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GENETIC INNOVATION AS A PATHWAY FOR CARBON REDUCTION

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I. INTRODUCTION

U.S. pork producers have a long-standing commitment to continuous improvement. Over the past 50 years this has led to significant improvements in production efficiency and a smaller carbon footprint [1]. These improvements can be attributed to multiple factors including innovations in swine housing, facility ventilation, diet formulation, biosecurity, disease elimination, and reproductive technologies. Innovations in swine genetics have also led to significant improvement in litter size, feed efficiency, and growth rate compared to the industry average. While these improvements have reduced production cost, there is no mechanism for pork producers or supply chain partners to monetarily benefit from producing pork with a smaller carbon footprint. At the same time, many companies within the pork value chain are establishing Environmental, Social, and Governance (ESG) goals including reduction of greenhouse gas (GHG) emissions within their supply chain. Companies committed to credibly and defensibly quantify reductions in their scope 3 emissions and wishing to make associated positive label claims, have limited options to do so. Therefore, 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.

II. MATERIALS AND METHODS

The first step in this process was to establish an ecoservices framework to serve as a standard for companies making a GHG reduction claim based on genetic innovation. The Context Network (Context, Wes Des Moines, IA, USA), an agriculture-based consulting group, was engaged to develop the framework by gathering input from companies and individuals representing links across the entire pork value chain from pork producers to retailers. They also gathered input from carbon experts and potential purchasers or users of the GHG reductions. The result is a framework that outlines what to measure, when to measure, and how to measure to establish a scientifically sound, defensible claim. The framework was vetted through two periods of public comment and revisions and received more than 100 suggestions, reinforcing the credibility and application across the pork value chain.

A life cycle assessment (LCA) is a systematic, science-based analysis of the environmental impacts (including GHG emissions) associated with all stages of a product or process' life. LCA practitioners use data from a variety of sources such as primary production data, industry benchmarking data, secondary databases, and research studies to conduct the analysis. An LCA can inform product development and improvement, benchmark performance, and inform strategic planning. Additionally, an LCA lends credibility and defensibility to GHG emissions reductions, particularly if the LCA conforms to ISO standards. In alignment with the framework, an LCA was conducted comparing the carbon footprint of pigs with PIC genetic background to the 2021 average of North America.

A demonstration project has been convened to establish the feasibility, functionality and scalability of a data-driven market mechanism which will enable novel interventions, like genetics, to be quantified and claimed in the framework. This will enable a new value stream for stakeholders across pork supply chains associated with the scope 3 GHG reductions made at the farm level. This project will combine the framework with the ISO-conformant LCA to establish the magnitude of the GHG reduction. It will also test the Measure, Monitor, Report and Verify (MMRV) requirements and establish an accounting platform for the GHG reduction. Finally, it will facilitate price discovery in pairing pork producers who raise pigs with PIC genetic backgrounds with downstream partners who desire to claim scope 3 GHG reductions against their 3 GHG emission goals.

III. 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]. As innovative genetic techniques or

processes are developed and incorporated into the genetic background of pigs from a genetic supplier, pork producers can take advantage of associated GHG reductions. The Genetic Innovations Ecosystems Services Framework is the critical first step in valuation of the associated carbon asset. In addition to outlining the players in carbon credit value creation, it sets expectations for MMRV, additionality and causality, baseline quantification, project boundary, leakage and potential co-benefits. It also highlights the risks involved and the required next steps. The LCA determined that pigs with PIC genetic background have 6.5% lower GHG emissions than industry average. Thus, innovations in pig genetics have a positive environmental outcome compared to 2021 North American pig production.

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. The project is a first of its kind, simultaneously advancing the three co-necessities for sustainability in the pork industry; the productivity of the supply chain, the profitability of farmers, and the impact on the environment.

The completed framework [4] is available at:
https://porkcheckoff.org/pork-production-management/sustainability/#geneticframework

The associated LCA entitled *A Life Cycle Assessment Study of the Impacts of Pig Breeding on the Environmental Sustainability of Pig Production* [5] can be found at:
https://www.mdpi.com/2076-2615/14/16/2435

IV. CONCLUSION

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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