

## FRANCE: DAIRY BREEDING AND GENETIC ADVANCES



### KEY FIGURES:

**9797** kg/year

this is the average milk produced by the 2.3 million French cows subject to official milk recording

## The French dairy stock an exceptional situation

With 11.3 million heads of cattle, including 3.8 million dairy cows, France is the leader in dairy production in the European Union. The national herd includes a wide diversity of breeds, including the Prim'Holstein (2.5 million dairy cows), the Montbéliarde (665 000) and the Normande (426 000). Along with the Abondance, the French Simmental, the Pie-rouge des plaines, the French Brune and the Tarentaise, these eight breeds benefit from modern, effective breeding programmes, which produce significant and regular genetic advances.

The French national herd has an exceptional genetic range that meets the diverse needs of breeders, breeding situations and industry sectors. It includes both internationally significant breeds with high yield levels and breeds that are well adapted to difficult feeding and climate conditions.

The national system for the genetic improvement of these breeds is managed by France Génétique Elevage (the French livestock breeders' genetics organisation), which brings together the different stakeholders of French breeding programmes.



# 1

## Comprehensive and rigorous breeding programmes

The French programmes combine **selection of pedigree, planned mating, genotyping, animal-rearing data registration and progeny testing.**

They are constantly being improved, and include the latest technological and scientific advances, particularly in terms of sanitary conditions and genome evaluation.

In order to maintain consistency and rigour, the technical protocols for each of these stages are identical for all breeds. They are laid down nationally by the Institut de l'Élevage (the French breeding institute), which is responsible for supervising and providing technical assistance to the breeding programmes operators.

# 2

## Diversity and complementarity of breeding criteria

Each breed defines its breeding objectives, taking into balanced consideration precise and varied performance criteria relating to:

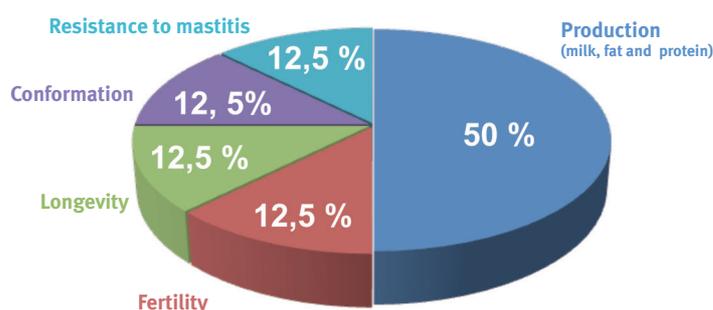
› **increasing the quantity and quality of the products** (milk, fat, protein).

› **improving functional traits** (fertility, resistance to mastitis, ease of calving, longevity, udder conformation, feet and legs, etc.) in order to reduce production costs.

Genetic value indices are published for each of these traits. A global merit index (ISU) which is a combination of the different criteria, uses a specific weight for each breed.

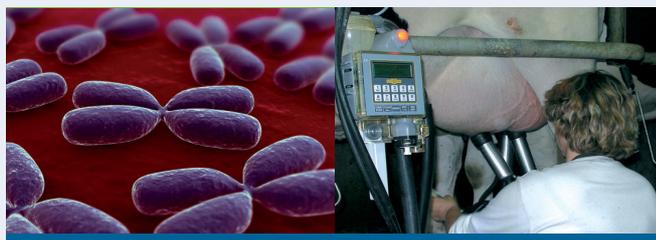
Each breeder can thus choose his breeding stock according to the combination of qualities that is most appropriate for his objectives and his holding, in France or anywhere else in the world.

### GLOBAL MERIT INDEX (ISU) PRIM'HOLSTEIN BREED



# 3

## Animal-rearing data enriched by genotyping



Genetic evaluation is based on:

› **animal-rearing data recorded on the farm** (yield quantity and quality, type evaluations, etc.) for over 2.3 million dairy cows each year. These recording operations are carried out under the responsibility of technical bodies which are independent of the breed organizations.

All these processes are subject to external checks and to a comprehensive quality management system, which is recognized internationally for its rigour. Therefore, it enabled France Génétique Elevage to obtain ICAR (International Committee for Animal Recording) quality certification.

› **the results of DNA analyses (genotyping)** of over 25 000 animals per year, carried out by approved laboratories. This genomic information enriches the animal-rearing data and makes it possible to make genetic advances even more rapidly.

To guarantee their reliability, all the animal-rearing and genetic data are registered through a unique national genetic information system. **The national genetic database is undoubtedly the largest in the world:** it includes information concerning over 150 million cattle and, for example, it contains nearly 600 million daily milk production records.

**The calculation of the genetic breeding values and the taking into account of all relationships are based on the most up-to-date statistical methods (blup animal model, etc.).**

Under the responsibility of the State, these genetic evaluations are carried out by the National Institute for Agronomic Research (INRA).

For each animal of a breed, they relate to the same traits. The genetic value indices are always expressed as a difference from a reference basis, re-evaluated each year taking into account the genetic advances. The breeding values, which are updated three times a year, are officially published by the *Institut de l'Élevage*.

## AN EFFICIENT INDIVIDUAL IDENTIFICATION

France was the first country in the world to make compulsory the individual identification of cattle all over its territory in 1978. Since then, the system gradually integrated every technological innovation, including electronic identification.

The bovine individual identification number is the basis for the registration for all the information gathered throughout its life (animal-rearing, genealogical, health, genetic, etc.).

In addition to the traceability for sanitary purposes of animals and their products, this particular feature of the French information systems is one more asset in the successful integration of all the data necessary to make the genetic indices rich and accurate.

## 4

### Long experience in progeny testing

For over 40 years, the only French sires diffused on a large scale by animal insemination (IA) have been those whose genetic superiority has been proven by progeny testing or by genomic evaluation since 2009.

The young bulls preselected for progeny testing are the result of planned mating combining the search for specific qualities and the maintenance of wide genetic diversity. The final selection is rigorous. **Only 25% of the preselected young males in the end proceed to progeny testing.**

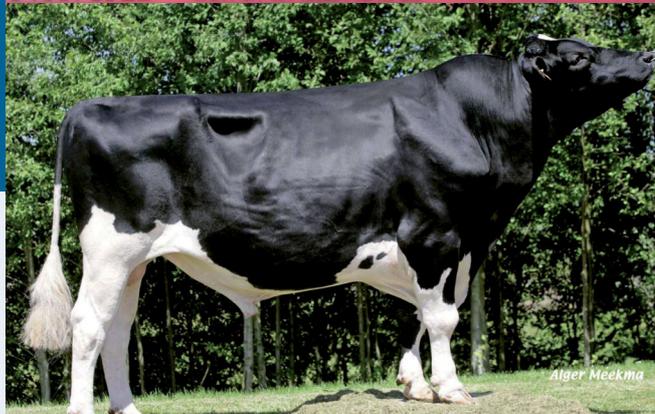
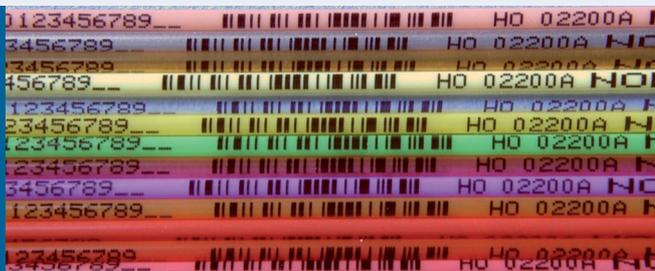
For each young bull, 300 to 1 000 AI are carried out in the same number of herds. All the female offspring are tested on their yield, their functional traits and their conformation.

## 5

### At the cutting edge of progress in genome-based breeding

Since 2002, breeding programmes for the Prim'Holstein, Montbéliarde and Normande breeds have included genomic information obtained through DNA analysis. **Since 2009, all breeders can access to this full, new-generation genetic data.** The genomic breeding values relate to all the traits evaluated up until that time on the basis of progeny (roughly 40).

These genomic evaluations are carried out by INRA and UNCEIA (the federation of the French breeding organizations), with the participation of the *Institut de l'Élevage*. **The size of the reference populations** on which they are based (animals with both genomic evaluation and breeding values) **ensures**



### LARGE-SCALE PROGRAMMES

In 2010:

- > 2.3 million dairy cows were subject to official dairy recording, of which 1.9 million were recorded in pedigree information and 350 000 were subject to morphological evaluation
- > 650 bulls subject to progeny testing and 3500 males were genotyped
- > only 325 bulls were selected for diffusion by insemination, of which 125 after progeny testing and 200 after genomic evaluation.

According to the estimated breeding values calculated using these results, only approximately 20% of the bulls tested are kept for diffusion through AI.

**that they are highly reliable:** 1 250 bulls for the Normande breed, 1 500 for the Montbéliarde breed and 18 300 for the Prim'Holstein breed within the framework of the Eurogenomics project.

The successful incorporation of this technological revolution makes it possible to achieve **even faster genetic advances in all the selected qualities** (yield quantity and quality, functional traits). It also makes possible to offer **a wider range of breeding stock**, in terms of genetic diversity, performance (longevity, resistance to diseases, etc.) and other desired criteria (red colour factor, hornless, etc.).

**In 2010, France was one of the first countries to get interbull official approval for its genomic evaluation method.** The acquired experience will make possible to expand it just as successfully to other breeds of dairy cow.

# 6

## Convincing and recognised results

For over 20 years, the annual genetic progress of the 3 main french breeds has been between 65 and 100 kg of milk. In 10 years, the annual average yield of a French Prim'Holstein cow has thus increased by 1 000 kg per lactation, thanks simply to the genetic improvement of the breed.

The official international lists of awards published by Interbull regularly attest to the excellence of these results, known for their accuracy and reliability. Since 1995, French sires have been amongst the best in the world. At the international Interbull evaluation in August 2010, 30 of the 154 Holstein bulls with over 165 ISU points were French. This result put **france in 2nd place worldwide**.

Many foreign countries with a very wide range of different breeding conditions rely upon the products of the French breeding programmes. In 2010, **over 2.5 million doses of semen, several thousand embryos and approximately 50 000 french breeding stock bovines were sold worldwide**.

With impeccable health guarantees, French genetics is thus contributing to the improvement of the yield and functional qualities of dairy cows in over 90 countries.

For further information, please contact **France Génétique Elevage**.



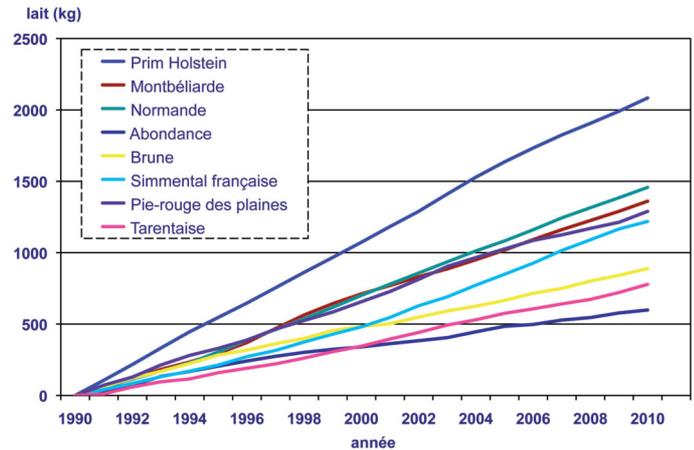
### OUTSTANDING PRODUCTION LEVELS

	COWS SUBJECT TO OFFICIAL MILK RECORDING	AVERAGE LACTATIONS	FAT CONTENT	CRUDE PROTEIN
All breeds	2 301 475	9797 kg	3,99 %	3,40 %
Prim'Holstein	1 575 591	10751 kg	3,97 %	3,37 %
Montbéliarde	369 387	7924 kg	3,91 %	3,44 %
Normande	218 050	7469 kg	4,29 %	3,63 %
Abondance	19 915	6155 kg	3,7 %	3,48 %
Brune	15 934	8374 kg	4,21 %	3,61 %
Simmental	13 938	7038 kg	4,04 %	3,54 %
Pie-rouge	9 075	8718 kg	4,25 %	3,47 %
Tarentaise	6 475	4919 kg	3,59 %	3,38 %

Equivalent Adult Lactations  
Source : Institut de l'Elevage / FCEL 2010



### REGULAR AND SIGNIFICANT GENETIC ADVANCES



Source : Institut de l'Elevage / INRA 2011



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