Yes, feedlot cattle produce some methane emissions, but really ...

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It's A Cow Problem

by **TROY SMITH,** *field editor*

They know how to push the right buttons. To further their particular agendas, activists often employ emotion, even fear, to coax their audiences into acceptance. The antics of many professional and amateur anti-meat activists are designed to worry consumers into accepting that livestock production is environmentally unfriendly and, thus, unsustainable. Often cited is the contribution beef production makes to the release of greenhouse gases into the atmosphere, which, in turn, contributes to climate change.

Activists have portrayed the cattle industry as a major source of greenhouse gases in general, often emphasizing methane emissions in particular. While carbon dioxide is the most abundant greenhouse gas, methane is of concern because it is believed that, during a 100-year period, it has up to 25 times the global warming potential of carbon dioxide.

Methane is a product of decomposition of organic material in the absence of oxygen. All cud-chewing animals do produce and expel methane as a byproduct of fiber digestion in the rumen. Often overstated, however, is the contribution cattle belches make to total global methane emissions relative to other sources, including the production and use of fossil fuels and the anaerobic decomposition occurring in landfills and waste-treatment facilities.

While cattle production is in their crosshairs, activists frequently target cattle finishing operations as the industry segment responsible for most methane emissions. That's just false. To the extent that methane emissions are a cattle industry issue, it's really more of a cow problem. It is the breeding herd that consumes some 70% of all feed used in beef production, and the lion's share of that feed is forage. That makes the cow-calf sector the largest methane emitter.

Plenty of people are surprised to learn that what they perceive to be the most environmentally friendly part of the beef industry actually produces the most methane. According to USDA Agricultural Resource Service (ARS) data, roughly 85% of North American beef cattle methane emissions are generated by the cow-calf sector, while 8% and 7% are attributed to the cattle finishing and stocker sectors, respectively.

An existing way to mitigate methane emissions from cattle on forage diets is to strive for optimal grazing management that promotes high-quality range and pasture, says Karen Beauchemin.

Sign of efficiency lost

Based in Lethbridge, Alberta, scientist Karen Beauchemin says cow-calf producers can't afford to ignore the implications. A methane mitigation researcher with Agriculture and Agri-Food Canada, Beauchemin says methane emissions are a concern that shouldn't be shrugged off, even by producers skeptical of global warming and the dangers of greenhouse gases. If consumers believe cattle are poisoning the atmosphere, it is a concern for the beef industry.

Also, producers should realize that methane emissions from cattle represent a cost to production.

From a production viewpoint, explains Beauchemin, methane expelled by cattle is lost feed energy — a loss of as much as 10% of the gross energy intake of beef cattle. So, if the energy lost in generating methane could be used for growth and weight gain, it would be economically beneficial to the cattle producer, as well as reducing methane emissions. That's a win-win for producers and the environment.

Discussion of how cow-calf producers can influence methane emissions might be helped along with a simplified explanation of why the bovine digestive system produces methane. Ruminants are capable of utilizing a wide array of feedstuffs, but are uniquely suited to the digestion of forage. The rumen serves as an anaerobic fermentation vat inhabited by microscopic organisms that break down feed, including the fibrous components that could not otherwise be digested by the animal. That's why beef cow herds can be maintained on diets consisting of grazed forage from pasture or range and harvested forage.

"The microbial community is very diverse," says University of Nebraska biochemist Samodha Fernando, explaining that it includes bacteria, protozoa, fungi, archaea and other types of microorganisms, which can be both collaborators and competitors. "All have roles in digestion, with many interactions among various kinds of microbes."

Included in the mix are organisms categorized as methanogenic archaea, or methanogens. Fernando explains that the role of methanogens is to remove hydrogen formed in the rumen during digestion of carbohydrates. Removal of hydrogen is necessary for optimal

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function of microbes involved in fermentation. Methanogens utilize hydrogen and produce methane, which is removed from the system when the critter belches.

Fernando says changes in cattle diet can cause shifts in the composition of the rumen microbial community, including the abundance of methanogens. Therefore, manipulation of the diet can influence methane production. Influential factors include daily feed intake, the relative digestibility of feedstuffs, whether and how certain feed is processed, and the inclusion of certain feed additives. The trick, cautions Fernando, is to apply interventions that reduce methane production without causing an imbalance in the rumen ecosystem that may hinder its efficiency.

Harvey Freetly, a researcher at the U.S. Meat Animal Research Center (USMARC), Clay Center, Neb., says the relationship between methane production and cattle performance is, for the most part, the same as the relationship between feed intake and cattle performance. Generally,

as more feed is consumed, methane production increases. This suggests that high-performance cattle have a greater methane footprint.

"The more days that it takes for an animal to reach target weight, the more feed is required for maintenance. The same principle applies to methane. Dilution of maintenance by steers with greater average daily gain results in a smaller methane footprint at a given body weight," says Harvey Freetly of the U.S. Meat Animal Research Center.

"However, if steers are marketed at a given weight, the greater daily methane production can be offset by the fewer number of days that steers need to reach that weight," says Freetly, explaining that the reduction is associated with the amount of feed required for maintenance vs. the amount of feed used for weight gain.

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The feedlot sector has lowered its contribution to methane emissions as a consequence of applying technologies designed to enhance feeding performance and efficiency. Rations utilizing highly digestible concentrates (grain) result in less methane production. The kind of grain makes some difference. For example, diets based on corn or sorghum produce less methane than those utilizing barley. Using steam-flaked corn has been shown to produce less methane than whole or ground corn, illustrating how grain processing can make a difference.

Dietary fat appears to have a methane mitigating effect. Ionophores, through their effect on feed efficiency, appear to moderately lower methane production. Opinions regarding probiotic feed additives are mixed. By stabilizing pH and promoting rumen function, probiotics may have some effect on performance and feed efficiency and thereby aid in lowering methane emissions. Growth promotants, including implants and beta agonists, also help — not directly, but as a result of performance enhancement effects.

Technologies that directly affect methane formation within the rumen and/or reduce days to market explain why the feedlot sector is not responsible for the bulk of methane emissions produced by the beef cattle industry. As a methane emitter, reliance on high-fiber forage diets makes the cow-calf sector the 800-pound gorilla.

The paradox, says Beauchemin, is that ruminants actually offer less competition to most other species. Yes, they emit methane, but their marvelous digestive systems allow cattle to graze a wide variety of forages that grow on land that, because of soil type, precipitation, topography or other reasons, is unsuitable for alternative agricultural purposes. An estimated 70% of land used to support beef cattle herds is nonarable and can't be used to grow food crops for humans or feed grain for livestock.

"People often forget that so much land in forage production is unsuitable for other food-production purposes. We all need to look at the broader picture," Beauchemin adds, noting that grazing lands provide other ecosystem services, including carbon sequestration, enhancement of mineral and water cycles, plus wildlife habitat.

Methane mitigation

The challenge is to find and apply more

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ways of mitigating methane emissions from cattle on forage diets. Beauchemin says an existing way is to strive for optimal grazing management that promotes high-quality range and pasture. Where applicable, making legumes part of the pasture forage mix will enhance the quality of a grazed forage diet. Whether grass or legume, highly digestible forages promote a more rapid rumen passage rate. Feed intake and performance increase, but total lifetime feed requirement decreases and methane emissions are reduced.

Beauchemin believes future interventions applicable to grazing situations will include dietary supplementation with methane inhibitors. In Australia, she says, cattle producers are currently using lick blocks containing nitrate, as a means of supplementing nonprotein nitrogen to grazing cattle and inhibiting methane production. In the rumen, microbes reduce nitrate to nitrite and then to ammonia. This process provides competition for the hydrogen utilized by methanogens, so less methane is produced. This intervention can be risky, though, because nitrate is toxic if animals consume too much or are not adapted to a diet containing nitrate. Feeding supplemental nitrate is not permitted in the United States or Canada.

While ionophores provide some methane mitigation effect among feedlot cattle, the effects have been less consistent among grazing cattle. There is too little evidence to say whether probiotics have any significant effect. According to Beauchemin, no commercial products are licensed as methane inhibitors specifically, but researchers are studying compounds that might be effective when used as dietary supplements. One such compound is a sort of synthetic enzyme called 3-nitrooxypropanol. Beauchemin says study results have been somewhat confusing thus far, but researchers still believe the compound has potential.

Since cattle exhibit differences in individual methane production, there appears to be opportunity to address emissions genetically. According to Freetly, methane production has an estimated genetic heritability of 0.27. Studies have shown positive genetic correlations with birth, weaning and yearling weights, so Freetly warns that selection against methane production could be antagonistic to production traits. However, selection for feed efficiency based on residual feed intake (RFI) is a strategy used to produce cattle that require less feed to achieve equal growth. Freetly says some studies suggest that cattle selected for low RFI and having lower feed intake at a given body weight and growth rate may exhibit reduced daily methane production.

While new methane mitigation methods are likely to be developed, producers should not expect a "silver bullet." Regardless of what interventions the future may hold, Freetly advises producers to mitigate through management that enhances production efficiency.

"The things producers do to improve production efficiency of the cow herd are the things that help reduce its methane footprint. Improvements to cow stayability, calf weaning rates and pounds of calf weaned relative to cow size are also associated with decreasing the amount of methane produced per unit of calf sold," states Freetly.

"Cattle produce methane, but we can have some control over how much is produced. The way forward is through nutrition and management that improves performance and efficiency. That will also reduce methane emissions, relative to the quantity of beef produced," adds Beauchemin. "We can make a difference by making incremental improvements through multiple means."

Editor's Note: *Troy Smith is a freelance writer and cattleman from Sargent Neb. Karen Beauchemin, Samodha Fernando and Harvey Freetly were presenters at the Beef Methane Conference, hosted May 11-12, 2016, in Lincoln, Neb. The program was organized by the University of Nebraska Extension, with funding by a USDA NIFA (AFRI) grant.*