France's strategy for a more profitable beef & sheep industry

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Abstract

France has developed genetic programs to improve beef cattle and sheep in order to set up a more profitable beef and sheep industry. To achieve this, for each ruminant species, the French livestock organizations have a single national genetic information system (called SNIG in French). It collects all the recorded traits in the same national recording scheme and it receives also data from other databases such as the national database for identification and traceability (I&T). The governance of all SNIG is provided by FRANCE GENETIQUE ELEVAGE (FGE), the national value chain organization for the genetic improvement of ruminants, and the Ministry of Agriculture. For the future, FGE is developing strategies to exchange even more with other databases, especially in small ruminants, in order to have a single system for all ruminants to exchange with all farmers, to reform all SNIG in the same single national genetic information system and to create custom built services for hosting particular data.

Keywords: national genetic information system, database, exchange, strategy

Introduction and context

France is an important bovine and ovine meat producer in Europe. France has the first rank for bovine meat production (in the top ten in the world) and the 3rd rank for ovine meat production. With more than 4.1 million heads of cows in 2010 (Institut de l'Elevage Geb, 2011a), the French herd is by far the largest in Europe and includes some specialized (Charolais, Limousin, …) and hardy (Salers, Aubrac, …) breeds. For sheep meat production, France owns about 4 millions of purebred or crossbred ewes (Institut de l'Elevage Geb, 2011b). A wide range of sheep breeds is available with some specialized breeds (Ile de France, Charollais …) or some hardy breeds (Lacaune, Blanche du Massif Central …) or prolificacy breeds (Romane …).

The particularities of the bovine meat production are a production with pure breeds, a high percent of meat produce with carcass of cows and a production of veal meat. Each year, about 1 million of weaned calves are sold to the Italian breeders making some fattening.

For the sheep meat production, the slaughters of lambs represent 86% of the total slaughters. We find purebred lambs and crossbred lambs (simple or double stage crossings).

About 102 000 farms own more than 5 suckling cows (Institut de l'Elevage Geb, 2011a) and there is a strong tendency toward bigger farm size. As of today, 28% of farms have more than 50 cows and represent 57% of the total number of suckling cows. For sheep, all suckling

ewes are owned by about 52 000 breeders and 63% of them have more than 200 ewes per farm.

France develops high-performance programs for nine beef breeds. For the main specialized breeds (Charolais, Limousin and Blonde d'Aquitaine), on-farm and on-station evaluation of young bulls are completed by a progeny testing for maternal traits and meat traits. For the other breeds, only on-farm and on-station evaluation of young bulls are made.

The beef recording scheme is composed by a large population (930 000 cows) followed by a parentage recording system where 760 000 birth weights are collected. About 60 performance recording organizations (PRO) collect weaning weights and linear scorings of 340 000 calves (Guerrier et al, 2011). The best males, born from planned matings or identified on farm with all recorded traits, are selected after weaning using individual on-station testing (more than 2200 bulls per year, for traits like feed efficiency, post-weaning growth and linear scoring) and for some future AI bulls and some breeds, using progeny testing on maternal qualities and beefing abilities.

France has complete selection programs for meat sheep. These programs are characterized by a large sheep recording scheme including on-farm and on-station evaluation of young rams and progeny testing only for few breeds and for meat abilities or/and maternal qualities. 58 PRO collect all matings, lambings, weights and all breeding events. 285 000 ewes are followed in more than 1 100 flocks (Tiphine et al, 2011). About 3 500 rams have each year an individual on-station evaluation. Finally, over 220 rams are progeny tested. Since 2002, a national program for scrapie resistance (more than 750 000 genotypes made in 10 years) was developed.

For both sheep and beef cattle, the selection criteria are chosen according to their economic interest, their interest for all breeding societies and the feasibility of the collect.

The selection objectives in beef cattle concern the calving ease collected on farm, the beefing abilities collected on station and on slaughterhouses (including traits on live animal and carcass traits), the maternal qualities (calving ability, fertility, suckling) and some new traits like docility. For sheep, the selection objectives concern the meat abilities, the maternal abilities (prolificacy and suckling), the mortality of lambs and the scrapie resistance.

To achieve these objectives and to collect all data from on-farm recording schemes, individual and progeny on-station recording schemes, French people have a SNIG for cattle called SIG and a SNIG for sheep called OVALL. The objective of this paper is to present the France's strategy towards the collects, the exchanges and the management of data.

National genetic information systems to achieve genetic improvement

At the end of the 20th century, all organizations of the national genetic programs decided to create a central genetic information system for each species. The objectives were:
- To centralize all data to manage genetic programs,
- To share data between all organizations,
- To modernize the database management system.

The first system created was the SIG for dairy and beef cattle. It is built on the national system of bovine identification and traceability. The SIG is composed of regional databases

and one national database (figure 1). Some regional databases use directly the SIG as their local database to manage identification and traceability. All organizations use different software to update their data. For genetic evaluations, INRA (Institut de la Recherche Agronomique) has a specific database called information and research database (BDIR) which gathers data from the SIG and the Normabev databases. This last database collects all the data about slaughter.

For sheep, France has two genetic information systems, OVALL and SIEOL (for milk sheep). OVALL has been the system for meat sheep since 2006 (figure 2). OVALL has its own management of the data of identification and traceability because no national system existed. The movements of sheep managed by batch and the management of all breeders have been developed since couple years. However OVALL has only the access to the management of breeders (identification numbers…). All the sheep organizations use the same software for the management of all their data. As in cattle, INRA uses its own database for genetic evaluations.

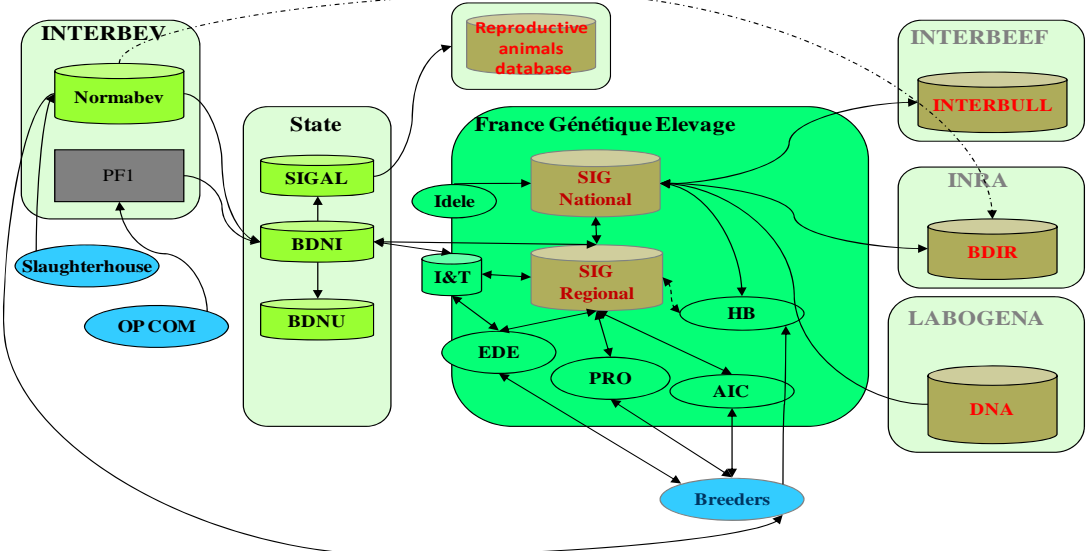FGE and the Ministry of Agriculture manage all the genetic information systems.

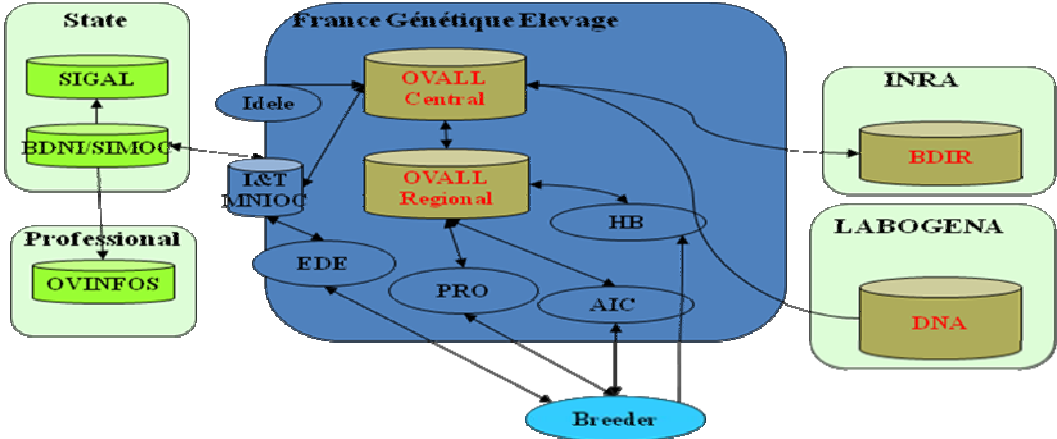*Figure 1. Relationship between SIG and others databases - Cattle data exchanges*

Figure 2. Relationship between OVALL and others databases – Meat sheep data exchanges

Strategies of France Genetique Elevage to collect or to exploit new data for the future

As for now, FGE is developing new strategies to exchange even more with other databases, especially in small ruminants. The main goals are to have a single system for all ruminants to exchange with all farmers, to reform all SNIG in a same single national genetic information system and to develop custom built services for hosting particular data.

Reform all SNIG in the same genetic information system

All the made evolutions are directed by manners to establish later a common information system to all ruminants. When the information is common, it is gathered in the same physical entity tables. For example, during the development of the management of informations about young rams in individual on-station evaluation, French organizations created some common tables between OVALL and SIEOL. Data about breeders such as their identification's numbers or their addresses are already managed in a common part of the SIG.

Exchange even more with others existing or new database

French organizations are developing the future national information system for traceability especially in sheep. The aim is to connect this system to OVALL and to the others small ruminants genetic information systems. As for now, the performance recording organizations are collecting all sheep movements and are managing the inventories. As soon as possible, we will have a connection between OVALL and the local I&T databases (two kinds: the same physical entity table or an exchange between two entity tables). In the same

time, in sheep, French organizations want to ameliorate the evaluation of the mortality of lambs since it is an important trait for livestock's profitability. We expect that the new system of management of traceability will be helpful to do so.

We also try to develop new genetic evaluations using new data like collected data by the computerized sanitary pads in cattle. The aim is to exploit data of these sanitary databases and perhaps to connect them with the SIG.

For sheep, all organizations want to share the genotypes of the PrP gene, the high prolificacy genes, the Myostatin gene in order to manage these genes in the breeding programs. So exchanges are developed between the databases of the genotyping laboratories and OVALL.

In the end, the priority is to valorize the maximum of the collected data which have an interest for the profitability of sheep and beef industry. All the new evaluations will be developed by using existing databases: productive life, stayability, carcass traits, sanitary data for beef cattle and mortality of lambs for sheep.

Exchange with a single system for all farmers

Since a few years, all the SNIG have direct data flow with the farmers. Farmers have software to send data of identities, births, movements, parentage recordings, performances, artificial inseminations and herd management. Many sheep farmers have bought specific software since the advent of the electronic identification.

Thanks to specific exchanges, breeders can also receive information from genetic information systems. For example in cattle, we use a File Transfer Protocol (FTP), an account for each breeder and an exchange standard vector (called VSE, in ASCII format) to exchange I&T data.

Under the responsibility of FGE, a national project named EDEL is setup to define standardized modalities for exchanging all data between databases and farm software only for the part of livestock management of ruminants. The aims are the standardization of data exchanges in both directions, the cooperation between breeding organizations and software editors, the use of Extensible Markup Language (XML) standards and FTP. For all ruminants, we develop a FTP count for each breeder and in small ruminants, we will use EDEL to exchange data for I&T.

Create custom built services

With the arrival of the genomics, FGE want to develop collection of new data. For example, in beef cattle and meat sheep, we want to have information about the docility and the behavior towards the breeders. For sheep, the collect will be made during on-station evaluation by the selection organizations. For beef cattle, the collect will be made during the weighings and the scorings of calves by the performance recording organizations. If in these examples, the new data are shared between all French organizations, this is not the case of all initiatives in the context of the genomics. So the last challenge of FGE is to develop custom built services to manage new data which are not shared between all genetic organizations. The

aim is to have the same standards (exchange formats, physical data structure, data dictionary, standards of software's development…) between these services and the collective genetic database. The collective database will accommodate these private data by managing access rights. The challenge is to facilitate the management of these data depending on the agreements between the organizations and the evolution of these agreements.

Conclusion

French livestock organizations have developed since the end of the 20th century a large genetic information system for each main ruminant species. The arrival of new technologies in computing or in genetics (like genomics) imposes some evolutions in the strategy of FGE. We must develop valorisations of all interesting data collected in other databases in order to increase the profitability of beef and sheep industry.

To achieve this, FGE want to develop connection between all databases, to give to all breeders a modern solution of exchange of data and to reform all the SNIG in a common genetic information system.

On the other hand, FGE must keep collective genetic databases and must develop a new service to offer a solution to all the genetic organizations for the collect of new private data.

FGE must have a reflexion about the management of the genotypes like the results of SNP chip. These results are really strategic and difficult to share. However it is important to avoid making several genotypes of the same animals.

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