Factsheet

How the mineral profile of the diet influences the milk fat content?

Duration : 2012 – 2016

Highlights

Research research has shown that the synthesis of fat content in milk fat from cows at the beginning of lactation receiving a ration rich in concentrates is affected by the mineral profile of the ration, particularly stimulated by the addition of a source of potassium carbonate (K_2CO_3).

This research project therefore aims to:

- Determine if the effects observed on production performance are due to an increase in:
  - K inputs;
  - the dietary cation-anion difference (DACA); or
  - buffering capacity;
- Evaluate the effects of the addition of K_2CO_3 to acidogenic rations (rich in concentrates and vegetable oil).

The results of this project have allowed us to observe that:

- There is a wide variability between animals in regards to the ability of their rumen to resist rations rich in concentrates and to maintain a high fat content;
- The addition of K_2CO_3 to the ration has an effect on the bacteria involved in the biohydrogenation of fatty acids in the rumen;
- An increase in K concentrations in the ration through the addition of K_2CO_3 leads to an imbalance in mineral ions, causing a decrease in production.

Objectives

- Separate out the effects of the DACA, K content and buffering capacity of the ration on the biohydrogenation of polyunsaturated fatty acids in the rumen and milk fat content.
- In high-producing cows receiving a ration rich in concentrates, verify the interaction between K_2CO_3 and soybean oil (source of polyunsaturated fatty acids) inputs on:
  - the rumen's microbial populations;
  - the biohydrogenation of fatty acids; and
  - animal performance.

Results and potential benefits

The results of this study allowed us to verify there is a wide variability between cows from the same herd in regards to the ability of their rumen to resist rations rich in concentrates. In addition, we observed that the addition of K_2CO_3 to the ration leads to modifications in bacterial populations, which then prevent rumen synthesis of fatty acids and inhibitors of the milk fat synthesis. However, contrary to the results obtained by other research teams, the current experiment does not allow us to associate an increase in the DACA and/or potassium concentrations from the ration with an increase in the daily production of milk fats. Lastly, this study allowed us to observe that the increase in K content through the addition of K_2CO_3 to the ration causes an imbalance that negatively affects animal production, specifically milk production.

Advances in scientific knowledge regarding the impact of the mineral profile of the ration on animal performance helps us to better identify feeding strategies that have a real impact on milk production and composition in high-producing dairy cattle. The data collected also gives us a better understanding of the importance of the ionic balance of the ration on the mammary gland's ability to produce milk. These results will allow us to develop innovative nutritional strategies that, once integrated into feeding systems, will have significant economic benefits for producers.

Contact persons

Project managers :

Rachel Gervais
rachel.gervais@fsaa.ulaval.ca

Yvan Chouinard
yvan.chouinard@fsaa.ulaval.ca

Edith Charbonneau
edith.charbonneau@fsaa.ulaval.ca

Département des sciences animales, Université Laval, 2425 rue de l'Agriculture, Québec (QC) G1V 0A6
(418) 656-2131

Contributors :

Gaëtan Tremblay
Agriculture and AgriFood Canada

Johanne Chiquette
Agriculture and AgriFood Canada

Daniel Lefebvre
Valacta

Alain Fournier
Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec

Professionals trained

Angel Rene Alfonso Avila, a PhD candidate, has developed unique expertise in the study of microbial populations and rumen metabolism, and assessing the use of minerals for dairy cattle.

For further information

Alfonso-Avila, A.R., É. Charbonneau, P.Y. Chouinard, G.F. Tremblay, and R. Gervais. 2015. Utilisation du carbonate de potassium pour maximiser la production de matières grasses du lait. Page 18. In: 39th Dairy Cattle Symposium. Centre de Référence en Agriculture et Agroalimentaire du Québec, October 29, 2015, Drummondville, Qc.

Alfonso-Avila, A.R., É. Charbonneau, P.Y. Chouinard, G.F. Tremblay and R. Gervais. 2015. Influence du profil minéral de la ration sur la production de matières grasses du lait chez la vache. In: Science information day–Dairy cattle and forag plants. Centre de référence en agriculture et agroalimentaire du Québec. Drummondville, Qc, February 25. http://www.craaq.qc.ca/documents/files/EBOV1401/alfonso_resume.pdf

Alfonso-Avila, A.R., A.-M. Richard, É. Charbonneau, P.Y. Chouinard, G.F. Tremblay and R. Gervais. 2015. Influence du profil minéral de la ration sur la production de matières grasses du lait chez la vache. 2015 AMVPQ Conference. Association des médecins vétérinaires praticiens du Québec, September 24-27, Saint-Sauveur, Qc.

Alfonso-Avila, A.R., P.Y. Chouinard, E. Charbonneau, J. Chiquette, G.F. Tremblay, A.-M. Richard and R. Gervais. 2016. Nutrition minérale: Nouvelles perspectives pour des performances laitières optimales. Forum Technologique Novalait. June 2. Hôtel et Suites Le Dauphin, Drummondville, QC.

Charbonneau, E., A.R. Alfonso-Avila, P.Y. Chouinard, J. Chiquette, G.F. Tremblay, A.-M. Richard and R. Gervais. 2016. Influence du profil minéral de la ration sur la production de matière grasse du lait. Forum Technologique Novalait. June 2. Hôtel et Suites Le Dauphin, Drummondville, QC.

Financial contributions

Partnership for innovation in dairy production and dairy processing (EPI2011-2017):

-Fonds de recherche du Québec – Nature et technologies
-Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
-Novalait

Centre de recherche en sciences animales de Deschambault

Total budget : $220 000