GÉNO SANTÉ: Improving productive health of dairy cows by genomic selection and management

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A collective achievement

GÉNOSANTÉ

Industry partners

From upstream

- Breeding compagnies
- Milk recording / herd support organisations

To downstream

- Milk processing industry

EVOLUTION Les éleveurs de vie

AURIVA L'ÉLEVAGE NOUVELLE GÉNÉRATION

élitest

GROUPE Seenergi GÉNÉRATEUR DE DÉVELOPPEMENT

Bretagne Conseil Elevage Ouest

EILYPS

AGRIAL

Scientific partners

- INRA
- IDELE
- ALLICE

Gathered in UMT 3G

3 G UMT

INRA SCIENCE & IMPACT

INSTITUT DE L'ELEVAGE www.idele.fr

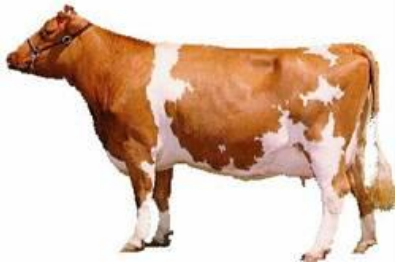
Allice ÉLEVAGE | INNOVATION | SERVICE

A first project bringing together in France stakeholders the whole dairy cattle sector!

Population and phenotypes available

2 (groups of) Breeds:

+



Holstein

Normande

3 (groups of) traits :

All phenotypes having the most significant impact on herd health, animal welfare, and economic viability of herd, and not already evaluated (eg. Mastitis):

- **Ketosis**: ketone bodies estimated from MIR analysis at monthly test-day **Evaluations available since Aug. 2016**
- **Claw health traits** recorded by trained trimmers
- **Other health traits** recorded by breeders for metritis, retained placenta, milk fever, displaced abomasum…

A genetic evaluation on Ketosis

What is ketosis? How to control it?

The main metabolic disease of dairy cows in early lactation

➔ What impacts?

- Decrease in **milk production** (-300 to -500 kg/lact)
- Impact on **reproduction** (cyclicity delayed and success at first service reduce up to 20%)
- Increased risk of **retained placenta** and **displaced abomasum** (x4 à 8)
- Increase in **clinical mastitis** (x3)

➔ How often?

- **Clinical ketosis: 3 to 4 % of cows**
- **Sub-clinical ketosis: 12 to 20 % of cows**

Aim: Prevent and reduce the risk of ketosis in dairy herd

- **Management:** From Cetodetect® indicator and specific technical services
- **Genetic:** a genetic evaluation of ketone bodies to improve genetic level of animals by selection.

1st step: a polygenic evaluation

A large population

- **2 traits for genetic evaluations:** log-transformed concentrations estimated from MIR equations:
  - **acetone**
  - **σβ–hydroxybutyrate (BHB)**
- **1 trait for validation and interpretation of the results: Cetodetect® indicator** determined by a decision tree from acetone and BHB concentrations (→health status of animals)
- **Population:** cows of herds from Western France with performances since 2012

Data edits

- Herds enrolled in **official milk recording**
- **Purebred** animals
- **Lactations 1-5**,
- **Days In Milk 7 to 120**

Data available for genetic parameters estimation

	Data	Nb Herd x Test-day	Nb Herds	Nb females	Nb lactations
Holstein	2 688 583	183 436	12 378	806 039	1 097 930
Normande	451 808	32 803	2 890	140 015	189 798

Model for polygenic evaluation

Model

- **2 traits, animal** model, **repeated data** over lactations
- **Fixed effects:**
  - herd x year
  - month x year of test-day
  - DIM x parity
  - age at 1st calving (or days dry x parity for multiparous)
  - milk analysis laboratory x year
- **Random effecs:**
  - Genetic value
  - Permanent envt

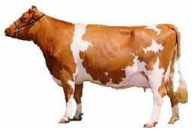
Genetic parameters: Results

Heritabilities and Genetic correlations

	log[BHB]	log[acet]
log[BHB]	**0.12**	0.851
log[acet]		**0.1**

Repetabilities and correlations betw. PE

	log[BHB]	log[acet]
log[BHB]	**0.22**	
log[acet]	0.879	**0.18**



	log[BHB]	log[acet]
log[BHB]	**0.15**	0.89
log[acet]		**0.16**

	log[BHB]	log[acet]
log[BHB]	**0.26**	
log[acet]	0.91	**0.24**

- Moderate/low h^2 , but low rpt (→ each performance brings much info)
- Analysis of EBVs with Single trait or Multiple trait model: very high EBV correlation

→ ST model for routine evaluation

2nd step: a genomic evaluation

Marker-Assisted (MA) BLUP Genomic Evaluation:

- Between 250 and 3000 pre-detected QTL (BayesCπ) using haplotypes

\+ SNP from EuroG10k chip for the residual polygenic part

Reference population = males + females

	Holstein	Normande
# genotyped cows with performances	26 899	5 832
# genotyped sires with DYD of ungenotyped daughters	4 314	1 038

First routine evaluation in Summer 2016

Data available

- >7 million of data in Holstein and 1.36 million in Normande

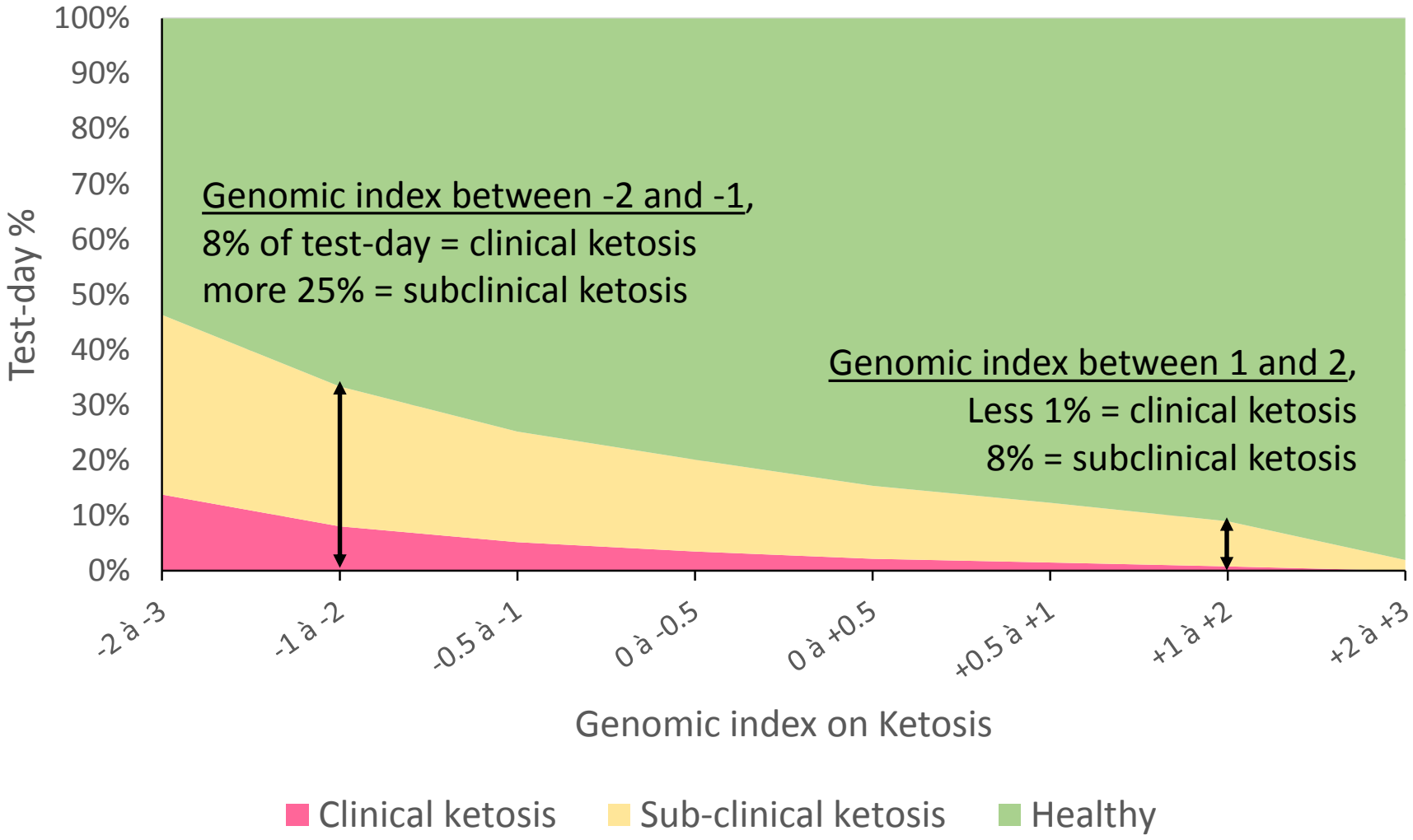
	Holstein	Normande
# females with EBV	1 394 951	257 785
# males with EBV	6 069	1 077
# females with GEBV	137 367	28 980
# males with GEBV	26 200	4 811

2 new indexes under GÉNOSANTÉ label

- **Ketosis index** = 50% BHB + 50% acetone
- **Productive health index** =
  30% Ketosis index
  30% Udder health index
  30% Fertility index
  10% Longevity

Evolution of the productive health index in the next years to **include new traits** such as claw health traits

Incidence of ketosis as a fonction of female genomic index



Reliability

- **Genomic evaluation:**

	Holstein	Normande
Young animals without performance	**0.66**	**0.58**

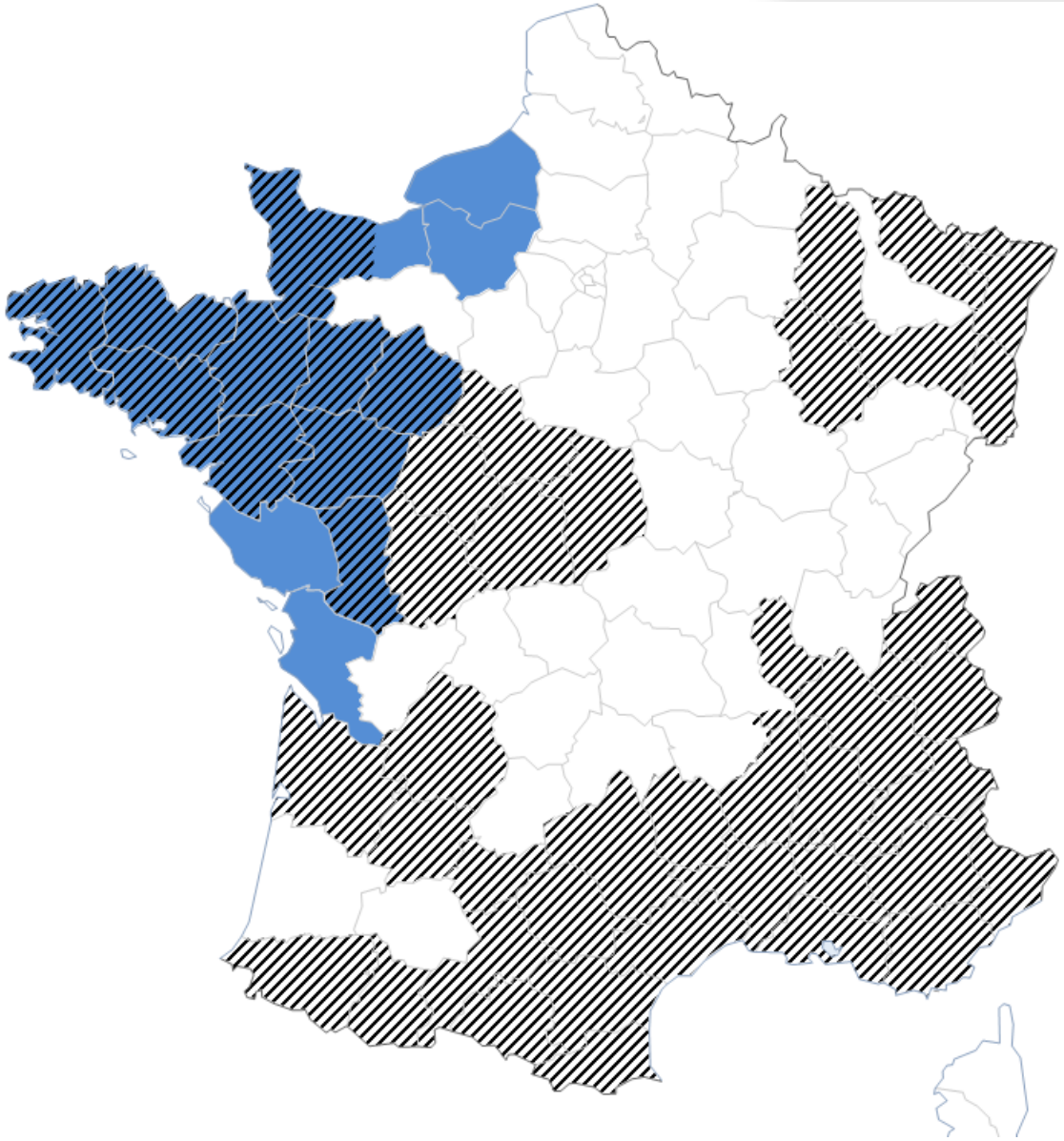
  - Reliability of Ketosis index close to that of other functional traits

- **Polygenic evaluation :**
  - Parent average reliability around 0,30
  - Cows with performances: from 0.50 to 0.60
  - Bulls : >0.90 when >100 daughters with performances

GENOSANTE label

Polygenic indexes available for herds subscribing to CETODETECT® services

Genomic indexes available for all animals genotyped by EVOLUTION and breeding compagnies partners of GÉNOSANTÉ



Conclusion

GÉNOSANTÉ is a **collective achievement** around a **joint project with shared interests** of the entire dairy cattle sector:

- For breeders: cows resistant to ketosis:
  - Limit the use of drugs and time spent to individual care.
  - Reduce production costs / increase profitability
- For herd support organizations:
  - Enhance Cetodetect® services
- For breeding companies:
  - A tool for differentiation in a competitive environment

Additional health traits are planned for next year…

Thank you for your attention