	13.8[b]	21.4[c]	3.4

[a] Corn = 100% corn wet distiller gain, 35% dry matter; Blend = 50% corn and 50% sorghum grain blend of wet distiller grain, 35% dry matter; Modified = 50:50 corn sorghum blend of wet distiller grain, 50% dry matter.

[b,c] Means without a common superscript differ ($P < .01$).

Table 4. Effect of Wet Distiller Grain Type on Finishing Steer Performance in Experiment 2.

	Treatment [a]				
Item	Corn	Sorghum	Blend	Corn(LF)	SEM
Head Ct, n	837	830	838	815	--
Pens, n	6	6	6	6	--
Initial Wt., lb	748	747	745	747	4.2
Final Wt.[b], lb	1353	1345	1341	1346	8.4
Days on Feed	172	172	172	172	--
DM Intake, lb/d	21.9 [cd]	22.0 [d]	22.1 [d]	21.6 [c]	.20
Daily Gain, lb	3.51	3.46	3.45	3.46	.22
DM Conversion	6.27 [e]	6.38 [f]	6.42 [f]	6.27 [e]	.06

[a] Wet distiller produced from: Corn = 100% corn; Sorghum = 100% sorghum; Blend = 50:50 combination of corn and sorghum grain; Corn (LF) = 100% corn with CCDS removed to lower fat concentration.

[b] Final weight = live weight pencil shrunk 4%

[c,d] Means differ $P < .05$.

[e,f] Means differ $P < .10$.

Table 5. Pooled Analysis of Finishing Steer Performance Fed Corn and Blend Treatments from Experiments 1 and 2.

	Treatment [a]			
Item	Corn	Blend	P-Value	Exp.*Trt [b]
Initial Wt., lb	697	695	.34	<.01
Experiment 1	647	646	.65	
Experiment 2	748	745	.39	
Final Wt.[c], lb	1326	1324	.67	.13
DM Intake, lb/d	21.3	21.4	.36	.16
Daily Gain, lb	3.64	3.63	.70	.16
DM Conversion	5.87	5.94	.19	<.01
Experiment 1	5.47	5.45	.80	
Experiment 2	6.27	6.42	<.01	

[a] Wet distiller grain produced from: Corn = 100% corn grain; Blend = 50:50 combination or corn and sorghum grain.

[b] Exp.*Trt: P-Value for Experiment × Treatment interaction.

[c] Final weight = live weight pencil shrunk 4%