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Christèle Robert-Granié, Coralie Machefert, Hélène Larroque

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Coralie MACHEFERT, Christèle ROBERT-GRANIÉ, Hélène LARROQUE

Genomic correlations between milk mid-infrared spectra and, milk production and feed efficiency related traits in French Lacaune dairy sheep

Context

Low-cost, high-throughput spectral data revealing chemical composition of milk could also be considered as predictors of the animal's feed and health

Our estimates of the heritability of milk spectral points varied between 0 and 0.42 in French Lacaune dairy ewes

AIM

Estimate genomic correlations between spectra and currently indexed dairy traits or new phenotypes (costly measures with low heritability)

These results could help to a better integration of spectral data into breeding program and improve genomic selection of complex traits

Data

Year	Milk samples	Dairy ewes	Farms	Test-day
2020-2021	36,873	4,712	8	6-monthly

Materials and methods

Bivariate mixed repeatability animal models

AI-REML method, airemlf90 software

$$\begin{matrix}
 \text{lactation stage*year parity} & \text{Additive genetic} & & \\
 \uparrow & \text{permanental environment} & & \\
 & \text{random effects} & & \\
 \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} X_1 & 0 \\ 0 & X_2 \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} + \begin{bmatrix} Z_1 & 0 \\ 0 & Z_2 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix} + \begin{bmatrix} W_1 & 0 \\ 0 & W_2 \end{bmatrix} \begin{bmatrix} p_1 \\ p_2 \end{bmatrix} + \begin{bmatrix} e_1 \\ e_2 \end{bmatrix} \\
 \downarrow \\
 \text{with SNP and pedigree}
 \end{matrix}$$

y₁ = each wavenumber

y₂ = traits

Dairy performance: DMY, FC, PC, SCS

Feed efficiency: Lactation feed conversion ratio (LFCR)

$$LFCR = \frac{\text{standardised DMY}^*}{\text{feed inputs}^* + BCS\Delta^*}$$

Residual energy intake (REI)

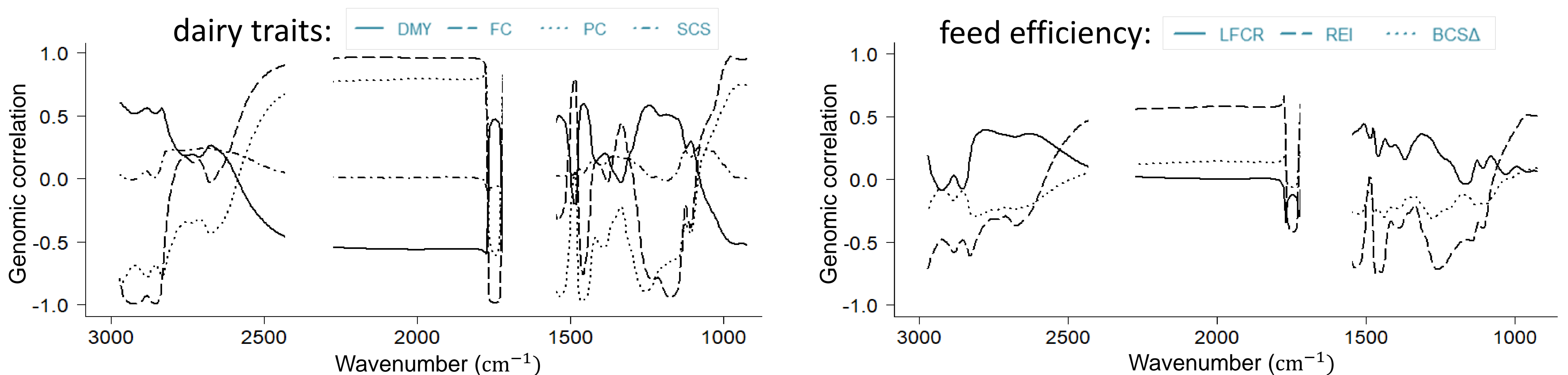
$$REI = \text{feed provided}^* - \text{theoretical feed intake}^{**}$$

*energy **from milk production and body reserve

Body reserve: BCSΔ

Results

Genomic correlations along milk mid-infrared spectra with ...



> **To conclude**, the wavenumbers most closely linked genetically to feed efficiency traits were in spectral regions associated with fatty acids and proteins