GENETIC INNOVATION AS A PATHWAY FOR CARBON REDUCTION

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INTRODUCTION

Pork producers in the U.S. have a long history of continuous improvement. Over the past 50 years, advancements in housing, ventilation, nutrition, biosecurity, disease control, and reproductive technologies have significantly improved production efficiency and lowered costs [1]. In parallel, these same innovations have also contributed to a reduced carbon footprint. However, there is currently no mechanism for pork producers or supply chain partners to quantify and claim the carbon benefit attributable to pork with a lower environmental impact. At the same time, many companies in the pork value chain are pursuing Environmental, Social, and Governance (ESG) goals—particularly reductions in greenhouse gas (GHG) emissions within their supply chains. This collaborative initiative aimed to link genetic advancements that provide a carbon advantage at the farm level with a measurable reduction in GHG, which can be claimed by downstream stakeholders within the pork value chain.

MATERIAL AND METHODS

Life Cycle Assessment (LCA)

- An ISO-conformant life cycle assessment (LCA) was conducted to quantify the environmental impact of pigs with improved genetics. The LCA compared the carbon footprint of pigs with PIC genetic backgrounds to the 2021 average for North American pig production. The analysis included data from 1.1 million parent sows and 4.7 million growing–finishing pigs, drawn from 53 sow farms and 34 grow-finish systems. LCA practitioners used primary production records, industry benchmarks, research publications, and secondary databases to complete the analysis.

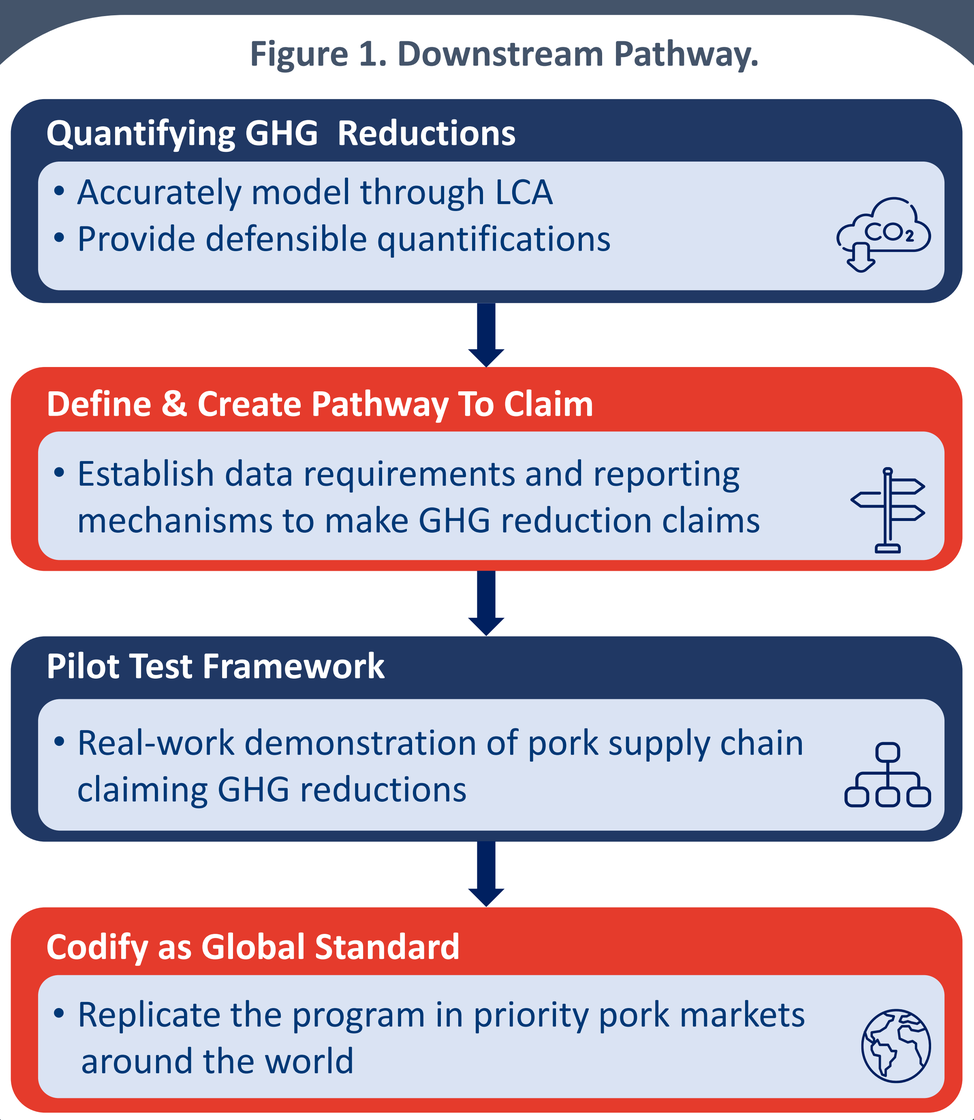
Framework for GHG Claiming

- A standardized approach for making credible GHG reduction claims based on genetic improvement was developed. Input was gathered from stakeholders across the pork supply chain—including producers, packers, retailers, and carbon market experts—to ensure broad applicability and scientific rigor. The resulting framework defines what to measure, when to measure, and how to measure in order to support defensible GHG claims. It was strengthened through two public comment periods (100+ stakeholder submissions), reinforcing its credibility and relevance to the pork value chain.

Enabling Scope 3 GHG Reductions

- The framework standardizes how genetic improvements can be recognized as a valid source of Scope 3 GHG reductions. This creates a pathway for downstream supply chain partners to incorporate farm-level genetic improvements into their corporate sustainability goals and emissions reporting (Figure 1).

Figure 1. Downstream Pathway.



RESULTS AND DISCUSSION

- Genetic innovation is recognized as playing a role in carbon reductions [1]. This can be attributed to improvements in carcass characteristics, litter size, and feed efficiency [2,3].
- The LCA determined that pigs with a PIC genetic background have 6.5% lower GHG emissions than the industry average [4].
- A finalized framework defines the technical requirements for claiming GHG reductions; it outlines what needs to be measured and tracked in order to support credible GHG reduction claims across the pork supply chain.
- This project pioneers both genetic innovation as a credible and defensible intervention to reduce GHG emissions and the associated claiming pathway for agricultural supply chains to leverage this intervention to attain their GHG reduction goals.

Table 1. Performance data from the PIC internal benchmark and the prominent industry benchmark. Means ± standard deviations.

	PIC-USA Internal Benchmark	North American Industry Benchmark
Sow performance		
Number of sows	1,093,952	1,273,698
Total number born	15.2 ± 0.68	15.1 ± 0.62
Number born alive	13.7 ± 0.62	13.7 ± 0.53
Weaning age (days)	21.4 ± 2.01	21.0 ± 1.42
Number weaned	11.6 ± 0.59	11.5 ± 0.62
Wean-to-finish performance		
Number of pigs	4,741,133	9,134,940
Start weight (kg)	5.98 ± 0.59	5.53 ± 0.39
End weight (kg)	129.0 ± 5.31	129.1 ± 2.09
Days on feed	158.7 ± 14.7	167.1 ± 5.15
Growth rate (kg/d)	0.77 ± 0.060	0.74 ± 0.023
Feed intake (kg/d)	1.96 ± 0.15	1.94 ± 0.11
Feed conversion ratio	2.55 ± 0.17	2.63 ± 0.12
Mortality rate (%)	6.30 ± 4.40	9.88 ± 3.48

*Developed from Thoma et al. (2024)

CONCLUSIONS

- Development of GHG claiming framework, used in conjunction with an ISO-conformant LCA, will demonstrate that genetic innovations can lead to a carbon savings compared to the national average for pork production. These carbon reductions are incremental to the normally expected improvement from standard genetic selection. This pioneering project demonstrates genetics as a credible, scalable intervention for carbon reduction, linking farm-level advancements to downstream ESG goals.

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