

Commentary

A Commentary on Extension Programming: An Overview of the Extension Program Related to Genetic Selection and Profitability on Dairy Farms

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JEL Codes: Q14, Q16

Keywords: evaluation, Extension program, farm management, genetic selection

Abstract

This commentary describes an Extension program that was developed from an academic research project. The program titled “Dairy Genetics: How does investment in genetics impact dairy farm profitability?” was developed for the 2025 Agricultural and Applied Economics Association (AAEA) Graduate Student Extension Competition. This program takes academic research and provides meaningful transitways to disseminate research results to applicable audiences. The delivery plans include in-person presentations, a podcast recording, two popular press articles, and an online fact sheet.

1 Introduction

Farm management is a key principle for success in farming operations. We analyzed the relationship between genetic selection and farm profitability to identify key management strategies for dairy producers as they establish the next generation of cows in their herd, and we developed an Extension program to disseminate results. The Extension program was presented as part of the 2025 Agricultural and Applied Economics Association (AAEA) Graduate Student Extension Competition. The delivery plans include in-person presentations, a podcast recording, popular press articles, and an online fact sheet. The Extension program was created using the principles of a logic model, which has three key components: inputs, outputs, and outcomes. These components are addressed in the next three sections, in which the underlying research is a key input, the Extension program is the output, and the outcomes are identified with the program evaluation. Referencing and using the logic model as a basis for structuring the Extension program is valuable in learning the skills and components for future work and programming.

The objective of this Extension program commentary is to describe the development of an Extension program. To provide more context, Section 2 outlines the issue that we addressed and summarizes the academic research that the extension program is based on. Section 3 describes the development of the extension program and key components to consider in the development phases. Section 4 discusses the program’s evaluation process, and Section 5 concludes.

2 Summary of Economic Research

In agriculture, producers are often price-takers, and markets are highly competitive. Thus, it is critical for producers to manage their operations efficiently. The Extension program described in this commentary is a result of academic research. This research focused on one management decision—genetic selection—and how the future herd genetic composition drives profitability on dairy farms. The primary question, or problem, of interest that was addressed by this work is “How does genetic selection within my herd influence my farm’s financial performance?” The Extension program described in this commentary relays

these findings to the appropriate audiences. Genetic selection is an important management decision for producers to consider; often, improved genetics are more expensive, while also being correlated with increased revenues from more productive dairy cattle. This research evaluates the tradeoff between costs and returns of genetics and its impact on farm profits. This work is relevant as the dairy industry is highly volatile in both input and output prices, such as feed costs and milk prices, so producers must implement management strategies to remain economically viable in the dairy industry. Specifically, the underlying problem that this program addresses is the financial outcomes of dairy operations from investment in their herd's genetic composition as a management strategy.

The objective of the research used to develop the Extension program was to evaluate the association between average sire net merit management decisions and farm profitability for Minnesota dairy farms from 2012–2018 using a unique herd–year dataset ($N = 227$) containing production data for dairy cows, sire net merit, and the respective financial information for the farm (Weir et al. 2025).¹ Genetic data were from the Council on Dairy Cattle Breeding (CDCB 2024), and farm financial data were from FINBIN (2022a,b). These data included all farm revenues and expenses and allowed for calculations of multiple profitability measures. We evaluated the relationship between investment in genetics and farm profitability by analyzing a genetic index, net merit, and the individual traits in the data (Weir et al. 2025). Net merit measures the expected lifetime profitability of a dairy cow in dollars by ranking US dairy cattle (VanRaden et al. 2021). The genetic index is a weighted average of several economically relevant traits, which include milk yield, milk components, productive life, and others. The traits included in the index vary by breed. For example, Holstein cattle have 39 traits in the index.² In our analysis, we analyzed both the net merit index and the contributions of the individual net merit traits that might be driving profitability. Ordinary least squares models were estimated for four profitability measures: rate of return on assets (RROA), operating profit margin (OPM), net farm income (NFI), and net farm income per cow (NFI per cow), with the formulas for these profitability measures reported in the appendix. The RROA measures the return on all investments of the farm and is considered a long-term profitability measure, whereas the OPM is a short-term profitability measure that measures the percentage of farm revenue retained as profit. NFI is the difference between total revenues and expenses on the farm. We include it in the analysis as an easily interpretable measure, but it is not a preferred measure of profitability as it is highly correlated with farm size. Therefore, we also include a standardized measure, net farm income per cow.

Results indicated that herd sire net merit has a positive and statistically significant relationship with RROA, NFI, and NFI per cow. A \$100 increase in the herd's sire net merit was associated with a 0.6-percentage-point increase in RROA, a \$12,100 increase in NFI, and a \$87 increase in NFI per cow, all else equal.³ A few of the individual net merit traits showed significant relationships with profit, but most of the individual traits did not.⁴ We concluded that it is not individual traits but rather the collective group of traits that influenced profitability. Thus, when selecting genetics, results confirmed that it was most effective to select sires based on an economic index rather than on specific traits. This result serves as a practical farm management strategy recommendation, which serves as the foundation for the Extension program developed.

¹ Sire net merit refers to the bull genetics, and the dam is female genetics. This research focused on sire, or bull, genetics, assuming that dam genetics are more fixed within a herd and that producer decision-making primarily comes from sire genetics.

² Holstein is a common breed of dairy cattle. The categories of traits considered in the net merit index include yield, health, fertility and calving, conformation, and feed efficiency.

³ The full study, including additional details and results tables, is available in Weir et al. (2025).

⁴ The data include 18 individual traits; for each of the four profitability measures (OPM, RROA, NFI, and NFI/cow), three, four, seven, and six traits, respectively, that held statistically significant associations.

3 Extension Program Development

An Extension program was developed from the research results as a submission to the AAEA Graduate Student Extension Competition. The overall goal of the program is to disseminate research findings to the applicable target audience to enhance the profitability of dairy farms. The key finding from the research was that genetic selection, measured by net merit, was positively associated with profitability. The Extension program will deliver core results to the target audiences to provide valuable management strategies. Three key components were considered in developing this program: identifying the target audience, setting program goals (short- and long-term), and determining delivery methods.

3.1 Target Audience

The primary audience for this program is dairy producers and dairy farm managers. We focus our dissemination of results on this group as the management recommendations are applicable to their operations. Providing this group with science-based insights and information can enhance the viability of operations. The underlying research was based on data from Minnesota dairy farms, but the results are applicable nationwide. A secondary audience is artificial insemination (AI) sales representatives, who will have goals and expectations within their respective organizations that will serve as their primary operating procedures. We consider the results and outreach activities applicable to them as well, even though their goals and expectations may not directly align with the outcomes of the previously conducted study. Each target audience has specific goals, described next.

3.2 Program Goals

The program for dairy producers and dairy farm managers has three goals: increasing knowledge, increasing confidence, and making behavioral changes. The first goal includes increasing producers' knowledge in four areas: (a) herd genetics, (b) the net merit index, (c) how individual traits impact the net merit index, and (d) the purpose and structure of the National Cooperative Dairy Herd Improvement Program (NCDHIP).⁵ The second goal focuses on increasing producers' confidence in selecting the sires or genetics for their operations, and the last goal is to identify and promote behavioral changes in the selection of genetics such that their selection is based on a better-informed decision. The first two goals are short-run or tactical goals, whereas the third goal provides the long-run impact of the program. The long-run impact of accomplishing these objectives is improved profitability and long-term herd stability for the operation. While milk prices, feed costs, and interest rates will fluctuate, improving the efficiency of dairy cattle can mitigate some production risk and enhance dairy farm financial performance.

For AI sales representatives, the primary goal is to strengthen the conversation between the representatives and producers. While not directly integrated into the research component, this group provides a link to the genetic selection of producers. Specifically, we expect that after participating in the programming, sales representatives will be more equipped to understand the producer decision-making process, given that each producer is maximizing their profitability subject to individual constraints. We also anticipate that this will improve the tailoring of recommendations to meet producers' needs.

The goals for these groups are integrated. Specifically, this work anchors on the goal of having genetic selection be a collaborative discussion and decision between both the dairy producer and the AI sales representative. As such, dairy producers receive informed suggestions for their genetic selections, which impact herd longevity and financial performance, and the collaborative decision-making process establishes strong relationships between sales representatives and their customers.

⁵ The NCDHIP is a collaborative effort to collect cow-level production, health, and genetic data from dairy herds to provide a public good that serves as input for dairy cattle genetic advancement.

3.3 Delivery Methods

This Extension program utilizes several communication channels to increase reach among dairy producers and sales representatives and to inform them about the study results. The methods include providing in-person presentations, a podcast recording, and written materials. The in-person presentations will be integrated into already established events which include the Carver County Dairy Expo and the University of Minnesota (UMN) Extension's Winter Dairy Series. The podcast, which is geared towards providing informational conversations to assist beef and dairy producers' success, has been recorded through the UMN Moos Room (University of Minnesota 2025b). The written output includes two components. A fact sheet will be made available on UMN Extension's Managing a Farm-Farm Finance webpage (University of Minnesota 2025a), and two popular press articles will be featured in the *Dairy Star* newspaper, which reaches a broad range of dairy producers and stakeholders in Minnesota, and the *Progressive Dairy* newspaper, which has a national reach (Weir 2025).

We understand that individuals have different preferences for consuming information, and we aim to address this delivery challenge by using multiple communication methods. Across multiple channels, we aim to reach a larger target audience, assuming that producers and sales professionals receive their information through different channels.

4 Extension Program Evaluation

A key part of Extension programs is evaluating their impact. Extension programs are evaluated for a variety of reasons, including assessing their effectiveness for the target audience, learning to improve future programs, and ensuring funding accountability.

The evaluation plan for this Extension program is focused on the informational content of the in-person communication methods (Carver County Dairy Expo and the UMN Extension's Winter Dairy Series), whereas the podcast and online fact sheet will be evaluated by the reach of the content. For the podcast, we will document the number of downloads and the location of listeners, and for the fact sheet, we will record the number of downloads. The remainder of the evaluation discussion herein focuses on the in-person presentations. We will record the number of attendees as well as gather information from attendees through a survey.

Based on the goals, we develop evaluation questions for each target audience to measure the impact of the Extension program. The questions for dairy producers are as follows:

After participating in the extension program, did you

- (1) increase your knowledge of genetic selection and its impact on farm profitability?
- (2) improve your understanding of the net merit index and individual traits?
- (3) increase your confidence in selecting genetics for your operation?
- (4) change your behavior in selecting genetics for your operation?

Questions 1–3 are directly measurable and will be evaluated at the end of the program. These correspond to short-run outcomes, and we expect a relatively high response rate given the distribution method and limited time investment required to respond. The fourth question relates to the long-run effects of participating in the program. We intend to evaluate this via site visits or phone calls 3–6 months after participating in the Extension program. Producers will have the option to opt in to these follow-ups on the survey distributed at the end of the program participation. The ultimate long-run goal of increasing profitability and herd longevity is not to be evaluated initially, given the biological process of cows and thus the inability to measure that impact in a timely manner. However, through repeated interactions with these producers and a commitment to developing a relationship with them as Extension

professionals, we will aim to measure the long-term goal by continuing site visits and phone calls to track and document the program's long-term economic impact.

We develop a similar survey for the AI representatives based on the previously identified goals, but for this group, we will collect email addresses as part of the registration process and send an evaluation survey 1–2 weeks after in-person participation, such that we are still receiving short-run, but not immediate, responses.

5 Conclusion

This commentary provided the details of establishing an extension program. The program was initially developed for the AAEA Graduate Student Extension competition, and outreach activities are currently underway. This commentary discussed problem identification, supporting research, and extension program development, which included identifying the target audiences and the goals for these audiences, as well as the delivery methods. Last, we described our evaluation method based on the program's delivery methods. This contributes to the literature on the development of an Extension program stemming from academic research.

Dairy producers are constantly challenged to be adaptable and to consider various management strategies to enhance the economic viability of their operations. The Extension program outlined in this commentary addressed management decisions related to genetics and described how these choices influence a farm's profitability. Continuing to develop Extension programming to support producers is valuable and essential for long-term financial resilience.

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Acknowledgments: The authors of this work report no conflicts of interest. This work received no financial support. There was no use of AI in the development of this manuscript.

Appendix

Formulas for profitability measures based on Farm Financial Standards Council (Center for Farm Financial Management 2022):

$$OPM = \frac{(NFI + \text{interest expense} - \text{opportunity cost of labor and mgmt})}{\text{Total Revenue}}$$
$$RROA = \frac{(NFI + \text{interest expense} - \text{opportunity cost of labor and mgmt})}{\text{Average Assets}}$$
$$NFI = \text{Total Revenues} - \text{Total Expenses}$$
$$NFI \text{ per cow} = \frac{NFI}{\text{Total herd size}}$$

References

- Center for Farm Financial Management. 2022. *Farm Financial Scorecard*. Available online: <https://www.cffm.umn.edu/wp-content/uploads/2019/02/FarmFinanceScorecard.pdf>
- Council on Dairy Cattle Breeding (CDCB). 2024. *Top Animal Listing* [database]. Available online: <https://uscdbc.com/> [Accessed January 3, 2024]
- FINBIN. 2022a. "Livestock Enterprise Analysis" [data file]. Available online: <http://finbin.umn.edu> [Accessed April 6, 2022]
- . 2022b. "Whole Farm Enterprise Analysis" [data file]. Available online: <http://finbin.umn.edu> [Accessed April 6, 2022]
- University of Minnesota. 2025a. "Farm Finance." Available online: <https://extension.umn.edu/business/farm-finance>
- . 2025b, October 6. "How Genetics Drive Dairy Profitability: Insights from Minnesota Herds." *UMN Extension's The Moos Room*. Available online: <https://moosroom.transistor.fm/episodes/episode-315-umn-extensions-the-moos-room>
- VanRaden, P.M., J.B. Cole, M. Neupane, S. Toghiani, K.L. Gaddis, and R.J. Tempelman. 2021. *Net Merit as a Measure of Lifetime Profit: 2021 Revision*. USDA Agricultural Research Service, AIPL Research Report NM\$8 (05-21). Available online: https://www.ars.usda.gov/ARSUserFiles/80420530/Publications/ARR/nmcalc-2021_ARR-NM8.pdf
- Weir, R.L. 2025, October 25. "Does Genetic Investment Improve Profitability?" *Dairy Star*. Available online: <https://cdn6.creativecirclemedia.com/dairystar/files/20251024-085628-cd8-10-25-25-Zone1.pdf>
- Weir, R.L., I.W. Haagen, C.E. Ambrozek, C.D. Dechow, and J.C. Hadrich. 2025. "Association of Sire Net Merit with Farm Profitability for Minnesota Dairy Farms." *Journal of Dairy Science* 108(7):7224–7234. <https://doi.org/10.3168/jds.2024-25922>

DOI: <https://doi.org/10.71162/aeed.140101>

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