From Thin Air

Kansas State University research adds to knowledge base on the genetic influence of methane production.

by Miranda Reiman, director of digital content and strategy

Decades ago, the idea of measuring cow belches to get at efficiency measures might have seemed far-fetched. But today the more researchers find out about methane emissions, the more they're convinced there might be a production benefit from doing so.

Kansas State University (K-State) recently completed work to identify best practices for measurement of enteric methane (or methane that is exhaled) for grazing cattle, as much of the previous work has been in confinement settings or in other species. They learned more about the collection process and how much data they need to explain the differences among animals.

The Angus Foundation helped fund this research to build knowledge on this topic specifically within the beef industry.

"This is a trait that is a bit of a win-win in terms of what consumers might like us to do and things that can positively affect our profitability," says Megan Rolf, K-State geneticist and lead researcher on the project.

Methane emissions are frequently in the news, often with animal agriculture taking the blame for rising worldwide levels. In the United States, methane is only 11.5% of the total greenhouse gas (GHG) emissions. But it is among the most potent of all greenhouse gases and, with a shorter lifespan in the atmosphere, the easiest to make measurable change in the near term.

The beef business has already made marked improvements just by making animals more efficient, Rolf notes. According to National Cattlemen's Beef Association (NCBA) analysis, the methane intensity, or methane per unit of beef produced, decreased by 15% from 1990 to 2021. Beef production increased 23%, while herd numbers declined — the ultimate definition of doing more with less, Rolf notes.

At the same time, however, total methane production is up 5%.

"The more productive the animals, typically means more methane emissions," she explains.

Are the goals of reduced methane and increased producer profits at odds with each other? Rolf says not necessarily.

Less methane, more production

"In my opinion, nobody is better stewards of the lands than beef producers, because that's what we rely on. So I would argue, we probably want to be able to provide the same human nutritional value of the food that we produce with lower methane emissions and more environmental sustainability," Rolf says.

"The second reason we really care about this is every time that animal belches out some methane, this is money you paid for feed that is now wafting away in the breeze."

That loss of gross energy can be anywhere from 2% with animals eating high-concentrate diets in the feedyards to up to 12% on more forage-based diets.

Dry-matter intake (DMI) is closely correlated with methane production. While bigger, more productive animals may eat more on the average leading to more methane output, there are outliers, Rolf explains.

"The relationship is not one-to-one, which means we can identify animals that gain a lot more than we would expect based on their methane emissions," she says, with a nod to the outliers that could help change that correlation. "So, these animals exist — the challenge is identifying them and developing tools to be able to select for them."

There is no methane emission work currently incorporated into any beef cattle genetic evaluations, but Rolf predicts there will be someday.

Measuring methane in wide open spaces

The K-State project used a GreenFeed system to quantify methane, carbon dioxide and oxygen. Animals chose to use the enclosed feeder, where pelleted feed came out at regular intervals to encourage the cows to stay there longer and to return later.

"The idea is to get them to stick their head in there long enough so that we can measure what they're exhaling," Rolf says.

When they exited, a fan pulled air back into the system so there was an ambient air measurement to compare to.

Of the 23 animals in the study, 17 used the system regularly for a 13% refusal rate. They allowed five visits a day, with a minimum of two hours between visits.

"One of the questions that we had while embarking on this mission was how much data we actually needed to collect on each individual animal and on the total number of spot samples that we would need," she says.

Their work showed 40 visits as the threshold for collecting enough quality information to run the calculations.

"It was right out in the middle of a pasture, and they had lots of other places that they could go, so it took us a bit longer to collect that data," Rolf says. "That does lead me to the conclusion that in our target protocols, we should probably have a focus on the number of spot samples rather than simply recommending a specific test duration."

More questions, more work

The discoveries in this round of research spur additional questions: Can they measure methane in growing animals and the rankings stay the same as mature animals? Can they use "incomplete" records, with fewer than the ideal visits and correlate to others?

"First we need to able to get enough data to fit a univariate model, and then, ideally, we want to fit multivariate so we can figure out what the genetic correlations are, identify important genetic antagonisms and all those relationships between different traits," Rolf says.

Today, feed additives and other management tweaks are the only way to directly get at methane reduction, but genetic solutions would provide a lasting and cumulative effect over time. Plus, it appears to be moderately heritable, giving hope that there could be reliable selection measures in the future.

"Ideally we want to be able to improve without sacrificing the levels of production we have," Rolf adds.

That would be the ultimate win for both the producer and the planet, she says. AJ

Editor's note: Megan Rolf presented at the 2023 Beef Improvement Federation Symposium in Calgary, Canada in July. View the presentation at www.beefimprovement.org/2023symposium.