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Dual purpose breed, a more sustainable choice ?

Background

Actually in France, milking bovine races are distinguished according to the orientation of their selection. There are dairy ones specialized and dual purpose one, balanced between milk and beef. In the past, farmers reared multi purpose cattle. They could produce milk, butter, beef and use animal draught and animal manures in autarkic farming systems. Gradually, animal traction and organic fertiliser became less important with the development of new techniques in agriculture. Then, around the fifties, multi purpose breed became dual purpose breed, restricted to milk and beef abilities. Dual purpose breed can be defined in contrast with specialisation (dairy or beef) through balanced abilities. A dual purpose cow is a milking cow, which have a beef production when it's culled and through her fattened sons (Jarrige, 1976). But such breeds weren't enough competitive during the thirty-year boom period and gradually declined. Farmers prefered moving towards dairy specialized breeds, especially Prim'Holstein or towards suckler breeds like Charolaise.

However, some dairy farmers have kept dual purpose cattle, in opposition to agricultural organisations advices. It was a complex way, especially in the selection because of negative genetic relationships between some beef and milk criteria (Aass, 1996).

Since the end of the eighties, we can observe an increasing of cows numbers in french dual purpose breeds while Prim'Hosteins cows are lightly decreasing (FCL, on farm recording, 2006). This kind of breeding way is also developed in other european countries, for example with Fleckvieh cattle in German or in Austria. Since the end of the eighties, the context of French breeding led to consider this dual purpose breed choice and made us wonder about the interest of this type of cattle. Perhaps farmers were they looking for a kind of sustainable breeding through dual purpose breeds?

The aim of this paper is to define the notion of dual purpose breed, then to understand its implementation in breeding schemes. Finally, we'll wonder whether this breeding way could contribute to sustainable livestock farming systems.

Method

In order to deal with our problematics, we have developed a research approach on the level of breed populations. We leaned on six french milking breeds, described as dual purpose breeds by national experts (FUS, 2007). We have studied breeding schemes applied to these six breeds wich are Montbeliarde, Normande, Abondance, French Simmental, Bleue du Nord and Vosgienne. We have interviewed fifteen breeding managers starting from a questionnaire. People we met were responsible for breeding schemes or for breeding organisations. Each survey has been studied in two directions, first about the perception of dual purpose aim and

second its implementation through the detailed description of breeding schemes. Data were qualitatively analysed.

Results

1. Characteristics of studied populations

There is a great variability between studied breeds (Table 1). Montbeliarde and Normande are the most important with cows numbers over 700 000 including between 250 000 and 370 000 milk recorded one. Then, Abondance and French Simmental appeared as little breeds with 30 000 at 60 000 cows including 15 000 at 21 000 milk recorded one. At last, Bleue du Nord and Vosgienne had even less cows numbers than the previous. They have less than 10 000 cows including about 1000 milk recorded one. Among these populations, Abondance and Vosgienne are first looked as mountain breeds. They are described as both hardy and dual purpose breeds.

2. Definition and view by breeding managers.

The dual purpose designation was not necessarily used by stakeholders. Some of them considered it is ambiguous, not enough precise, indeed pejorative. Dual purpose meaned both "all and nothing". "Cows produced milk and beef, but not milk enough for a good profitability".

Globally, dual purpose designation appeared like a plural notion. Three main meanings have been raised (table 2).

Dual purpose through technical production terms concerning milk yield, growth rate and carcass yield. We had to distinguish mountain breeds, for which beef abilities took a particular way. Musculature was important for adaptation to mountain conditions but little sizes were necessary for animal mobility. These two criteria together did not contribute to high carcass weights.

Dual purpose through economic ratio, considering the respective part of each production milk and beef in the livestock income. For a dual purpose cattle, proportion of meat sales could reach 30 to 40 % of animal income instead of 10 to 15% for a dairy specialized breed like Holstein.

Dual purpose through robustness traits. Four breeding managers (of Montbeliarde, Normande, Abondance and Simmental) integrated robustness traits in the dual purpose breeding goal. They talked of resistance to sanitary or feed aleas. They also talked of ability to mobilise body tissues but not too much. In this way, dual purpose cows were able to preserve their health and especially their fertility. Managers of Montbeliarde and Simmental believed that keeping some musculature preserve this regulation capacity and allow a better control of milk increasing.

This different perceptions are expressed in the breeding goal. Almost all breeding managers gave the first part to increasing dairy abilities. Selection is focused to improve milk yield. The weighting adapted to the goal system (method of total merit index ISU) is always superior to 50 % (table 3). In second, four of them (in breeds Normande, Simmental and Bleue du Nord) tried to keep beef abilities, the others tried not to decrease meat production too much and emphasized on fitness traits. Little populations stakeholders (Abondance and Vosgienne) mainly talked of maintaining the genetic diversity.

3. Implementation of dual purpose aim in breeding schemes

The six studied breeds had genetic strategies on farm recording based. They followed the classical stages of a dairy breeding scheme, firstly preparing breeding mating to obtain males for progeny test, secondly sorting out of males in breeding centres and thirdly, progeny test.

31. *selection of sires and bull dams*

Sires choice was generally based on main dairy abilities. Managers took sires with better total merit index (ISU) and without failings especially concerning type or fitness traits. Beef abilities were not considered at this stage, excepted for French Simmental, connected with German Fleckvieh.
By comparison, bull dams choice appeared as a real choice, based on better merit index (ISU or INEL). A Control Committee, formed with managers, farmers and technicians examined precisely possible dams, considering elementary genetic values, type notations, milk yields...This choice associated genetic data and empirical knowledge of animals and rearing conditions.
We have identified two strategies of bull dams selection. Once according to"complementarity in mating". Bull dams were choosen with balanced abilities, genetic dairy value, animal type and beef morphology as fitness traits. Breeding managers tried to correct some lacks of sires in this dams choice (breeds Abondance, Simmental, Bleue du Nord and Vosgienne). The other strategy was according to "genetic dairy accumulation" (breeds Montbeliarde and Normande). This second was turned towards obtaining an important genetic dairy gain and beeing sure to end at a dairy improved sire. In this case, we had the same criteria as before, excepted beef traits. In this way, the Committee could chose a high dairy productive female even if it is not very muscled.

32. *Bull performances testing*

Males stemming from selective mating were tested in breeding centres with a same environment for all males (protocol Institut de l'Elevage, 2005). This stage led an evaluation of growth rate, feeding efficiency and beef conformation. These three criteria are combined in a global index. Managers of breeds Montbeliarde, Normande, Abondance and Simmental believed that performances testing is an essential mean to control beef abilities. All studied breeds were carrying out such a testing but only three of them (Montbeliarde, Normande and Abondance) in accordance with INRA protocol. At the end of testing, some males were sorted out for three main reasons. These were the evolution of their parents dairy genetic values, their own performances, especially not enough growth and some feet or legs troubles, then marker assisted selection for breeds Montbeliarde and Normande. We have observed two situations according to sorting out practices (table 4). Breeds Montbeliarde and Normande had a high total elimination rate, about 60 %, and a much lower elimination rate for animal type about 30 %. Males which have been sorting out for bad beef traits were only the extremes unfavourable.
Other breeds had a lower rate elimination, about 40 % for breeds Abondance and Simmental, about 50 % for breeds Bleue du Nord and Vosgienne. But in this case, more males (more than 50 %) were sorted out for less correct type. Selection strategies seemed to be linked to sorting out. High total rate elimination and low beef traits elimination for breeds were observed with the main dairy strategy. Less high total rate elimination and more higher sorting out for type were observed with the strategy "complementarity in mating".

33. *Progeny test*

Progeny test lead to estimated breeding value. Sires can be used according to the level of their total merit index (ISU). Breeding value estimations had to be positive, amply positive for dairy value, not decreasing for fitness traits. The beef evaluation is carried out by means of tested daughters scoring about muscularity, feet and legs and udder. We have noted that about a half of tested sires in breeds Montbeliarde and Normande have a positive specific type beef evaluation. The type of "dual purpose "sire was used by farmers on their own herds only when it also had a high genetic dairy value. Sires with negative beef evaluations were also used in mating because they had a very high genetic dairy value This stage suggested the influence of farmers bearing out dual purpose breed implementation, through mating in their own herds.

Discussion-conclusion

This study showed the difficulties of driving a breeding dual purpose scheme. First, because of several mobilised breeding criteria; it appeared more difficult to obtain a genetic improvement on both several criteria, especially with negative relationships between them. Furthermore, it's difficult to find a right selection agreement. There were many debates between breeding managers, farmers .. inside the studied breeds, concerning the ways to reach a dual purpose aim in final breeding schemes and the proportion accorded to beef criteria.
The actual situation seemed to be more difficult for according real importance to beef, because of increasing milk and fitness traits importance. Such a development was important to keep dual purpose breed competitive in the economic trend. But difficulties appeared when we consider breeding assessments of animal insemination. Beef abilities tended to decrease after several years of high genetic dairy gain and to a certain extent with fitness traits improvement (INRA-Institut de l'Elevage, 2006). Type index in genetic assessment of animal insemination were lightly decreasing particularly in Montbeliarde and Simmental. This tendency beared out opinions of some managers from meat production sector. Perhaps this situation can be linked to main using of growth rate in breeding operations without carcass traits control.
In spite of these difficulties, breeding stakeholders emphasised some interest of dual purpose aim. Keeping some beef abilities gave flexibility in farming systems management, for example in a context of decreasing milk market. Furthermore, some managers believed such a balance could allow a milk increasing with less negative repercussions, compared to specialized dairy schemes, for example infertility or mastitis.
The possible contribution of dual purpose breed to sustainability depends on each studied breed, especially on population's size and local development stake. In large populations, such as Montbeliarde and Normande, but also Simmental, managers felt the pressure of next dairy quota system suppression. This event and the prospect of more increasing herds seemed to encourage a high genetic dairy improvement to the detriment of beef traits. In much small populations such as Bleue du Nord and Vosgienne, different managers didn't focus on milk yield especially when breeds are connected with produce quality signs. The case of Abondance probably remained in between.
Finally, diversity of choices and more flexible orientations given by the dual purpose breed seem to be a potential contribution to sustainable development. However, it called for careful thought, particularly in methods of implementation.

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Table 1: Cattle numbers and abilities for the six dual-purpose breed studied

	Cow numbers	Milking qualities			Meat qualities
		Milk production (kg)	**Fat Content** (g per kg)	**Protein content** (g per kg)	
Montbéliarde	710 000 cows *386 933 recorded*	6451	39,2	32,7	carcass weight - young bulls (18 months) : 380 kg - culled cows : 340 - 370 kg
Normande	810 000 cows including *263 095 recorded*	5901	43,1	34,5	carcass weight - young bulls (17 months) : 370 kg - culled cows : 380 kg - steers : 400 kg
Abondance	65 000 cows including *21 267 recorded*	5155	37,2	33,1	carcass weight - young bulls (18 months) : 320 - 380 kg - culled cows : 300 – 380 kg carcass yield: 55 %
Simmental	35 000 cows including *14 042 recorded*	5702	40,1	33,2	Carcass weight : - young bulls (18 months) : 390 kg - culled cows : 360-390 kg
Bleue du Nord	3 000 cows including *643 recorded*	4797	36,5	31	bulls live weights : 1000 to 1300 kg cows live weights: 700 to 900 kg
Vosgienne	8 500 cows including *1 189 recorded*	3 966	37,7	32,1	Bulls live weights : 800 kg Cows live weights : 600 kg

Adapted from FUS – http://www.inapg.fr and FCL – on farm milk recording, 2006

Montbéliarde

Normande

Abondance

French Simmental

Bleue du Nord

Vosgienne

Table 2 : Breeding aims in six studied breeds

Number of interviews	Race	Breeding aims
4	Montbéliarde	Maintaining beef abilities optimizing dairy abilities and fitness traits
		Milk yield (50%ISU), fitness traits (37,5%), animal type (12,5%) Well balance between milk production and mobilizing body tissues Not too decreasing beef performances
		Milk production with a high milk protein content Udder morphology Fitness (feet and legs, resistance to aleas, productive life) Not to increase beef abilities but also not to decrease too much
3	Normande	Increasing milk yield (50% of ISU), maintaining beef animal type, fitness traits since 2001
		Increasing milk yield , maintaining protein and fat content, preserving muscularity improving fitness traits, especially somatic cell counts and productive life increasing size
2	Abondance	Maintaining balance between milk contents and productive life, walking abilities, well beef performances Improving udder quality, precocity, maintaining genetic diversity
		Improving milk yield, maintaining cheese production and hardiness
1	Bleue du Nord	Improving dairy abilities with a dual purpose aim and easy calving. Keeping well balanced animals with a good carcass conformation.
2	Simmental	Improving milk yields, with maintaining animal type et dual purpose abilities Beef criteria and resistance to aleas Not forgetting fitness traits
3	Vosgienne	Milk yield, maintaining genetic diversity, beef abilities

Table 3 : Weighting of different criteria in total merit index (ISU) definition (in %)

Breed	INEL	Animal type	Somatic cell count	Fertility	Productive life
Montbéliarde	50	12,5	12,5	12,5	12 ,5
Normande	53	18	13	10	10
Simmental Française	51	18	13	13	5
Vosgienne	50*****	25	15	10	

*******in Vosgienne breed , it's a merit dairy with a great importance for milk content.*

Table 4 : Sorting out of males after bull performances testing

Breed	number of performances testing bulls	number of testing males	Elimination rate (%)	
			total	for animal type
Montbéliarde	445	163	63	33
Normande	354	137	61	30
Abondance	30	18	40	50
Simmental	14	9	36	70
Bleue du Nord	8	4	50	68
Vosgienne	6	3	50	60