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Evaluating Syngenta Enhanced Feed Corn on Finishing Cattle Performance and Carcass Characteristics

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Summary

Two experiments were conducted to compare Syngenta Enhanced Feed Corn™ containing an alpha amylase enzyme trait (SYT-EFC) with commercially available corn grain without the alpha amylase enzyme trait (Conventional) for cattle performance and carcass characteristics at 2 locations. In Exp. 1, steers were fed SYT-EFC or Conventional corn with or without the addition of 25% Sweet Bran, or a BLEND (Conventional and SYT-EFC) without Sweet Bran. In Exp. 2, steers were fed SYT-EFC, Conventional, BLEND, or Conventional with an alpha amylase enzyme supplement (NZ). In Exp. 1, feed conversion improved 8.5% for SYT-EFC compared with Conventional when Sweet Bran was included in the diet. In Exp. 2, feed conversion improved 5.4% for cattle fed SYT-EFC, BLEND, and NZ compared with the Conventional corn. Feeding SYT-EFC corn containing the alpha amylase enzyme trait improves feed conversion of feedlot cattle.

Introduction

A greater extent of starch digestion is ideal to allow feedlot producers to maximize efficiency if acidosis can be controlled. The primary way to increase the extent of starch digestion for high-moisture and dry-rolled corn is to increase the rate of degradation in the rumen. Another way producers can maximize efficiency is by selecting hybrids with kernel traits that are associated with improved digestibility when fed as dry-rolled corn (*2004 Nebraska Beef Report*, pp. 54–57). Genetically modified traits producing alpha amylase enzyme in corn grain may increase starch digestion and improve the performance of finishing steers.

Therefore, the objectives of these studies were to compare 1) SYT-EFC corn (Syngenta Seeds, Inc.) containing an alpha amylase enzyme trait, alone or blended with commercially available corn grain in diets with or without Sweet Bran, 2) feeding a commercially available alpha amylase enzyme supplement on feedlot steer performance and carcass characteristics.

Procedure

Experiment 1

Three hundred crossbred steers (initial BW = 658 lb, SD = 36) were utilized in a feedlot finishing trial at the UNL Agricultural Research and Development Center (ARDC) feedlot near Mead, NE. Cattle were limit fed a diet at 2% of BW consisting of 32% corn wet distillers grains plus solubles, 32% alfalfa hay, 32% dry-rolled corn, and 4% supplement (DM basis) for 5 d prior to the start of the experiment. Two-day initial weights were recorded on d 0 and 1 which were averaged and used as the initial BW. The steers were blocked by BW into light, medium, and heavy BW blocks (n = 3, 2, and 1 pen replicates, respectively) based on d 0 BW, stratified by BW and assigned randomly to 1 of 30 pens with pens assigned randomly to 1 of 5 dietary treatments. There were 10 head/pen and 6 replications/treatment. Dietary treatments included 1) SYT-EFC corn, 2) Conventional commercial corn source (CON), 3) 50:50 blend of SYT-EFC and CON (BLEND), 4) SYT-EFC with Sweet Bran (Cargill wet milling, Blair, NE), and 5) CON with Sweet Bran in a randomized block design (Table 1). Steers were adapted to the finishing diets over a 21-d period with corn replacing alfalfa hay, while inclusion of corn silage, corn wet distillers grain plus solubles (WDGS), and supplement remained the same in all diets. In diets containing Sweet Bran, the concentration remained the same in all grain adaptation diets. Diets were formulated to meet or exceed NRC requirements for protein and minerals. The final finishing diets provided 338 mg/steer daily of Rumensin (30 g/ton of DM), and 90 mg/steer daily of Tylan (9 g/ton of DM). Steers were implanted on d 1 with Revalor-XS.

All steers were harvested at a commercial abattoir (Greater Omaha, Omaha, NE) on d 174. Final live BW were collected prior to d of slaughter and a 4% pencil shrink was applied for calculation of dressing percentage. Feed offered on d 173 was 50% of the previous day DMI and cattle were weighed at 1600 h. Steers were then shipped and held until slaughter the next day. Hot carcass weight and livers scores were recorded on the d of slaughter. Fat thickness, LM area, and USDA marbling score were recorded after a 48-h chill. Final BW, ADG, and F:G were calculated using HCW adjusted to a common 63% dressing percentage.

Performance and carcass characteristics were analyzed using the MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.). Initial BW block was included as a fixed effect and pen served as the experimental unit. Data were analyzed as a 2x2 factorial with main factors including Sweet Bran inclusion and corn trait. The model included the effects of Sweet Bran, trait, and the Sweet Bran x trait interaction. Data were also analyzed for treatments not containing Sweet Bran (SYT-EFC, BLEND, and CON) as a randomized block design using a protected F-Test.

Experiment 2

Two hundred-forty crossbred steers (initial BW = 634 lb, SD = 34) were utilized in a feedlot finishing trial at the UNL Panhandle Research and Extension Center (PHREC) feedlot near Scottsbluff, NE. Cattle limit feeding and initial BW protocols were the same as *Exp 1*. The steers were blocked by BW into light, medium, and heavy BW blocks based on d 0 BW, stratified by BW and assigned randomly to 1 of 24 pens with pens assigned randomly to 1 of 4 dietary treatments. There were 10 head per pen and 6 replications per treatment. Dietary treatments included 1) SYT-EFC, 2) CON, 3) BLEND, and 4) CON with enzyme supplement (Amaize; Alltech, Inc.) added to the diet at a rate of 5g/steer daily (NZ;

Table 1. Dietary treatments evaluating SYT-EFC corn and Conventional commercial corn with or without Sweet Bran (*Exp 1*)

Ingredient, % DM	Wet Distillers Grains plus Solubles			Sweet Bran	
	CON[a]	SYT-EFC[b]	BLEND	CON[a]	SYT-EFC
Conventional Dry Rolled Corn	68.0	—	34.0	58.0	—
SYT-EFC Dry Rolled Corn[b]	—	68.0	34.0	—	58.0
Sweet Bran	—	—	—	25.0	25.0
Wet distillers grains plus solubles	15.0	15.0	15.0	—	—
Corn silage	12.0	12.0	12.0	12.0	12.0
Meal supplement[c]	5.0	5.0	5.0	5.0	5.0
Fine ground corn	2.174	2.174	2.174	2.435	2.435
Limestone	1.6	1.6	1.6	1.6	1.6
Urea	0.6	0.6	0.6	0.4	0.4
Salt	0.3	0.3	0.3	0.3	0.3
Tallow	0.125	0.125	0.125	0.125	0.125
Trace mineral premix	0.05	0.05	0.05	0.05	0.05
Potassium chloride	0.02	0.02	0.02	—	—
Rumensin-90	0.0165	0.0165	0.0165	0.0165	0.0165
Vitamin ADE premix	0.015	0.015	0.015	0.015	0.015
Tylan-40	0.01	0.01	0.01	0.01	0.01
Nutrient Composition, %					
Starch	52.48	52.55	52.52	47.75	47.81
NDF	15.91	15.16	15.54	18.80	18.16
CP	14.15	14.22	14.18	13.45	13.51
Fat	4.07	4.01	4.04	3.19	3.13
Ca	0.63	0.67	0.65	0.61	0.64
K	0.58	0.59	0.59	0.67	0.68
P	0.40	0.39	0.39	0.46	0.44
Mg	0.20	0.20	0.20	0.23	0.23
S	0.16	0.15	0.16	0.19	0.18

[a]CON = Commercially available corn grain without the alpha amylase enzyme trait
[b]SYT-EFC = Syngenta enhanced feed corn provided by Syngenta under identity-preserved procedures. Stored, processed, and fed
separately
[c]Supplement included 30 g/ton Rumensin and 9 g/ton Tylan.

Table 2). Limit feeding, weighing, blocking, implanting, and grain adaptation procedures were the same as *Exp 1*. Steers in the heavy, middle, and light BW blocks were harvested at a commercial abattoir (Cargill Meat Solutions, Fort Morgan, CO) on days 148, 169, and 181, respectively. On the final day steers were withheld from feed and weighed at 0800 h before being shipped and slaughtered on the same day. Carcass data collection procedures and calculation of final BW were the same as *Exp. 1.*

Data were analyzed as a randomized block design with initial BW block as a fixed effect and pen as the experimental unit. Treatments were evaluated using a protected F-Test and mean separation when significant variation was observed due to treatment.

Results

Experiment 1

When data were analyzed without including Sweet Bran in the analysis there were no differences ($P \geq 0.35$) in final BW, DMI, ADG, and F:G (Table 3). Hot carcass weight, dressing %, marbling score, LM area, and incidence of liver abscesses were not impacted ($P \geq 0.12$) by dietary treatment. Fat depth was greater ($P = 0.03$) for steers fed SYT-EFC and BLEND compared with CON. Similarly, calculated yield grade was greater ($P = 0.02$) for steers fed SYT-EFC and BLEND compared with CON corn.

A tendency for a Sweet Bran X trait interaction ($P = 0.07$) for carcass adjusted final BW was observed (Table 4). In diets without Sweet Bran, cattle fed CON had numerically greater final BW. Conversely, BW was heavier for steers fed SYT-EFC in diets containing Sweet Bran. Interactions were also observed for ADG and F:G ($P = 0.05$ and 0.02, respectively). Cattle that were fed SYT-EFC with Sweet Bran had the greatest ADG, SYT-EFC and CON without Sweet Bran were intermediate, and CON with Sweet Bran had the lowest gains. Feed conversion was poorest for cattle fed CON with SB, intermediate for both SYT-EFC and CON in diets without Sweet Bran while cattle fed SYT-EFC with Sweet Bran were the most efficient. No interaction was observed for DMI ($P = 0.99$), however steers consuming CON tended ($P = 0.07$) to consume more DM compared with SYT-EFC. Hot carcass weights followed the same trend ($P = 0.07$) as final BW. Interactions were not observed for the remaining carcass characteristics (dressing %, marbling score, fat depth, LM area, calculated yield grade, and incidence of liver abscesses). For the main effect of trait, marbling scores, fat depth and calculated yield grade were greater ($P < 0.01$, $P = 0.01$, and $P = 0.03$, respectively) for cattle fed SYT-EFC compared with CON (Table 4).

When comparing corn processing methods or traits the response (i.e. feed conversion) may be masked by acidosis if ruminal starch fermentation is too rapid. To control acidosis, Sweet Bran or elevated concentrations of roughage are often used in the diet. In diets without Sweet Bran there was no difference between SYT-EFC and CON. However, when Sweet Bran

Table 2. Dietary treatments evaluating SYT-EFC and Conventional corn with or without added enzyme (*Exp 2*).

Ingredient	CON[a]	SYT-EFC[b]	BLEND	NZ[c]
Conventional Dry Rolled Corn	64.0	—	32.0	64.0
SYT-EFC Dry Rolled Corn[b]	—	64.0	32.0	—
WDGS	15.0	15.0	15.0	15.0
Corn silage	15.0	15.0	15.0	15.0
Liquid Supplement[d,e]	6.0	6.0	6.0	6.0
Nutrient Composition, %				
Starch	51.40	52.23	51.82	51.41
NDF	15.46	15.66	15.56	15.46
CP	12.96	13.41	13.18	12.96
Fat	3.44	3.89	3.67	3.44
Ca	0.60	0.60	0.60	0.60
K	0.55	0.53	0.54	0.55
P	0.34	0.31	0.32	0.34
Mg	0.15	0.15	0.15	0.15
S	0.15	0.15	0.15	0.15

[a]CON = Commercially available corn grain without the alpha amylase enzyme trait
[b]SYT-EFC = Syngenta enhanced feed corn provided by Syngenta under identity-preserved procedures. Stored, processed, and fed separately
[c]NZ = Conventional corn with enzyme supplement (Amaize; Alltech, Inc.) added to the diet at a rate of 5g/steer daily
[d]Liquid supplement contained; 0.6% urea, 1.6% Ca, 0.3% salt, 0.02% potassium chloride, vitamins and trace minerals.
[e]Rumensin (30 g/ton) and Tylan (9 g/ton) were added via micromachine.
[f]Enzyme added via micro-machine at the rate of 5 g/steer daily.

Table 3. Effect of corn hybrid on finishing steer performance and carcass characteristics without Sweet Bran (*Exp. 1*)

Item	Dietary Treatments[a]				
	CON	SYT-EFC	BLEND	SEM	F-Test[b]
Animal Performance					
Initial BW, lb	672	673	673	1	0.31
DMI, lb/d	23.0	22.4	23.0	0.3	0.35
Final BW, lb[c]	1296	1291	1304	11	0.71
ADG, lb[c]	3.61	3.57	3.64	0.06	0.70
F:G[c,d]	6.44	6.31	6.34	—	0.81
Carcass Characteristics					
HCW, lbs	816	814	821	7	0.73
Dressing %	62.7	62.8	62.9	0.2	0.63
Marbling Score[e]	461	489	511	17	0.13
Fat Depth, in	0.48[g]	0.55[h]	0.57[h]	0.02	0.03
LM Area, in[b]	12.9	12.5	12.3	0.18	0.12
Calculated Yield Grade[f]	3.68[g]	3.99[h]	4.10[h]	0.09	0.02
Liver Abscesses, %	8.33	5.00	5.37	—	0.73

[a]Dietary treatments: CON = Commercially available corn grain without the alpha amylase enzyme trait; SYT-EFC = Alpha amylase enzyme corn from Syngenta; BLEND = 50:50 blend of CON and SYT-EFC on a DM basis
[b]F-Test = F-test statistic for the effect of treatment.
[c]Calculated from HCW adjusted to a common 63% pressing percentage.
[d]Analyzed as G:F, the reciprocal of F:G.
[e]Marbling Score: 300=Slight^{00}, 400= Small^{00}.
[f]Calculated as 2.5 + (2.5 × 12th rib fat) + (0.2 × 2.5 [KPH]) + (0.0038 × HCW) – (0.32 × LM area).
[g,h]Means within a row with unlike superscripts differ ($P < 0.05$).

was included in the diet there was an 8.5% improvement in F:G for steers that were fed SYT-EFC (as the diet) compared to CON. Because corn trait was the only ingredient changed, when calculating feed conversion based on corn grain inclusion level there was a 14.9% improvement due to SYT-EFC compared to CON for the grain.

Experiment 2

Dry matter intakes were not different ($P = 0.80$) among treatments (Table 5). Final BW and ADG were greater ($P < 0.01$) for steers fed SYT-EFC, BLEND, and NZ compared with CON. Similarly, F:G was improved ($P < 0.01$) for steers fed SYT-EFC, BLEND, and NZ compared with CON. Hot carcass weights were greater ($P < 0.01$) for SYT-EFC, BLEND, and NZ compared with CON. Marbling score tended ($P = 0.08$) to be greatest for BLEND, intermediate for SYT-EFC and NZ, and least for CON. Ribeye area was greater ($P = 0.03$) for BLEND and NZ compared with SYT-EFC and CON. Dressing percent, fat depth, calculated yield grade and incidence of liver abscesses were not different ($P \geq 0.22$) among treatments.

In *Exp 2*, differences were observed when comparing CON with BLEND, NZ, and SYT-EFC. Comparing feed conversion of steers fed CON to SYT-EFC there was a 5.4% difference, but when accounting for concentration of corn grain in the diet, the difference for the grain itself was 8.4%. Similar improvements in F:G were also observed for steers fed BLEND and NZ. Previous research using alpha amylase supplements in feedlot finishing diets has not been consistent. Differences between the two locations and the magnitude of the response are likely due to several factors: environment, acidosis, and grain source for the conventional and/or SYT-EFC. The control and test corn hybrids used at each location were procured from different regions in the state and may have contributed to the differences we observed at each location.

These data suggest an improvement in feed conversion was observed when feeding SYT-EFC compared with Conventional corn at both locations if acidosis was controlled. Producers that can source or grow their own corn for feeding cattle may be able to take advantage of the improvement

Table 4. Effect of corn hybrid and inclusion of Sweet Bran on finishing steers performance and carcass characteristics (*Exp 1.*)

	Dietary Treatments				SEM	*P*-Value[a]		
	0% Sweet Bran		25% Sweet Bran					
	CON[b]	SYT-EFC[c]	CON[b]	SYT-EFC[c]		Trait	SB	Trait * SB
Animal Performance								
Initial BW, lb	671	673	673	674	1	0.09	0.13	0.51
DMI, lb/d	23.0	22.4	23.3	22.7	0.3	0.07	0.36	0.99
Final BW, lb[d]	1295	1290	1278	1317	11	0.14	0.68	0.07
ADG, lb[d]	3.60[hi]	3.57[hi]	3.49[i]	3.72[h]	0.06	0.15	0.74	0.05
F:G[d,e]	6.44[ij]	6.31[hi]	6.71[j]	6.13[h]	—	< 0.01	0.68	0.02
Carcass Characteristics								
HCW, lb	816	813	805	829	7	0.14	0.72	0.07
Dressing %	62.7	62.8	62.8	63.1	0.2	0.48	0.39	0.79
Marbling Score[f]	456	484	443	488	11	< 0.01	0.68	0.43
Fat Depth, in	0.48	0.56	0.48	0.53	0.02	0.01	0.56	0.41
Ribeye Area, in[b]	12.9	12.5	12.8	13.0	0.2	0.53	0.34	0.20
Calculated Yield Grade[g]	3.67	3.98	3.67	3.83	0.10	0.03	0.46	0.45
Liver Abscesses, %	8.96	5.63	11.12	5.63	—	0.23	0.77	0.77

[a]Trait = *P*-value for the main effect of corn trait, SB = *P*-value for the main effect of Sweet Bran inclusion, Trait * SB = *P*-value for the interaction between corn trait and Sweet Bran inclusion.
[b]CON = Commercially available corn grain without the alpha amylase enzyme trait
[c]SYT-EFC corn provided by Syngenta under identity-preserved procedures. Stored, processed, and fed separately.
[d]Calculated from HCW adjusted to a common 63% pressing percentage.
[e]Analyzed as G:F, the reciprocal of F:G.
[f]Marbling Score: 300=Slight[00], 400= Small[00].
[g]Calculated as 2.5 + (2.5 × 12th rib fat) + (0.2 × 2.5 [KPH]) + (0.0038 × HCW) – (0.32 × LM area).
[h,i,j]Means within a row with unlike superscripts differ ($P < 0.05$).

in feed conversion by feeding the Syngenta Enhanced Feed Corn which contains the alpha amylase enzyme trait.

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Table 5. Effect of corn hybrid and inclusion of an alpha amylase enzyme supplement on finishing steer performance and carcass characteristics (*Exp 2*)

Item	Dietary Treatment[a]				SEM	F-Test[b]
	CON	SYT-EFC	BLEND	NZ		
Animal Performance						
Initial BW, lb	646	649	647	647	1	0.38
DMI, lb/d	23.6	23.8	23.5	23.4	0.3	0.80
Final BW, lb[c]	1257[g]	1301[h]	1299[h]	1299[h]	7	< 0.01
ADG, lb[c]	3.71[g]	3.94[h]	3.93[h]	3.93[h]	0.04	< 0.01
F:G[c,d]	6.53[h]	6.18[g]	6.07[g]	6.07[g]	—	0.03
Carcass Characteristics						
HCW, lbs	792[g]	820[h]	818[h]	818[b]	5	< 0.01
Dressing %	62.7	63.2	63.3	63.2	0.3	0.58
Marbling Score[e]	451[g]	468[gh]	481[h]	468[gh]	8	0.08
Fat Depth, in	0.57	0.60	0.61	0.60	0.01	0.22
Ribeye Area, in[b]	12.1[g]	12.1[g]	12.4[h]	12.4[h]	0.1	0.03
Calculated Yield Grade[f]	3.47	3.64	3.55	3.55	0.07	0.35
Liver Abscesses, %	3.33	5.00	0	5.33	—	0.41

[a]CON = Commercially available corn grain without the alpha amylase enzyme trait, SYT-EFC = Alpha amylase enzyme corn from Syngenta, BLEND = 50:50 blend of SYT-EFC and CON on a DM basis, NZ = Inclusion of a commercially available alpha amylase enzyme supplement in CON based diets.
[b]F-Test = F-test statistic for the effect of treatment.
[c]Calculated from HCW adjusted to a common 63% pressing percentage.
[d]Analyzed as G:F, the reciprocal of F:G.
[e]Marbling Score: 300 = Slight[00], 400 = Small[00].
[f]Calculated as 2.5 + (2.5 × 12th rib fat) + (0.2 × 2.5 [KPH]) + (0.0038 × HCW) – (0.32 × LM area).
[g,h]Means within a row with unlike superscripts differ ($P < 0.05$).