

Milk fatty acid profiles in early lactation as potential indicators for reproduction success

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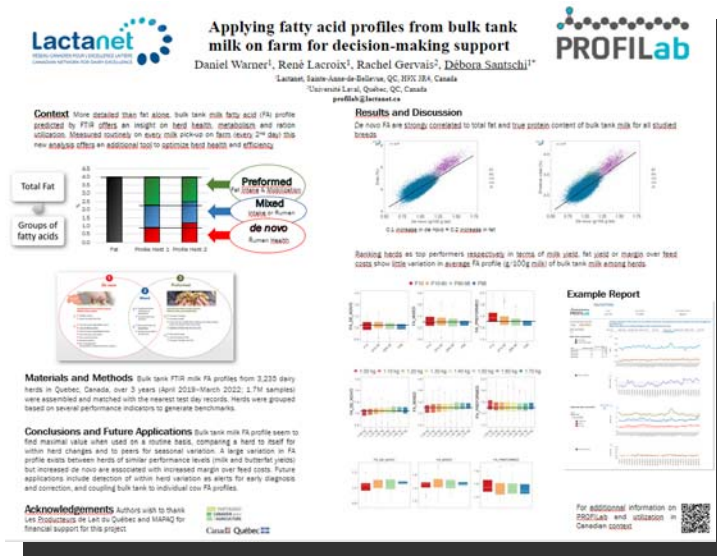


ICAR/Interbull Annual Conference 2022
Montréal

Context of the project

Bulk tank FA tool launched in 2020

- Herd management tool based on regular tank collection
- Insight into herd health, metabolism and ration utilization



Visit our ICAR 2022 poster



Context of the project

What about the **individual cow** FA profile?

Records since 2020 in our Montreal lab

FTIR predictions on FOSS machines

Monthly test day data



Cow FA profile prototype



Acides Gras du Lait

Réservoir

Lactation

Début

Historique

Inventaire



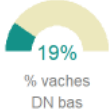
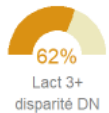
Prototype PROFILab Individuel v.4.6

Auteurs: Daniel Warner, Débora Santschi

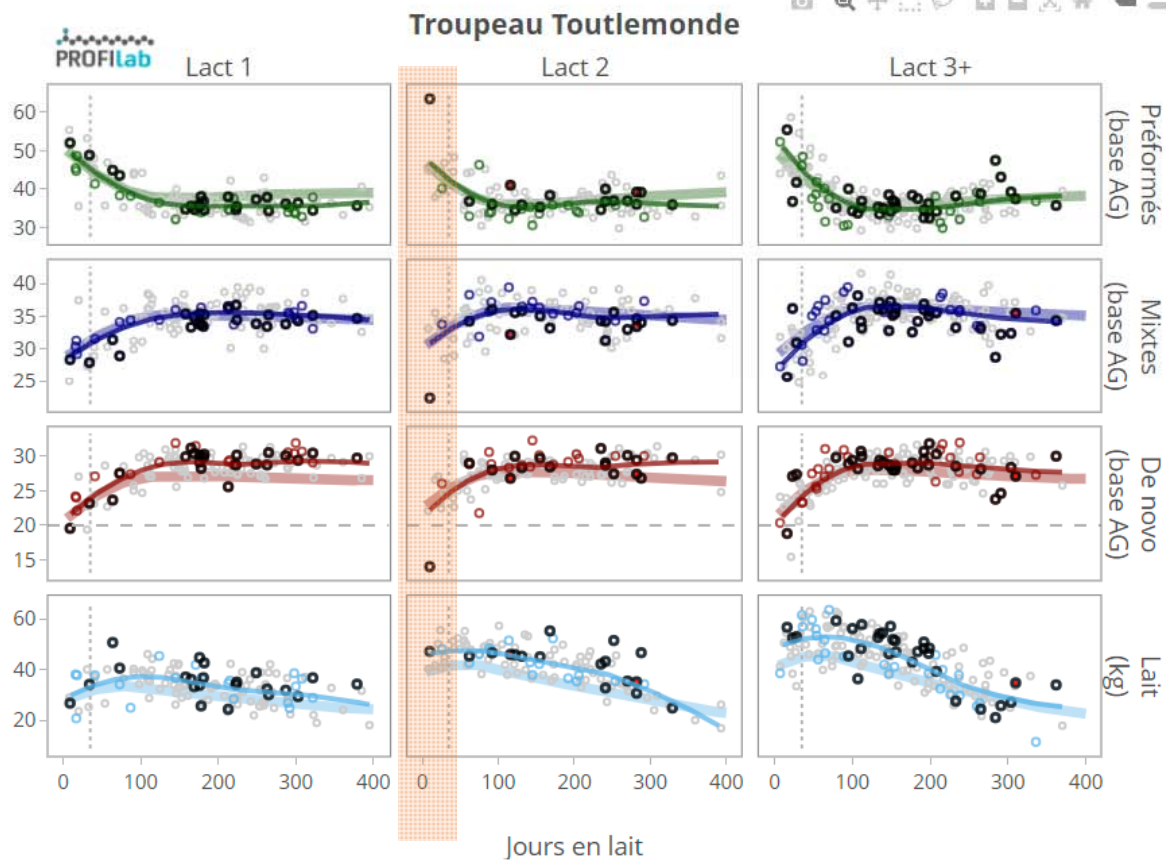
04 avril 2022

Informations supplémentaires

CONFIDENTIEL – ne pas distribuer sans le consentement de Lactanet



Tous Lac Tables



- Within-herd variation
- Insight into parities, groups of cows
- Top performing cows (production, genetics...)
- **Early lactation**



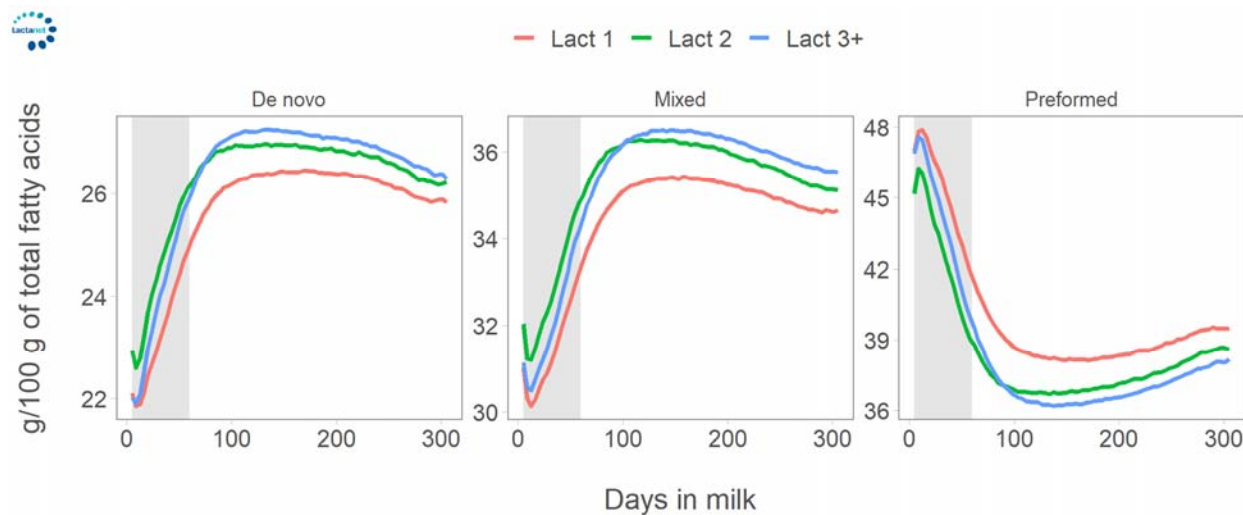
Early lactation

Important changes in the milk yield and components

Milk FA affected by the energy status

Increased mobilization of body reserves

- Increased preformed FA and uptake by mammary gland
- De novo synthesis inhibited



Early lactation

Critical phase for later production and reproduction performance

Early evidence from small scale experiments of a link between milk fatty acids and post-partum diseases, probability of removal

On a larger population basis:

Can the milk FA explain the reproduction success?



Our dataset

First test date records in early lactation (< 35 DIM) over 2 years (as of February 2020)

- Cow side information (DIM, lactation, TD milk yields)
- ~265K cows from 2,841 Holstein herds in Quebec, Canada



Milk composition at first test date

Milk FA by FTIR (in g/100 g of total FA)

Major components and others (fat, protein, lactose, BHB, SCC)



Cow production and reproduction performance



Our dataset

Cows grouped in similar cohorts based on first TD milk

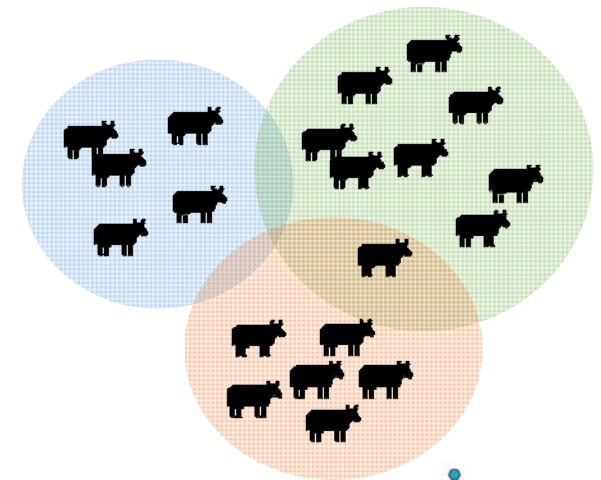
- Large dataset → CLARA clustering with a k-medoid approach on subsamples
- Similar milk components → Clustering on principal components to balance their combined influence



Milk composition at first test date

Milk FA by FTIR (in g/100 g of total FA)

Major components and others (fat, protein, lactose, BHB, SCC)



Cluster description

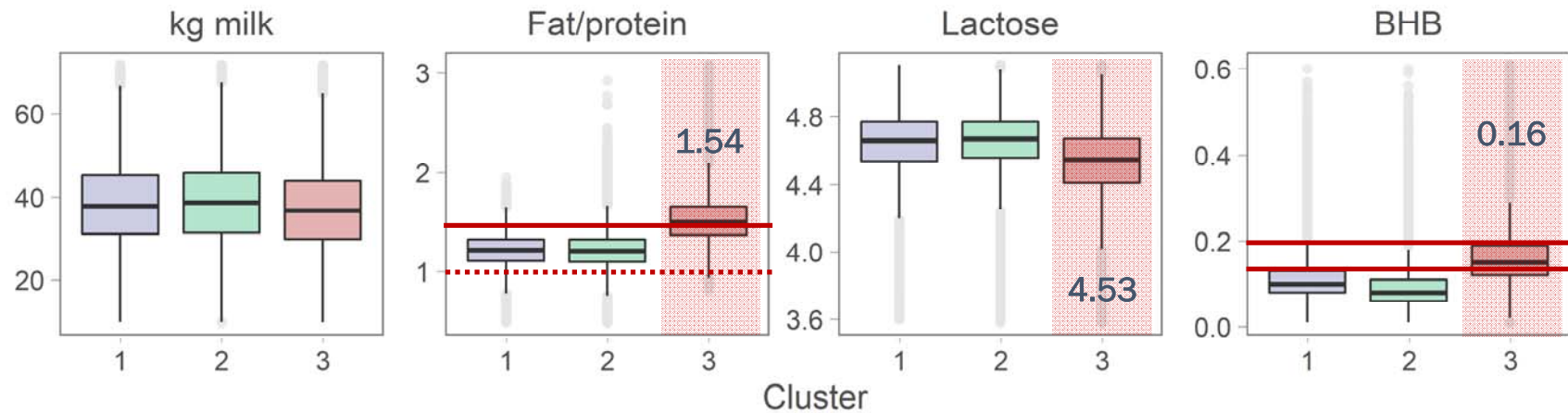
3 Clusters were identified

No predominant cluster in terms of size and milking type

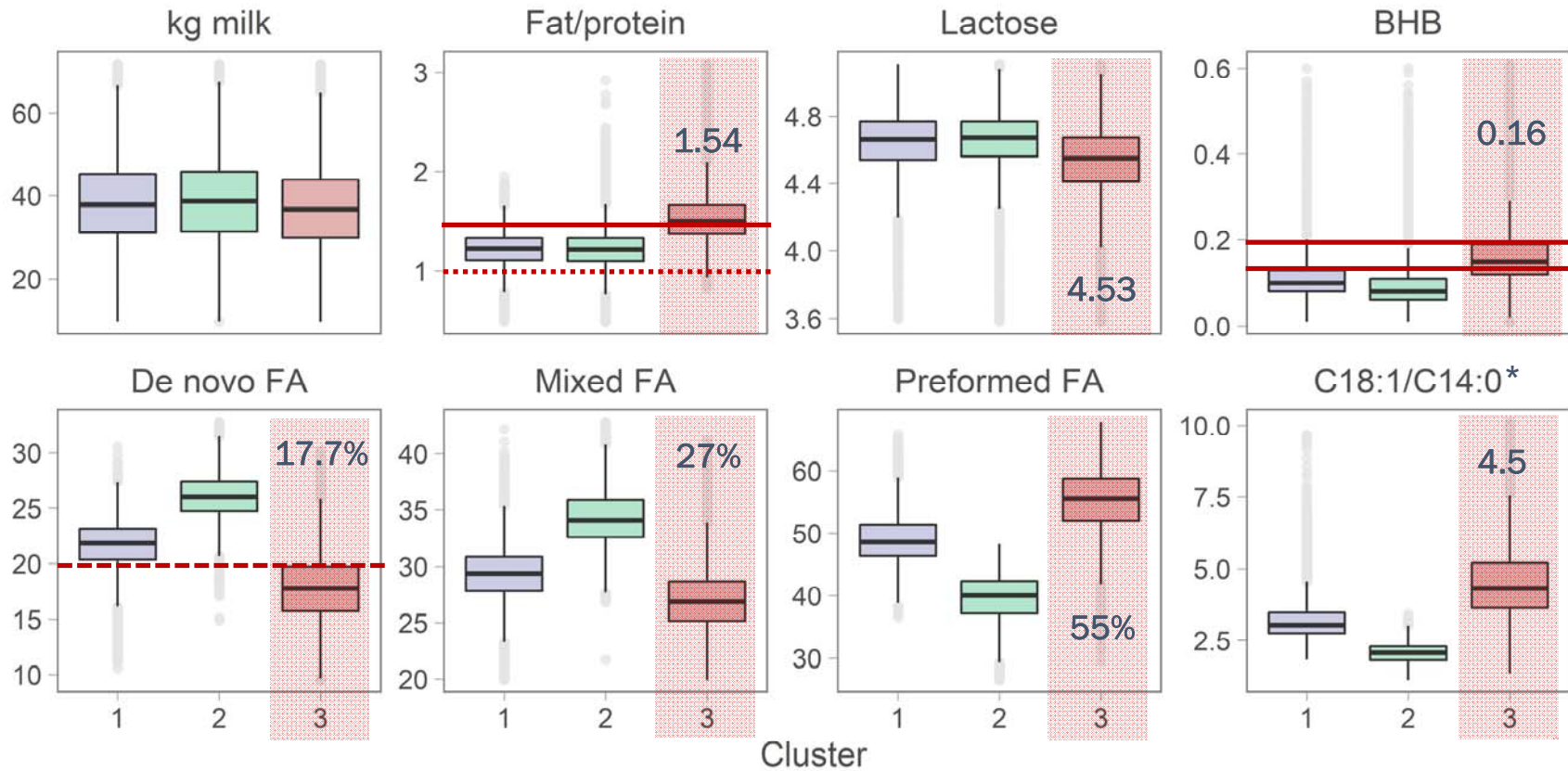
No clear seasonality effect (very strong on bulk tank FA)



Cluster description – first TD milk composition



Cluster description – first TD milk composition



Suggested threshold by Bach et al 2019



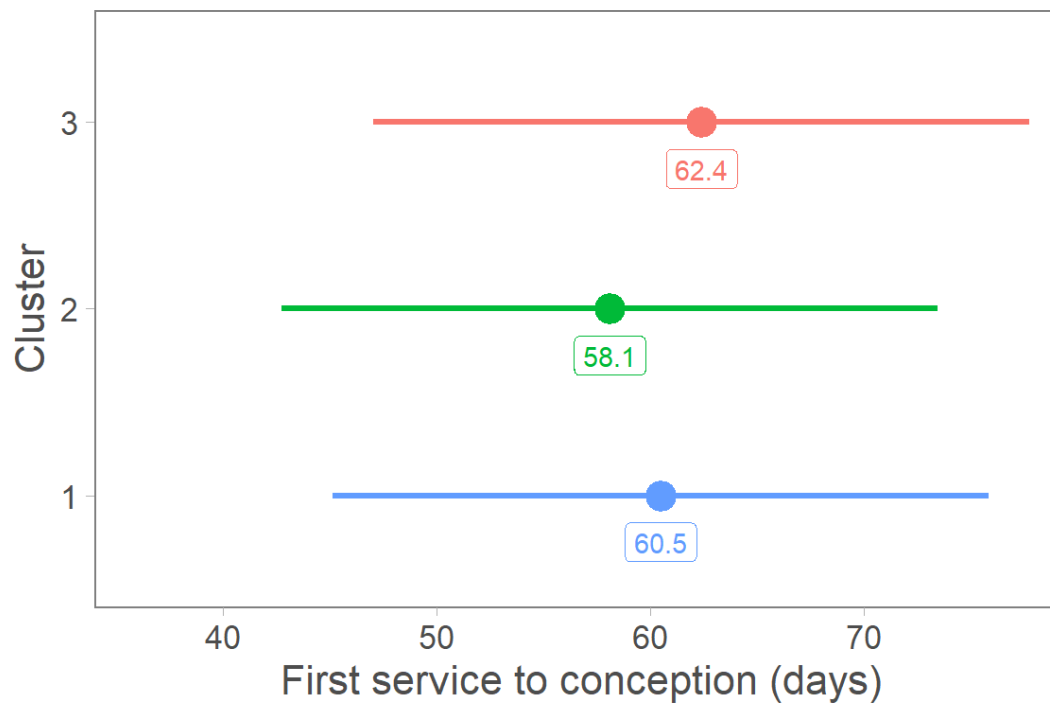
* C18:1 refers to total predicted C18:1 fatty acids



Cluster description

Interval of first service to conception

Linear regression mixed effect model



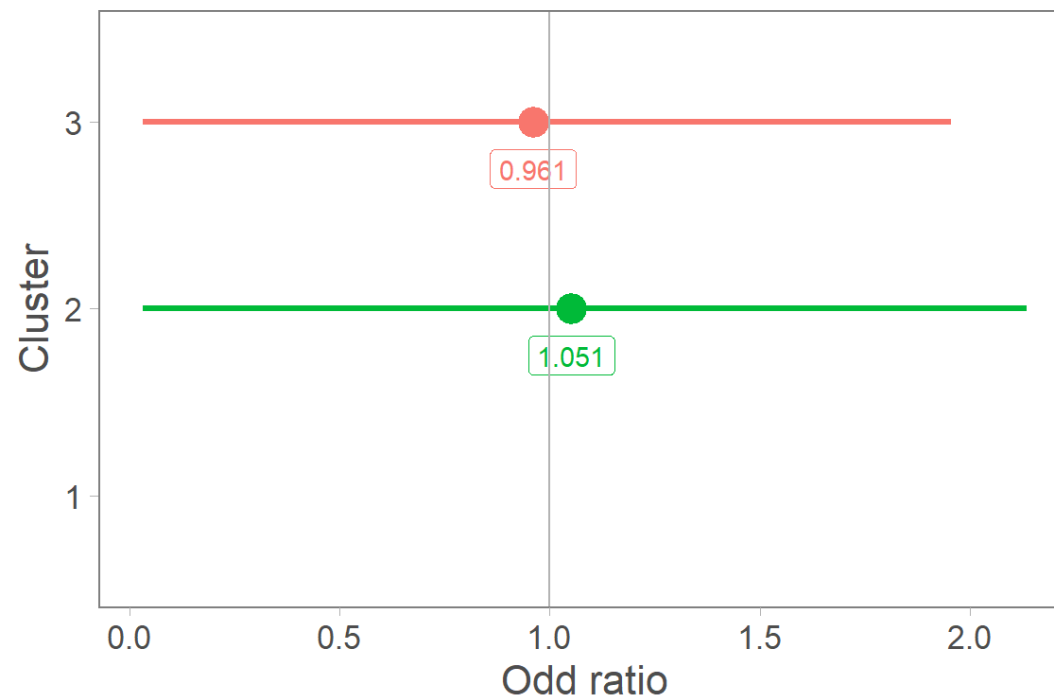
Use as prevention measure (probably too late for current lactation)



Cluster description

Conception at first service

Binomial logistic regression mixed effect model (0 or 1)

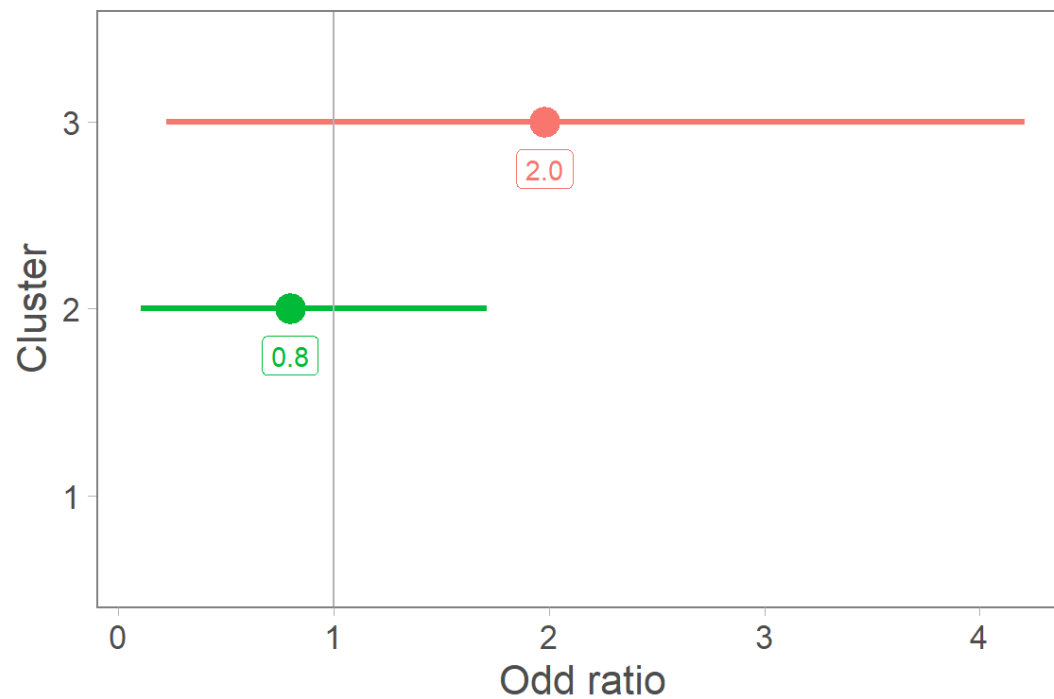


No impact on conception rate at first service

Cluster description

Culled by 60 DIM

Binomial logistic regression mixed effect model (0 or 1)



Higher probability for a cow to be removed from herd

+100% increased odds



Future applications

- 🏠 Milk fatty acid profile at first test date can be a potential **early indicator** for the following **reproduction success**
- 🏠 Can help with **transition management**
- 🏠 Some practical considerations
 - 🏠 Might be too late for the current lactation performance but could be used for prevention
 - 🏠 Monthly test sampling → ideally **more frequent test sampling** during early lactation – DHI testing needs to be adapted

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Our ICAR 2022 fatty acid presentations

Lactanet Applying fatty acid profiles from bulk tank milk on farm for decision-making support
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Context: More detailed than fat alone, bulk tank milk fatty acid (FA) profiles analyzed by FTIR offers an insight on feed health, metabolism, and micronutrient status. However, existing on-farm tools often do not provide the detailed FA analysis often an additional tool to estimate feed health and efficiency.

Results and Discussion: De novo FA are strongly correlated to total fat and total protein content of bulk tank milk for all studied herds. Preformed, Mixed, and de novo fatty acids are also correlated to total fat and total protein content of bulk tank milk for all studied herds. Feeding trials on two performance objectives in terms of milk yield, fat yield or protein yield have shown some variation in average FA profile in 2016 and 2018 of both tank milk and individual cows.

Materials and Methods: Bulk tank FTIR milk FA profiles from 2,222 dairy herds in Québec, Canada, over 3 years (April 2018-March 2022, 1.7M samples) were assembled and matched with the nearest test day records. Herds were grouped based on season performance indicators to general benchmarks.

Conclusions and Future Applications: Bulk tank FA profiles seem to feed relevant value when used on a smaller herd, comparing a herd to itself or within herd changes and to peers for seasonal variation. A large variation in FA profile exists between herds of similar performance levels and similar periods but increased de novo are associated with increased margin over feed costs. Future evaluations include detection of within herd variation as early as early diagnosis and correction, and coupling bulk tank to individual cow FA profiles.

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Example Report: For additional information, contact Rachel Gervais at rachel.gervais@profilab.com



Bulk tank fatty acid utilization – Canadian context

11h30 – Automated Anomaly Detection for Milk Components and Diagnostics in Dairy Herds / Maryam Ayat, Lactanet



Anomaly detection of within-herd variation + diagnostics