Performance and Carcass Traits of Market Beef Cattle Supplemented Self-Fed Byproducts on Pasture: Final Report

A.S. Leaflet R2592

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Summary and Implications

Over a two year period (2007 and 2008), 162 head of beef steers were finished with self-fed byproducts on cool season grass pastures. Yearling steers were continuously grazed at the Neely-Kinyon Farm in southwest Iowa on cool season grasses that were predominantly fescue at a stocking density of 2.25 head/acre. Half of the cattle were implanted (with Synovex®-S) or half were not. Cattle received a diet of either soyhulls-dried distillers grain with solubles (DDGS) or ground corn-dried distillers grains with solubles that was offered through self-feeders. The rations were mixed at a 1:1 ratio with a mineral balancer added which included Rumensin®.

Live cattle performance and carcass traits were not affected by diet. Implanted cattle outgained non-implanted over the entire finishing period (3.52 lbs/d vs. 3.17 lbs/d). This led to implanted cattle coming off test heavier (1324 lbs vs. 1277 lbs) and railing with heavier carcasses (826 lbs vs. 800 lbs). Ribeye areas were greater (13.1 in^2 vs. 12.7 in^2) for implanted cattle; which was probably due to the heavier carcass weights. Non-implanted cattle had superior quality grades (55% vs. 40%) of low choice or better.

Fatty acid profiles from the first year were analyzed and showed that raw beef samples from cattle on the soyhulls diet had significantly higher $C18{:}2_{c9,\,t11}$ conjugated linoleic acid (CLA) (0.666 g/100g fatty acid vs. 0.436, $p<0.0001$).

Year differences in quality grade (1023 vs. 985 in 2007 and 2008, respectively) were observed. This difference was attributed to factors that include genetic makeup of cattle, initial weights of cattle, time of year when cattle were harvested and grading technology.

In conclusion, pasture rearing cattle, when given access to self-fed by-products, provides for excellent performance on both live performance and carcass traits. Some considerations should be made by the feeder in regards to time of year when marketing cattle and the cattle's genetics. This system is an alternative to high-grain conventional beef finishing production in feedlots.

Introduction

Due to rising costs of conventional feedstuffs, more focus has been put on feeding byproducts, albeit from ethanol production or further processing of grains. As of the July 2010, there were 28 ethanol refineries in Iowa and an additional 71 refineries in neighboring states; making this potential feedstuff readily available. The effects of using these feedstuffs on live animal performance, carcass traits and the economic benefits are still under investigation.

CLA has been shown to have many health benefits, including anticancer properties in animals. Because of this discovery more attention has been paid to the CLA content of food products, especially meat and milk which are major sources of daily CLA intake. Studies have shown that CLA levels of meat can increase when cattle are supplemented with byproducts.

The objective of this study was to investigate the effects of finishing yearling type cattle on pasture utilizing combinations of self fed byproducts and corn grain on growth and carcass traits and investigating the fatty acid profiles, especially CLA content of beef raised in this type of feeding system.

Materials and Methods

Cattle in 2007 were initially commingled, weighed and sorted at the ISU Allee Research Farm near Newell, IA. In the first year, cattle were of British influence. In 2008, Continental influenced cattle were processed at the ISU Armstrong Farm near Lewis, IA. In both 2007 and 2008, one-half of the steers received an implant of Synovex®-S (200mg progesterone/20mg estradiol). After allotment to treatment groups in both years, cattle were shipped to the Neely-Kinyon Research Farm in Greenfield, IA. Upon arrival, cattle were turned out onto pasture that was predominantly tall fescue. Cattle were continuously grazed throughout the entire finishing period in 18 acre pastures within their diet treatment. Cattle were offered either a soyhulls-dried distillers grains with solubles (referred to as Diet 1) or ground corn-dried distillers grains with solubles (referred to as Diet 2) diet as a meal in self feeders. The diets were mixed at 48% byproduct; 48% DDGS and 4% mineral balancer that included Rumensin®.

Cattle were weighed approximately every six weeks throughout the finishing period. Body condition (BCS) and disposition scores were recorded at the initial sort, the second weighing and the final weighing. Final live measurements (average daily gain, feed: gain) were recorded on the day that cattle were shipped. Cattle were harvested at Tyson in Denison, IA when all had reached a BCS of 6.5 or greater. Twenty-four hours post-harvest carcass measurements (hot carcass weight, ribeye area, 12th rib fat thickness, kidney, pelvic and heart fat, marbling score) were recorded.

Samples from the longissimus dorsi muscle were extracted from the carcasses and were analyzed by gas chromatography for fatty acids. This analysis was done at Iowa State University.

Results were analyzed using PROC GLM of SAS (SAS Inst. Inc., Cary, NC). Main effects of implant, diet and year were analyzed and all interactions were investigated.

Results and Discussion

Diet. No significant differences concerning performance or carcass traits were found among groups offered the two different diets. Over the two years, cattle on diet 1, on average, consumed more supplement (24.55 lbs/d vs. 24.05 lbs/d). Using Beef Ration and Nutrition Decision Software (BRaNDS), dry matter intake of grazed forage was estimated at 4-6 lbs/day. Additionally, no digestive problems were observed with either diet.

Cattle fed diet 1 did have higher CLA content (0.666 g/100g fatty acid vs. 0.436, $p < 0.0001$) Cattle on diet 1 also had greater Ω-3:Ω-6 ratio (0.199 vs. 0.116, $p < 0.0001$), which some consider an indicator of a healthier food product. Total lipid values between treatments were not significantly different.

Implant. As expected, implanted cattle had greater ADG throughout the trial ($p<0.0001$). Greater gains translated into heavier final weights ($p=0.0001$) and hot carcass weights (HCW) ($p=0.0009$) and measured with larger ribeyes ($p=0.03$). Despite these differences, calculated yield grades were not significantly different as fat cover and kidney, pelvic and heart fat (KPH) were not different. Although marbling scores were numerically larger for non-implanted cattle (1010 vs. 999), there was no significant difference between implanted and non-implanted cattle. However, there was significant difference in percent of cattle that graded low choice or better (55% vs. 40%, $p=0.05$). This effect on quality grade was due to the marbling scores being so close to the break line of low choice and high select. Implant status had no effect on fatty acid profiles.

Year. Cattle fed in 2007 gained significantly faster (3.43 lbs/d vs. 3.26 lbs/d, $p=0.01$), yet were lighter coming off test (1291 lbs vs. 1310 lbs, $p= 0.12$). The difference in performance and off-test weights was attributed to the 2007 cattle being significantly lighter (828 lbs vs. 952 lbs, $p <0.0001$) when starting the trial.

Cattle in 2007 were fatter at the 12th rib (0.60 in vs. 0.47 in, $p<0.0001$), had smaller ribeyes (12.2 in^2 vs. 13.6 in^2, $p<0.0001$) and markedly poorer calculated yield grades (3.6 vs. 2.9, $p<0.001$) as a result. This translated to greater percentage of cattle with yield grade 4's in 2007 (17.0% vs. 1.3%, $p=0.003$) than in 2008.

However, cattle in 2007 had higher marbling scores (1023 vs. 985, $p<0.0001$) and a greater percentage of cattle graded low choice or better (63% vs. 33%, $p<0.0001$). Though the spread in marbling score was not great, as was the case for implanted and non-implanted cattle, the fact that marbling scores were close to the break line for high select and low choice led to the significant difference in this benchmark.

Significance in the all traits measured from year to year can be attributed to a number of factors besides the major difference in initial weights.

First, the genetic makeup of the cattle was different. In 2008, cattle had more continental breed influence which led to larger framed cattle that were leaner and heavier at harvest. Secondly, cattle were harvested in mid-September in 2007 and late August in 2008. The hot weather experienced just prior to harvest 2008 could have negatively impacted marbling scores. Cattle were on feed for135 days and 111days in 2007 and 2008, respectively.

Costs. Feed cost per ton was $148 and $202 for Diet 1 in 2007 and 2008, respectively. For Diet 2, cost per ton was $160 and $234 in 2007 and 2008, respectively. A more thorough discussion concerning the economics of this type of feeding system can be found in A.S. Leaflet R2420 (2009).

Using a diet that is 48% corn did not improve performance or quality grade. Diet 1, which used soybean hulls as its energy source produced the same results as corn. This implies that a finishing system using an energy source that is minimal in starch can provide the same favorable results in regards to performance and quality grades.

Previous research of finishing cattle on grass with byproduct supplementation has been conducted at ISU (A.S. Leaflet R2067, 2006). Cattle were supplemented (on self-fed basis) either at the start of the feeding period or later on. In that study, cattle that were supplemented at the beginning of the feeding period experienced greater gains and efficiency (2.50 lb/d and 7.56 lb F:G vs. 2.17 lb/d and 8.01 F:G, respectively). Cattle in the current study had even greater gains and were more efficient than the cattle in the early supplementation group of the previous study. Cattle in this study were implanted and this could be the major reason for the difference in results. Still, both studies show the benefits of supplementing byproducts as a more efficient method to finishing cattle on grass.

A study conducted in 2007 (A.S. Leaflet R2273, 2008) investigated the fatty acid profiles of cattle finished in either a pasture or feedlot system. Cattle finished on pasture were supplemented with byproducts once daily. CLA content of cattle finished on pasture were significantly greater (0.19 g/100g FA vs. 0.94, respectively; $p<0.05$). These results are consistent with numerous studies out there stating that cattle finished with diets higher in forage: concentrate ratio have increased CLA content compared to cattle finished with diets lower in forage: concentrate ratios.

The results from this study fall within the ranges of this previous study. However, the CLA values of cattle in this current study are closer to the CLA values of cattle finished in a feedlot setting. In order to produce cattle with greater CLA content, a producer would have to limit the amount of supplementation and have a finishing ration with greater forage: concentrate ratio.

This study shows that including soyhulls and/or DDGS to a cattle diet could potentially produce a healthier beef product. Needless to say, further research is merited to determine the potential health benefits of feeding cattle byproducts and the effect on fatty acid profiles.

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Table 1. Composition and calculated analysis of finishing diets.

	% Dry Matter	
Feed Ingredient	Diet 1	Diet 2
DDGS	46	46
Ground corn	--	46
Soyhulls	46	--
Mineral	4	4
Total	100	100
Calculated Analysis		
Dry matter, %	93.9	87.6
Crude protein, %	18.3	20.6
TDN, %	68.3	76.8
Calcium, %	1.13	0.78
Phosphorus, %	0.40	0.56
NE_m, Mcal/lb	0.74	0.86
NE_g, Mcal/lb	0.46	0.57

Table 2. Allotment of cattle by treatment.

	2007	2008
Soyhulls-DDGS Diet		
Non-implanted, n	20	20
Implanted, n	21	20
Corn-DDGS Diet		
Non-implanted, n	20	20
Implanted, n	21	20
Feeding period, d	135	111

Table 3. Year 1 (2007) least square means of fatty acids (g/100g FA) of diet treatments.

	Diet		
	Soyhulls/DDGS	Corn/DDGS	p-value
Total lipid	4.016	4.172	NS
CLA[1]	0.666	0.436	***
Total SFA[1]	45.94	44.07	***
Total MUFA[1]	45.38	46.20	NS
Total PUFA[1]	8.670	9.720	*
PUFA:SFA	0.188	0.221	**
Ω-3 fatty acids[1]	1.427	0.970	**
Ω-6 fatty acids[1]	7.080	8.552	**
Ω-3:Ω-6	0.199	0.116	***

[1] CLA= $C18:2_{c9,t11}$ conjugated linoleic acid, SFA= saturated fatty acids, MUFA= monounsaturated fatty acids, PUFA= polyunsaturated fatty acids

* p-value <0.05; **p-value <0.01, ***p-value <0.0001, NS- Not significant

Table 4. Least square means of performance and carcass traits of grazing steers supplemented self-fed byproducts by effect.

	Year			Diet			Implant		
	2007	2008	p-value	Soyhulls/DDGS	Corn/DDGS	p-value	No	Yes	p-value
On test wt, lbs	828	952	**	890	890	NS	889	891	NS
Harvest wt, lbs	1292	1310	NS	1296	1306	NS	1278	1324	**
Overall ADG, lbs/d	3.43	3.26	NS	3.30	3.38	NS	3.17	3.52	**
HCW, lbs	810	817	NS	809	818	NS	800	827	**
Dressing %	62.7	62.4	NS	62.5	62.6	NS	62.6	62.5	NS
REA, in^2	12.2	13.6	**	12.9	12.9	NS	12.7	13.1	*
12^{th} rib fat, in	0.60	0.47	**	0.54	0.53	NS	0.55	0.53	NS
KPH fat, %	2.3	2.1	NS	2.2	2.2	NS	2.2	2.2	NS
Calculated YG	3.6	2.9	**	3.2	3.3	NS	3.3	3.2	NS
Marbling score[1]	1023	985	**	1002	1007	NS	1010	999	NS
Low choice, %	63	33	**	47	48	NS	55	40	*

* p-value< 0.05, **p-value< 0.01, NS- Not significant

Table 5. Feed intake and efficiency of grazing steers supplemented self-fed byproducts.

	Daily Feed Intake, lbs/d		
	Soyhulls/DDGS	Corn/DDGS	Year means
2007	24.44	23.16	23.78
2008	24.75	24.88	24.82
Overall ADFI, lbs/d[1]	24.55	24.05	
	Feed:Gain, lbs/lb		
	Soyhulls/DDGS	Corn/DDGS	
2007	7.28	6.59	6.94
2008	7.61	7.63	7.62
Overall F:G, lbs/lb[2]	7.45	7.11	

[1]ADFI= average daily feed intake; does not include forage intake
[2]F:G does not include grazed forage dry matter intake; grazed forage intake was estimated at 4-6 lbs/d using BRaNDS