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Grass-finished Beef Pilot Project: Cattle Performance

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Abstract

Consumer interest in the potential benefits of grass-finished beef is high, but adoption of this approach to cattle feeding has been limited in Iowa. Although some producers successfully meet this niche market demand, consistently producing a high-value carcass from forage-fed cattle is challenging. Intramuscular fat or marbling is a major factor in quality grading of beef. Marbling is heavily influenced by cattle genetics and energy concentration of the diet. Finishing cattle on grain is a proven approach to consistently produce a high-value carcass for the commodity beef market. Researchers at Iowa State University have pioneered the use of ultrasound measurements to select Angus cattle with high-marbling potential. Forage quality can be manipulated through pasture management, ultimately influencing cattle growth and performance. It is hypothesized that grass-finished cattle will consistently produce high value carcasses if excellent pasture management is combined with combining high-marbling genetics.

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Introduction

Consumer interest in the potential benefits of grass-finished beef is high, but adoption of this approach to cattle feeding has been limited in Iowa. Although some producers successfully meet this niche market demand, consistently producing a high-value carcass from forage-fed cattle is challenging. Intramuscular fat or marbling is a major factor in quality grading of beef. Marbling is heavily influenced by cattle genetics and energy concentration of the diet. Finishing cattle on grain is a proven approach to consistently produce a high-value carcass for the commodity beef market. Researchers at Iowa State University have pioneered the use of ultrasound measurements to select Angus cattle with high-marbling potential. Forage quality can be manipulated through pasture management, ultimately influencing cattle growth and performance. It is hypothesized that grass-finished cattle will consistently produce high value carcasses if excellent pasture management is combined with combining high-marbling genetics.

The purpose of this project was to examine the feasibility of producing USDA Quality Grade Choice beef–without grain-based finishing–through genetic selection and pasture management. This summary reports the growth and carcass characteristics of high-marbling potential beef cattle finished on either high quality pastures or grain-based feedlot rations.

Materials and Methods

High-marbling potential Angus heifers were born spring 2011 and were fed a backgrounding forage-based ration at the ISU McNay Research Farm, Chariton, Iowa. The heifers were moved to the ISU Armstrong Research Farm, Lewis, Iowa for this trial on May 1, 2012. The cattle were placed in the feedlot and fed a forage-based starter ration for one week prior to allotment. The heifers were allotted to either pasture (grass-fed) or feedlot (grain-fed) treatments based on live weight and intramuscular fat from ultrasound. Ten heifers (grass-fed) were moved to a high quality alfalfa-brome pasture on May 7, 2012. The remaining 12 heifers (grain-fed) were finished on grain-based diets in a feedlot on site and were used as the control treatment for this project.

The grazing cattle and pasture were intensively managed with cattle moved to a fresh paddock every 3 to 4 days until dry conditions prevailed mid-July and then the heifers were allowed to graze the entire pasture (26 acres). In order to maintain high-quality forage through the grazing season, surplus forage in paddocks was harvested on May 29 and July 2. A total of 42 tons of hay was harvested from the 26-acre pasture in addition to the grazing. Stockpiled forage was grazed to extend the grazing season.

A 10 × 30 ft portable steel shade that was 10 ft high was provided to the pasture cattle. The shade was located on high ground near the water source. Bloat preventative blocks were offered free choice to the pasture cattle because the pasture was a 50:50 alfalfa/bromegrass mix. Fly control was maintained with insecticide dust bag for the pasture cattle.

The feedlot cattle were fed daily a complete mixed ration of 16 percent ground hay, 36 percent corn, 2 percent supplement, and 46 percent modified distiller's grains on an as-fed basis. The complete mixed ration was 70.7 percent dry matter. No cattle were fed MGA or antibiotics, or implanted. Only the grain-fed cattle were fed Rumensin.

Both groups of cattle were regularly weighed at 28-day intervals throughout the feeding period/grazing season to calculate average daily gain. Both groups of cattle were scanned with ultrasound to determine ribeye area, fat cover, and intramuscular fat prior to allotment and prior to marketing. Cattle activity and animal welfare assessments were also monitored at the 28-day intervals (data not included in this report). The feedlot cattle reached market weight sooner and the pasture cattle were also scanned at that time. Paddocks were regularly monitored to estimate forage consumption and forage samples were collected to estimate energy intake (data not reported in this report). Feed disappearance and energy concentration of the grain-fed cattle was also recorded. When reaching market weight (±1,000 lb), all heifers were harvested at the Tyson plant, Denison, Iowa and carcass data was collected.

Results and Discussion

The growth performance of the heifers is shown in Table 1. As expected, the grain-fed cattle gained much faster than the grass-fed cattle (3.44 vs. 1.98 lb/day). This is a reflection of the greater energy density of the grain-fed based diet. As a result, the grain-fed heifers reached market weight in 111 days compared with the grain-fed heifers feeding time of 177 days. The cattle were small to medium frame and thus 1,000 lb liveweight was the target market weight. The grass-fed heifers were on pasture until November 1 and grazed stockpiled or dormant forage for the last few weeks. Grazing beyond November 1 was not feasible due to freezing temperatures interrupting the water supply and that the forage was no longer growing. Greater stockpiled pasture area or hay feeding would have been required to extend the feeding period for the grass-fed heifers. On November 1, the grass-fed cattle were marketed with an average liveweight of 985 lb, which was approximately equal to the 1,000 lb target weight.

The scan characteristics of the heifers is shown in Table 2. The preliminary scan on April 11, 2012 showed that the grain-fed heifers averaged 4.1 percent, IMF vs. 4.4 percent IMF for grass-fed heifers.

Intramuscular muscular fat is the critical factor in USDA quality grades. Previous work at ISU showed that 4 percent IMF will result in a USDA Choice grade (Table 4). Thus, both groups of heifers had a level of IMF that would grade Choice at 60-67 percent prior to the beginning of the trial when they weighed an average 565 lb. The high percentage of IMF in these heifers is indicative of the elite marbling-potential of the Angus herd. In each group of heifers, there were four individual heifers that had less than 4.0 percent IMF prior to the trial.

When the heifers reached (~1,000 lb) market weight as a group and were scanned, the grain-fed heifers increased IMF from 4.1 to 6.2 percent IMF or 51 percent with a range of 30 to 82 percent increase. The grass-fed heifers increased from 4.4 to 5.4 percent IMF or 24 percent with a range of 2 to 51 percent increase. Thus, at the same end weight, the grass-fed heifers only had half the increase of IMF and were more variable than the grain-fed heifers. In other words, by feeding high-energy diets, which are grain-based, a higher level of IMF is insured.

The carcass characteristics of the heifers are shown in Table 3. The grain-fed heifers had a yield of 60.5 percent, which was 2 percentage points more than the grass-fed heifers. This difference is attributed to a more distended digestive tract and a leaner carcass for the grass-fed cattle. The lower market weight (1,023 vs. 985 lb) and lower yield (60.5 vs. 58.5) resulted in lower carcass weight (619 vs. 576 lb) for the grass-fed cattle. Also the grass-fed heifers had more light carcasses (<550 lb) (33 vs. 8%).

The grass-fed cattle carcass grades at the plant reflected their leaner condition (Table 2). The grass-fed heifers were 60 percent Choice vs. 92 percent Choice for the grain fed. For the grass-fed cattle, the ultrasound scan predicted 90 percent Choice grade (≥4% IMF), but at the plant only 60 percent graded Choice (Tables 2 and 3). For the grain-fed cattle, the ultrasound scan predicted 100 percent Choice grade, and at the plant they graded 92 percent Choice (Tables 2 and 3).

As expected, after almost 6 months of green forage as the only feed, the fat cover of the grass-fed heifer carcasses was yellow…the color of butter. This can cause lower grades in a system designed around grain-fed cattle. Also, the yellow-colored fat in the grass-fed cattle may explain why the IMF percent did not always predict the more subjective quality grade in the packing plant.

Constraints and Lessons

With grass-fed beef cattle, there are a number of constraints that must be addressed. First, is the grazing season, which in Iowa is limited to about 180 days maximum. Efforts to extend the season should be encouraged. Second, is forage production, which is governed by pasture quality, species, quantity, soils, and rainfall (both amount and timing). Third, is the genetics of the beef cattle. Because of the relatively low energy density of the grass-based diet and the limited grazing season, smaller-framed, high marbling potential cattle are essential, if Choice grade beef is the desired outcome.

In conclusion, some "lessons" for grass-fed Choice beef in Iowa follow:

- Use small-framed, high marbling potential beef cattle.
- The cattle should have most of their frame grown prior to going to grass.
- Use strategies to extend the grazing period, e.g. various forages or stockpiled grazing.
- Have plenty of high quality pasture. Do NOT run out.
- Pasture quality supply must maintain gains throughout the grazing season.
- A target of 2 lb/day gain for the season is attainable.
- Cattle should have ready access to a quality water supply.
- If forage supply is in excess of grazing needs, cut hay to maintain forage quality.
- Shade, fly control, and bloat preventative are important management tools.
- Rotational grazing is beneficial in managing forage quality and reducing forage waste.
- Expect fat that is more yellow than grain-fed beef.

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Table 1. Performance of grain-fed and grass-fed Angus heifers.

	Grain-fed	Grass-fed
Start weight, lb	641	634
End weight, lb	1,022	985
Start date	5/7/12	5/8/12
End date	8/26/12	11/1/12
Days on test, d	111	177
Gain, lb	382	351
ADFI, lb/d[a] (dm)	23.7	NA
ADG, lb/d[b]	3.44	1.98
F/G, lb/lb[c]	6.89	NA

[a]ADFI = Average daily feed intake.
[b]ADG = Average daily gain.
[c]F/G = Feed per gain.

Table 2. Ultrasound scan characteristics for grain-fed and grass-fed Angus heifers.

	Grain-fed		Grass-fed		
Date	4/11/12	8/7/12	4/11/12	8/7/12	10/26/12
IMF[a], %	4.1	6.2	4.4	4.9	5.4
Rib fat, in.	0.12	0.45	0.11	0.20	0.37
REA[b], sq. in.	6.7	11.3	6.4	8.8	10.4
Liveweight, lb	562	970	567	821	989
IMF ≥ 4%	67	100	60	80	90
IMF ≥ 5%	8	83	20	50	80

[a]IMF = Intramuscular muscular fat.
[b]REA = Rib eye area.

Table 3. Carcass characteristics of grain-fed and grass-fed Angus heifers.

	Grain-fed	Grass-fed
Carcass wt, lb	619	576
Yield, %	60.5	58.5
USDA Choice or better, %	92	60
Yield grade 2, %	50	50
Yield grade 3, %	33	50
Yield grade 4, %	17	0
Light carcasses, < 550 lb, %	8	33
Fat cover, in.	0.52	0.36
KPH[a], %	2.4	2.3
REA[b], sq. in.	11.4	10.8
YG[c],	2.7	2.5

[a]KPH = Kidney, pelvic, heart fat.
[b]REA = Rib eye area.
[c]YG = USDA yield grade.

Table 4. Relationship between ultrasound IMF and USDA Quality grade.[1]

IMF %	USDA Quality grade
2.3-3.0	Select -
3.1-3.9	Select +
4.0-5.9	Choice -
5.8-7.6	Choice 0
7.7-9.7	Choice +
9.9-12.1	Prime -
12.3+	Prime 0

[1]Relationship between chemical percentage intramuscular fat and USDA marbling score. ASL-R1529. D.E. Wilson, G. H. Rouse, and S. Greiner. ISU 1998 Beef Research Report.