How does feed production influence GHG emissions?

GHG Fact Sheet Series

FEED PRODUCTION AND PASTURE EMISSIONS BASICS

Activities like tillage, planting, irrigation, harvest, grain drying, pasture management, and nutrient application all influence GHG emissions.

Note: FARM Environmental Stewardship users are not asked about their unique feed production practices because the model uses the dairy LCA research to make well-informed assumptions about typical regional practices.

FACTORS THAT INFLUENCE EMISSIONS FROM FEED

GHGs emissions during feed production or grazing can come from energy usage or nutrient application and are influenced by soil type, soil health, temperature, weather conditions, and other various factors.

Nutrient application: Machinery used to spread manure or apply fertilizer requires fuel use, which releases GHGs. Nutrients applied to fields also result in GHG emissions by emitting nitrous oxide (N_2O).

Leaching and volatilization: When excess nutrients are applied to crops or pasture, volatilization and leaching can occur, resulting in the loss of available soil nitrogen. Volatilization occurs when urea changes to ammonia gas, releasing nitrogen to the atmosphere. Leaching can occur with excessive rainfall, draining away available nitrate from crops.

Feed production makes up about 26% of farmgate GHG emissions.[1]

Soil health: Soil health directly relates to a soil's ability to supply water, nutrients, and support plant growth. When farmers implement climate-smart practices that maximize carbon storage, soil captures and stores water, cycles nutrients, and increases overall productivity.

Equipment use: Feed production uses energy for various farm operations such as powering irrigation systems and fueling farm equipment. Energy use and electricity are created through the burning of fossil fuels, which contribute to GHG emissions.

Upstream emissions: Upstream emissions from feed production are those that occur prior to production activities on the farm. Examples are the manufacturing of pesticides and synthetic fertilizers.

OPPORTUNITIES FOR IMPROVEMENT

Reducing energy usage and pursuing energy efficiency through equipment maintenance, limiting idling time to less than 10 minutes, and other strategies can reduce fuel use, lower costs, and lower the operation's carbon footprint. Reference the energy use one-pager in FARM's GHG Fact Series for ideas to reduce emissions from machinery/equipment use.

[1] Adapted from Thoma 2013, *Regional Analysis of greenhouse gas emissions from USA dairy farms. A cradle to farm-gate assessment of the American dairy industry, circa 2008*. https://www.sciencedirect.com/science/article/pii/S0958694612002051

Nutrient management principles – familiar to and used by dairy farms today – have the potential to reduce GHG emissions. Nutrient management plans (NMPs) document crop and soil nutrient needs as well as application of nutrients to crop fields. The 4R method uses best management practices that get the most efficient use out of applied fertilizer and manure. The 4R framework for nutrient stewardship includes[2]:

Replacing synthetic fertilizer with manure is an opportunity to reduce emissions.

- Right source: Determine if the nutrients being made available to crops are sufficient for those crops nutrient uptake.
- Right rate: Match the amount of nutrients applied to uptake to ensure there is no excess nutrients impacting GHG emissions.
- Right time: Plan nutrient availability to match crop demand, considering factors like weather conditions and season (e.g. close to planting to match crop uptake).
- Right place: Place nutrients where they can be best absorbed to avoid excess GHG emissions.

For example, testing manure nutrient content supports implementation of the 4R concept. As a note, each farm's practices will look different according to their cropping needs and geography.

Field-level conservation practices can help improve soil quality and carbon sequestration. Practices like cover cropping, crop rotation, rotational grazing, no-till, and conservation tillage promote the accumulation of organic matter in the soil and support carbon sequestration. Some of these practices mean fewer field passes, resulting in fuel savings and emissions reductions. Such practices can also help maintain biodiversity and soil health. Each practice should be evaluated within the context of the farm's unique situation as not every practice is appropriate or beneficial for every farm.

Carbon sequestration reduces atmospheric carbon through capture and storage: a great opportunity for agriculture to mitigate climate change.

LEARN MORE

- Field to Market
  https://fieldtomarket.org/
- MSU Extension: Management of Nitrogen Fertilizer to Reduce N_2O Emissions from Field Crops
  https://www.canr.msu.edu/resources/management_of_nitrogen_fertilizer_to_reduce_nitrous_oxide_emissions_from_fi
- The Nature Conservancy: AgEvidence
  https://www.agevidence.org/
- US Farmers & Ranchers in Action: Nutrient Cycling Resource Center;
  https://usfarmersandranchers.org/our-work/nutrient-cycling-resource-center/

[2] Rogers, E. (2019, May 13). *The 4R's of Nutrient Management*. MSU Extension Field Crops. Retrieved from https://www.canr.msu.edu/news/the-4r-s-of-nutrient-management