PhenoFinLait

French national program for high scale phenotyping and genotyping related to fine composition of ruminant milk

Félicie Faucon-Lahalle and PhénoFinlait Consortium
Felicie.faucon@inst-elevage.asso.fr

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www.phenofinlait.fr

phenofinlait@inst-elevage.asso.fr

Felicie Faucon-Lahalle

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History of dairy bull genetic evaluation

- 1960's => productivity
- 1980's => fat percentage and protein percentage
- From the 1990's to now => functional traits (mastitis, longevity, fertility…)

Many traits related to animals or production

Absence of traits related to product : milk

Why fine milk composition ?

- Fine milk composition = fatty acid (FA) and/or individual protein (IP) profiles of milk
- New phenotypes that give precious help for
  - Farmers (C18:1t10/C18:1t11 ratio as marker of acidosis)
  - Industries (level of protein phosphorylation, FA profile and milk fat texture)
  - Consumers (nutrition, flavor…)

How fine milk composition can be modulated ?

- Herd management
  - Feeding : in comparison to maize silage diet, pasture, grass forages or some supplemented diets increase milk mono- and poly-unsaturated FA content
- Genetics
  - High inter-individual variability and heritability non negligible => selection on fine milk composition is possible
  - QTL for fine milk composition detected : DGAT1, SCD1 and β-lactoglobulin.

A French dairy industry R&D program on thin milk composition

PhénoFinlait

PhenoFinlait : The French national program

- Many partners with shared interests for these new phenotypes :

CNIEL (Dairy industries and farmers)

France Génétique Elevage :
(France Livestock Genetics)

UNCEIA, ANIO and CapGène
(about 10 breeding companies)

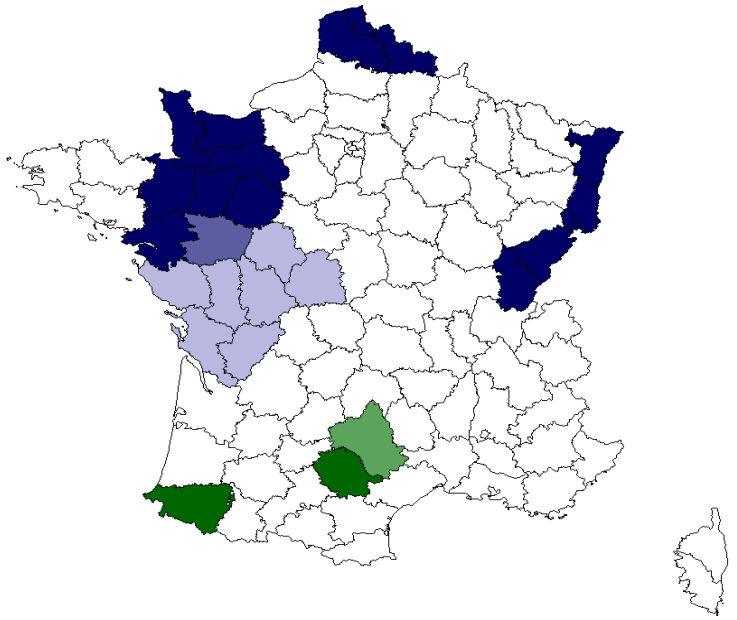
FCL and CNBL
(Milk recording organizations)

Actilait and regional laboratories

INRA
(French National Institute for Agricultural Research)
(4 labo, 4 exp. units, 2 dép.)

Institut de l'Elevage
(French Livestock Institute)
(4 teams, 3 dép.)

And about 1 500 farms



26 departments
3 species
7 breeds

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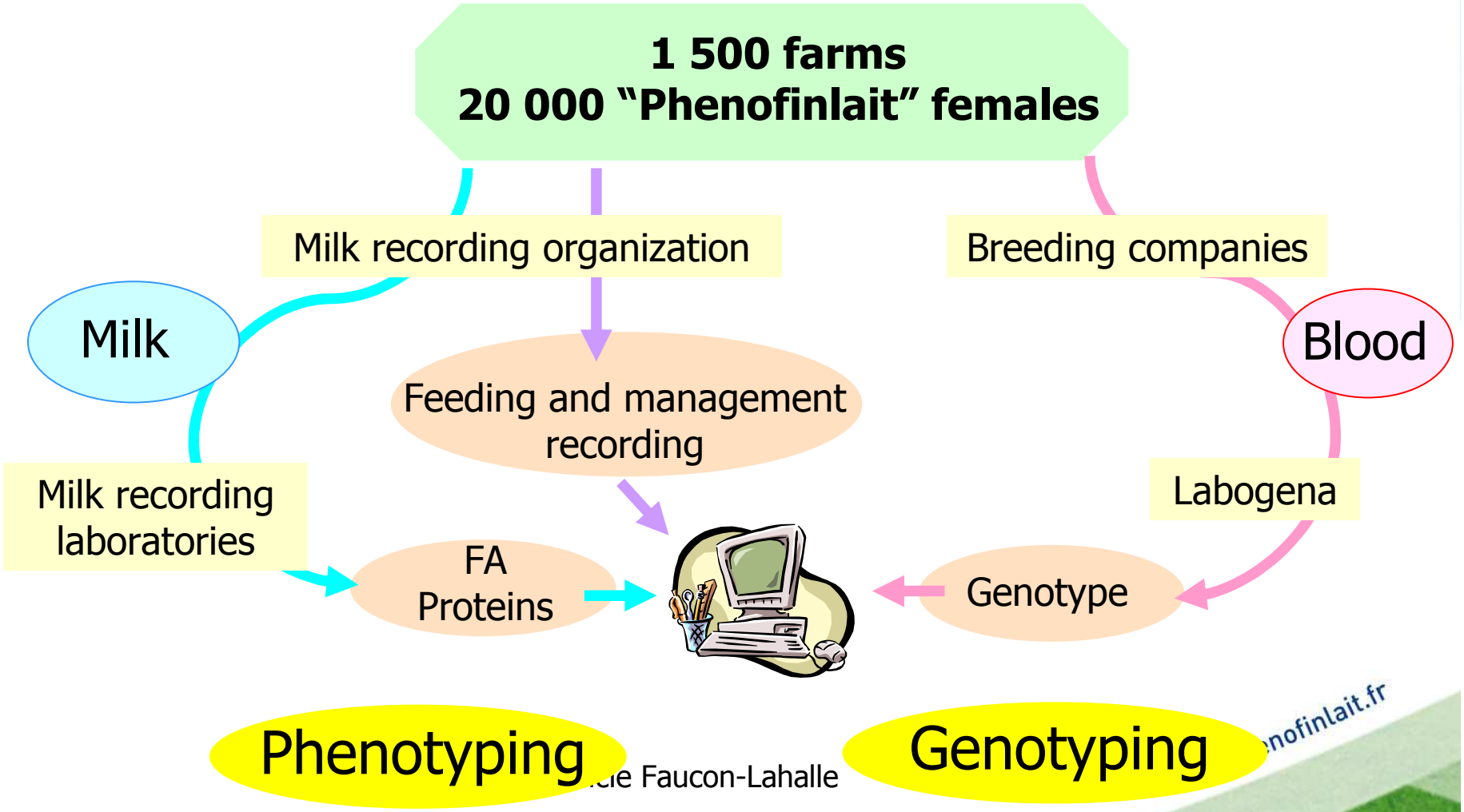
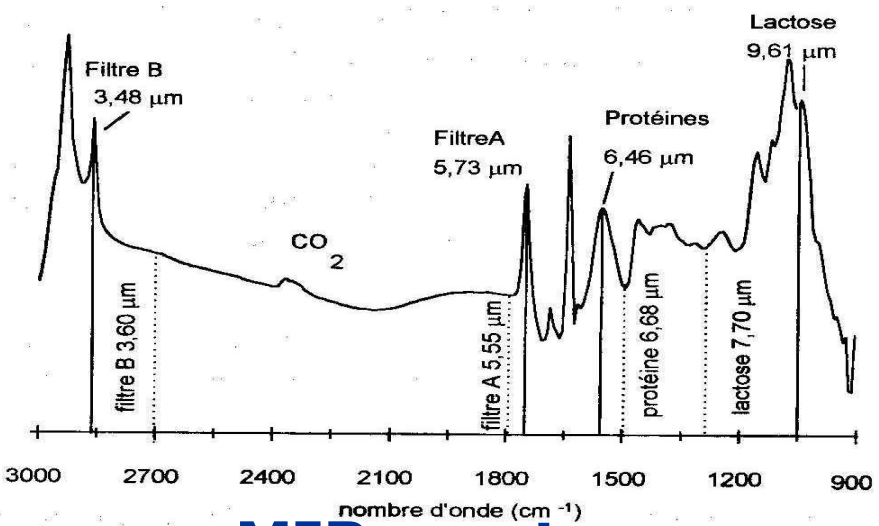
Several objectives

- Develop and control methods to analyze fine milk composition
- High scale analysis of milk composition and development of a huge data base
  - Fine composition (FA and proteins)
  - Feeding strategies and management of herd
  - Biological samples (blood for genotyping and milk)
- Understand how genetic and feeding strategies impact fine milk composition
- Create tools (genetics + feeding strategies) to adapt milk to variation to consumers demand and health

Materials and methods



Phenotyping method for FA



MIR spectra

- **60 FA analyzed with reference method (GC)**
- **Good estimations for 10 to 20 FA**
- **In milk of 3 species (cow, ewe and goat)**

Work is ongoing to calibrate MIR spectra of different analysers

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Phenotyping method for proteins

- Difficult to estimate with MIR spectra (many variants)
- Development of a reference analysis method: HPLC-MS
- Creation of reference databases for protein identification
- Analysis of 20 000 samples
- Attempts to link milk protein composition to MIR spectra

Conclusions

- An ambitious program
- Implicates all French dairy industry partners
- Diversity of stakes, including new breeding goals:
  - For the future: create knowledge basis for fine and ultra-fine milk composition, its control and its improvement
  - At medium-term: **enrichment of new selection program** and farmer feeding and herd management advice
  - At short-term: analysis methods for milk composition validated and operational. Capacity to improve these methods. Experience to manage and treat this new kind of data.

Thanks to every partners of this project

Thank you for your attention !

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