Dairy Research Summary

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Dairy cow diets based on conventional or brown midrib corn silage: effects on cow performance, cow methane production and methane emissions from stored manure

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Why is this important?

The agricultural sector contributes to greenhouse gas production through emissions related to gut fermentation, manure management, and crop cultivation processes. Corn silage is one of the most popular forage sources in dairy cow diets, as it increases starch supply and changes the rumen environment such that it is less suitable for methane production. Compared with conventional corn silage (CCS), brown midrib corn silage (BMCS) is lower in indigestible lignin and is more easily digested. This increase in digestibility could result in improved feed intake and milk yield and a decrease in methane (CH_4) production by the cow. However, these improvements may be counterbalanced by increased CH_4 emission from manure management due to the volatile solids excreted by the animal. Two experiments were conducted with the first focused on methane production and digestibility characteristics of the cow and the second on emissions from stored manure. The objectives were to assess the effect of replacing CCS with BMCS in dairy cow diets on: 1) gut CH_4 production, digestion, ruminal fermentation, nitrogen excretion, milk production, and milk composition; and 2) CH_4 emissions of stored manure from dairy cows.

What did we do?

Sixteen lactating Holstein dairy cows fitted with rumen cannulas were used in the first study. They were fed a TMR ad libitum (65:35 forage:concentrate ration on a dry matter basis) based on either conventional corn silage (CCS) or brown midrib corn silage (BMCS). Cows were milked twice daily with milk production recorded at each milking and samples collected. Researchers measured feed intake, rumen fermentation characteristics, digestibility, and nitrogen balance. Methane emissions were determined using 2 airflow-controlled chambers.

Eight lactating Holstein dairy cows were used in the second study. They were fed the same experimental diets as described above. All manure and urine was collected from the cows, mixed, and monitored for methane emissions.

What did we find?

For cows fed the BMCS-based diet, dry matter intake (DMI) increased by 1.6 kg/d/cow, which resulted in higher intakes of fibre, starch, and energy compared with cows fed the conventional CCS-based diet. Feeding the BMCS-based diet increased milk yield by 3 kg/d/cow and increased yields of milk fat and milk protein compared to feeding the CCS-based diet. Gut CH_4 emissions were not significantly different. However, when expressed on a DMI basis (g/kg of DMI), CH_4 emissions were lower for cows fed the BMCS-based diet. Methane energy losses expressed as a percentage of gross energy intake were also lower for cows fed the BMCS-based diet. Total nitrogen excretion was lower in cows fed the BMCS-based diet compared to the CCS-based diet.

In the second experiment, cows fed BMCS excreted 31% more volatile solids than cows fed CCS (8.6 vs. 6.5 kg). This is mainly due to an increase in organic matter intake and no change in organic matter digestibility when cows were fed BMCS. The lower lignin concentration in BMCS results in increased feed intake in the cows. Overall, manure from cows fed BMCS produced 55% more CH_4 than manure from cows fed CCS. When added to the CH_4 production results from the first experiment, total CH_4 emissions (sum of gut and manure emissions) were 668 and 611 g/d for cows fed BMCS and CCS, respectively.

What does it mean?

There are some positive aspects of feeding BMCS in comparison to feeding CCS. Specifically, BMCS is more digestible and results in increased DMI and improved milk, milk fat, and milk protein yield. The overall CH_4 production from the cow was not different, thereby suggesting a net benefit to feeding BMCS. However, any dietary strategy aiming to mitigate CH_4 emissions from dairy cows must also consider the effect of nitrogen losses in manure and the potential for increased N_2O and NH_3 emissions. These two studies found that the initial positive impact observed in animal performance with no increase in CH_4 production associated with feeding BMCS was counterbalanced by an increase in CH_4 emissions from stored manure.

Replacing CCS with BMCS would not be considered an ideal strategy if a producer's end goal is to reduce methane emissions on their farm.

Summary Points

- Feeding a brown midrib corn silage-based diet in comparison to a conventional corn silage-based diet results in greater DMI and higher milk, milk fat, and milk protein yield.
- Total nitrogen excretion and methane energy losses were lower in cows fed the brown midrib corn silage-based diet compared to the conventional corn silage-based diet.
- Methane production from stored manure was greater when cows were fed brown midrib corn silage.

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