Evaluation of implant strategies in Angus-sired steers with high and low genetic potential for marbling and gain

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The purpose of this research was to assess the use of genetic testing as a tool for feeding steers in a feedlot setting with two different implant strategies (moderate or aggressive). GeneMax scores allow producers and feedlot managers to select cattle with high GMX scores to achieve a greater percent of intramuscular fat (IMF).

Summary

Sixty-nine Angus-sired steer calves (average initial body weight [BW] = 731 pounds) were used to determine the effects of a moderate and aggressive implant strategy on steers of high and low genetic potential (GP) using the GeneMax (Zoetis, Florham Park, N.J.) genetic profiling test. Steers were assigned to treatments in a 2 x 2 factorial design with factors of 1) composite GP score [high (HI), mean score of 86.5, or low (LO), mean score of 25.3]; and 2) implant strategy [aggressive (AGG) or moderate (MOD)]. All steers were given the same implant (Revalor-S, Merck Animal Health, Summit, N.J.), with the AGG group implanted on days 0 and 70 and the MOD group only on day 70. A high-concentrate (84.5 percent) diet was fed ad libitum once daily. Ultrasound was used to measure body composition characteristics on day 0. Steers were harvested after 140 days on feed. On day 0, HI steers had a greater ($P < 0.001$) percent intramuscular fat than LO steers. During the entire 140-day feeding period, t we found no differences ($P \geq 0.6$) in BW, average daily gain (ADG), dry-matter intake (DMI) or feed-to-gain ratio (F:G) between GP groups; however AGG steers had greater ($P = 0.03$) ADG, compared with MOD steers, while still having similar ($P \geq 0.12$) DMI and F:G. Marbling score tended (P = 0.06) to be impacted by a GP x implant strategy interaction (493, 538, 481, 464 for HI AGG, HI MOD, LO AGG and LO MOD, respectively). No differences ($P \geq 0.7$) were observed between GP groups for hot carcass weight (HCW), LM area; rib-fat thickness; kidney, pelvic, heart fat (KPH); or yield grade. Steers in the MOD group had less ($P = 0.003$) rib-fat thickness than AGG steers, but similar ($P \geq 0.14$) HCW, marbling, longissimus dorsi muscle (LM) area, KPH and yield grade. Steers in the HI GP group were more likely ($P = 0.03$) to grade choice (100 percent) than LO steers (88 percent). Results of this study indicate that GeneMax scores may be indicative of marbling potential and quality grades.

Introduction

Hormone implants are used in beef production to improve performance and lower the cost of production (Duckett et al., 1997). A range of implant strategies are available to producers, including the option of placing cattle on an aggressive implant regime to foster additional growth and feed efficiency (Samber et al., 1996; Parr et al., 2011). Unfortunately, aggressive implant strategies can lead to reduced marbling scores (Samber et al., 1996; Duckett et al., 1997; Parr et al., 2011).

Tools to predict marbling based on an animal's genetic potential are available, but what is unknown is if steers with greater genetic potential for marbling will grow differently in response to an implant, compared with steers with lower genetic potential. Perhaps an early indication of genetic potential for growth and marbling can be paired with an optimal implant strategy to maximize feedlot profitability.

This study was conducted to evaluate the effects of moderate and aggressive implant strategies in Angus-sired steers with varying genetic potentials for gain and marbling using the GeneMax test (Zoetis, Florham Park, N.J.).

Experimental Procedures

Sixty-nine (average initial BW = 731 pounds) Angus-sired steers were selected from the original population (114) originating from the Central Grasslands Research Extension Center in Streeter, N.D. These steers represent the greatest (HI) and least (LO) composite genetic potential (GP) scores based on GeneMax evaluation.

Steers were assigned to treatments in a 2×2 factorial arrangement with factors of GP and implant strategy (moderate, MOD, or aggressive, AGG). The four treatment groups were as follows: 1) HI with AGG implant (HI AGG, n = 17), 2) HI with MOD implant (HI MOD, n = 18), 3) LO with an AGG implant (LO AGG, n = 18), and 4) LO with MOD implant (LO MOD, n = 16).

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Steers in the AGG group were implanted (120 milligrams [mg] of trenbolone acetate and 24 mg of estradiol; Revalor-S, Merck Animal Health, Summit, N.J.) on days 0 and 70, whereas steers in the MOD group were implanted (Revalor-S) only on day 70. Steers were fed an ad libitum 85 percent concentrate finishing diet individually using a Calan gate feeding system (American Calan, Northwood, N.H.). The percentage intramuscular fat (IMF) was determined at the initiation of the experiment (day 0) using ultrasonography (Wall et al., 2004).

Steers were harvested after 140 days on feed. After routine processing procedures, HCW was collected and carcasses chilled for 24 hours (36 F) before determining LM area, 12th rib fat (RF) depth, yield grade (YG), quality grade, marbling number and KPH. Final BW was calculated using HCW adjusted to a common dressing percent of 63.4 percent. All ADG and F:G calculations were made using the carcass-adjusted final weight.

Results and Discussion

By design, composite GP scores for HI steers (86.5 ± 1.7) were greater (P < 0.001) than LO steers (25.3 ± 1.7). In addition, marbling score was greater (P < 0.001) for HI steers (3.7± 0.1) than LO steers (1.4 ± 0.1) and gain scores were greater ($P < 0.001$) for HI steers (3.83 ± 0.2) than LO steers (2.88± 0.2).

At the start of the experiment, HI steers had a greater percentage of intramuscular fat ($P = 0.001$) than LO steers (Table 1). To our knowledge, no other reports have been made of diverging IMF percentages being observed before steers of differing genetic potentials are placed onto finishing diets.

Overall, 25 percent of steers had IMF ≥ 4 percent (the anticipated value needed to be considered for a choice carcass), with a greater proportion ($P = 0.01$) of steers in the HI group (36.8 percent) having IMF ≥ 4 percent, compared with LO steers (11.8 percent). Observation of differing IMF percentages between GP groups before being placed on feed may foreshadow potential differences in marbling at the conclusion of the finishing period.

No differences ($P \geq 0.60$) were observed between GP groups in feedlot performance (Table 1). No differences ($P \geq 0.12$) were observed in final BW, DMI or F:G between MOD and AGG implant strategies. Steers in the AGG group had greater overall ADG ($P = 0.03$) than MOD steers; however, this appears to be strictly a result of increased ADG during the first 70 days (data not shown), when MOD steers did not have the growth-promoting benefits of an implant.

No differences ($P \geq 0.28$) were observed between GP groups in HCW, LM area, RF, KPH percentage or YG. (Table 2). A greater proportion ($P = 0.03$) of steers in the HI group had choice carcasses (100 percent), compared with LO steers (87.8 percent).

Interestingly, a tendency for an interaction ($P \leq 0.08$) between GP and implant factors was present for marbling score and proportion of carcasses qualifying for the Certified Angus Beef (CAB) program (Table 3). Marbling score and percent of CAB were reduced by the AGG implant strategy in HI steers, but the same effect was not present in LO steers. Steers in the AGG group had thicker ($P = 0.003$) RF and greater ($P = 0.003$) yield grades than MOD steers, and no differences ($P \geq 0.14$) were observed in HCW, marbling, LM area or KPH.

Results of this study indicate that the GeneMax evaluation can be indicative of marbling potential and quality grades. Steers with greater genetic potential had greater percentages of intramuscular fat before consuming high-concentrate diets, and improved marbling scores and quality grade at slaughter, compared with low-genetic potential steers. The difference in intramuscular fat on day 0 between genetic potential groups indicates that marbling accretion occurs before steers are being fed high-concentrate diets.

Table 1. Effect of genetic potential and implant strategy on feedlot performance of Angus based steers.

	Genetic Potential[1]		Implant Group[2]		
Item	Low	High	Moderate	Aggressive	SEM
Intramuscular fat, %, day 0	3.26[x]	3.83[y]	3.58	3.52	0.09
Start BW, lb.	728.6	719.4	724.9	723.4	9.8
Final BW, lb.[3]	1,278.6	1,270.9	1,159.6	1,290.9	15.0
ADG, lb./d	3.92	3.94	3.81[x]	4.05[y]	0.009
DMI, lb./d	21.2	21.1	20.9	21.4	0.24
F:G	5.26	5.26	5.56	5.26	0.003

[1]Low = mean genetic potential score, 86.5; High = mean genetic potential score, 25.3. determined using GeneMax, Zoetis, Florham Park, N.J.

[2]Moderate = steers implanted on day 70; Aggressive = steers implanted day 0 and day 70, all implants contained 120 mg of TBA and 24 mg of E_2 (Revalor-S, Merck Animal Health, Summit, N.J.)

[3]Calculated as HCW divided by 0.634 (average dressing percentage)

[xy]Means within factor and row differ ($P < 0.05$)

Table 2. Effect of genetic potential and implant strategy on carcass composition of Angus based steers after 140 days on feed.

	Genetic Potential[1]		Implant Group[2]		
Item	Low	High	Moderate	Aggressive	SEM
HCW, lb.	817.1	812.2	797.9	818.4	9.57
LM Area, in.[2]	34.46	34.2	34.46	34.2	0.43
RF[3], in.	0.53	0.21	0.46[x]	0.59[y]	0.08
KPH, %	2.35	2.34	2.33	2.37	0.05
Yield Grade	3.35	3.33	3.19[x]	3.50[y]	0.07
Quality Grade, % Choice	87.8[x]	100y	90.6	97.2	0.04

[1]Low = mean genetic potential score, 86.5; High = mean genetic potential score, 25.3. determined using GeneMax, Zoetis, Florham Park, N.J.

[2]Moderate = steers implanted on day 70; Aggressive = steers implanted day 0 and day 70, all implants contained 120 mg of TBA and 24 mg of E_2 (Revalor-S, Merck Animal Health, Summit, N.J.)

[3]Carcass rib fat thickness

[xy]Means within factor and row differ ($P < 0.05$)

Table 3. Effect of genetic potential[1] × implant strategy[2] interaction on marbling score and carcasses qualifying for Certified Angus Beef of Angus-based steers after 140 days on feed[3].

	Treatment group[4]				
Item	HI AGG	HI MOD	LO AGG	LO MOD	SEM
Marbling score[5]	492.9[x]	538.3[y]	481.1[x]	463.8[x]	16.7
Certified Angus Beef, %	35.3[x]	66.7[y]	33.3[x]	25.0[x]	0.11

[1]Genetic potential (GP) determined using GeneMax, Zoetis, Florham Park, N.J.

[2]Moderate = steers implanted on day 70; Aggressive = steers implanted day 0 and day 70, all implants contained 120 mg of TBA and 24 mg of E_2 (Revalor-S, Merck Animal Health, Summit, N.J.)

[3]Marbling score GP × Implant strategy $P = 0.08$; % Certified Angus Beef GP × Implant strategy P = 0.06

[4]HI AGG: Average GP score of 86.4, received implant on day 0 and day 70; HI MOD: Average GP score of 86.5, received implant on day 70; LO AGG: Average GP score of 25.8, received implant on day 0 and day 70; LO MOD: Average GP score of 24.8, received implant on day 70

[5]Marbling Score based on $Small^{00} = 400$

[xy]Means in the same row lacking a common superscript differ ($P \leq 0.05$)

The overall quality of carcasses in the current study indicates that producers may be able to adopt management strategies that result in acceptable performance of cattle with poor genetic potential. More aggressive implant strategies can affect feedlot performance and carcass characteristics at different points throughout the feeding period, but carcass marbling in steers of greater genetic potential appears to be more sensitive to implant strategy than that of steers with lesser genetic potential for marbling.

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