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The value of measuring a farm's environmental footprint

Julie Berry

PRO-DAIRY and the Northeast Dairy Producers Association hosted a panel discussion on greenhouse gas management in the dairy industry at the Northeast Dairy Management Conference. An excerpt is shared below.

"A lot of commitments are being made on behalf of the dairy industry for greenhouse gas reductions," said Karl Czymmek, PRO-DAIRY Dairy Climate Leadership specialist who moderated the panel. "We have the New York Climate Leadership and Community Protection Act and legislation in other states. The Innovation Center for U.S. Dairy has made commitments for greenhouse gas neutrality by 2050. Many companies are also making science-based, target-initiative commitments for greenhouse gas (GHG) reductions. Over 5,000 companies around the globe have made public commitments. A number of those are companies involved with dairy, company names that you would recognize.

So, what does that have to do with a dairy farm? For any company with milk in the supply chain, about three-quarters of the carbon footprint of a gallon of milk occurs before the milk truck picks it up. Since much of the GHG footprint of milk is at the farm or comes from things we buy to support our dairy farms, companies that use milk must also find ways to reduce emissions from dairy farm activities to meet GHG commitments they have made. So, this is not just about reducing greenhouse gas emissions from milk processing, refrigeration, packaging and transportation; dairy farms are being called upon to reduce emissions as well. This is why a lot of attention is being focused on dairy."

What are you working on today? And what do you think farmers should know about in this greenhouse gas space?

MIKE VAN AMBURGH, PROFESSOR, ANIMAL SCIENCE, CORNELL UNIVERSITY

One of my frustrations is that a lot of work is being done to find a magic bullet to eliminate methane. However, the cow had 40 million years to figure out the fermentation pattern. And the bacteria we're working with is 1.8 billion years old and made the first environment on the earth. So, it's smart and old, and I don't think we're going to outsmart it that fast. But what that does mean is that everything that we've been doing for the last 40 years is very important. It comes down to feed efficiency. How much milk and milk components can we get from a cow per unit of dry matter intake? I will tell you with the current genetic capacity of the cow, and as a nutritionist who helped develop a formulation model, I don't think we know where their requirements for amino acids and fatty acids are right now because of genomics. The point is we have to work to be as efficient as possible and work to reduce the intensity of methane, while we try to figure out how to find something that abates it directly. I'm focused on the nitrogen side. Farmers are going to be under severe pressure on nitrogen, and we are overfeeding protein to cows. We have opportunities to reduce protein being fed to cows so that less nitrogen is excreted as urine, and with this comes more opportunities for true precision feeding with amino acids, and more precise nitrogen supplies. We're working hard to figure out how to fix that aspect of nutrition. But we all are going to have to come together on that. You will have to learn to think a little differently than you do about how diets are formulated. Some of you will say that new approach looks expensive. Well, on the surface it is, but with some adjustments in the diet to get the right nutrients, we can take cows from 4.2 to 4.6 or greater butterfat and increase milk protein at the same time with the same dry matter intake.

LAUREN RAY, AGRICULTURAL SUSTAINABILITY AND ENERGY ENGINEER, CORNELL CALS PRO-DAIRY

On the manure management side, up through storage before field

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application, the Dairy Environmental Systems team is focused on measuring on-farm manure liquid or slurry storages of various types, ranging from anaerobic digested and separated effluent to untreated. We need to understand the on-farm measurements we're seeing long-term, so we're doing this work over two years at various manure storages, to analyze how they align with the estimated emissions (predominantly methane) using available equations. Right now those equations are pretty gross - the information that goes into the accounting is not very refined. And we are anxious to better understand that so we can inform state-level program development to quantify, measure, monitor, and show how greenhouse gases and methane can be reduced with various on-farm practices, some of which are already in place on N.Y. dairy farms. Associated with this work also is looking for ways to evaluate methane losses from systems that are supposed to contain biogas. This includes anaerobic digester-to-energy systems and covered and flared manure storage systems. We need to understand how they are performing and if there are common loss points. We have tools that allow us to see methane losses from those systems that helps us inform how these systems are performing, how practices are reducing greenhouse gas emissions, and what we need to improve. We are also investigating the carbon accounting of manure anaerobic digestion to renewable natural gas systems, to understand how greenhouse gases are quantified, and work closely with the state on other climate-smart practices.

KIRSTEN WORKMAN, NUTRIENT MANAGEMENT AND ENVIRONMENTAL SUSTAINABILITY SPECIALIST, CORNELL CALS PRO-DAIRY

Historically, we focused more on phosphorus losses in our dairy crop fields as we worked to protect water quality in the Northeast. However, for greenhouse gas emissions when we're talking about our field practices, whether that's the application of manure, tillage, or fertility, the biggest concern is nitrogen and nitrous oxide emissions. Like PRO-DAIRY Dairy Environmental Systems is measuring emissions from manure storages,

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Julie Berry

A Cornell panel including Olivia Godber, Lauren Ray, Kirsten Workman, and Mike Van Amburgh, facilitated by Karl Czymmek, discussed reducing the dairy environmental footprint at the Northeast Dairy Management Conference.

we're measuring GHG emissions from the field. We have a big project measuring the greenhouse gas emissions from real farm fields in New York state that compares "business as usual" manure and tillage practices to a suite of soil health and climate-smart practices and measures GHG emissions, soil health and production/yield parameters. We're also looking at larger sustainability metrics. For example, if we're going to feed less nitrogen to the cow, what does that look like for our fertility source, and how do we then manage that nitrogen most efficiently? We're also looking at soil health and water quality impacts of our cropping systems and manure applications, as well as the value of manure, which we've been talking about for decades. We know manure is a valuable resource. Keeping that resource on our farm, using it effectively, and being highly efficient with the circular nature of a dairy farm's nutrients, will continue to be important.

Most of the greenhouse gas emissions from manure handling and storage around the farm is methane. On the crop side, nitrous oxide dominates, a very potent greenhouse gas. And then back on the cow side of things, it's methane again. So, something like 70 to 80 percent of dairy-related emissions are methane. And that's another reason why dairy is a focus.

OLIVIA GODBER, RESEARCH ASSOCIATE, NUTRIENT MANAGEMENT SPEAR PROGRAM, CORNELL UNIVERSITY

My work with the Nutrient Management Spear Program, through the dairy sustainability project, is to look at the tools available for dairy farmers that bring together all these pieces. Lauren explained the complex equations. We're looking to identify tools that bring all that robust, complex science together, using easily obtainable information from the farmer, and still give an accurate evaluation of how a dairy farm is performing at that whole-farm level. Within our group we have the nutrient mass balance calculator, which is a whole-farm tool that looks at nutrients, simple inputs and outputs, on the farm. We're now looking to identify greenhouse gas tools that work similar to that and give us a meaningful result to evaluate how a farm is performing. We're looking at the whole-farm level because homegrown feed is so important in this region - we want to capture what the cow is doing and what the crops are doing. We want to pull all this information together, with as many different types of farms in the region as possible, so we can say with confidence, how is the region performing? How do we compare to other regions in the U.S. or even globally? Where are our strong points? What good practices are already being done successfully? And how can we acknowledge those? What is our future potential? Where can the dairy industry get to and what is feasible for dairy farmers to achieve without compromising economics?

KARL CZYMMEK, DAIRY CLIMATE LEADERSHIP SPECIALIST, CORNELL CALS PRO-DAIRY

One of the real values of this process is getting in early before you have to do it, understanding where you are, and the opportunity to compare yourself to your peers and where your farm is in comparison to other dairy farms.

KIRSTEN WORKMAN, NUTRIENT MANAGEMENT AND ENVIRONMENTAL SUSTAINABILITY SPECIALIST, CORNELL CALS PRO-DAIRY

By knowing your farm's footprint (and N.Y. dairy's on a larger scale), it helps us keep ahead of future regulations. We know from the water quality space that if we can show we're proactive, and have the data to support it, we can say, "You know what? We're on this, we've got it, and we're doing a good job already." By demonstrating we're performing at a high level already and that we have identified the tools and resources we need to do it, we can ask for help to implement solutions that will work for our farms, instead of being told what to do. ▮

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