Technical Bulletin

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Igenity® Beef Molecular Breeding Values an Effective Estimate of Carcass Quality in Crossbred Cattle

Key Points

- This study was conducted on 6,249 commercial cattle of various breed composition, fed for 170 days in five various feedlots across the United States. Carcass measurements and camera information were provided by the abattoir.

- All cattle with genomic test results received Igenity® one to ten scores that were normally distributed for hot carcass weight (HCW), marbling (MARB), 12th rib fat thickness (FAT), and ribeye area (REA). Relationships between these estimates and actual performance data were strongly positive.

- Based on the Igenity Terminal index score, the top 25% of cattle returned $110.58, or 7%, more on a per head basis than the bottom 25%. This results in a total of $177,038.58 additional revenue across the 1,601 head of cattle.

Introduction

Designed to predict genetic merit for straight and crossbred cattle of Angus, Gelbvieh, Hereford, Limousin, Red Angus, and Simmental descent, Igenity Beef was developed by the scientists at Neogen® Genomics, in collaboration with International Genetic Solutions, as a tool to help commercial producers select replacement heifers to fit their operations goals.

Using only genotypes, Igenity Beef translates a molecular breeding value into a simple one to ten score for 17 traits fitting into maternal, growth, and carcass categories. These scores give commercial producers the ability to gauge the genetic merit of their herd and better inform replacement heifer selection as well as mating decisions. In addition, Igenity Beef provides producers with three indexes to aid in multi-trait selection.

The objective of this report is to outline the efficacy of Igenity Beef when predicting genetic merit on an individual animal basis for many carcass traits. Using commercial crossbred cattle, this report describes the relationship between Igenity scores and carcass performance.

Materials and Methods

Between 2018 and 2021, a total of 6,249 commercial cattle of varying breeds and sex weighing 760.02 lb (standard deviation (StDev) = 100.66; range = 429–1138 lb, 194.6–516.2 kg) were transported to one of five feedlots across the United States and processed. Individual body weights were recorded on arrival (day zero) and an initial Synovex Choice or Synovex Plus (Zoetis LLC, New York, NY) implant given before being separated into pens. On day 133.8 (StDev = 19.3), heifers in site five were weighted and reimplanted with Component TE-200 (Elanco US, INC, Greenfield, IN).

Cattle were harvested on day 170.18 (StDev = 27.18 d). Data were recorded on all 6,249 head and included carcass measurements and camera information reported by the abattoir. Only cattle with electronic identification numbers verified to align from enrollment to slaughter are included in this report.

At enrollment, a tissue sample unit was collected on all animals and sent to Neogen Genomics (Lincoln, NE)

for processing. All samples were first characterized using BreedSeek v2 to determine genomic breed composition and then with Igenity Beef.

Statistical analysis of these data was completed based on the allocation of animals to pens and the protocol of the feedlot.

Results and Discussion

To fully describe the cattle in the study, two tables have been provided. Table one includes enrollment information, closeout data, and summarized Igenity scores, while table two provides a snapshot of breed composition (as a percentage) of the cattle included in this study. Cattle were majority Angus (54% as a combination of Angus and Red Angus), followed by Hereford (11%), Limousin (9%), Gelbvieh (9%), and Simmental (9%), all of which are included in the training population for Igenity Beef. Outside of the six breeds, these cattle also had some Brahman (3%), Shorthorn (3%), and other (2%) influence as well. Overall, it can be concluded these animals were very representative of the population of cattle within the training population for Igenity Beef.

The relationship between Igenity Beef scores and average closeout data were estimated for HCW, MARB, REA, FAT, and average daily gain (ADG) with R^2 values of 0.95, 0.92,

0.95, 0.96, and 0.58, respectively. These values are an aggregate across all lots of cattle. Actual correlations on an individual animal basis between Igenity score and HCW, MARB, REA, FAT, and ADG were 0.30, 0.41, 0.38, 0.41, and 0.26, respectively. As a summary, figure one shows the relationship between closeout data and Igenity scores on average for REA, HCW, MARB, and FAT. The actual data and estimated trend line are very similar as an average across all animals and pens of cattle. Even when summarized over all cattle in the study, the more common scores ranging from four to eight are well characterized. The variation in relationship exists in less frequently observed Igenity scores of one to three and nine to ten. An occurrence that is explained by the intentional distribution of Igenity scores.

Designed to be normally distributed, many cattle tested on Igenity Beef should receive scores ranging from four to seven, followed by scores ranging from two to three or eight to nine, and the smallest number, or extremes, receiving scores of a one or ten. This distribution is designed to help producers distinguish and select heifers who are exceptional or cull those less than ordinary. Investigation into the distribution of scores of these data prove this to be accurate. Because of this, the scores with most variation shown in figures two a– two d are those with lower numbers of animals categorized, and therefore suffer from only having limited animals to average.

Table 1. Summary statistics, closeout data, and Igenity carcass traits for all 6,249 head of cattle.

Variable	n	Mean	SE	Range
Enrollment Weight, lb	6249	760.02	1.27	429–1138
Days on Feed, d	6249	170.18	0.34	133–232
Average Daily Gain, lb/d	6249	4.07	0.01	1.03–7.36
Hot Carcass Weight, lb	6249	901.65	1.22	576–1244
USDA Quality Grade[1]	6249	2.92	0.01	2–4
USDA Yield Grade[2]	6249	2.65	0.01	1–5
Ribeye Area, sq in	6249	15.26	0.02	10.03–22.55
Marbling Score[3], sq in	6249	480	1.16	311–918.5
Fat Thickness, in	6249	0.63	0.001	0.11–1.93
Igenity Score				
Average Daily Gain	6249	5.20	0.02	1–10
Marbling Score	6249	5.25	0.02	1–10
Ribeye Area	6249	5.61	0.02	1–10
Fat Thickness	6249	5.28	0.02	1–9
Hot Carcass Weight	6249	5.30	0.02	1–10

[1] Grades: 1 = United States Department of Agriculture (USDA) Standard or lower; 2 = USDA Select; 3 = USDA Choice; 4 = USDA Prime.
[2] Carcasses that graded USDA Standard or lower did not receive a USDA Yield grade.
[3] Marbling score: <300 = trace, 300 = slight, 400 = small, 500 = modest, 600 = moderate, >700 = slightly abundant.

Finally, all cattle were sorted based on their Igenity Terminal index score, which ranges from one (worst) to ten (best). The top (n = 1601) and bottom 25% (n = 1527) were then separated and their closeout data summarized. Based on this closeout data, estimated revenue was calculated on a per head basis using grid information provided in table three. Differences in means were tested using a simple t-test, with these results summarized in table four. While enrollment weights of cattle were different, it is clear they were fed to a set ultrasound backfat thickness prior to slaughter. While this resulted in similar yield grade cattle, their carcass composition was significantly different. Overall, the top and bottom 25% of cattle differed by approximately two Terminal index scores, with an estimated revenue difference per head of $110.58, or 7%. This results in a total of $177,038.58 additional revenue across the 1,601 head of cattle.

## Table 2. Summary of breed composition, as a percent, for all cattle.

Breed	Percent
Angus[1]	0.54
Brahman	0.03
Gelbvieh	0.09
Hereford	0.11
Limousin	0.09
Shorthorn	0.03
Simmental	0.09
Other[2]	0.02

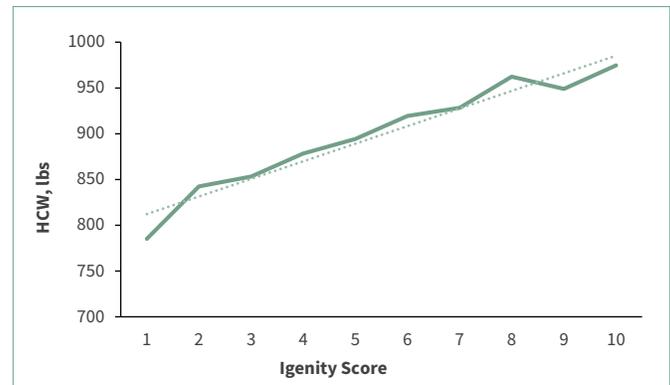[1] Angus and Red Angus composition was combined.
[2] Includes those breeds not listed above.

Figure 2. Relationship of Igenity Beef scores with phenotype information for REA, HCW, MARB, and FAT on 6,249 head of cattle.
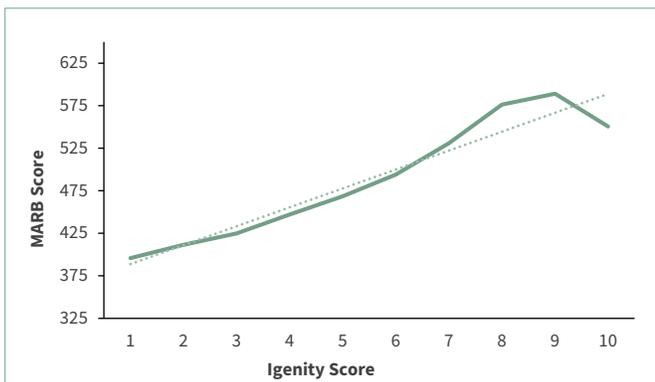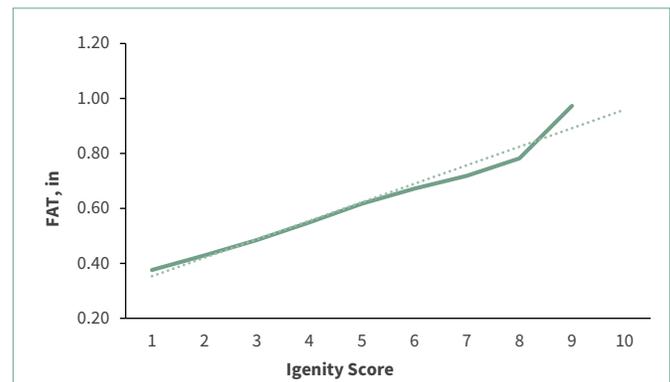

a) Relationship with REA, on average
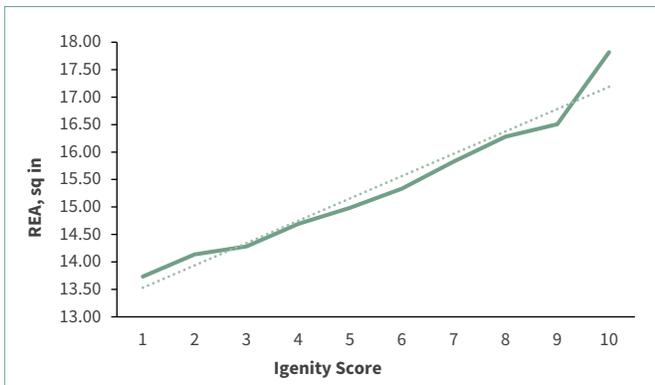
b) Relationship with HCW, on average

c) Relationship with MARB, on average

d) Relationship with FAT, on average

Conclusion

Igenity Beef is the first genomic profile designed to predict genetic potential in commercial crossbred cattle. It provides commercial producers with yet another tool to help improve their bottom line. Using only the DNA of an animal, Igenity Beef can help predict future performance in many economically relevant traits. Cattle in this study were an admixture of breeds representative of the commercial industry and included in the training population for Igenity Beef. Results of this study support this products ability to accurately differentiate performance in a feedlot environment. Specifically, variances in the Igenity Terminal index resulted in over $177,000 profit over 1,601 head of cattle. Overall, Igenity Beef is an effective product to help estimate genetic potential in commercial crossbred cattle.

Table 3. Grid premiums and discounts used to calculate revenue[1].

USDA Quality Grade	USDA Yield Grade				
	1	2	3	4	5
Prime	22.19	20.185	18.61	7.38	1.76
Choice	3.58	1.575	BASE[2]	-11.23	-16.85
Select	-20.67	-22.675	-24.25	-35.48	-41.10
Standard	-22.19	-32.355	-33.93	-45.16	-50.78

Base Price/CWT: $179.28			
400–500 lb	-29.29	-1.07	900–1000 lb
500–550 lb	-22.64	-5.00	1000–1050 lb
550–600 lb	-11.57	-16.07	Over 1050 lb

[1] Prices summarized from USDA National Weekly Direct Slaughter Cattle Report August 3, 2022.
[2] Premiums and discounts given $/cwt.

Table 4. Summary statistics and difference in revenue between the top and bottom 25% of cattle based on the Igenity Terminal index.

	Top 25%[1]	Bottom 25%[2]	P value[3]
Average Terminal Index	**6.36**	**4.48**	**P <0.001**
Enrollment Weight, lb	768.77	745.56	P <0.001
Days on Feed, d	172.29	169.09	P <0.001
Average Daily Gain, lb/d	4.29	3.85	P <0.01
Ribeye Area, sq in	15.45	15.01	P <0.001
Marbling Score[4]	494	467	P <0.001
Fat Thickness, in	0.64	0.61	P <0.001
Hot Carcass Weight, lb	933.19	867.49	P <0.001
USDA Quality Grade[5]	2.97	2.88	P <0.001
USDA Yield Grade[6]	2.74	2.58	P <0.001
Revenue[7], $	1619.03	1508.45	P <0.001
Difference per animal	**$110.58**		

[1] Top 1,601 head, based on Igenity Terminal index score.
[2] Bottom 1,527 head, based on Igenity Terminal index score.
[3] Calculated using a two-sided t-test, P <0.05 considered significantly different.
[4] Marbling score: <300 = trace, 300 = slight, 400 = small, 500 = modest, 600 = moderate, >700 = slightly abundant.
[5] Grades: 1 = USDA Standard or lower; 2 = USDA Select; 3 = USDA Choice; 4 = USDA Prime.
[6] Carcasses that graded USDA Standard or lower did not receive a USDA Yield grade.
[7] Revenue calculated using the grid provided in table three.