Interbeef Genetic Evaluation of Charolais and Limousine Weaning Weights

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Abstract

New sets of genetic parameters were estimated in 2009 for pure bred Charolais and Limousine weaning weights from Denmark, France, Ireland and Sweden (and United Kingdom only for Limousine) and used to run a new Interbeef test genetic evaluation. This article gives a general presentation of the Interbeef results.

Keywords: interbeef, genetic evaluation, weaning weight

1. Introduction

The different Interbeef tools were built and tested until 2008 (Venot *et al.*, 2007, 2008). The Interbeef working group decided therefore to rerun the complete Interbeef process from data validation to joint genetic evaluation using on new set of data.

This new analysis considered Charolais (CHA) and Limousine (LIM) weaning weights (WW) from five countries: Denmark (DNK), France (FRA), Ireland (IRL), United Kingdom (GBR) and Sweden (SWE).

Paper of Venot *et al.* (2009) presented the ingredient preparation for the Interbeef evaluation recipe: it gave a general description of data structure and connectedness between countries, along with multiple country genetic parameter estimation results.

This article presents the following-up of this study with the description of Interbeef genetic evaluation results.

2. Material and Method

2.1 Joint genetic evaluation

Joint genetic evaluation was run for both breeds with the software developed by INRA and the French Livestock Institute (IE). This software can run multi-country models with direct and maternal genetic effects and maternal permanent environment effects, with specific fixed (co-variables or categorical) effects for each trait. All the details of the country specific fixed effect models and the genetic parameters can be found in Venot *et al.* (2009). The model of analysis is an animal model containing only direct genetic effect for each country associated with country specific maternal permanent environment effect to correct for a global maternal effect. Some countries didn't have actually enough information to properly estimate maternal genetic effects within country and even more problematic the maternal genetic correlations between countries.

An animal model was used but, in this article, we will focus only on sire predictions and more particularly on sires with at least 10 progeny whatever the country (s10 will refer to these bulls thereafter).

Table 1 gives a general description of information (performance and pedigree data) used in this joint genetic evaluation. Detail on Artificial Insemination (AI) French bulls was available also at the time of the analysis and will be used in the analysis of the evaluation results.

Table 1. Description of the data taken into account.

	DNK		FRA		GBR	IRL		SWE	
Breed	CHA	LIM	CHA	LIM	LIM	CHA	LIM	CHA	LIM
Number of performances	10 863	29 046	2 533 253	1 531 675	79 300	10 826	7 170	78 341	15 085
Number of animals in pedigree	125 537	270 151	3 473 468	1 985 826	129 067	39 337	23 878	103 104	19 126
Number of sires	736	1 657	66 287	30 788	3 878	1 402	825	2 945	604
Number of sires with at least 10 progeny whatever the country (s10)	229	608	42 569 (655 AI bulls)	22 410 (342 AI bulls)	1 168	117	61	1 570	293
Average number of s10 per year between 1984 and 2004	10	28	1 906	1 005	53	5	3	70	13

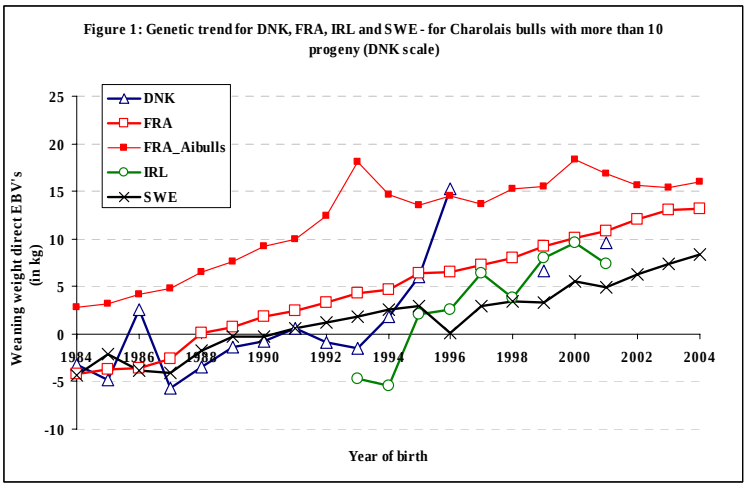
2.2 Reliability assessment

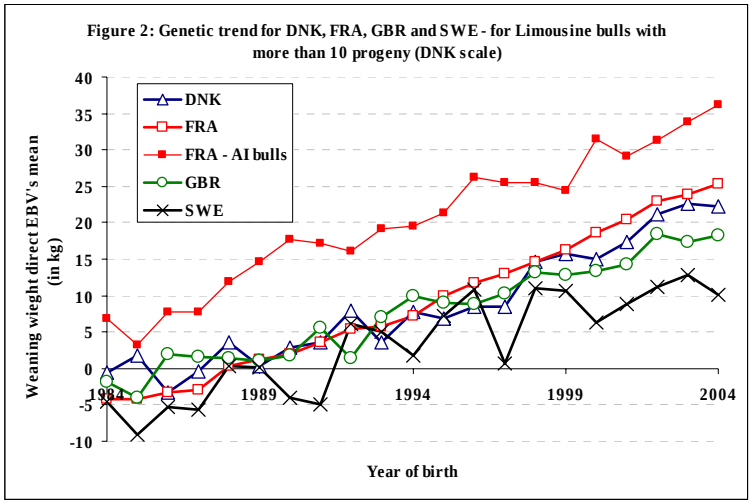
The 2009 release of Sullivan's software makes possible to compute EBV reliability (REL) for models including maternal effects. It was therefore used for estimating reliability in this Interbeef genetic evaluation.

The difference between REL obtained with the complete model and REL from the same model but with correlations between countries set to 0 was defined as the REL increase.

3. Genetic trends

A first global picture of the Interbeef results can be given by the genetic trends in the different participating countries. Figures 1 and 2 show genetic trends for s10 bulls (only birth year with more than 5 bulls were included). The genetic progress is higher for Limousine (between 15 and 30 kg in 20 years) than for Charolais (less than 20 kg).





4. Interbeef EBV's

4.1 General description

Table 2 gives a general description of the average number of progeny per bulls and country, and the direct EBV's mean in each country scale for the s10 bulls (distinction has been made between French natural mating and AI bulls). Among the s10 bulls, the ones used in different countries are mainly French AI bulls, followed by DNK bulls.

Due to the high direct genetic correlations, the ranking of countries with regards to direct EBV's means are identical whatever the country scale. Figures 3 and 4 present EBV's distributions (on the Irish scale as example).

Table 2. General statistics on Interbeef evaluation results for bulls with at least 10 progeny in total.

		Average number of progeny per sire in:					EBV's mean (std) on the specific country scale				
Origin of the sires	Number of sires	DNK	FRA	GBR	IRL	SWE	DNK	FRA	GBR	IRL	SWE
Charolais breed											
DNK	229	25	0		0	7	1.0 (12)	0.8 (10)		1.6 (20)	0.7 (9)
FRA non AI	41 914	0	43		0	0	5.2 (11)	6.1 (13)		9.3 (19)	5.4 (12)
FRA AI	655	2	907		4	1	10.6 (11)	12.7 (13)		19.1 (20)	11.2 (12)
IRL	117	0	0		21	1	4.4 (12)	4.9 (10)		7.8 (20)	4.3 (9)
SWE	1 570	0	0		0	41	2.1 (10)	2.5 (11)		3.8 (18)	2.3 (11)
Limousine breed											
DNK	608	30	0	0	0	2	7.1 (13)	6.0 (11)	5.3 (9)	7.0 (12)	6.1 (11)
FRA non AI	22 068	0	52	1	0	0	9.4 (15)	8.5 (14)	7.9 (13)	9.5 (15)	8.4 (14)
FRA AI	342	6	821	4	5	1	18.4 (16)	16.8 (14)	15.7 (14)	18.6 (16)	16.6 (14)
GBR	1 168	0	0	48	1	0	7.7 (12)	6.8 (12)	6.2 (12)	7.7 (12)	6.7 (12)
IRL	61	0	0	0	21	0	12.6 (13)	10.7 (12)	9.1 (11)	12.6 (13)	10.7 (12)
SWE	293	0	0	0	0	36	5.5 (13)	4.9 (11)	4.6 (11)	5.6 (13)	5.0 (12)

Figure 3.

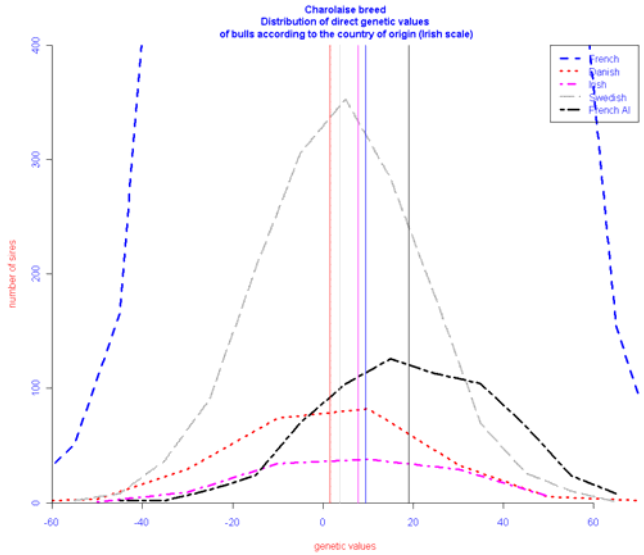
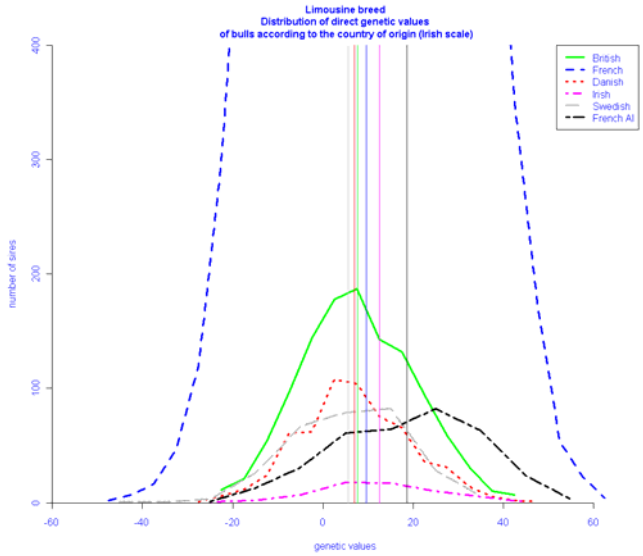


Figure 4.



(vertical lines corresponds to the mean of direct genetic values for each country)

4.2 Interbeef ranking

The main interest of Interbeef for the participating countries is to obtain a unique bull ranking specific to their country genetic variability for domestic and foreign bulls. Tables 3 and 4 gives the number of bulls, the best rank and the rank mean for the 10% best bulls among the 2571 CHA and 2472 LIM s10 bulls (French natural mating bulls being excluded) with regards to the country of origin of the bulls and the country scale.

A large part of the 10% best bulls are originated from France (66% and 47% respectively of the CHA and LIM bulls), followed by SWE for CHA (27%) and GBR for LIM (32%) in agreement with sire population size. However, every origin can be found in the first ranks.

Table 3. Ranking of the 10% best Charolais bulls (257 bulls, French natural mating bulls excluded) in each country scale.

Origin of the bulls	Country considered											
	DNK			FRA			IRL			SWE		
	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean
DNK	13	1	99	4	34	117	10	1	97	4	27	106
FRA	165	3	126	177	1	123	164	3	125	169	1	123
IRL	15	10	140	6	94	164	12	19	139	8	87	176
SWE	64	17	140	70	9	142	71	10	141	76	7	138

Table 4. Ranking of the 10% best Limousine bulls (247 bulls, French natural mating bulls excluded) in each country scale.

Origin of the bulls	Country considered														
	DNK			FRA			GBR			IRL			SWE		
	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean	Nb of bulls	Best rank	Rank mean
DNK	42	6	139	32	6	153	23	9	154	39	6	153	33	6	149
FRA	118	1	110	118	1	108	117	1	111	117	1	107	115	1	106
GBR	69	16	139	82	7	138	92	4	135	75	13	142	81	7	138
IRL	8	8	110	6	12	94	6	8	107	6	8	76	6	12	92
SWE	10	61	141	9	56	125	9	33	120	10	64	144	12	54	145

5. Interbeef reliability

Thanks to the direct genetic correlations between countries, Interbeef genetic evaluation allows to take into account the whole information available in the participating countries. This supplement of information leads to an increase of reliability for domestic bulls. As presented in table 5, adding Interbeef information has a very large impact on IRL LIM reliability: 50% of the LIM bulls used in IRL have their reliability increased by 0.31. On the other side, French bull reliability is not impacted by joint genetic evaluation (except for very few bulls). Between these two extremes, DNK, GBR and SWE reliabilities increase between 0.06 and 0.20.

Table 5. Reliability increase due to Interbeef for s10 bulls with already local progeny.

			Statistics for s10 bulls with increase in reliability > 0.001						
		Total number of bulls	Proportion of bulls with REL increase	REL mean without Interbeef data	REL increase mean	REL increase median	First quart.	Third quart.	Max
CHA	DNK	303	68 %	0.41	0.12	0.03	0.004	0.20	0.71
	FRA	42 480	1 %	0.67	0.007	0.002	0.001	0.004	0.22
	IRL	294	80 %	0.43	0.21	0.09	0.02	0.39	0.86
	SWE	1 640	5 %	0.52	0.20	0.06	0.009	0.36	0.85
LIM	DNK	713	58 %	0.56	0.06	0.007	0.002	0.04	0.82
	FRA	22 112	5 %	0.67	0.007	0.002	0.001	0.004	0.58
	GBR	1 623	61 %	0.48	0.15	0.02	0.003	0.18	0.90
	IRL	252	100 %	0.30	0.37	0.31	0.09	0.62	0.92
	SWE	363	28 %	0.56	0.14	0.02	0.006	0.24	0.88

Reliability increase varies from one bull to another depending on the data and pedigree associated to each bull and its relatives. Figures 5 and 6 present the increase distributions for both breeds.

Figure 5.

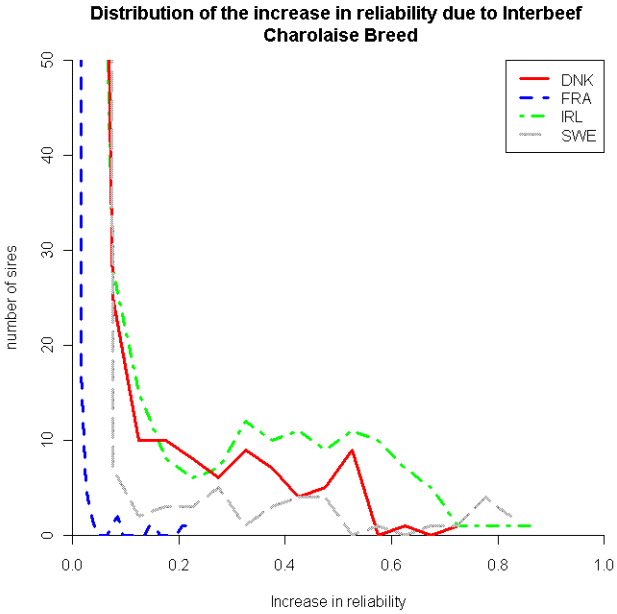


Figure 6.

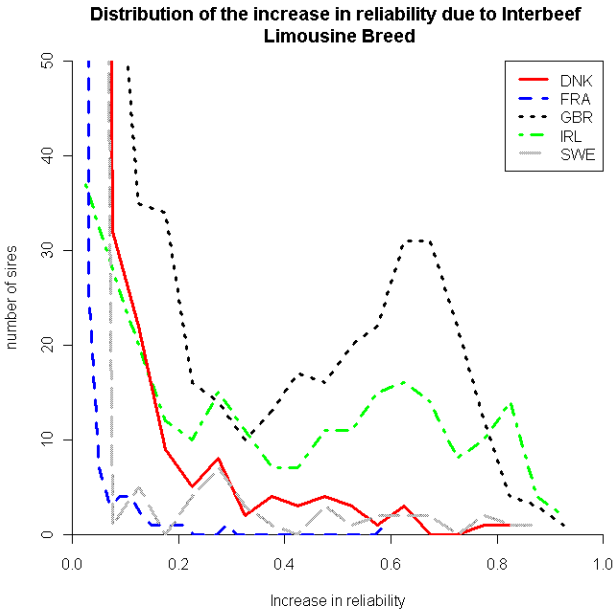
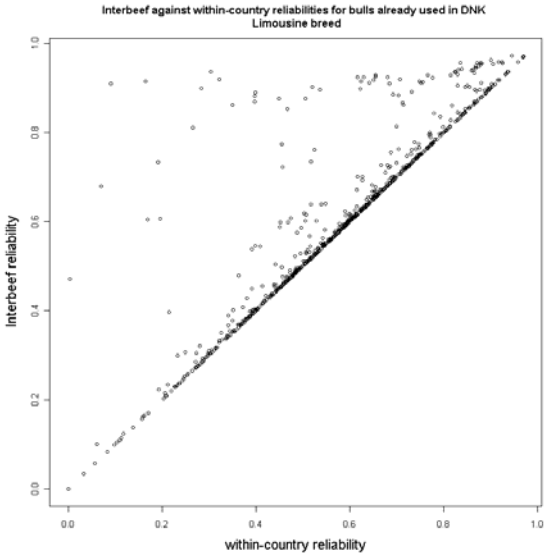


Figure 7 illustrates reliability increase for LIM bulls: Interbeef evaluation allows breeders to get more accurate EBV's for some domestic bulls that have not enough local progenies.

Figure 7.



It can also provide to breeders EBV's for foreign bulls that are not yet used in their own country. Without considering practical problem of semen supply for example, breeders will get access to a large panel of new foreign bulls with country specific EBV's and reliability estimate A list of about 44 000 new CHA bulls with a reliability of 0.55 in average will be available for DNK, IRL and SWE breeders. It will be the same for about 24 000 LIM bulls for DNK, GBR, IRL and SWE. On the other side, France will obtain EBV's for about 2 000 foreign bulls with 0.40 REL for both breed.

6. Correlation with national EBV's

To check consistency between Interbeef and national EBV's, rank correlations were computed for s10 sires.

For this purpose, another genetic evaluation was run for each breed with no genetic correlation between countries. By this way, performances from other countries are not taken into account for each country EBV's prediction. These evaluations can be therefore considered as pseudo national evaluations. They differ from the national evaluations only by some particularities of the national models that could not be included in the Interbeef model (see Venot *et al.*, 2009 for more details) and by the fact that new pedigree information brought by Interbeef central pedigree is still considered.

Table 6. Correlations between pseudo national and Interbeef EBV's.

Country	CHA	LIM
DNK	0.92	0.95
FRA	0.999	0.999
IRL	0.86	0.62
GBR		0.94
SWE	0.98	0.91

Rank correlations, shown in table 6, are very high for all countries, except for Ireland. Reranking between the present national and the new Interbeef evaluations is expected for this country therefore.

7. Conclusion

This general description of Interbeef evaluation results gave a good overview of the different outcomes that can be expected by the breeders of the participating countries. The development of the different Interbeef tools these last years along with time consuming international identification validation make the international beef evaluation become now a reality.

Routine tools for data exchanges have however to be finalized before routine Interbeef run can take place.

8. References

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