

Developments in National and International Beef Evaluations; Some Experiences from Ireland

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Introduction

Irish beef production is predominantly grass based with a seasonal aspect to calving (>80% of beef sired calves are born from January to May across both beef and dairy herds). Ninety percent of the beef output from beef and dairy herds is exported (mainly as carcass beef but also a live animal component) with beef production accounting for about 30% of the gross agricultural output. Most commercial beef produced from suckler herds is the product of crossbred suckler cows crossed to a purebred beef sire. Traditionally, genetic improvement in beef herds has been hampered by a lack of sire ancestry information, over reliance on sourcing replacements from dairy herds and poor data continuity between pedigree herd recording systems and subsequent commercial beef herds.

The aim of this paper is to discuss the recent developments in national beef evaluations in Ireland with a focus on use of purebred and crossbred data and the use of information from foreign evaluation centres.

Beef Production Statistics

There are 2 main databases in relation to Irish cattle. Since 1996 the Department of Agriculture, Fisheries and Food maintain the animal movement and monitoring system database (CMMS) which is compulsory for all herds and ensures full tracking of all cattle in Ireland including calf registration. The second database, set up in 2000 is operated by ICBF for genetic evaluation purposes and is voluntary as regards farmer participation (Evans *et al.*, 2007). CMMS statistics indicate that the Republic of Ireland has just over one million suckler beef and dairy cows, respectively (CMMS statistics report, 2006). Charolais (43%) was the most predominant

sire breed used on suckler beef cows in 2006 followed by the Limousine (30%), Angus (8%), Simmental (7%), Hereford (5%) and Belgian Blue (4%). Other less numerous breeds used include Blonde d'Aquitaine, Saler, Piemontese, Partenaïse, Aubrac and Shorthorn. The most predominant beef breeds used on dairy herds were Angus (15%), Hereford (13%), Limousine (9%), Belgian Blue (4%), Charolais (4%) and Simmental (4%).

Since the establishment of ICBF, pedigree registration of cattle is only facilitated through ICBF 'Animal Events' recording so therefore all herds (dairy and beef) actively pedigree recording cattle were on the ICBF database since 2002. However, this system captures registrations on all calves in these herds in a similar way irrespective of pedigree status. In the region of 40,000 additional commercial suckler herds were added to the database during the spring of 2008.

Table 1 shows 5 different herd classifications for 48,270 beef herds on the ICBF database in June 2008 in relation to the mix of cows calved (pedigree beef, crossbred beef, dairy) in the herd in the period since the end of May 2007 to end of May 2008. Of the 653,583 cows calved 77% were in exclusively crossbred beef cow herds with the majority of the remainder in herds with mixtures of crossbred and pedigree beef cows (19%). 23,618 herds (48%) had less than 10 beef cows calving and 49% of herds had between 10 and 49 cows calving in the period. Table 2 shows 7 different herd classifications based on type of animal in the herd for 35,601 herds on the ICBF database which sent animals to a slaughter house in 2007. Beef animals in Table 2 were defined as animals > 50% beef and <25% dairy, dairy animals were defined as >50% dairy and no beef %, 1st cross dairy x beef are defined as having a beef sire but also >25% dairy. 81% of herds fattening cattle fattened less than 25 cattle in the yearly period

with the majority of the remainder in herds up to 49 cattle. The availability and herd size (average of 38) of herds fattening dairy, beef and 1st cross dairy-beef animals is important in the context of a joint dairy-beef carcass evaluation.

Genetic Evaluations

Up to December 2007 80% of dairy cows (16,000 herds) and 30% of beef cows (12,000 herds) were available to the ICBF database for genetic evaluation purposes. Lack of sire ancestry recording in commercial herds remains the biggest obstacle to genetic improvement. The recording of sires is not compulsory for calf registration purposes, although dam id and breed of sire is compulsory. Table 3 shows the level of phenotypic data available and the resulting percentages useful for genetic evaluation purposes for the range of traits evaluated. Further information in relation to the ICBF database and its industry links, animal movements, field staff, and the initial development of a breeding objective can be found in Evans *et al.* (2007).

Currently there are 3 different genetic evaluations in place which collectively allow the construction of the economic indexes (4 sub-indexes and the overall SBV Index). In each of the 3 evaluations genetic groups are used in the pedigree and general heterosis and recombination are adjusted for in the models. In addition, an across-breed linear type evaluation is being developed to replace the existing within breed BLUP evaluations for linear type for Charolais, Limousine, Simmental and Hereford. Herd year seasons are defined using the Crump algorithm (Crump *et al.*, 1997).

Calving performance Evaluation

The Calving Performance evaluation conducted in MIX99 (Lidauer *et al.*, 2006) is an across breed (dairy and beef) animal model and consists of 3 bivariate analyses for calving difficulty (including maternal), gestation and mortality. Each bivariate analysis incorporates the data from the old systems (pre-ICBF) and the new information from Animal Events.

Heritability estimates used are 0.23 for direct calving difficulty, 0.04 for maternal calving difficulty, 0.39 for gestation and 0.01 for mortality.

Growth, Feed intake and Carcass Evaluation

The Beef Production evaluation is conducted in MIX99 and is a multi-trait across breed (dairy and beef) animal model involving 15 traits; Carcass weight, carcass conformation, carcass fat, weaning weight, liveweight, cull cow weight, feed intake, calf quality and 7 linear type traits. Maternal effects are included for weaning weight. Heritability estimates used range from 0.31 for carcass fat score to 0.59 for carcass conformation for the performance traits and from 0.28 to 0.36 for the 7 linear type predictor traits.

Maternal Traits Evaluation

The maternal traits evaluated include age at first calving, calving interval, survival and lifespan. The evaluation is a multi-trait across breed animal model performed in PEST (Neumaier and Groeneveld, 1998) with Lifespan incorporated as a predictor of survival (Pool, *et al.*, 2005). Currently only first parity records are used for the traits calving interval and survival. Heritability estimates used are 0.05 for calving interval, 0.02 for survival, 0.28 for age at first calving and 0.04 for lifespan.

Linear Conformation at Weaning Evaluation

An across breed linear type evaluation incorporating 15 linear type traits is under development. The age range for this evaluation is targeted at 150-300 days of age.

Integration of foreign data

Most of the commercial beef breeds in Ireland at present have larger populations in their respective home countries from which there is substantial importation of germplasm each year. 3 projects are ongoing in relation to utilising information from country of origin. Firstly, both a method of ranking EBV and

post evaluation conversion formulae have been developed and implemented as part of routine evaluations (Pabiou *et al.*, 2007). The French Limousine and Charolais are the only breeds currently with sufficient Irish and home country sire links and data to facilitate using conversion formulae. A large part of this work involved identification of common animals and solving of multiple identifications on these animals across both countries. Secondly, ICBF are participating in the pilot INTERBEEF project for weaning weight (Venot *et al.*, 2007). The integration of crossbred data into the INTERBEEF project is paramount to the usefulness of across country evaluations from an Irish point of view given the level of crossbred animals in Irish evaluations. Finally a project is underway exploring the integration of foreign EBVs directly into the Irish domestic evaluation using MIX99. Initial testing involved the French Charolais, Limousine and Blonde d'Aquitaine breeds and initial results are positive.

Publication and Economic indexes

EBVs are calculated 4 times a year. An Overall Suckler Beef Index and 5 sub indexes for the improvement of calving performance, growth and calf quality, carcass merit, ability to milk and reproductive efficiency were launched in November 2006 (Evans *et al.*, 2007). Changes to genetic evaluation procedures and economic values are updated once a year in agreement with industry partners.

In order to simplify the presentation of the indexes each animals index figures are presented along with a 5 star grid representing where an animal lies within its breed but also across all breeds (1 star = bottom 20%, 5 star = top 20%). Indexes and EBVs are made available on the ICBF website after each evaluation run for all pedigree male animals.

Industry Acceptance

The levels of data available for genetic evaluations and thus the accuracy of the proofs should improve dramatically due to recent developments in the industry. The commencement of a new scheme called the Animal Welfare, Recording and Breeding

Scheme for Suckler Herds has resulted in 53,336 Suckler herds now available to ICBF representing 80% of the total beef calving herds and 90% of beef cows. Sire ancestry and calving survey recording are prerequisites of the scheme.

Also a research trial currently being undertaken at Teagasc Grange Research Station to validate the Beef Carcass index using progeny of high reliability AI sires will be completed shortly.

Future Developments

Future work planned includes:

- Maternal Fertility: the expanding of the evaluation for calving interval and survival to include later lactations and the integration and evaluation of insemination data.
- Continued research into the best use of available foreign information for breeds requesting this information. This includes continued participation in INTERBEEF pilot evaluations.
- Accounting for heterogeneity of variance and refining of genetic groups assumed in evaluations based on work of Hickey *et al.* (2007, 2008).
- Research into new traits such as docility and polledness with potential inclusion in economic indexes.
- Development of an inbreeding check and sire advice for beef farmers.

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Table 1. Different herd classifications based on type of beef cows calved for beef herds currently on the ICBF database and with at least one beef cow calving record in the period May 2007 to May 2008.

Type of Calving herd on ICBF database	Count of herds	Count of cows calved	Averages no. of cows per type of herd		Count of calving herds in various categories of herd size (total beef cows only)					
			pedigree	crossbred	<5	5 to 9	10 to 24	25 to 49	50 to 99	>100
Crossbred beef cows only	40,482	503,270	0	12	10,786	10,328	14,439	4,238	651	40
Pedigree beef & crossbred beef cows	5,905	126,512	4	17	385	1,036	2,704	1,375	382	23
Pedigree beef, crossbred beef & dairy cows	967	17,712	4	14	135	227	377	168	52	8
Pedigree beef cows only	702	5,028	7	0	366	171	135	29	1	0
Pedigree beef & dairy cows	214	1,061	5	0	146	38	24	5	1	0

Table 2. Different herd classifications based on type of animals sent to slaughter houses for herds currently on the ICBF database and with at least one animal slaughter record in 2007.

Type of fattener herd on ICBF database	Count of herds	Count of animals	Averages no. of animals per type of herd			Count of fattening herds in various categories of herd size				
			Dairy	Beef	Dairy x Beef	<25	25 to 49	50 to 99	100 to 499	>500
beef animals only	11,598	57,919	0	5	0	11,303	241	46	8	0
beef, dairy & 1st cross dairy-beef animals	7,257	273,193	13	12	13	3,574	2,100	1,169	402	12
dairy & 1st cross dairy-beef	6,384	120,927	12	0	7	4,792	1,236	331	25	0
beef & 1st cross dairy-beef	5,250	89,065	0	14	3	4,207	706	264	73	0
dairy animals only	2,937	26,562	9	0	0	2,700	192	40	5	0
1st cross dairy-beef	1,216	2,855	0	0	2	1,215	1	0	0	0
beef & dairy animals	959	10,223	6	4	0	874	74	10	1	0

Table 3. Type of data available for genetic evaluations and losses due to the editing procedure and levels of crossbred data for each set of traits.

Type of data stored in ICBF	Total Records Available	With a sire recorded	Qualifying for evaluation	% crossbred animals in evaluation
Calving Performance	11,911,056	5,121,424	1,738,659	91%
Carcass data	2,740,449	1,026,848	547,211	96%
Weaning Weights	366,257	149,782	75,708	62%
Liveweights	491,716	205,624	89,055	59%
Linear Scores	146,257	142,114	94,476	14%
Calf Price per kg	297,476	59,859	23,739	100%
Feed Intake	3,300	3,290	3,200	0%
Fertility/Survival	1,276,595	255,200	210,841	84%