Genetic and environmental effects on individual wavenumbers of bovine milk InfraRed spectra

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Background

- FTIR is used to predict milk composition.
- Estimation of genetic and herd variances of individual wavenumbers can give insight in the information captured by milk InfraRed spectra.

Objective

Quantify the importance of genetic and environmental factors on individual wavenumbers milk InfraRed spectra .

Material and Methods

Data

- **1,759** Holstein Friesians cows
- One-morning milk sample; Winter
- **354** herds
- **1,060** Mid-InfraRed wavenumber
  – FOSS MilkoScan FT 6000

Analysis

$$y_{ijkl}=\mu+\beta_1*lactst_{ijkl}+\beta_2*afc_{ijkl}+season_i+$$

$$sirecode_j+herd_k+a_l+e_{ijkl}$$

Mixed model

y: individual wavenumber

Fixed effects: lactation stage ($lactst_{ijkl}$)
age at first calving (afc_{ijkl})
seasons of calving ($season_i$)
sirecode ($sirecode_j$)

Random effects: herd ~ $N(0, I\sigma_h^2)$
animal ~ $N(0, A\sigma_a^2)$
residual ~ $N(0, I\sigma_e^2)$

1,060 single trait analyses in ASREML 3.0

- Significance fixed effects ($-Log_{10}(P)$)
- Estimated variance components

Conclusions

- ✓ Lactation stage - significant effects on many individual IR wavenumber of milk.
- ✓ Many IR wavenumbers were strongly affected by genetic differences (up to 70% of total variance).
- ✓ Differences between herds explained up to 50% of the variance in IR wavenumbers.

Results and Discussion

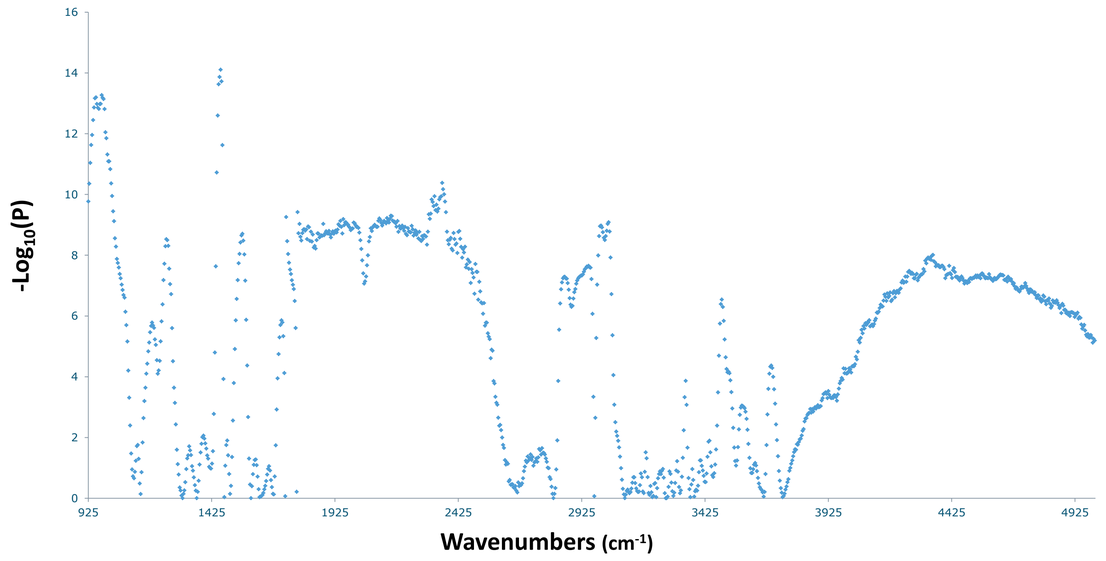

Figure 1. The $-Log_{10}$(P-value) of lactation stage effects on 1,060 infrared wavenumbers.

- **712** wavenumbers were significantly affected by lactation stage.
- Small effects for some wavenumbers, e.g. wavenumbers between 3,096 and 3,332 cm^{-1} .

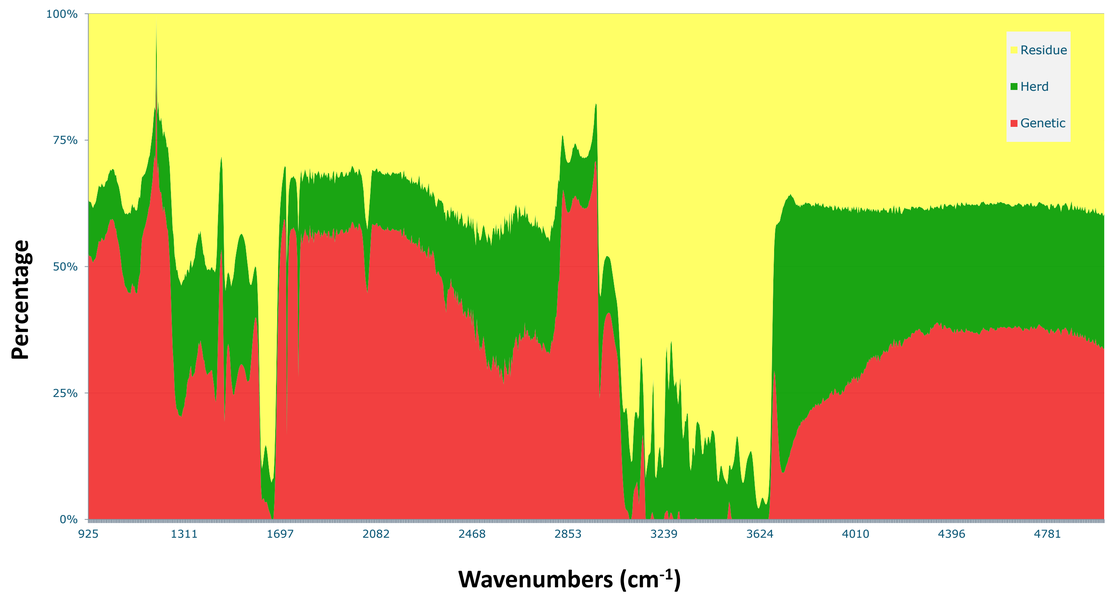

Figure 2. The fraction of the total variation explained by genetic, herd and residual variations for all 1,060 infrared wavenumbers.

- Most wavenumbers are highly heritable.
- Considerable part of the variance in wavenumbers is explained by herd differences.

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