Variation of Lactoferrin Content Predicted by Mid-Infrared Spectrometry (MIR)

H. Soyeurt [1,2], F. Colinet [3], V. Arnould [3], P. Dardenne [4], I. Misztal [5] and N. Gengler [1,6]

[1] Gembloux Agricultural University, Animal Science Unit, Passage des Déportés 2, 5030 Gembloux, Belgium

soyeurt.h@fsagx.ac.be

[2] F.R.I.A., Rue d'Egmont 5, 1000 Brussels, Belgium

[3] Gembloux Agricultural University, Animal and Microbial Biology Unit, Avenue Maréchal Juin 6, 5030 Gembloux, Belgium

[4] Walloon Agricultural Research Centre, Quality Department, Chaussée de Namur 24, 5030 Gembloux, Belgium

[5] University of Georgia, Animal & Dairy Science Department, 425 River Road, 30605 Athens, USA

[6] F.N.R.S., Rue d'Egmont 5, 1000 Brussels, Belgium

1. Aim and Objectives

Mastitis is the most frequent and costly disease in dairy cattle.

Advanced breeding tools require help to improve the mastitis resistance. Lactoferrin (**LTF**) could be an indicator trait for mastitis resistance.

Reference method (ELISA) is expensive and time consuming.

➔ **New approach :** Used **MIR Spectrometry to predict the LTF content.**

2. Material and methods

Calibration Equation

- 69 samples on a total of 1,609 milk samples taken between April 2005 and April 2006 analyzed by MilkoScan FT6000 and ELISA to measure LTF content (mg LTF/l of milk).
- Prediction equation by Partial Least Squares (RPD = 1,90).

Animal Population

- 7,690 samples in 25 herds and from 7 breeds were collected between April 2005 to May 2006.

Prediction of LTF (PLTF) by MIR Spectrometry

- Prediction equation applied to 7,690 spectra recorded between April 2005 to May 2006.

Quantitative Genetic Model

- Added 40,007 records on milk yields, %fat, %protein and somatic cell score (**SCS**).
- Multi-trait mixed model :

  Fixed effects : herd*date of test*class of lactation number; class of days in milk*class of lactation number; age*class of lactation number.

  Random effects : residual effect, animal additive, permanent environment within and across lactations.

3. Results and discussion

Table 1 : PLTF content in bovine milk for different breeds compared to Holstein breed.

	Difference	P-value
Brown-Swiss	15.73	0.19
Dual Purpose Belgian Blue	11.67	0.26
Jersey	31.21	0.04
Montbeliarde	18.39	0.15
Non Holstein Red and White	-20.11	0.09
Normande	14.4	0.13

Stage and number of lactation influence PLTF content in milk.

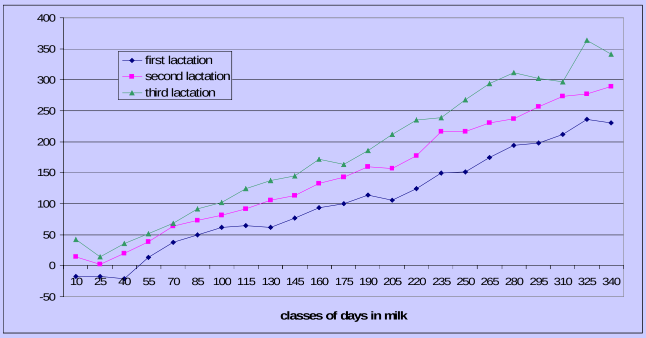

Figure 2 : Effect of the class of days in milk (represented by mid-point of the class) and the lactation number on PLTF content in bovine milk.

Heritability of PLTF close to 20 % : possibility to select for increased LTF in milk.

Table 2 : Estimate of variances ratio (in % of phenotypic variance) and corresponding standard error (SE) for each random effects (genetic, 2 permanent environments, residual).

	Genetic		Permanent environments: Within lactation		Permanent environments: Across lactations		Residual	
Trait	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Milk (in kg/day)	18.8	2.2	30.6	0.7	8.1	1.9	42.3	0.2
Fat (%)	31.2	2.3	4.9	0.3	5.7	1.7	58.2	0.3
Protein (%)	28.2	2.5	11.6	0.4	9.3	1.9	50.8	0.3
PLTF (mg/l)	19.7	3.1	22.0	2.1	6.2	3.2	52.1	0.7
SCS	12.1	1.8	29.6	0.7	7.2	1.6	51.1	0.3

Close to **zero genetic correlation** between **SCS and PLTF** indicates **differences in metabolic processes** for these traits.

Positive phenotypic correlation between these same traits (0.26) could suggest that the **PLTF** is also a **mastitis indicator**.

Table 3 : Genetic (above the diagonal) and phenotypic (below the diagonal) correlations between milk yield, percentage of fat, protein content, PLTF and SCS.

Trait	Milk	Fat	Protein	PLTF	SCS
Milk (kg/day)		-0.33	-0.45	-0.36	-0.02
Fat (%)	-0.18		0.6	0.33	0.06
Protein (%)	-0.32	0.39		0.5	-0.08
PLTF (mg/l)	-0.28	0.12	0.39		0.04
SCS	-0.17	0.07	0.13	0.26	

4. Conclusion

Indirect selection for LTF is possible.

Next step : **Genomic selection** based on the PLTF and solutions from the quantitative genetic models.

Gembloux Agricultural University