Igenity® BCHF Case Study

Bovine Congestive Heart Failure Test

Mitigate Risk for Costly BCHF

KEY POINTS

- This study was conducted in the Pacific Northwest across a herd of over 32,000 commercial-fed cattle that were phenotypically identified for cardiac morphology; a subset of 25,187 individuals underwent genotyping using **Igenity BCHF** to assess genetic characterization.

- Testing with Igenity BCHF assesses animals' genetic predisposition for bovine congestive heart failure (BCHF). Test results are scored on a 1-to-10 scale, ranging from 1 (lowest risk) to 10 (highest risk), which directly correlates with the percentage of BCHF risk an animal genetically carries and passes on to their progeny. Each score decreased in scale has a 3.5% lower expected incidence rate for BCHF.

- An example of demonstrated variability in a feedlot setting, (example on page 2) of animals tested, Animal A received an Igenity Score of 2, producing a genetic effect of 3.5% – while Animal B received an Igenity Score of 7, correlating to a genetic effect of 21.2%. This demonstrated Animal A's 17.7% lower probability for experiencing BCHF.

- Genetically testing with Igenity BCHF allows producers to identify BCHF-predisposed animals to ensure early intervention, improved selection for heart health, mitigation of economic losses attributed to BCHF, and an overall uplift in bovine heart health standards.

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INTRODUCTION

Bovine Congestive Heart Failure (BCHF) stands as a significant threat to the health and productivity of feedlot cattle. In severely affected cattle pens, mortality rates have surged to 7%, translating to staggering annual losses surpassing $250,000 for a single operation (Heaton et al., 2022). Implementing genetic management for BCHF in feedlot operations – considering strategically grouping high risk animals to better monitor and mitigate potential health issues – might reduce mortality risks (Buchanan et al., 2023). By identifying animals with higher genetic susceptibility to BCHF, feedlot managers can provide targeted care and management strategies, such as enhanced monitoring, tailored nutritional plans, and reduced environmental stressors, which may alleviate the impact of the condition.

GENOMIC TESTING IMPLEMENTATION

Igenity BCHF is a revolutionary genomic test designed to assess an animal's genetic predisposition to heart failure. The test results, ranging from 1 to 10, directly correlate with the percentage of BCHF risk an animal carries (and should pass on to their progeny), serving as a genetic indicator of the likelihood of disease development. A lower score on the scale signifies a more favorable genetic profile for a healthier heart, with a score of 1 representing the most favorable indicator. On the other hand, individuals with higher scores tend to present a higher risk of BCHF, with a score of 10 representing the least favorable indicator. By employing DNA testing for BCHF in cattle, producers gain the confidence to pinpoint animals harboring genetics conducive to enhancing bovine heart health. In this context, veterinarians and technicians can use genetic testing to identify animals predisposed to BCHF, enabling early intervention. By incorporating genetic insights, feedlots can better allocate resources and reduce the risk of BCHF-related losses.

In addition, the selection of animals with superior genetic predispositions through Igenity BCHF testing promises to uplift bovine heart health standards. Curbing the prevalence of heart failure-associated genes within the breeding herd anticipates a subsequent decline in BCHF risk among calf crops. This proactive approach not only safeguards the health of cattle, but also mitigates economic losses attributed to BCHF incidents within the feedlot. In herds grappling with a pronounced incidence of BCHF among finishing cattle, an accurate culling of breeding animals bearing higher Igenity BCHF scores emerges as a pivotal strategy.

Figure 1. The table below allows you to cross-reference the 1–10 Igenity scores with their corresponding expected genetic effects:

Igenity Score	BCHF (%)
1	0.0
2	3.5
3	7.1
4	10.6
5	14.1
6	17.6
7	21.2
8	24.7
9	28.2
10	31.8

More Favorable

Less Favorable

This chart provides a comparative assessment of genetic potential rather than predictive rates. It illustrates the genetic impact anticipated in progeny, offering a reference between Igenity scores and genetic effects for BCHF. These values predict the relative profile of an animal compared to the progeny of other reported animals, where minor scores indicate a lower risk in the development of Bovine Congestive Heart Failure.

COMPARING SCORES BETWEEN PROFILED ANIMALS

The examples below show you how to equate Igenity scores to variations in genetic effects from the genetic table:

Bovine Congestive Heart Failure (BCHF)	Igenity Score	Genetic Effect	Description
Animal A	2	3.5%	Animal A will produce progeny with a 17.7% lower probability of experiencing congestive heart failure.
Animal B	7	21.2%	
Difference	5	17.7%	

BCHF DISTRIBUTION
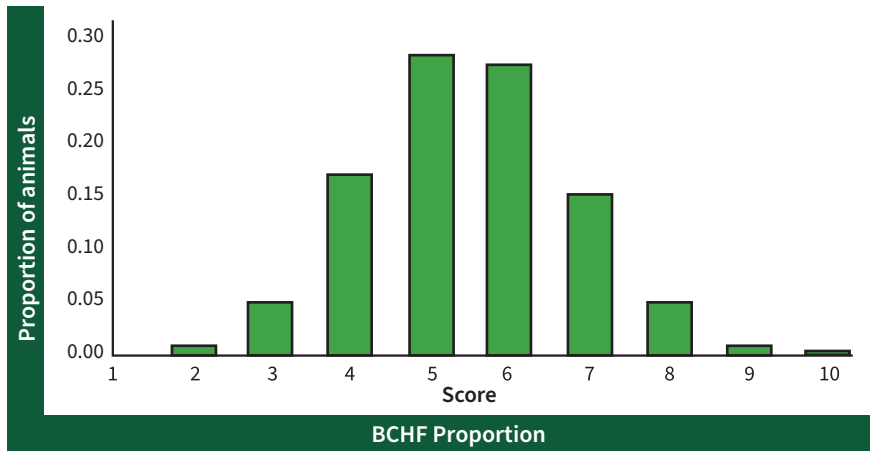
WHY IS IGENITY BCHF DIFFERENT?

Igenity BCHF represents an additive polygenic effect across the entire genome profile instead of the initially discovered two single nucleotide polymorphism (SNP) markers based on the USDA-ARS research, which was based on the non-additive effects of the two SNPs. In other words, Igenity BCHF captures more genetic effects along the entire genome instead of a few genomic regions. The new approach will lead to a more precise outcome. In summary, Igenity BCHF is not based on a single marker effect, but rather considers tens of thousands of SNP markers for genome-wide association study (GWAS) characterization of genomic effects. With more robust marker sets, the polygenic effects can be better characterized, resulting in a more precise test.

REFERENCE POPULATION

Over 32,000 commercial-fed cattle in the Pacific Northwest were phenotypically identified for cardiac morphology (Buchanan et al., 2023). A subset of 25,187 individuals underwent genotyping to assess the genetic characterization. The Breeds in the reference population were Angus; Angus X Charolais; Angus X Charolais X Hereford; Angus X Hereford; Angus X Holstein, Charolais; Charolais X Hereford; Charolais X Holstein; Charolais X Holstein X Jersey; Charolais X Jersey; Hereford; Holstein; Multi-breed.

REFERENCES:

Buchanan, J. W., Flagel, L. E., MacNeil, M. D., Nilles, A. R., Hoff, J. L., Pickrell, J. K., & Raymond, R. C. (2023). Variance component estimates, phenotypic characterization, and genetic evaluation of bovine congestive heart failure in commercial feeder cattle. Frontiers in Genetics, 14, Article 1148301.

Heaton, M. P., Harhay, G. P., Bassett, A. S., Clark, H. J., Carlson, J. M., Jobman, E. E., Sadd, H. R., Pelster, M. C., Workman, A. M., Kuehn, L. A., Kalbfleisch, T. S., Piscatelli, H., Carrie, M., Krafsur, G. M., Grotelueschen, D. M., & Vander Ley, B. L. (2022). Association of ARRDC3 and NFIA variants with bovine congestive heart failure in feedlot cattle. F1000Research, 11, 385.

Contact Neogen for more information at:
DNAhelp@neogen.com or at 877.443.6489
neogen.com
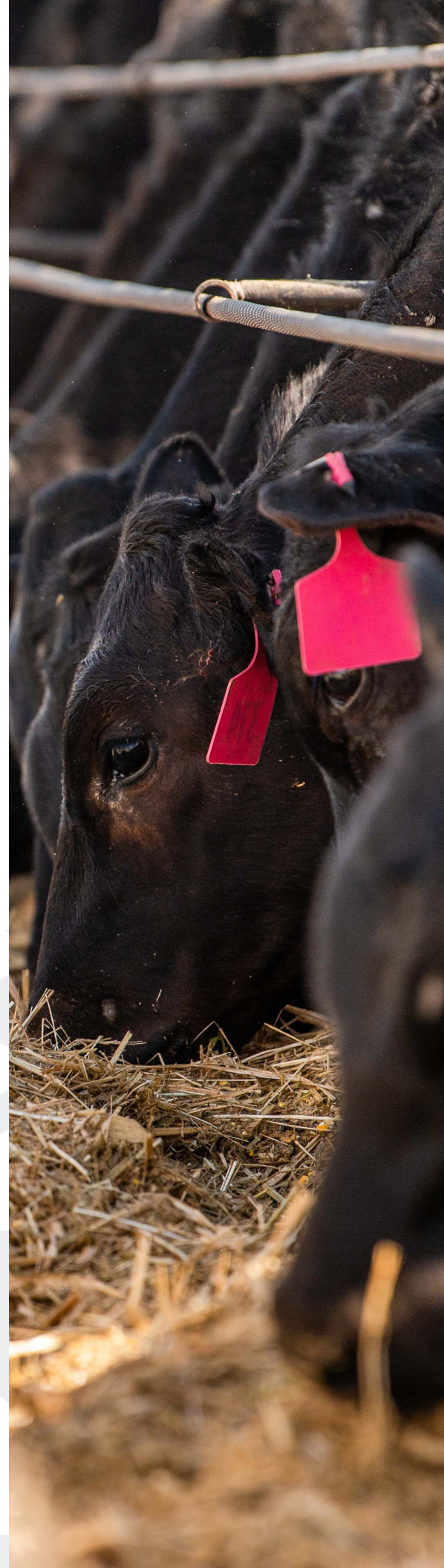
GENOMIC PROFILING WITH A DIFFERENCE

Neogen's genomic products include the genomic profiling of animals with one of our premium, proprietary genotyping platforms, which have been designed and developed to explain maximum genetic variation in each different breed population.

Igenity BEEF

Igenity Beef is a genetic profiling test specifically designed for commercial crossbred and composite cattle to assist producers in selecting, managing, and marketing their cattle with more confidence.

IGENITY BEEF USES DNA TO RANK THE GENETIC MERIT OF ANIMALS FOR 17 KEY TRAITS, INCLUDING:

MATERNAL: birth weight, calving ease direct, calving ease maternal, stayability, heifer pregnancy, docility, and milk
PERFORMANCE: residual feed intake, average daily gain, weaning weight, scrotal circumference, and yearling weight
CARCASS: tenderness, marbling, ribeye area, fat thickness, and hot carcass weight

IGENITY BEEF RESULTS CAN BE USED TO DETERMINE:

- **Calves with the highest genetic value**
- **Heifers to retain for your breeding herd**
- **Calves to keep as commercial sires**

Igenity FEEDER

Igenity Feeder brings genomic testing to a new sector of the beef industry, empowering producers at the stocker, backgrounder, and feedlot phase to make more informed decisions based on the genetic potential of feeder cattle.

With Igenity Feeder, you can easily verify a calf crop's genetic potential for growth and carcass characteristics using the Igenity Terminal Index. Cattle tested on Igenity Feeder receive Neogen's Days on Feed (DOF) Index to help feedlot operators group lots of cattle according to their optimal days on feed.

IGENITY FEEDER RESULTS CAN BE USED TO:

- **Quickly and accurately sort calves based on their genetic predisposition to grow and grade**

- **Pair the Igenity Terminal Index with Igenity Branded to market superior cattle for a premium on sale day**

- **Predict DOF, manage with precision, and optimize your head day with Feeder**

- **Calves tested with Feeder can qualify for Igenity Branded if they meet the qualifications listed**

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