

Transforming routine MIR milk data into actionable tools for Dairy Herd Improvement and cheese production

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Cheese-making properties (CMP) strongly depend on milk composition, which is partly genetically determined. The FROM'MIR programme (2015–2019), conducted in the Montbéliarde breed, demonstrated the feasibility of using routine milk mid-infrared (MIR) spectra to predict CMP related to milk coagulation and cheese yield (El Jabri et al., 2020), and to develop associated genomic evaluations (Sanchez et al., 2022). Building on these results, the FROM4ALL project, launched in 2024, extended this approach to eight French dairy breeds. The FromACT project now aims to implement MIR equations and genomic indexes at a large scale to support Dairy Herd Improvement (DHI) and sustainable milk and cheese production systems.

Prediction equations for seven CMP- three cheese yield traits and four coagulation parameters predicted from MIR spectra (two related to soft cheese and two to cooked pressed cheese technologies) - were developed and validated under laboratory conditions. Large-scale MIR datasets from routine milk recording were used to assess robustness across breeds and production contexts. Genetic parameters were estimated using more than 50 million test-day records from 1,699 to 1,141,657 primiparous cows depending on the breed, applying linear mixed repeatability models. In parallel, multi-stakeholder consultations were conducted in four French regions with strong cheese-making traditions to identify field needs and expectations.

Heritabilities of MIR-predicted CMP were moderate to high (0.26–0.49, except for one trait whose equation is much less accurate) and consistent across breeds, confirming their suitability for genomic evaluation. CMP indexes are already integrated into Montbéliarde breeding programmes, while pilot single-step genomic evaluations are under development for seven MIR-predicted CMP. These results illustrate how routine milk spectral data can be transformed into operational indicators for DHI, linking milk production, genetic improvement and cheese processing. Future developments will focus on strengthening information systems and developing advisory and training approaches to facilitate dialogue between farmers, advisors and processors and improve the sustainability, efficiency and competitiveness of dairy production systems and cheese value chains in France.