METHANE CREATED IN THE MANURE PIT differs from that produced by the rumen because methanogens there have enough time to digest starches.

Feed cows, not the manure pit

Starch not digested by the cow is fair game for anaerobic bugs in the lagoon known as methanogens. These organisms can produce at least as much methane as rumination.

by Mary Beth de Ondarza

DAIRY methane emissions are a growing global warming concern. If that doesn't worry you, the energy converted to methane is a waste to your dairy and feed budgets that could have otherwise made milk. A number of dietary strategies exist to reduce methane belched from the cow, including boosting digestible starch in the ration, adding dietary fat, and feeding ionophores such as monensin. These strategies were discussed in the first article in this series, "Divert energy from methane to milk," that appeared in the June 2016 issue on page 392.

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Higher total milk production also lowers enteric methane . . . output methane directly from cows . . . per pound of milk. In one recent Wisconsin study, about 1.3 pounds of methane per cow per day came from cows that were producing about 83 pounds of milk.

The other methane producer

Methane is also produced from manure fermentation on the farm. This varies a great deal depending on manure handling. Methanogenic microbes need an environment that has little or no oxygen. So, more methane is produced when manure is stored in an anaerobic lagoon than when it is immediately spread on the field.

A recent California field study concluded that current greenhouse gas predictions from dairy manure are actually low. They estimated, with an anaerobic lagoon, 810 pounds (+/- 425 pounds) of methane is generated per cow per year. With aboveground tank storage, 222 pounds (+/- 103 pounds) of methane is produced per cow per year. Often as much methane, if not more, is generated from the manure fermentation as is belched from the cow's rumen.

The fermentation of manure is slightly different than what occurs in the rumen. Rumen bacteria must be able to grow and reproduce fairly quickly before they are washed out by the relatively quick turnover rate of the rumen. Feed particles generally only reside in the rumen for about 48 hours.

Methanogens thrive in manure

The methanogens that survive in the rumen produce methane from carbon dioxide and hydrogen, which are products of fiber fermentation to acetate and butyrate. Since manure is generally stored in a pit or lagoon for more than a month, there are some slower growing methanogens that thrive in stored manure that could not survive in the rumen. In a lagoon, not only are the by-products of fiber fermentation (carbon dioxide and hydrogen) converted to methane, but other nutrients including starches are as well. The slow-growing methanogenic microbes break down and oxidize these nutrients into products that are eventually transformed to methane.

Manure's potential to make methane depends on the amount of nutrients available for the methanogens. One study found cows that were fed a higher starch diet in order to limit enteric methane emissions produced manure containing extra fiber (probably due to rumen acidosis). This manure then produced more methane than usual when it fermented during storage. Swedish researchers had similar findings noting manure from cows fed higher starch diets had a greater potential to produce methane.

Depending on rumen conditions and starch fermentation rates, higher starch diets could result in both more fiber and more starch in the manure. German researchers fermented regular manure (23.5 percent organic matter) and manure with added potato starch (34.5 percent organic matter) for 29 days. With the regular manure, 4.23 units of methane were produced per unit of manure. In contrast, manure with the added potato starch yielded 8.63 units of methane per unit of manure.

Although manure with too much fiber content is a concern, a greater issue on many dairies is too much starch in manure. University of Pennsylvania researchers say that 2 to 3 percent manure starch is optimal, and more than 5 percent is a problem. University of Illinois researchers analyzed manure from 15 fresh cows (less than 60 DIM) that had fecal starch values ranging from 2.3 to 22.4 percent. Cumberland Valley Analytical Services Inc. looked at 1,420 manure samples discovering that 38 percent of the samples contained more than 5 percent starch and 16 percent contained more than 15 percent starch.

Undigested starch found in the manure never had a chance to be converted into milk. If you can see the grain in the manure or you can pick up a corn kernel from the manure, put your fingernail through it, and see the white starch, be assured that the cow did not use it. University of Pennsylvania researchers estimated that every 1 percentage unit inflation in manure starch over 5 percent represents 0.72 pound less milk. So, a residual 15 percent manure starch versus 5 percent can result in 7.2 pounds less milk.

Keep the starch where it belongs

The primary reasons for more starch in the manure are inadequate physically effective fiber, poorly processed grain, and insufficiently fermented corn silage. When the cow is not eating enough physically effective fiber, not ruminating enough, and not forming an adequate fiber mat inside her rumen, dietary grains pass from the rumen more quickly than they can be digested. This means more starch passes out into the manure. Bumping up physically effective fiber in the diet, controlling TMR sorting, reducing dietary starch, and improving feeding behavior (no slug feeding) can all help to curtail the amount of starch in manure.

When grain is not ground to a fine enough particle size, or when corn silage is improperly processed or insufficiently fermented (less than four months' storage time), more starch will end up in the manure. Smaller particles allow the rumen microbes to have additional surface area to grab onto and digest grain before it passes out of the cow.

As you strive to make more money and take care of the environment, consider if you are giving away too many nutrients to the methanogens growing in your manure pit.

This issue: Feed cows, not the manure pit
Last issue: Divert energy from methane to milk
Final issue: Knock down nitrogen waste