Project Summary

Can DNA Marker Technology Improve Feedlot Growth Promotion Management Decisions to Ultimately Improve the Consumer's Beef Eating Experience?

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Background

Millions of dollars have been invested in studying and mapping the bovine genome and diagnostic tools have been developed to predict genetic potential for numerous traits. These tools can be used to select breeding stock with superior genetics for marbling and tenderness. Genetic tools also may be used to sort feedlot cattle upon arrival into outcome groups with carcasses of similar predicted marbling or tenderness. Using growth promotion technologies has significantly reduced beef production costs. Maintaining end-product quality is also important. End-product quality may be improved if DNA marker assisted technology can allow feedlot operators to make more appropriate growth promotion technology decisions.

The objectives of this project were to:

1. Evaluate the effectiveness of sorting feedlot cattle into marbling or tenderness outcome groups based on DNA marker technology; and
2. Determine if interactions related to end-product quality and palatability exist between predicted outcome group and growth promotion management strategy.

Methodology

Yearling steers (n = 1100, pay-weight = 794 lb) were individually weighed and whole blood was collected for DNA analysis. Using the DNA profile data individuals were identified with: 1) low tenderness and low marbling (**LL**), 2) low tenderness and high marbling (**LH**), 3) high tenderness and low marbling (**HL**), and 4) high tenderness and high marbling (**HH**). Within each tenderness x marbling outcome group, 90 steers were selected for the study and assigned to 10 pens of 9 steers. Five pens were assigned to a moderate growth promotion strategy (**MGP**) that included an initial (day 0) and re-implant (day 70) with Revalor-IS and no beta– agonist. Five pens were assigned to an aggressive growth promotion strategy (**AGP**) that included a Revalor-XS implant on d 0 and Zilmax at 6.8 g/ton^{-1} of dry matter (DM) for 20 of the final 23 days on feed. Steers were harvested at a commercial beef processing facility in northern Colorado on day 140 (replicates 3, 4 and 5) and day 154 (replicates 1 and 2) using conventional, humane procedures and carcass data were collected. A 5 cm portion from the 13th rib portion of the *Longissimus* (striploin) muscle was removed from the right side of three carcasses from each pen, vacuum-packaged and aged for 14 days, frozen at the end of the aging period, and stored at -20°C prior to steak fabrication and determination of Warner-Bratzler shear force (**WBSF**) measurements.

Findings

Predicted Tenderness

Steers sorted into the HT genotype were 13 lb heavier at the start of the study and 26 lb heavier at harvest than steers sorted into the LT genotypes (Table 1). Average daily gain through most of the study was not affected by tenderness genotype. Dry matter intake day 1-harvest was greater for the HT steers as compared with the LT steers (21.61 versus 20.69 $lb/hd^{-1}/d^{-1}$). Feed efficiency was not affected by tenderness genotype. Most carcass variables were not affected by tenderness genotype. Hot carcass weight was numerically, but not statistically, higher for the HT steers as compared with LT steers. Shear force was 0.33 kg lower (more tender) for the HT steaks as compared with the LT steaks.

Predicted Marbling
Steers sorted into the HM genotype were 20 lb heavier at the start of the study and 46 lb heavier at harvest than steers sorted into the LM genotype (Table 2). Average daily gain was greater for the HM steers as compared with the LM steers (3.43 versus 3.25 $lb/hd^{-1}d^{-1}$). Average DMI was greater for the HM genotype steers as compared with the LM genotype (21.60 versus 20.70 $lb/hd^{-1}/d^{-1}$). Feed efficiency was not affected by marbling genotype. Hot carcass weight was 28 lb heavier for HM steers as compared with LM steers. High marbling carcasses also had greater average yield grade and marbling scores as compared with LM steers. There were no differences in WBSF associated with predicted marbling genotype.

Growth Promotion Strategy
Steers subjected to the AGP were 18 lb heavier at harvest than steers subjected to the MGP (Table 3). From day 1-harvest, DMI was not affected by growth promotion strategy; however, ADG and FG were improved for AGP steers as compared with MGP steers. Hot carcass weight was increased 27 lb for steers assigned to the AGP as compared with MGP. Increased HCW was a function of an increase in dressing percentage for the AGP compared with MGP steers. Average yield grade was lower for the AGP as compared with the MGP. Marbling score and the distribution of USDA quality grades were not affected by growth promotion strategy. Steaks from the AGP carcasses had increased WBSF as compared with MGP steaks.

Implications
Yearling steers can successfully be sorted into marbling or tenderness outcome groups using DNA marker technology. Tenderness can be improved by using MGP as compared with AGP; however, growth promotion strategy did not impact marbling or USDA quality grade distribution and few interactions related to end-product quality and no interactions for WBSF existed between predicted outcome group and growth promotion management strategy indicating that the degree that end product quality is impacted by growth promotion strategy is largely independent of marbling and tenderness genotype.

Table 1. Effect of predicted tenderness, marbling, and growth promotion strategy on feedlot performance and carcass merit.

Tenderness:	Low	High	SEM	Prob. > F
Initial weight, lb	837	850	42.4	0.0154
Final weight, lb	1316	1342	41.9	0.0047
ADG (d 1 - finish)	3.30	3.39	0.07	0.1021
DMI (d 1 - finish)	20.69	21.61	0.57	0.0140
FG (d 1 - finish)	6.29	6.38	0.09	0.3957
Hot carcass weight	849	861	26.45	0.1194
Dressing percent	64.37	64.19	0.18	0.4533
Yield Grade	3.11	3.23	0.09	0.2161
Marbling Score[1]	447	454	10.20	0.3993
WBSF	3.92	3.59	0.11	0.0209
Marbling:	Low	High	SEM	Prob. > F
Initial weight, lb	833	853	42.4	0.0004
Final weight, lb	1307	1353	41.9	< 0.0001
ADG (d 1 - finish)	3.25	3.43	0.07	0.0031
DMI (d 1 - finish)	20.70	21.60	0.57	0.0158
FG (d 1 - finish)	6.37	6.30	0.09	0.5156
Hot carcass weight	841	869	26.45	0.0115
Dressing percent	64.42	64.14	0.17	0.1634
Yield Grade	3.04	3.30	0.10	0.0826
Marbling Score[1]	437	464	10.20	0.0226
WBSF	3.79	3.72	0.11	0.6092
GP strategy:	Moderate	Aggressive	SEM	Prob. > F
Initial weight, lb	843	843	42.8	0.9622
Final weight, lb	1321	1339	41.9	0.0536
ADG (d 1 - finish)	3.28	3.40	0.07	0.0347
DMI (d 1 - finish)	21.28	21.02	0.57	0.4626
FG (d 1 - finish)	6.50	6.17	0.09`	0.0074
Hot carcass weight	842	869	26.50	0.0171
Dressing percent	63.67	64.89	0.18	0.0032
Yield Grade	3.31	3.03	0.09	0.0278
Marbling Score[1]	448	454	10.49	0.5219
WBSF	3.55	3.96	0.11	0.0054

[1] $Small^{00}$ = 400.


Squeeze chute and data collection computer at the Southeast Colorado Research Center


Cattle illustrating the diverse breed types on the study

Equipment used to measure WBSF

Obtaining the core sample for WBSF evaluation

For more information contact:

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