Breeding goals!
How to handle different breeding goals in a highly competitive market between AI organisations

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Summary:
Every AI organisation tries to stay competitive. A better understanding of the future of the milk market, and dairy farmers production conditions results in a different breeding goal for Amelis, focused on protein, reproductive traits, udder, feet and legs.
A combination of domestic bull selection and foreign ones leads to a greater genetic variability and better chances to pick the best genetics from any source. Marker-assisted selection and management of genetic variability programs, developed by French research, are tools which permit to maximize the genetic gain on short and long term at the same time.

Introduction
AI organisations try to meet the dairy farmers demands for the next 10 years as dairy selection is a long term process. Amelis tries to figure out what the dairy industry conditions will be like in the future in order to fix its breeding goal. Other breeding organisations might well do the same thing. The bull selection sources and other selection tools will make the difference in the end. We will have an overview of the Amelis breeding criteria and the selection tools made available to achieve this goal.

Breeding goal:
It's fairly easy to find the best breeding goal for now. But in our AI organisations we have to buy bulls now to breed cows in 6 years time. And so we have to make the best choices looking at what would be the demand over that period.

Amelis is a cooperative organisation so we first follow our local members needs, and try to anticipate their future breeding goals. The Amelis breeding goal is now based on the day to day living of its members and their cows on the long term.

Looking at the economic trend of the milk market is the first way to define our breeding goal in regard to production. The market is clearly oriented towards protein world wide.

Secondly, our members are located in an area where the density of cows (over 18 dairy cows/km^2) is one of the highest in Europe. This means that they have a good chance to be able to keep on producing milk because most of the milk factories are close by. But also they will have to deal more and more with environmental conditions. The first example is the “140 units of fertilizer per hectare” regulation for farmers located in an area close to a river. Those dairy farmers have to decrease their number of cattle by 20 to 30 %. So if they want to produce the same volume of milk, they need to breed for more productive and efficient cows.

Thirdly, the average herd size will increase dramatically in the future. In France, it is expected to go from 97 000 milking herds to 40.000 dairy farms in 2012. And the average milk quota should go from 250 000 litters per herd to 600.000 (INRA studies made by Vincent Chatellier). At the same

time, it is expected that the number of people in charge of those herds will not increase. So cows will get less individual care. Less care means that cows need to be more functional.

Reproductive traits have a major impact on the cows' functionality. First, cows have to calf easily. Farmers will not have the time to spend looking after each calving, and easy calving is also correlated to daughter fertility.

The fertility of cows has now become a big issue. Firstly, the genetic trend on fertility potential is decreasing. Secondly, for the same genetic level, fertility is worse in bigger herds.

Finally cows need to last longer. Low cell count and good fertility help a lot to improve longe-vity. The genetic correlation for longevity with cell count is + 0,50 and with daughter fertility +0,48. Also type improves longevity, but not all criterias. Udder is highly correlated with longevity (Udder depth + 0,47, fore attachment +0,25, rear attachment: +0,26). Body depth is correlated negatively to longevity (- 0.35). It doesn't mean that we need small cows because they need to be big enough to carry a calf and handle high production, but this means that cows we are milking now are big enough and we don't need to look for bigger ones.

Therefore the Amelis breeding goals for the coming years are protein, functional traits (especially daughter fertility) and type (udder, feet and legs).

Genetic tools:

Bull selection world wide.

French breeding organisations have imported Holstein genetics for many years. First through live bulls in the 60's and 70's. Then through embryos starting in the middle of the 80's, those embryos were resulting in bull and heifer calves. The heifer calves were a new local base to work on for genetic progress. At the same time, that some French bulls were becoming known world wide , we were able to make some different matings, mixing American, Dutch and French genetics in our members herds, resulting in bulls like Fatal, Heldostar, Jocko Besne, and today Rikonvi, Survivor or Roumare.

In order to stay competitive and to gain the benefits from the best genetics, the French AI organisations never gave up the import of embryos or live animals from different countries: still from American countries but also in recent years from the Netherlands, Germany, Italy and Denmark. About 2000 embryos are imported each year from high potential cows. In this way we try to stay open to the different sources of genetics.

Local bull sourcing

Half of the breeding program for Amelis is built around our members best cows. 3000 females are followed very closely and mated with a wide range of bulls. Among the 3000, there are 200 that we mate specifically for a bull contract. But for the others we also provide a mating device to the breeder. We employ specific technicians to do this job from farm to farm. There are 3 reasons why we do this:

- we can use a wider list of bulls and avoid ourselves the from one bull drop,
- half of bull dams are heifers, so if they don't turn out well, you can find a replacement in the second part.
- periodically the breeding goals are changing so by keeping one eye on a wider group of cows, we have more guarantees to find new bull mothers still close by and get first choice for buying a bull.

A strong partnership with our local breeders, that are also members of the cooperative, provide Amelis a secured bull sourcing by a good knowledge of the farm management and the cow families

Optimized management of genetic variability

Loss of genetic gain is a big risk if we decrease the genetic variability at the same speed we do now. In 2006, the French national institute for agriculture research (INRA), set optimisation algorithms for minimizing the average pair wise kinship coefficient at each step of the breeding schemes. Those steps are procreation of young bulls, selection of bulls for progeny-testing, selection of recently progeny-tested bulls and use of service bulls.

Practically, the AI organisations provide to INRA the list of animals that they want to work with at each step (potential bull dams and bull fathers, young bulls, service bulls). Also, they set their average genetic level for overall selection index (ISU) to a pre-defined value.

Each AI organisation receives a list of recommendations telling us how intensively we should use a bull, or how many sons we should sample from each bull dam or sire of sons. Those theoretical recommendations permit to reduce about 20% of the average kinship coefficient between individuals.

Marker-assisted selection

In 2000, a partnership between the INRA and the French AI organisations was concluded to implement a marker-assisted selection (MAS) in the three main French dairy breeds: monbéliarde, normande and Holstein. 43 microsatellite markers (identified pieces of DNA) allowed following transmission over generations of 14 chromosomal regions containing QTL (chromosomic regions with significant effect on a quantitative trait), and affecting milk production or composition, type, mastitis resistance or female fertility. The value of such a program concerned young bulls before progeny test or young females before first breeding, all without performance. The objective of MAS was to provide breeding companies with more precise estimations of breeding values for breeding goals in particular for low heritability traits. MAS provides more precise comparisons between full sib or half sib offspring of a sire of sons or a bull dam. Observed prediction abilities were in favour of MAS.

A new generation of QTL detection system based on SNP (Single-Nucleotide Polymorphism) technology (smaller DNA pieces compare to microsatellite) will provide breeding organisations an even more precise genetic estimation as comparisons will able to be done between any individual young animal. QTL detected by SNP's will be informative in any cow family and then offer the opportunity to get better genetic estimations on animals quite low on regular pedigree index that were put aside on the traditional selection system.

Conclusion

By breeding for protein, fitness traits and functional type, Amelis geneticians hope to be close to the future demand of their farmer members. Competition on the world semen market is more and more aggressive. In order to stay competitive on their market segments, AI organisations have to choose the right breeding goals but also combine the regular bull sourcing with the use of new tools. Even if we are able to detect and multiply one individual animal, we need to keep an eye on the reduction of the genetic variability in the whole population in order to keep going on in the long term with genetic progress.