

Genetic Improvement in the Irish Suckler Beef Herd: Industry Expectation and Experience so far

R.D. Evans, T. Pabiou, A. Cromie, F. Kearney and B. Wickham

Animal Evaluation Unit¹ Animal Sciences Group² Peter Amer³

¹ Irish Cattle Breeding Federation, Highfield House, Bandon, Co. Cork, Ireland

²Animal Sciences Group (ASG-WUR), Division Animal Resources Development, PO Box 65, 8200 AB Lelystad, The Netherlands

³ Abacus Biotech, AbacusBio Limited, Otago House, 475 Moray Place PO Box 5585, Dunedin New Zealand

Introduction

The Irish Cattle Breeding Federation (ICBF) was established in 2000 as an independent umbrella body to oversee development of cattle breeding in Ireland. At this time the Irish cattle breeding industry (both dairy and beef) featured multiple databases, multiple breeding companies, multiple identification systems, and a genetic evaluation unit within a state body (DAF – Department of Agriculture and Food). For beef there were three different genetic evaluation systems each covering different traits and different segments of the breeding population, for a limited range of breeds and these databases were unlinked and incompatible. There was excessive duplication of activities with farmers having to supply information about the same animal several times e.g. for the calf registration at birth and then again at registration with the breed society. The net effect of these was a high cost of operation, little or no value added to data, and farmers' disaffection resulting in less participation. The initial focus concerned the establishment of a central database, an on-farm 'animal events' recording system (beef & dairy), a genetic evaluation system for all traits across breeds and an index to identify and select superior animals. In 1997 under EU legislation, and driven by the BSE crisis, DAF introduced a system of calf registration and animal movement monitoring (CMMS) which ensures full tracking of all cattle in Ireland. One of the keys to success in establishing the ICBF database has been the integration of the cattle breeding system with this tracking system thus avoiding duplication of effort by farmers. The new technologies introduced have simplified data recording and reduced costs. The database adds value to data and

facilitates accurate and timely genetic evaluation.

The aim of this paper is to review the recent development of economic selection indices for beef cattle in Ireland. The Suckler Beef Index has been launched as an Overall Beef Index for Suckler farmers and is composed of sub-indexes describing genetic merit for Calving, weanling, carcass and maternal components.

National Herd Statistics

The Republic of Ireland has just over one million suckler and dairy cows, respectively (DAF- CMMS, 2005). There is a seasonal aspect to calving with 78% of calves born from January to May across both dairy and beef herds. 32% of replacements in Commercial Suckler Herds are 1st cross (dairy and beef breeds) cows from dairy herds while the majority of the remaining 68% are 2nd cross replacements bred in the suckler herds. The average suckler herd size is 17 cows. There are about 7,000 pedigree beef herds with an average herd size of 4 cows (DAF-CMMS, 2005). Table 1 shows the breed profile for beef and dairy breeds in Ireland in 2005 as represented by the number of calves by sire and dam breed. Forty-two percent of all the calves born in 2005 (dairy and beef) were same breed mating (breed of dam was same as breed of sire) while the remaining 58% were crosses including beef crosses and dairy-beef crosses. The table shows that there is a high interdependency between dairy and beef herds in Ireland where there are more crossbred calves born yearly than purebred pedigree calves. Charolais (44%) was the most

predominantly used sire breed used on suckler beef cows (classified as having a beef breed as their primary breed) followed by the Limousine (29%), Simmental (7%), Angus (7%), Hereford (5%) and Belgian Blue (5%). The most predominant beef breed used on dairy herds was Angus (15%), Hereford (13%), Limousin (9%), Belgian Blue (4%), Charolais (4%) and Simmental (4%).

Production Flow

There are regional differences in Ireland with regard to type of production system practised with the majority of dairy herds located in the South of the country and the majority of Suckler cow herds found in the West, Northwest and South West regions. Feedlot/fattening operations are concentrated in the midland and Mid Eastern areas. As a result of the seasonal calving there is a seasonal aspect to movement of cattle in Ireland. Male dairy calves and crossbred beef male and female calves, all from dairy herds are mainly sold in the spring as young calves. In contrast, the majority of movements from Suckler herds occur in the Autumn after weaning takes place. There were 2.4 million cattle movements in total in the Republic of Ireland in 2005 of which the majority were recorded through the 90 listed Livestock Marts all of which are linked to the DAF CMMS database. The remaining 0.7 million movements were recorded as farm to farm movements. Farm deaths are recorded through 40 Licensed Knackereries which supply data to CMMS. 34 of the 90 livestock marts are classified as approved export points. Up to 15% of calves from the Suckler Herd are exported each year to mainland Europe destinations, the majority of which are between 6 and 18 months of age. There is also a large export of bull calves in Spring from dairy herds (up to 6 wks of age). The remaining animals from dairy and beef herds are slaughtered in Local Authority Abattoirs or in the 36 Export Approved Meat Plants for local consumption and export.

ICBF Data Recording Systems

On-farm recording

The 'Animal Events' data recording system was launched by ICBF in 2002 as part of its strategy on data recording (Olori *et al.*, 2005). This one point of entry allows data to be supplied only once by the farmers for all purposes and obligations and covers calving data including calving difficulty, gestation, mortality, inseminations, health recordings, change in identification and pedigree recording. Since inception of the scheme in 2002, total number of calving survey records have increased from 25,000 a year previously to over 500,000 a year while the proportion of these records, where both sire and dam records are known, have increased from 10% historically, to 70%.

Industry Linkup

Factory data has been made available since 2004 from DAF 3 times a year from the 36 Export approved Meat Plants. The data received contains information on individual carcasses (weight, conformation, fat) and profile of the animal (heifer, bull, steer, cull cow). Livestock Mart data was made available from ten of the larger marts on a pilot study in October 2006. Analysis showed that the data was useful for genetic evaluation purposes and a more automated process is being put in place for routine downloads.

Field staff

Ten linear scorers which were contracted to individual breed societies pre-ICBF were contracted by ICBF and underwent a series of harmonisation sessions. This then allowed each scorer the scope to score across all breeds. The linear scoring is envisaged to form an integral part of early carcass merit prediction in a future progeny testing scheme on both purebred and crossbred cattle.

Research Team

The development of ICBF beef indexes was done in collaboration with various research institutes both in Ireland (Teagasc) and abroad: ID-Lelystad, The Netherlands (genetic evaluations) and Abacus Biotech N.Z. (Economic Values).

Definition of breeding objective

Work on the definition of a beef breeding objective commenced soon after the establishment of ICBF (Amer, 2006) leading to the recommendation of an Overall Suckler Beef Index and 5 sub indexes for the improvement of calving performance, growth, weaned calf, carcass quality and reproductive efficiency (See table 2). Ninety percent of the beef output is exported (mainly as carcass beef but also a live animal component) with beef production accounting for about 30% of the gross agricultural output which were important considerations in the development of an index.

With the implementation of routine genetic evaluation for calving and beef performance traits, three of the 5 sub-indexes were made official in 2005 which have now been termed the Calving Traits Index, Weanling Export Index and the Beef Slaughter Index. Development and release of the remaining two indexes related to maternal performance and subsequently the Overall Suckler Beef Value was delayed due to a lack of sufficient data in particular for traits such as maternal weaning weight and calving interval and survival. However in November 2006 enough data was available to launch the Maternal Milk & Fertility, Maternal Calf Quality and Overall Suckler Beef Value. The Suckler Beef Value is constructed based on the expected proportions of calves born which are: Sold at weaning for live export (P_E), Retained for slaughter in Ireland (P_S), Sold or retained as replacement females (P_R). Thus:

$$SBV = (P_E) * \text{Weanling Export Index} + (P_S) * \text{Beef Carcass Index} + (P_E + P_S) * \text{Calving Traits Index} + P_R * (\text{Milk \& Fertility index} + \text{Calf Quality index})$$

An equivalent Index is in construction designed towards farmers who wish to select beef sires for the dairy herd.

Genetic Evaluations

Currently there are 4 different genetic evaluations in place which collectively allow the construction of the sub-indexes and the Overall Index.

- (a) The Beef Production evaluation is conducted in PEST (Neumaier and Groeneveld, 1998) and is based on a multi-trait across breed animal model involving 7 goal traits (Carcass weight, carcass conformation, carcass fat, weaning weight, cull cow weight, feed intake, calf quality) and 8 predictor traits (liveweight and 7 linear type traits). Heritability estimates used range from 0.31 for carcass fat score to 0.59 for carcass conformation for the goal traits and from 0.28 to 0.36 for the linear type predictor traits.
- (b) The Calving Performance evaluation is conducted in ASREML (Gilmour *et al.*, 2002) in a Sire-MGS 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.
- (c) An evaluation for the maternal goal traits calving interval, survival, age at first calving. The evaluation is a multi-trait animal model ran 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.

- (d) An evaluation for the goal trait maternal weaning weight. This evaluation is performed in ASREML (Gilmour *et al.*, 2002) and is a multi-trait Sire-MGS model with weaning weight, liveweight and carcass weight as predictor traits. The heritability estimated for maternal weaning weight was 0.05.
- (e) ICBF also perform an across breed linear type evaluation incorporating 14 linear type traits performed in PEST (Neumaier and Groeneveld, 1998).

Genetic Variation

The across breed genetic evaluations facilitate comparison of animals both within and across breeds. Results to date indicate substantial variation within the well established breeds for the full range of traits and indexes. Comparisons at a breed level indicate the traditional British breeds such as Angus and Hereford show strengths in calving ease in particular resulting in high values for the Calving traits Index. Alternatively the continental breeds (Charolais, Limousine, Belgian Blue) show superiority for traits related to growth, calf quality and carcass attributes resulting in higher index values for Weanling Export and Beef Carcass. Breeds such as the Simmental, Angus and Hereford show superiority for traits such as maternal weaning weight, calving interval, survival and age at first calving resulting in high index values for the Replacement Milk & Fertility Index.

Education and Rollout to Farmers

A Beef implementation group was formed by ICBF in October 2006 involving a cross section of the beef industry including commercial suckler farmers, pedigree breeders, AI representatives, beef specialist advisors from Teagasc (State Advisory Body) and ICBF. The purpose of this group was to design a rollout plan and educational material for the launching of the new indexes. The recommendations included the presentation of the indexes on both a within breed and an across breed basis to cater for both the commercial and pedigree breeder

simultaneously. The design includes a 5 star grid representing where an animal lies within its breed and across all breeds (1 star = bottom 20%, 5 star = top 20%). This approach has been adopted by AI companies in their catalogues for the upcoming season.

Future Developments planned regarding beef genetic evaluations

Future work planned includes:

- Maternal Fertility: the expanding of the evaluation for calving interval and survival to include later lactations.
- New software: Testing of running the beef performance evaluation in MIX99 (Lidauer *et al.*, 2006) to allow simultaneous estimation of direct and maternal effects for key traits such as weaning weight.
- Development of conversion formulae for populations which export genetic material to Ireland.
- Incorporation of INTERBEEF evaluations into the domestic evaluation.
- Rollout of Herd Reports with new indexes to pedigree and commercial farmers.
- Replacement of current within breed linear type evaluation with an across breed evaluation.

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Table 1. Number of purebred (diagonal) and crossbred calves born in 2005 by breed of sire and breed of Dam as recorded through CMMS and published by the Irish Department of Agriculture.

Dam Breed	Breed of Sire															
	Charolais	HolFries	Limousin	Angus	Hereford	Simment	BBlue	Montbel	Sht_horn	Blonde	Saler	Rotbunt	Jersey	MRI	Other	Total
Charolais	168,419	556	52,559	9,711	4,651	11,170	7,807	117	1,245	1,156	1,123	6	3	22	561	259,106
HolFries	39,698	487,285	92,520	148,908	131,275	38,874	41,959	12,656	2,851	1,744	1,577	4,455	4,135	1,157	4,211	1,013,305
Limousine	90,048	1,052	120,731	12,487	5,357	11,618	12,827	126	1,610	1,701	1,304	30	7	35	663	259,596
Angus	52,017	1,371	31,193	28,814	5,129	6,742	5,914	105	1,473	685	834	27	12	27	573	134,916
Hereford	62,654	1,534	40,474	10,428	27,400	12,246	5,949	133	1,464	965	656	22	9	19	446	164,399
Simmental	67,216	1,522	40,954	7,923	5,309	32,844	7,326	306	856	1,114	818	33	5	36	459	166,721
BBlue	20,460	848	17,111	4,314	1,890	2,958	7,349	76	478	621	317	23	11	10	235	56,701
Montbel	1,736	3,805	2,615	3,576	2,002	1,061	1,181	6,110	124	97	76	197	85	32	283	22,980
Shorthorn	13,597	538	8,754	2,844	1,675	1,992	1,373	59	7,207	219	386	20	17	10	189	38,880
Blonde	1,472	28	1,550	311	128	238	494	3	17	1,793	69	1	0	2	47	6,153
Saler	2,385	10	1,122	275	111	194	193	2	57	24	1,952	0	0	1	45	6,371
Rotbunte	115	1,212	248	939	451	78	117	108	47	36	14	1,488	110	14	58	5,035
Jersey	116	1,177	135	351	167	26	101	41	26	8	3	18	1,328	7	54	3,558
MRI	353	917	560	415	521	186	212	252	93	21	22	145	15	1,095	101	4,908
Other	802	811	839	1,229	324	253	249	119	77	34	58	66	94	9	2,472	7,436
Total	521,088	502,666	411,365	232,525	186,390	120,480	93,051	20,213	17,625	10,218	9,209	6,531	5,831	2,476	10,397	2,150,065
percent	24.2	23.4	19.1	10.8	8.7	5.6	4.3	0.9	0.8	0.5	0.4	0.3	0.3	0.1	0.5	100.0

Table 2. The Suckler Beef Index, sub-indexes, traits, genetic standard deviations (rg), economic weights (EW) and relative emphasis in each sub-index.

SBV (Suckler Beef Value)				
<i>Beef Value</i>				
Index	Trait	rg	EW	%
Calving Traits (€)	Calving Difficulty (%)	2.88	1.09	53
	Gestation Length (Days)	1.5	0.79	25
	Calf Mortality (%)	0.73	2.19	22
Weanling Export (€)	Weaning Weight (Kgs)	30	0.774	55
	Calf Quality (€)	14.876	1.29	45
Beef Carcass (€)	Carcass Weight (Kgs)	20	1.17	46
	Weaning Weight (Kgs)	30	0.52	24
	Carcass Conformation (Grade)	1.54	5.37	11
	Dry Matter Intake (Kgs)	365.82	0.03	12
	Carcass Fat (Grade)	0.94	3.04	7
<i>Replacement Value</i>				
Milk & Fertility (€)	Cow Survival (%)	3.6	8.3	26
	Calving Interval (Days)	6.58	3.16	18
	Age at First Calving (Days)	16	0.69	10
	Maternal Calving Difficulty (%)	2.7	4.31	10
	Maternal Weaning Weight (Kgs)	10	3.3	29
	Cull Cow Carcass Weight (Kgs)	40	0.21	7
Calf Quality (€)	Calving Difficulty (%)	2.88	4.08	6
	Gestation Length (Days)	1.5	2.96	2
	Calf Mortality (%)	0.73	9.76	4
	Weaning Weight (Kgs)	30	2.1	32
	Dry Matter Intake (Kgs)	365.82	0.07	13
	Carcass Weight (Kgs)	20	2.88	29
	Carcass Conformation (Grade)	1.54	13.21	10
	Carcass Fat (Grade)	0.94	7.49	4