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Introduction

There has been increasing interest by consumers in beef from cattle that are finished or fattened "on grass" rather than in a conventional feedlot. Also recently, Iowa has had a proliferation of plants that produce ethanol from corn. One by-product of this process is distillers dried grains with solubles (DDGS). The objective of this study was to feed beef cattle to market weight by grazing cool-season grass supplemented with self-fed by-product pellets.

Materials and Methods

The study took place at the Neely-Kinyon Farm, Greenfield, IA, during 2006. Yearling steers were used with an average starting weight of 850 lb/head. Cattle were allotted by weight to treatments of continuous grazed or rotationally grazed in three paddocks. Cattle were rotated weekly for the first six weeks of grazing and then every two weeks for the remainder of the trial. All pasture acres were clipped in mid-June to help control undesirable plants and maintain forage quality. The by-product pellets were a blend of DDGS, soy hulls, and wheat midds (Table 1). The by-product feed was chosen because of its low starch content and high digestible fiber content, which compliments the forage and minimizes negative associative effects. It is also easy and safe to feed in a self-feeder with minimal risk of acidosis, over eating, or bloat problems. A similar trial was conducted in 2005 with the same diet without any health problems from the self feeding.

The pasture at the Neely-Kinyon Farm was a mixture of fescue, bromegrass, and bluegrass with a small legume component of primarily birdsfoot trefoil. The cattle were accustomed to the self-fed pellet while grazing a non-research paddock prior to initiating the trial and were weighed every 42 days. They were scanned by a certified ultrasound technician for backfat, ribeye, marbling, and tenderness three weeks before harvest. Carcass data was collected along with rib sections for fatty acid composition and Warner Bratzler shear force. A SAS analysis was ran on growth, ultrasound and carcass data comparing rotational versus continuous grazed cattle. Pearson correlations were run on ultrasound values and carcass measurements.

Results and Discussion

The cattle performed well with an overall gain of 3.16 lb/day, regardless of which grazing method. Cattle daily consumption on average was 22.94 and 22.49 lbs for the continuous and rotational groups, respectively. This was more than in 2005. Cattle were much heavier at the end of the summer grazing season and all animals went directly to harvest with 60% grading low choice or better, also improved over the 2005 results.

The yearling steers grew faster (ADG=3.2 vs 2.6) in 2006 than in 2005. The cattle consumed about 6 lb more pellets/day in 2006 versus 2005 (data not shown). Improved gains and intakes in 2006 versus 2005 may have been due to heavier starting weights of the cattle. The grazing method did not impact cattle gains or carcass parameters. Sward stick estimates for dry matter availability/acre exceeded 1,200 lb on April 26, 1,800 lb in early June, and 1,250 lb in mid-August. Stocking rates of two steers/acre is very conservative when self-fed by-products are provided.

Carcass data. All cattle were harvested off grass in 2006 compared with less than 25% in 2005. Cattle started heavier and ended heavier in 2006 with an average end weight of 1,258 lb/head. The cattle graded approximately 60% choice with no significant differences between grazing treatments.

There were no significant differences in carcass traits between continuous and rotational grazing. Both treatments had similar back fat, rib eye area, % kidney, heart and pelvic fat, and fat color. The rotationally grazed steers graded 76.5% low Choice or better while the continuous grazed steers graded 48.5% low Choice or better. However, there was no significant difference in the marbling score between the treatments, which aligns with other experiments where many of the cattle were right on the line between high Select and low Choice. An encouraging factor, however, is that the average marbling score number for this set of 68 steers was 1000.3 which is on the Choice/Select line and a total of 62.7% graded USDA Choice or better and only one steer graded USDA Standard. The cattle used were of unknown genetic origin with the majority being black hided cattle.

A grant from the Leopold Center for Sustainable Agriculture allowed greater detail in carcass evaluation both from a live basis as well as normal carcass data collection. Ultrasound scans and interpretations were done by a Tallgrass Beef technician utilizing a computer model for the prediction of tenderness. This model and theory were tested by taking post-harvest rib sections at the Tyson Fresh Meats, Denison, Iowa, transporting them to the ISU Meat Lab for boning, trimming, aging for 14 days, cooking, followed by Warner-Bratzler Shear Force evaluation. The average WBSF was a very acceptable 6.66 lbs with a standard deviation of .89 lbs and a maximum WBSF of 9.51 lbs and a minimum of 5.22 lbs. Pearson product moment correlations were run between ultrasound estimate of tenderness and WBSF and a correlation not significantly different from zero (-.065) was found. Interesting to note were the negative correlations between the ultrasound estimate of tenderness and ultrasound IMF and marbling score number. However, there was no relationship between marbling score and WBSF (-.06) and WBSF and rib eye area (-.11).

Fatty acid composition of a rib steak facing was done in the ISU Animal Science Nutritional Physiology Laboratory using standard procedures. No significant differences were found between continuous and rotationally grazed steers on the DDG finishing routine. However, it is interesting that a high degree of Conjugated Linoleic Acid was found in these cattle. The overall average CLA content was .67%. When compared to other literature this is equal to values observed in cattle on straight pasture grazing regimes. Thus it appears a distinct possibility that the feeding of DDG does not decrease CLA. Further study is needed to repeat this observation and test against cattle that have received a starch component in their diet while on grass.

Costs. The self-fed pellets cost $108 to $119/ton at the mill. Delivering the pellets to the farm added about $25/ton. Thus the average daily feed cost excluding the pasture was $1.70 to $1.80/head/day or $0.55 to $0.60/lb of gain.

Conclusions

Some lessons can be derived from this study.

- The by-product feed was safe and consumed readily.
- The by-product feed should be offered immediately for maximal gains.
- One key to having cattle at market weight in the fall is to start with heavier yearlings in the spring.
- Daily gains over 3 lb/day can be achieved with this system.
- Achieving a high % choice quality grade is possible with this system.
- Cattle will not meet "natural," "grass-finished" or "organic" using this system but could be called pasture-raised.
- Ultrasound estimates of tenderness by a private scanner had zero correlation to WBS values.

Table 1. Composition and calculated analysis of a by-product feed mix.

Composition	%
DDGS	50.0
Soy hulls	25.0
Wheat midds	20.9
Molasses	2.5
Calcium carbonate	1.6
Total	100.0
Calculated analysis	
Dry matter, %	90.1
Crude protein, %	21.8
Calcium, %	.94
Phosphorus, %	.67
NE_m	.91
NE_g	.61
TDN, %	85.9

Table 2. Performance of grazing beef cattle supplemented with by-product feed.[1]

	Continuous	Rotational	Significance
Number, head	34	34	
Stocking rate, hd/acre	2	2	
Live weight			
Avg lb (4/26/06)	852	846	
Avg lb (6/21/06)	1,061	1,087	
Avg lb (7/24/06)	1,150	1,162	
Avg lb (8/19/06)	1,200	1,191	
Avg lb (9/05/06)	1,258	1,257	
Average daily feed intake, lbs/day	22.94	22.49	
	LS Means		
First period, lb/day	3.91	4.46	P<.01
Second period, lb/day	2.97	2.56	P<.05
Third period, lb/day	1.70	.84	P<.01
Fourth period, lb/day	3.29	3.62	ns
Overall gain, lb/day	3.16	3.16	ns

[1]During the study one steer died.

Table 3. Analysis of DDG Finishing Trial-NK Farm, 2006.

Trait	Continuous	Rotational	Significance
Ultra sound			
REA[B], in	12.11	11.73	ns
BF[C], in	0.378	0.381	ns
Shape	0.629	0.638	ns
IMF[D], %	3.323	3.327	ns
Tenderness sc.	29.285	28.582	ns
Carcass			
HCW[E], lb	767.0	756.1	ns
BF[C], in	0.443	0.442	ns
KPH[F], %	2.271	2.259	ns
REA[B], in	13.90	13.47	ns
MS Num[G]	980.2	1004.4	ns
REA[B] /cwt	1.807	1.780	ns
% Choice or better	58.8	63.6	ns
WBSF[H]	6.71	6.82	ns
Fat Color	2.658	2.400	ns
Fatty Acid	201.94	199.9	ns
% of FA			
CLAc9t11[I]	0.691	0.663	ns
TotalSFA[J]	46.24	46.84	ns
TotalMUSFA[K]	44.15	44.560	ns
TotalPUSFA[L]	9.611	8.596	ns
MUSFA:SFA[J]	0.213	0.185	ns
PUS:SFA[J]	0.213	0.185	ns
USFA:SFA[J]	1.176	1.142	ns
IndexA[m]	0.739	0.755	ns

Correlations:	Pearson Corr.	Significance
uTend:WBSF	-0.065	ns
uTend:MSNum	-0.52	P<.01
uTend:uIMF	-0.51	P<.01
uTend:Fat	-0.29	P<.05
uTend:REA	0.34	P<.01
uREA:uShape	0.46	P<.01
uREA:REA	0.42	P<.01
uBF:Fat	0.63	P<.01
uBF:uShape	-0.39	P<.01
uBF:uIMF	0.34	P<.01
uBF:MSNum	0.32	P<.01
uIMF:MSNum	0.63	P<.01
uIMF:REA	-0.33	P<.01
uIMF:FatColor	-0.25	P<.05
Fat:MSNum	0.44	P<.01
Fat:uShape	-0.34	P<.01

ADG[A] = average daily gain
REA[B] = ribeye area
BF[C] = back fat
IMF[D] = intramuscular fat
HCW[E] = hot carcass weight
KPH[F] = kidney, pelvic and heart
MS[G] = marbling score

WBSF[H] = Warner Braztler Shear force
CLAc9t11[I] = conjugated linoleic acid cis 9 trans 11
SFA[J] = saturated fatty acids
MUSFA[K] = monounsaturated fatty acids
PUSFA[L] = polyunsaturated fatty acid
Index A[m] = atherogenic index