



Practical tools for assessing and improving a farm's environmental footprint: an example from the United States

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In 2017, the National Milk Producers Federation (NMPF) initiated a new component of the Farmers Assuring Responsible Management (FARM) Program: FARM Environmental Stewardship (ES). The FARM ES program tracks and communicates a farm's environmental achievements. The tool uses a model that is scientifically robust – it explains 98% of the variability in total GHG footprint across farms – while only requiring a limited amount of farm data. Over 1,800 dairy farms have completed a FARM ES assessment through the end of 2020. FARM ES supports farms in identifying opportunities to improve efficiency and productivity; the farm's environmental footprint; and internal management systems. Cooperatives and dairy processors can use FARM ES to collect on-farm GHG emissions data in a consistent and streamlined way; helping dairy farmers and the entire U.S. dairy value chain demonstrate its commitment to environmentally responsible production.

Abstract

Translating the concept of circular economy into the practical and actionable requires farmer-friendly programs and tools. In 2017, the National Milk Producers Federation (NMPF) initiated a new component of the Farmers Assuring Responsible Management (FARM) Program: FARM Environmental Stewardship (ES). The FARM ES program tracks and communicates a farm's environmental achievements. The online tool combined with the program's resources assist farms with pursuing continuous improvement in ways that align with business goals. Some of the program's key features include:

Introduction

- Strong scientific basis with periodic updates.
- Implemented by a network of trained, 2nd party evaluators.
- Offers farms resources for continuous improvement.
- Enables supply chain reporting and collaboration.

Methods

Enrollment and training

Dairy cooperatives and proprietary processors in the United States are eligible to enroll in FARM Environmental Stewardship (ES). Their staff complete a training program to become certified, second-party evaluators. The training program is self-paced and online. It is composed of 7 discrete modules. The purpose of the training is to equip evaluators with knowledge on how to collect the data inputs and interpret results. The training encourages consistent program implementation across organizations involved in FARM ES.

Selecting farms

Dairy cooperatives and processors can use the FARM ES Random Sampling Protocol to enroll a representative sample of their farms in the program. The protocol is based on a stratified random sampling method. The stratifying factors used in this protocol are: 1) quartile of Fat and Protein Corrected Milk (FPCM) produced on a dairy in a day, and 2) geographic region defined as the first 3 digits of the dairy zip code. In order to streamline the selection process for dairy cooperatives and milk marketing organizations, a Microsoft Excel spreadsheet has been created that performs the necessary calculations to select farms according to the protocol

Evaluation process

FARM is implemented through a network of trained, second-party evaluators. Evaluations can be conducted on-site, remotely, or a combination of both approaches. The steps of an evaluation are generally:

1. **Pre-Visit:** The evaluator schedules a visit or phone call with the farm to conduct the evaluation. The evaluator provides the farm with resources and information to prepare, such as the FARM ES Evaluation Prep Guide.
2. **Evaluation:** Data is collected from the farm. The data is entered into the FARM ES platform through either the web portal or the app.
3. **Results:** The FARM ES platform provides the farm's carbon and energy use footprints. The evaluator reviews the results with the farm and discusses considerations for improvement.

Resources

Several resources have been developed and released as part of the FARM ES program to support evaluators and farmers during evaluations:

- The FARM ES User Guide helps evaluators and individual farmers input their data into the FARM ES platform. It explains which resources may contain the data on their farm, as well as answers common questions about how to interpret each measure.
- The FARM ES Evaluation Prep Guide is a resource for farmers to learn about the program and prepare for an evaluation.
- The FARM ES Data Gathering Sheet facilitates process of collecting information by capturing all of the required data input into an Excel sheet or fillable PDF.

FARM ES estimates farm-level GHG emissions and energy intensity using a scientific, peer-reviewed model. The FARM ES model was generated out of a life cycle assessment (LCA) published in April 2013 (Thoma *et al.*, 2013). The study collected data from 536 farms covering a wide range of management practices. Authors of the study published another paper that proposed using the lifecycle assessment results and narrowing down the inputs into a simplified model for on-farm use (Asselin-Balençon *et al.*, 2013). The model is intended to create an accurate and representative tool for farmers to determine and potentially reduce their cradle to farm gate carbon footprint. The simplified model strongly reduces the farm specific data requirement from 162 animal-rations in the detailed LCA survey to 12 feed rations for lactating cows, while explaining 91% of the variability in feed print and 98% of the variability in total footprint.

Model

The FARM ES evaluation includes key data inputs that highlight circular economy concepts – including ration composition and manure management strategies. The full list of data inputs is located at nationaldairyfarm.com. The following summarizes model inputs:

Inputs

- Milk Production: total annual milk production, annual average protein and fat content.
- Herd Profile: average herd size, average % dry, calves / heifers raised on and off farm, cows.
- Energy Use: annual total energy used by category (electricity, diesel, gasoline, etc.), solar / wind generated.
- Feed: time spent on pasture, average daily DMI, ration breakdown on dry matter basis.
- Manure and Nutrient Management: types of manure management systems, use of digester or solid-liquid separation.

The evaluation results are life cycle based, representing all the GHG emissions and energy use associated with the farm's milk production from cradle to farmgate. The emissions footprint is broken down by source: feed production, on-site manure management, on-site enteric fermentation, and on-site energy use. The energy results are divided into feed production and on-site energy.

Outputs

“On-site” refers to dairy activities on the farm. If the operation purchases feed and does not engage in feed production activities, the output will still generate an estimate for the environmental impacts of the purchased feed.

Results are compared to regional and national averages. These averages come from the industry's LCA research. Benchmarks for feed production emissions are not available in the current version (Version 2.0) of the tool.

FARM ES supports farms in improving their environmental footprint in ways that align with business goals. The primary resource to aid in this effort is the FARM ES Reference Manual. The FARM ES Reference Manual offers science-based considerations on ration formulation, forage quality and concentrate management, manure management, energy efficiency as well as animal health, nutrition and cow comfort to achieve gains

Results

Farm benefits

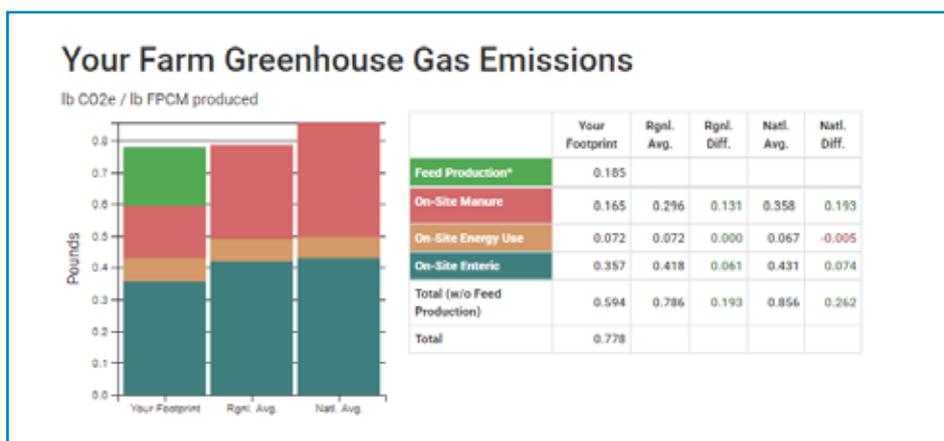


Figure 1. Sample FARM ES output.

in productivity, feed efficiency, and GHG emissions intensity. In other words, the FARM ES Reference Manual offers ideas for management practices, technologies and other considerations that can help reduce on-farm GHG emissions and energy use *in ways that make business sense*. For example, improving herd health and optimizing ration formulations are key opportunities.

The FARM ES Reference Manual benefited from independent review and input by a panel of subject matter experts – the Technical Review Panel – led by the World Wildlife Fund (WWF). The panel’s goal was to ensure FARM Environmental Stewardship provides a best in class guide to support farmers in understanding the FARM ES results and to identify opportunities for improvement. The panel was comprised of farmers, academics, processors, and conservationist.

Additionally, use of FARM ES can lead to improved internal management systems. Farms must gather documents and records to complete the FARM ES evaluation: nutrient management plans, milk production records, crop production data, and more. Collecting and reviewing these records in one place is a chance to think about on-farm management in a new way. Farms report creating or improving systems to track data as a result of the FARM ES evaluation, which can enable better management over time.

Finally, FARM ES is an opportunity for a farm to demonstrate its commitment to natural resource stewardship. U.S. dairy farms improved their carbon footprint by 19% between 2007 and 2017 (Capper and Cady, 2020). And they continue to innovate by adopting new technologies and management practices. FARM ES captures these efficiency gains and helps identify opportunities to continue the path toward continuous improvement. By addressing a topic that society views as an urgent natural resource risk – GHG emissions – the program helps strengthen consumer confidence and maintain U.S. dairy’s leadership position in the global marketplace.

Participation and sharing our progress

Since program inception, the FARM ES evaluation has been implemented on more than 1,800 farms by 38 different cooperatives and processors (Figure 2). With each FARM ES evaluation, farmers, cooperatives and processors can assess change over time, identify areas of operational improvement, and report progress to their customers. Indeed, dairy processors, retailers, and food service customers are making public commitments to

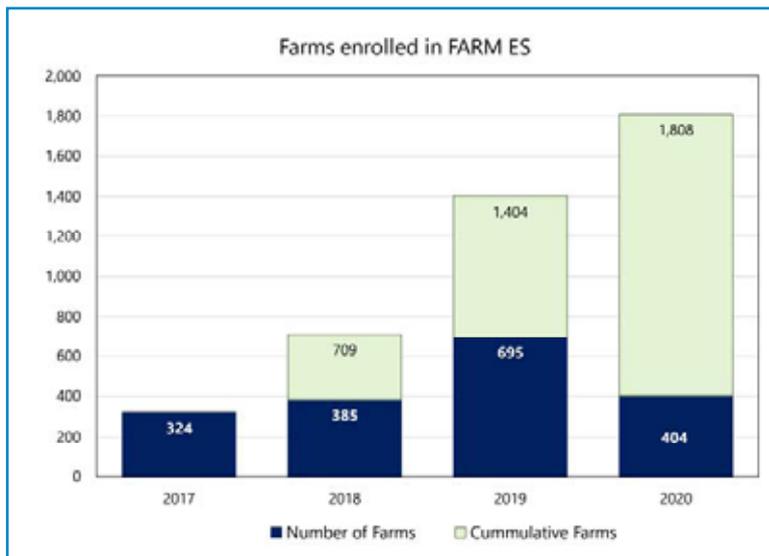


Figure 2. Farm enrollment in FARM ES by year of first evaluation.

reduce the environmental footprint of their products. These commitments include targets to reduce the GHG emissions of their entire supply chain beginning at the farm level. To meet those targets, dairy buyers are asking cooperatives and dairy processors to provide aggregated farm-level data on GHG emissions.

Cooperatives and dairy processors can use FARM ES to collect on-farm GHG emissions data in a consistent and streamlined way; helping dairy farmers and the entire U.S. dairy value chain demonstrate its commitment to environmentally responsible production.

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