Igenity® BeefxDairy: A genomic tool for identifying genetic merit of Beef on Dairy cross calves

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Abstract

An increasing number of dairy farms are interested in managing their replacement heifer inventories. They utilize genomic testing and sexed semen to create enough replacement heifers for their dairy herd replacement needs. From a dairy system sustainability perspective, this facilitates the opportunity to utilize beef semen on cows not destined for dairy replacement purposes to increase profitability based on beef on dairy cross calve production. In general, these beef on dairy calves have advantages over straightbred dairy calves; however, there is interest in specific animal performance insights in this growing class of beef on dairy cattle. With the large influx of beef-influenced dairy cattle into the feeder space, it is becoming more imperative to better understand the genetic differences among those calves. This need has led Neogen to develop a commercial genomic testing tool to help rank beef influenced dairy calves for terminal traits of interest. This facilitates an opportunity to choose how to manage the animals through the growth and finishing stages of production.

In a study population of 1,002 feedlot cattle, we investigated the genomic breed composition as well as the relationship between genomic prediction of performance and actual phenotypic harvest and performance data. Samples taken on 438 steers and 564 heifers were approximately 55% beef influence and 45% dairy influence. Statistical analysis (R software) demonstrated positive correlations between Igenity® scores and phenotypic performance of 0.29, 0.23, and 0.22 for marbling (MARB), average daily gain (ADG), and hot carcass weight (HCW), respectively. Furthermore, when ranking cattle according to Neogen's Terminal Index and comparing the top quartile (average = 6.71) to the bottom quartile (average = 5.22) of animals, phenotypic performance was significantly different for ADG (1.32 kg/d vs. 1.24kg/d, $P < 0.001$, respectively), HCW (390.6 kg vs. 372.2 kg, $P < 0.001$), and USDA yield grade (2.59 vs. 2.43, $P < 0.05$). Based on August 2022 grid pricing, this resulted in a ~US$78 difference in individual carcass revenue, per head between Terminal Index top quartile and bottom quartile. Igenity® BeefxDairy demonstrates a viable opportunity to manage animals relative to their genetic potential during the feeding period, representing appropriate investment of precious feedstuffs and improving the production footprint of beef production out of dairy cows.

Keywords: genetic profiling, breed verification, calf management.
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Introduction

The use of genomic information can provide more reliable phonotypic estimates, which are essential for designing or refining selection indicators in cattle breeding programs (Pedrosa *et al*, 2023). Genomic selection has been shown to increase accuracy and decrease generation interval in US dairy cattle (Guinan *et al*, 2023). Dairy farms are working to increase the value of every calf produced on the farm. Many farms are utilizing beef semen on the dairy cow inventory which they need to maintain and get more lactations out of due to development costs, but those cows do not represent the future genetic attributes for replacement female creation (NAAB, 2022). As the calves are generated from beef semen on dairy cows, many producers want to genetically confirm three key attributes of those calves:Are they really beef x dairy cross? If so, what is the percent beef and the percent dairy of the individual?

Can I sort and manage these animals based on their ability to grow?

Can I have a prediction of what the likely revenue potential of this animal will be at harvest?

Beef production from dairy cows offers a unique opportunity to utilize animals less suitable for dairy herd replacement. However, optimizing their growth and carcass quality requires efficient management strategies. This study aims to evaluate the effectiveness of Igenity® BeefxDairy, a novel genetic testing technology, in identifying the genetic potential for growth and carcass traits on dairy herds.

Materials and methods

Cattle for this study were sourced as Beef x Dairy cross cattle entering commercial feedlots in the summer and fall of 2020. Samples for Igenity® BeefxDairy (Neogen Corporation) genetic testing were collected with tissue sampling units (TSUs, AllFlex) at time of arrival into the feedlot with other feedlot entry processing activities. Cattle were managed under the feedlot's normal management system and harvest dates were chosen by feedlot management based on lot based optimum harvest date. Cattle (438 steers and 564 heifers entered the feedlot at an average of 570.0 pounds and were fed an average of 274.1 days with average hot carcass weight at harvest of 844.6 pounds (Table 1).

Table 1. Summary statistics for carcass traits, closeout data, and Igenity scores.

Variable	n	Mean	SE	Range
Enrollment wt, lb	1002	570.09	3.22	355 to 950
Days on feed, d	1002	274.11	0.80	207 to 305
ADG, lb/d	1002	2.84	0.01	0.81 to 4.06
HCW, lb	1002	844.62	2.87	511 to 1149
USDA Quality Grade[1]	1002	2.83	0.01	2 to 4
USDA Yield Grade	1002	2.52	0.03	1 to 5
Rib-eye area, sq in	1002	13.86	0.05	9.1 to 19.5
Marbling	1002	498.27	3.30	310 to 898
Fat Thickness, in	1002	0.49	0.01	0.12 to 1.16
Igenity Score				
Marbling	1002	5.73	0.04	2 to 8
Rib-eye area	1002	6.86	0.04	3 to 10
12th-rib fat thickness	1002	4.92	0.04	1 to 7
HCW	1002	6.47	0.04	2 to 9

Results and discussions

Igenity BeefxDairy report information

The average breed composition of animals in this study was 55% Beef and 45% Dairy. Igenity® BeefxDairy scores represented the majority of the expected 1 to 10 range for the traits of interest: average daily gain (ADG); marbling (MARB); and hot carcass weight (HCW). Furthermore, Igenity Terminal Index (ITI) was calculated for each animal and then animals were sorted into quartiles based on ITI for further evaluation and reporting.

Performance information

Performance of the cattle in the feedlot and carcass trait information is summarized in Table 1, which represents tremendous variability which exists within the beef x dairy cattle production systems.

Robust positive relationships were found between Igenity® BeefxDairy scores and actual phenotypic performance across both steers and heifers for average daily gain (Figure 1), marbling (Figure 2), and hot carcass weight (Figure 3).

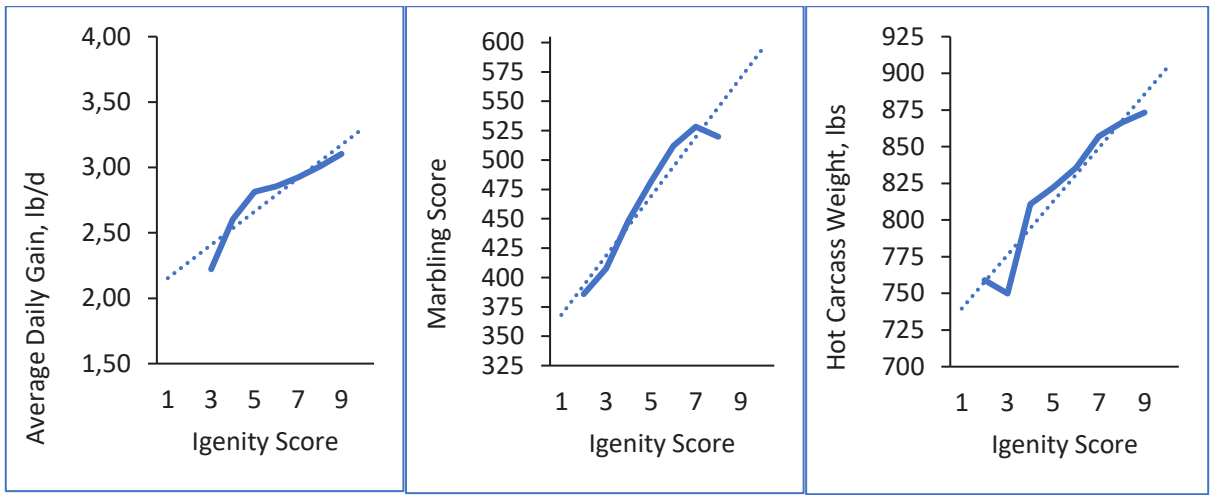

Figure A Figure B Figure C

Figure 1. Robust positive relationships were found between Igenity® BeefxDairy scores and actual phenotypic performance across both steers and heifers for average daily gain (Figure A), marbling (Figure B), and hot carcass weight (Figure C).

Igenity® Terminal Index (ITI) Quartile Analysis

Phenotypic performance for animals in the top 25% based on ITI were compared to animals in the bottom 25% for ITI and were tested for significant differences. Significant ($P < 0.05$) differences were found between top quartile ITI animals and bottom quartile ITI animals for enrollment weight, average daily gain, hot carcass weight, USDA yield grade and revenue (Table 2). Marbling score had a suggestive ($0.05 < P < 0.10$) difference between top quartile ITI animals and bottom quartile ITI animals. This is likely due to the modest emphasis of marbling in the ITI compared to weight.

Revenue for each individual animal was calculated based on the value-based pricing grid represented in Table 3. Top ITI quartile animals averaged $77.23 more per animal than the bottom ITI quartile animals.

Conclusions

Igenity® BeefxDairy is a viable tool to manage animals relative to their genetic potential during the feeding period, representing appropriate investment of precious feedstuffs and improving the production footprint of beef production out of dairy cows.

Table 2. Summary statistics and difference in revenue between the top 25% and bottom 25% of animals based on Igenity® Terminal Index (ITI).

	Top 25% N = 250	Bottom 25% N = 250	P value[1]
Average Terminal Index	6.71	5.22	P < 0.01
Enrollment Weight, lbs	586.10	564.03	P < 0.05
Days on Feed, d	271.13	272.47	P = 0.57
Average Daily Gain, lb/d	2.91	2.73	P < 0.01
Marbling Score[2]	504	489	P = 0.09
12th – rib fat thickness, sq in	0.49	0.49	P = 0.98
HCW, lbs	861.17	820.55	P < 0.01
USDA Quality Grade[3]	2.86	2.79	P = 0.11
USDA Yield Grade	2.59	2.43	P < 0.05
Revenue[4], $	1500.62	1423.39	P < 0.01
Difference per animal	**$77.23**		

[1]Calculated using a two-sided t-test, P < 0.05 considered significantly different.
[2]Marbling score: < 300 = Trace, 300 = Slight, 400 = Small, 500 = Modest, 600 = Moderate, >700 = Slightly Abundant
Grades: 1 = USDA Standard; 2 = USDA Select; 3 = USDA Choice; 4 = USDA Prime.
[4]Revenue calculated using the grid in Table 3.

Table 3. Beef carcass grid premiums and discounts used for carcass revenue calculation, $US/Carcass.

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		900-1000 lb		-1.07
500-550 lb	-22.64		1000-1050 lb		-5.00
550-600 lb	-11.57		Over 1050 lb		-16.07

[1] Prices summarized from USDA National Weekly Direct Slaughter Cattle Report August 3. 2022
[2] Premiums and discounts given $/CWT of hot carcass weight.

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