Igenity® BeefXDairy

Genomic Profile | Product Number 20005

Key Points

- Neogen® Igenity BeefXDairy enters the industry as a first-of-its-kind genomic profile designed specifically for the marketing and differentiation of beef influenced dairy calves destined for the feedlot.
  - o Delivery of genomic predictions for Average Daily Gain (ADG), Marbling (MARB), and Hot Carcass Weight (HCW) provides insight into an animal's genetic potential for economically relevant traits.
  - o Genomic breed composition helps to verify the magnitude of beef influence in each animal and the majority beef breed (of sire) and dairy breed (of dam).
- Igenity Terminal Index (ITI) is designed to identify animals with increased growth and carcass potential, especially when sold on a grid.
  - o Cattle ranked in the top 25% for ITI had higher average daily gain, hot carcass weight, and marbling scores as compared to animals in the bottom 25%. If sold on the same grid, that would have resulted in a $77.23, or 5%, increased revenue per animal.
- Igenity BeefXDairy helps to market beef-on-dairy calves by verifying the genetics of strategic matings designed to create calves with increased profitability.

Igenity BeefXDairy Product Development and Features

It is no secret that modern technology has played an instrumental role in all aspects of livestock production. The most recent advancement being the use of beef semen to inseminate dairy females of lower genetic quality. This breeding strategy allows producers to receive the benefits of milk production without creating inferior dairy heifer genetics or lower-value dairy bull calves.

The National Association of Animal Breeders (NAAB) reports that dairy semen sales dropped from 22.8 million units in 2017 to 15.4 million units in 2023 (Holstein and Jersey; **Figure 1**). Meanwhile, beef semen sales grew from 2.5 million to 9.0 million annually during the same timeframe (**Figure 1**). While not all this increase can be attributed to beef-on-dairy production, the 2020 Continuing Market Study from Hoard's Dairyman revealed that 56.3% of the 3,000 farms surveyed reported using beef semen, with over half of those herds reporting usage on 25% of their mature cows.

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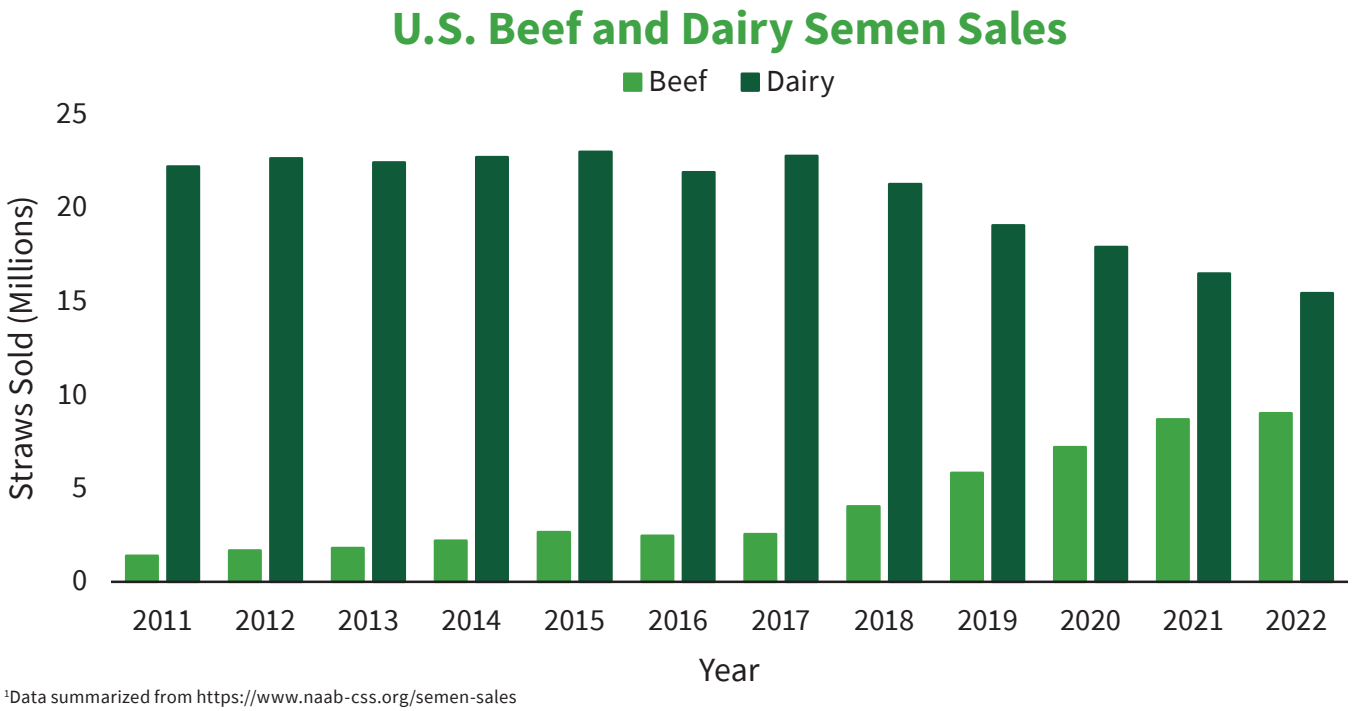
With the realization that each uterus on the farm no longer needs to be reserved for potential replacement production, there will be increased desire to explore alternative breeding strategies like beef-on-dairy. Just like straight-bred animals in the beef and dairy industries, not all beef-on-dairy calves have the same genetic potential, nor will they perform the same. Neogen's Igenity BeefXDairy enters the industry as a first-of-its-kind genomic profile designed specifically for the marketing and differentiation of beef influenced dairy calves destined for the feedlot.

Figure 1. Straws of beef and dairy semen sold into the United States from 2011 to 2022[1]



[1]Data summarized from https://www.naab-css.org/semen-sales

The scientists at Neogen have developed Igenity BeefXDairy as a tool to help dairy producers and feedlot operators maximize their investment in terminal calves. First, delivery of genomic predictions for Average Daily Gain (ADG), Marbling (MARB) and Hot Carcass Weight (HCW) provide insight into the potential of each calf separately, while the Igenity Terminal Index (ITI) is designed to rank cattle according to their genetic potential for revenue when sold on a grid. In addition, the delivery of genomic breed composition helps to verify the magnitude of beef influence in each animal. Together, these data will assist in the marketing and management of cattle at all stages in the supply chain.

Igenity BeefXDairy does not include parentage verification; however, it does qualify for Neogen's Igenity Branded Program.

Target Population

As a commercial crossbred tool, the target population for testing is limited by the breeds of cattle used in the development of the predictions. For Igenity BeefXDairy, these include animals of any combination:

Beef Breeds: Akaushi, Angus, Brahman, Gelbvieh, Hereford, Limousin, Red Angus, Shorthorn, Simmental, Wagyu

Dairy Breeds: Holstein, Jersey

Cattle with breed composition outside of those listed above are not recommended for testing on Igenity BeefXDairy.

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Results Delivered

In the dairy industry, predictions of genetic merit are expressed as Predicted Transmitting Abilities (PTA) and are a summation of pedigree, phenotype, and genomic information (when available) for a single trait at a time. Neogen's Igenity BeefXDairy estimates a Molecular Breeding Value (MBV) using genomic information, for three economic traits of interest:

Average Daily Gain (ADG) is pounds of weight gain per day. Higher ADG values indicate animals with increased genetic potential for post-weaning growth.

Marbling (MARB) is an animal's USDA marbling score at a similar endpoint. The higher the score, the higher the USDA quality grade.

Hot Carcass Weight (HCW) is the weight of an animal's unchilled carcass at harvest. The higher the score, the greater the hanging beef weight.

These MBV are a prediction of how each dairy-beef calf is expected to perform compared to other profiled animals. However, to better rank animals, Igenity reports genetic merit on a scale of 1 (low) to 10 (high).

If interested in phenotypic differences between animals, Neogen does provide a Genetic Effects Table (**Table 1**) that expresses the MBV cut off points for each Igenity score. For example, if Animal A has a HCW Score of 3 and Animal B an 8, we would expect Animal B to weigh 56.9 lbs. more than Animal A at harvest.

Table 1. Igenity BeefXDairy Genetic Effects Table

Igenity Score	Average Daily Gain (lbs./d)	Marbling (marb. units)	Hot Carcass Weight (lbs.)
10	0.52	300	205.0
9	0.48	266	182.2
8	0.43	234	102.5
7	0.36	200	91.1
6	0.30	166	79.7
5	0.24	134	68.3
4	0.18	100	56.9
3	0.12	66	45.6
2	0.06	34	22.8
1	0	0	0

While knowledge of an animal's underlying value for specific traits of interest is useful, it can sometimes be a lot of information to balance at once. This is especially true when producers are trying to group like cattle together. Selection indexes provide an opportunity to rank animals based on a summation of their genetic merit across a multitude of traits. These traits can also be weighted according to their importance and economic impact.

Therefore, Igenity BeefXDairy also reports an index value that provides insight into the potential economic return of an animal from 1 (low) to 10 (high) based on their genetic predisposition for carcass revenue:

Igenity Terminal Index (ITI) is designed to rank animals according to their genetic potential for terminal traits of interest. It places the most emphasis on hot carcass weight, followed by marbling and ribeye area, with negative emphasis placed on residual feed intake and fat thickness. Higher ITI values indicate animals with increased carcass potential, especially when sold on a grid.

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Lastly, like commercial beef production, each beef breed of sire brings different strengths to the dairy cross. To identify and help market beef influenced dairy calves, Igenity BeefXDairy also delivers:

Primary Beef Breed (of Sire) lists the breed that makes up the largest genomic portion of the beef influence in the animal. It could likely also be referred to as the "Breed of Sire".

Primary Dairy Breed (of Dam) lists the breed that makes up the largest genomic portion of the dairy influence in the animal. It could likely also be referred to as the "Breed of Dam".

Note: Primary Breed will not report if the percentage Beef or Dairy within an animal is greater than 85%.

Figure 2. Example of a detailed report for Igenity BeefXDairy

Detailed Report

Animal Information						*Igenity Scores*				*Percentage Beef vs Dairy*		*Breed of Origin*	
Sample ID	Bar Code	Animal ID	Breed	Date of Birth	Sex	ADG	MARB	HCW	Terminal Index	% Dairy	% Beef	Primary Dairy Breed	Primary Beef Breed
41086343	NPD23BV0041824	A1824	HO		M	5	3	6	5.85	54%	46%	Holstein	Gelbvieh
41086344	NPD02691354	B1354	JE		M	9	7	7	6.30	18%	82%	Jersey	Angus
41086345	NPD02309789	C9789	AN		M	3	4	3	4.40	88%	12%	NR	Angus
41086346	NPD03188612	D8612	AN		M	5	2	5	5.15	7%	93%	Holstein	NR
41086347	NPD03634773	E4773	HF		M	5	6	7	6.60	8%	92%	Holstein	NR

Adding Value by Utilizing Results

Igenity BeefXDairy results are designed to assist producers in the marketing, management, and sorting of beef influenced dairy cattle, providing insight into the genetic footprint previously unknown.

For the Dairy, primary breeding decisions should always be centered around driving long-term breeding strategies forward. This is done by estimating yearly replacement needs and making selection and breeding decisions to create the proper amount of desirable replacement heifers.

A genomic testing program is the most effective way to achieve this ranking. By knowing the genetic potential of the cow herd and combining that with how many replacements are needed, genetic thresholds can be developed to determine optimal breeding strategies. In other words, how many elite females to breed to sexed heifer semen, and what females should be bred with semen from beef sires.

But it's no longer enough to just create beef influenced dairy calves. With such high inventory entering the space, they must be successfully marketed. To differentiate these calves, dairymen and women need to think like a person marketing beef animals and about the people they are marketing to. Whether marketed to the calf-ranch, stocker, or feedlot, beef influenced dairy cattle are profitable due to two things: efficient weight gain and carcass quality. In general, dairy cattle are less efficient beef producers due to selective breeding for traits that make them more profitable for dairy purposes. However, if bred to a complimentary beef bull, those assumptions can be mitigated. Igenity BeefXDairy helps to verify the genetics of these strategic matings. By obtaining more information and decreasing the risk associated with beef-on-dairy calves, the right buyers will be ready to pay a premium.

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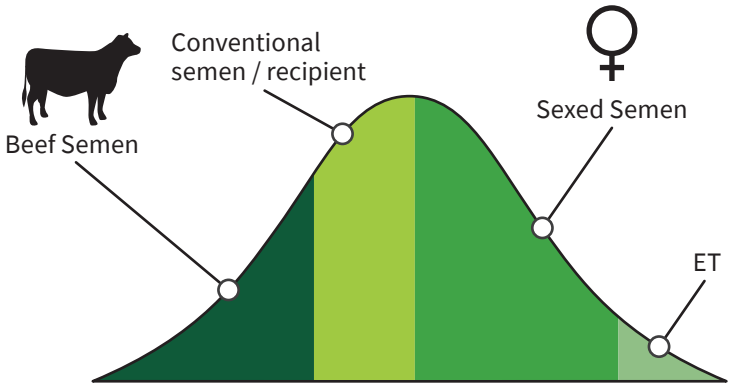

*The image above is a visual representation of a hypothetical breeding strategy. The graph represents a distribution graph based on overall genetic quality for dairy purposes. Lower genetic quality animals (to the left of center) would be bred to conventional or beef semen or be used as embryo transfer recipients. Higher genetic quality animals (to the right of center) would be bred to sexed semen or used to create embryos.

But how can producers go about obtaining that premium? If purchasing Igenity BeefXDairy, producers can choose to enroll their calves into Neogen's Igenity Branded program to help with marketing.

Igenity Branded. A program designed to verify the genetic value of feeder calves, allowing buyers to manage risk, take advantage of premiums on superior calves, and optimize sorting to achieve greater production system efficiency.

Initially launched in partnership with Superior Livestock Auctions, Igenity Branded is a marketing channel nationally available to innovative producers who have invested in profiling their cattle. When tested on Igenity BeefXDairy, load lots of animals will receive their Igenity Branded Tier as an average of their Igenity Terminal Index (ITI) value. Based on their ITI, animals are placed into one of four groups:

- **Elite** – Best of the best. Cattle rank genetically superior to 75% of Igenity BeefXDairy tested cattle.
- **Premier** – The next level. Based on Igenity BeefXDairy, these calves rank in the top 50% for genomic merit geared towards end-product characteristics.
- **Choice** – A cut above entry-level tier. These calves rank in the 3rd quartile.
- **Tested** – Entry-level tier. Calves have received a verified Igenity BeefXDairy profile.

Groups of cattle can then be sorted and delineated within sale books, web, and television to ensure buyers are notified when Igenity Branded cattle are available.

For the Feedlot Operator, there is a known negative relationship between milk production and carcass conformation as well as carcass fat (McGee et al., 2005). This means that by default, the carcass composition and therefore profitability of a dairy carcass is less than that of a beef carcass. This knowledge is the driving factor behind the discounts applied to calves of known dairy origin. However, just as in the crossing of beef breeds of cattle, heterosis is known to exist for performance traits relevant to beef-on-dairy production (Berry, 2021). While this breed complementarity does not result in any difference in feed intake or feed efficiency when comparing beef-on-dairy calves to dairy calves (Berry, 2021), beef-on-dairy cattle do appear to have higher average daily gain (0.15 lb./d; Vestergaard et al., 2019) and carcass weights (3% heavier, Berry et al., 2019). It is the change in carcass composition that provides the largest return on investment.

Igenity BeefXDairy helps the calf buyer by analyzing an animal's genetic merit for a multitude of economically relevant traits. Knowledge of that information can then be used to better understand how specific beef-on-dairy calves will mature and deposit muscle and fat, ultimately impacting their profitability.

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To show how Igenity BeefXDairy can pick up genetic differences in terminal traits of interest, **Table 2** includes summary statistics between the top and bottom 25% of cattle sorted using the ITI. Overall, there was a 1.5 score difference in the ITI, but cattle in the top 25% had increased daily gain (0.18 lb./d, $P < 0.01$), marbling score (15 units, $P = 0.09$), and increased hot carcass weight (40.62 lbs., $P < 0.01$), when fed to the same backfat thickness (0.49 sq in, $P = 0.98$).

Overall, if these cattle had been harvested on the same day and sold on the same grid (**Table S.1**) the animals in the top quartile would've been worth $77.23 more per head than those in the bottom quartile.

Table 2. Summary statistics and difference in revenue between the top and bottom 25% of cattle based on the Igenity Terminal Index. (See **Table 3** for breed composition of animals included in this summary.)

	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
[3]Grades: 1 = USDA Standard; 2 = USDA Select; 3 = USDA Choice; 4 = USDA Prime.
[4]Revenue calculated using the grid provided in Table S.1.

Table 3. Summary of breed composition, as a percent, for all calves

Breed	Percent
Angus[1]	42
Gelbvieh	1
Holstein	44
Jersey	1
Limousin	6
Simmental	5
Beef	0.55
Dairy	0.45

[1]Angus and Red Angus composition was combined.

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*All statements and analyses contained herein are a product of research and development conducted by Neogen Corporation. Any equations, product development, and validation are considered proprietary intellectual property. Data on file. 2023.

Supplemental Information

Table S.1. Grid premiums and discounts used for carcass revenue calculation[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		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.