# Practical Aspects In Setting Up A National Cattle Breeding Program For Ireland.

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## Introduction

Setting up a breeding program involves the definition of a breeding goal and the design of a scheme capable of delivering genetic progress in line with the set goal. The practical aspect of setting up a cattle-breeding program is very much to do with the management of people and resources as much as it has to do with the application of principles of genetics and animal breeding. Each aspect of the breeding program involves many processes, individuals and, sometimes, organisations.

In Ireland, dairy and beef production is primarily based on grass and emphasis is on profitability from a low input production system. Genetic progress must therefore translate to 'more money in the pocket' if it is to be seen as progress in a commecial set up like cattle production. The challenge for the Irish Cattle Breeding Federation, in setting up a breeding program was thus how best to manage available resources, acquire new facilities, replace outdated processes and non-profitable practices in order to achieve genetic progress that translates directly to more money in the pocket of farmers. To achieve this, emphasis was put into;

1. Defining a breeding objective that increases farm income and reduces farm costs.
2. Develop infrastructure to facilitate the recording and management of records
3. Deliver genetic evaluation to allow the identification of superior animals.
4. Set up of a national progeny-testing program to facilitate the identification of superior animals and dissemination of superior genetics.

The objective of the paper is to highlight our experience in setting up a national cattle breeding program in Ireland.

## The Cattle Industry in Ireland

The republic of Ireland is an Island nation in North West Europe. The climate is generally mild all year round with average winter temperatures of $4^oC$ -$7^oC$ and summer temperatures of $14^o$-$15^oC$. Total land mass is 6.9 Million hectares, 51% of which is devoted to grass production (pasture, silage and hay) while another 7% is used for rough grazing (DAF, 2002).

The dairy cattle inductry contributes 32% of the gross agricultural output. Ten percent of the milk produced is consumed locally as liquid milk while 90% goes into the manufacturing industry mainly for the production of Cheese and butter. Fifteen percent of the manufactured products are consumed locally while 85% is exported. The export value in 2000 was worth about two Billion Euros (DAF, 2002).

Beef production accounts for about 30% of the gross agricultural output. Ninety percent of the beef output is exported (Carcass and life animals). The country has about 1.2 million breeding suckler cows, 32% of which are 1st cross (dairy and beef breeds) cows from dairy herds while 68% are 2nd cross replacement calves bred in the suckler herds. The dairy and beef enterprises are therefore intertwined with extensive use of beef bulls in dairy herds to produce cross calves some of which become replacement cows in beef herds. 1700 pedigree beef herds with an average herd size of 4 cows produce pedigree bulls for used in AI or as stock bulls. (DAF, 2002).

Cattle production in Ireland is based on grass with predominantly seasonal breeding pattern (Dillon et al., 1995). For example, 77% of dairy cows calve between January and April yearly while the breeding season is usually March and May when 80% of all AI is done.

### Breeds of cattle

Dairy production is dominated by the Holstein Friesian breed which was the sire breed for over 90% of all milk recorded cows and 25% of all calves (dairy and beef) born in Ireland in 2003 (DAF, 2004). Holstein Friesian cows were dam of 48% of all calves born in 2003 in Ireland.

In dairy herds, the HF breed sired 50% of calves born in 2003. The remaining calves were by Angus (11%), Hereford (11%), Limousin (8%), Charolais (6%) and Belgian Blues (5%) breeds of bull. Bulls of other dairy breeds sired only 9% of the calves. In beef herds, most of the calves were by charolais bulls (45%) followed by Limousin bulls (27%). Other popular breeds of sire were Simmental (8%), Belgian Blues (6%) and Herefords (5%). Table 1 shows the popular dairy and beef breeds in Ireland and the number of calves by sire and dam breed. Forty-three percent of all the calves born in 2003 were pure breed (breed of dam was same as breed of sire) while the remaining 57% were crosses including dairy-beef crosses. This 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.

Table 1. Number of purebred (diagonal) and crossbred calves born in 2003 by breed sire and dam of sire and breed of Dam.

| BREED OF SIRE | | BREED OF DAM | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HF | HE | CH | SI | LM | AA | BA | BB | JE | MO | RB | MY | SA | SH | Other | Total | (%) |
| | HF | 544174 | 1622 | 597 | 1780 | 1087 | 1294 | 32 | 754 | 579 | 2276 | 419 | 768 | 9 | 546 | 505 | 556442 | 25.9 |
| | HE | 119951 | 30102 | 4638 | 5338 | 5384 | 4768 | 125 | 1710 | 85 | 881 | 92 | 409 | 43 | 1735 | 279 | 175540 | 8.2 |
| | CH | 43476 | 80773 | 158135 | 73926 | 81817 | 55345 | 1172 | 16992 | 101 | 838 | 55 | 307 | 1467 | 15329 | 750 | 530483 | 24.7 |
| | SI | 45697 | 16021 | 10524 | 33601 | 10500 | 7008 | 242 | 2539 | 24 | 705 | 67 | 170 | 75 | 2049 | 238 | 129460 | 6.0 |
| | LM | 84495 | 46992 | 45646 | 40590 | 99845 | 30927 | 992 | 14016 | 92 | 1280 | 109 | 436 | 780 | 9386 | 717 | 376303 | 17.5 |
| | AA | 113841 | 10320 | 8037 | 7148 | 10027 | 24856 | 226 | 3594 | 146 | 1686 | 269 | 279 | 157 | 2721 | 618 | 183925 | 8.6 |
| | BA | 1663 | 1245 | 1031 | 1107 | 1261 | 710 | 1382 | 388 | 3 | 41 | 4 | 28 | 11 | 225 | 20 | 9119 | 0.4 |
| | BB | 52762 | 9759 | 9799 | 10076 | 14577 | 8052 | 297 | 7721 | 94 | 770 | 53 | 272 | 163 | 1932 | 259 | 116586 | 5.4 |
| | JE | 2296 | 4 | 0 | 6 | 6 | 12 | 0 | 1 | 912 | 39 | 44 | 4 | 0 | 8 | 11 | 3343 | 0.2 |
| | MO | 16706 | 212 | 100 | 436 | 133 | 111 | 6 | 69 | 26 | 5260 | 49 | 283 | 0 | 57 | 116 | 23564 | 1.1 |
| | RB | 5303 | 11 | 9 | 66 | 15 | 19 | 0 | 8 | 3 | 127 | 966 | 106 | 0 | 16 | 59 | 6708 | 0.3 |
| | MY | 2144 | 41 | 30 | 89 | 20 | 57 | 10 | 14 | 2 | 33 | 23 | 1216 | 1 | 31 | 24 | 3735 | 0.2 |
| | SA | 1133 | 485 | 656 | 603 | 731 | 622 | 17 | 187 | 3 | 58 | 0 | 11 | 1246 | 219 | 61 | 6032 | 0.3 |
| | SH | 2345 | 1509 | 1001 | 919 | 1273 | 1251 | 20 | 392 | 26 | 44 | 28 | 88 | 28 | 6302 | 54 | 15280 | 0.7 |
| | Other | 3430 | 482 | 414 | 449 | 513 | 414 | 17 | 176 | 31 | 174 | 26 | 14 | 32 | 133 | 1855 | 8160 | 0.4 |
| | Total | 1039416 | 199578 | 240617 | 176134 | 227189 | 135446 | 4538 | 48561 | 2127 | 14212 | 2204 | 4391 | 4012 | 40689 | 5566 | 2144680 | |
| | % | 48.5 | 9.3 | 11.2 | 8.2 | 10.6 | 6.3 | 0.2 | 2.3 | 0.1 | 0.7 | 0.1 | 0.2 | 0.2 | 1.9 | 0.3 | | |

## Coordination of cattle breeding: The role of the Irish Cattle Breeding Federation (ICBF).

Genetic progress in cattle breeding requires input from farmers (who are the source of most records and users of the end product), data recording organisations, breed societies, AI organisations and many more. Data obtained from various sources needs to be utilised and turned into useful information for farm management, animal selection and breeding in order to maximise profit for all stakeholders. Success in this regard, requires a skillfull cordination of all sectors towards a common objective, which aught to be 'profitability for all'.

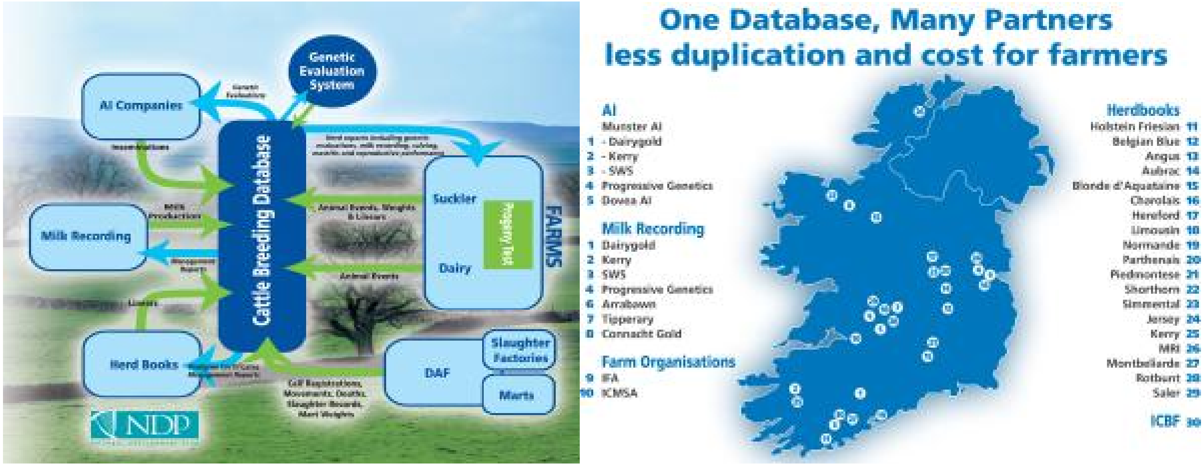
The Irish Cattle Breeding Federation (ICBF) was established as an independent umbrella body to oversee development of cattle breeding in Ireland. Some background on its establishement and structure has been reported previously (Wickham, 2005). Its mission statement is '*To achieve the greatest possible genetic improvement in the national cattle herd for the benefit of Irish farmers, the dairy and beef industry and its members*'.

Before the ICBF was established, cattle breeding activities in Ireland were disjointed. Data for genetic evaluation and provision of cattle breeding information was sourced from numerous databases that were unlinked and non compatible. Service providers such as breed societies, milk recording organisations and farmers had different systems of identification for the same animal. 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, registration with the breed society, admission to milk recording etc. The net effect of these was high cost of operation, little or no value added to data, and farmers' disaffection resulting in less participation. The information available under this condition were incomplete and prone to error.

The immediate challenge for an organisation like the ICBF, was to coordinate the industry is such a way as to stimulate interest from all stakeholders in a shared purpose towards the improvement of the industry for the good of all. To this end the establishment of a shared, integrated database that will offer a one stop shop for all cattle breeding activities and provide a single point of entry was priority for the ICBF.

Wickham (2005) has described the background and major challenges involved in the establishement of the ICBF central cattle breeding database in Ireland. Figure 2 shows the general design of the database and the location of all its clients. Based on a Wide Area Net (WAN) principle and VPN technology, nodes were established for about 29 organisation all over the country having direct access to the database for their respective activities.

Figure 2. Design of Central database




## Data Collection and Management

Central to the set up of a breeding program is a breeding goal. Definition of such a goal requires information on a set of economically important traits. Data recording in the cattle industry is an expensive business. For example, milk recording currently costs about 2 million Euros per annum. At such a high level of cost, all of the data recorded should be useful (e.g. for genetic evaluation) and value must be added to turn the data into useful information for the farmers.

The usefulness of collected data depends on completeness, accuracy of the record, and availability of associated information. For example, data from milk recording will be useless for genetic evaluation if the calving date of the cow is unknown or if the pedigree information is absent. Also the ability to evaluate maternal traits such as calving difficulty requires information on the sires of both the calf and the dam of the calf.

In Ireland the 'Animal Events' data recording system was launched by the ICBF in 2002 as part of its strategy on data recording. The object of the scheme was to encourage recording of farm events as they occurred. To facilitate this, pocket notebooks were developed which the farmers carried on themselves while in the farm. Events noted all day are translated either to the animal events notebook or directly to the equivalent form on farm management computer software were available. The paper forms are mailed directly to ICBF, while the electronic version is sent by e-mail and automatically captured into the database. Information in paper forms are keyed in daily by a data handling company contracted by the ICBF.

The animal events recording sheet allow farmers to enter in information which is valid for both calf registration, processing the animal passport, and for the purpose of pedigree registration. This information is stored in the central database which has a direct interface with the government's Information and registration (I&R) database as well as the government's central movement monitoring system (CMMS). This one point of entry allows data to be supplied only once by the farmers for all purposes and obligations.

The animal events system allows unbiased recording of events for all cattle from all farms. For example, the genetic correlation between calving difficulty scores under the historical calving survey conducted by the AI organisations and the data collected under the animal events scheme was 0.45. Corresponding correlation between calving scores from these sources and those from the breed society records were close to zero. This suggests variation in the definition of calving difficulty in pedigree and commercial herds prior to the introduction of the independent 'animal events recording scheme', which led to the exclusion of the historical breed society data from the national evaluation of calving difficulty in Ireland. Since inception of the scheme in 2002, total number of calving survey records have increased two thousand times while the proportion of these records, were both sire and dam records are known, have increased from 10% historically, to 70%. There has also been a significant increase in recording of inseminations and other traits that has given scope for the genetic evaluation of functional traits in Ireland.

## Definition of breeding objective

### *Beef breeding objective*

In Ireland, work on the definition of a beef breeding objective commenced soon after the establishment of ICBF (Amer et al., 2001) leading to the recommendation of 5 sub indexes for the improvement of growth, weaned calf, calving performance, carcass quality reproductive efficiency. Following an extensive review in 2004 (Amer, 2005 unpublished) and the implementation of genetic evaluation for calving difficulty and carcass traits, 4 sub indexes and 2 total indexes were introduced in early 2005. Table 2 shows the proposed sub indexes, the component traits and the relative weighting on each trait in the sub and total indexes.

### *Beef Sub Indexes*

Calving sub index is derived from the breeding values for direct calving difficulty (DCD), direct gestation length (DGL) and direct mortality (DM) breeding values. Two calving sub indexes were derived for selecting beef bulls. The Dairy calving sub index (DCSI) was designed for selecting beef bulls for use on dairy cows while the Beef calving sub index (BCSI) was designed for selecting beef bulls to use on beef cows. The difference arises from the higher cost of difficult calving and the additional loss in revenue from milk due to longer gestations in dairy herds. In herds however, value of the calf is much higher that the value of the calf from a dairy cow.

The weaned calf sub index (WCSI) is derived from breeding values of weaning weight and calf quality. Calf quality is currently derived as a function of weaning weight and carcass conformation (Amer, 2005). This index was introduced to facilitate selection of high quality animals for live export to European markets as the animals slaughtered locally do not reflect the same price differential.

Selection of beef animals for carcass production is based on the Beef Production sub index (BPSI). Traits in this index include weaning weight, carcass weight, carcass conformation, carcass fat and dry matter feed intake. Carcass weight is the most important trait in this sub index while daily dry matter feed intake carries the highest economic weight. The full production sub index includes economic values for the weight of individual cuts (not shown in table 2) such as loin cut, hind quarter cuts and other cuts. These traits will be included in the sub index as soon as data becomes available for genetic evaluation. It is hoped that this data will become available from the operation of the recently introduced mechanical grading machines in Ireland.

A maternal sub index, based on calf survival, fertility, maternal calving difficulty, maternal weaning weight, cull cow weight, has also been planned to facilitate selection of replacement cows in beef suckler herds.

Table 2. Relative weights in sub and total index for the beef breeding objective

| | Genetic | Economic | Relative | Relative import | |
|---|---|---|---|---|---|
| | SD | Weight (€) | import | in total in( | TBI |
| Dairy Calving sub index (DCSI) | | | within SI | TDBI | TBI |
| Direct Calving Difficulty | 2.5 | -1.69 | 34% | 12% | |
| Direct Gestation Length | 1.86 | -3.55 | 53% | 18% | |
| Direct Mortality | 1.09 | -1.48 | 13% | 5% | |
| | | | | 35% | |
| Beef Calving sub index (BCSI) | | | | | |
| Direct Calving Difficulty | 2.5 | -0.88 | 48% | | 7% |
| Direct Gestation Length | 1.86 | -0.26 | 10% | | 2% |
| Direct Mortality | 1.09 | -1.78 | 42% | | 6% |
| | | | | | 15% |
| Weaned calf sub index (WCSI) | | | | | |
| Direct Weaning Weight | 16.41 | 0.65 | 29% | | 7% |
| Calf Quality | 33.19 | 0.65 | 71% | | 16% |
| | | | | | 23% |
| Beef production sub index (BPSI) | | | | | |
| Direct Weaning Weight | 16.41 | 0.07 | 5% | 3% | 3% |
| Carcass Weight | 12.94 | 1.09 | 61% | 40% | 37% |
| Carcass Conformation | 1.29 | 2.38 | 13% | 9% | 8% |
| Carcass Fat | 0.53 | -1.86 | 4% | 3% | 3% |
| Dry Matter Intake (daily) | 0.36 | -10.97 | 17% | 11% | 9% |
| | | | | 65% | 62% |

## Dairy breeding objective.

Prior to 2001, selection of dairy bulls in Ireland was based on a 100% production index similar to the trend in many countries then (Miglior et al., 2005). Preliminary results from a three year study comparing strains of the black and white cattle in Ireland confirmed that high index bulls on the production index were worse in fertility (Horan, 2005). This, along with the noticeable decline in pregnancy rate and increase in inter-calving interval caused the ICBF to review the production index to include components of fertility and survival (Olori et al., 2002) in the dairy breeding objective for Ireland (Veerkamp, et al., 2002). This resulted in an index with relative weighting of 69% for production and 31% for non production traits

In a review in 2004 orchestrated by proposed CAP reforms, the economic weights for all traits were modified to give a more balanced reflection of the importance of the functional traits and economic realities of the dairy farmer. This resulted in a reduction in the relative importance of production traits to 60% and an increase in the others to 40%. This change still placed Ireland in the bottom 6 of the countries surveyed with the least weight on non production traits (Miglior, 2005).

With ongoing developments in across breed beef and calving traits evaluation, it soon became apparent that significant improvement in dairy farm profitability could be achieved by breeding cows that calve easily within breed average gestation length, and were capable of adding some beef quality to their calves. Reducing calf mortality also had great potential for increasing dairy farm profitability. Thus four sub indexes and one overall economic breeding index (EBI) were introduced in 2005 for the selection of dairy animals in Ireland. Table 3 shows the component traits of the various dairy sub indexes in the overall dairy breeding goal. The milk production sub index accounts for 52%, while fertility, calving and beef production accounts for 35%, 8% and 5% of the overall index respectively. This total index places Ireland in with the Top 5 of the countries surveyed (Miglior, 2005), who place high emphasis on non production traits. The development of the various sub indexes is essential in a country like Ireland with multiple breeds as it gives scope for the selection of different kinds of animals all within the breeding objective for the overall improvement of profitability.

Table 3. Relative weights in sub- and total dairy breeding objective in Ireland

| Traits | | | Sub indexes for trait sets | | | | | Rel to |
|---|---|---|---|---|---|---|---|---|
| | GSD | EW | MSI | FSI | CSI | BSI | rel_wt | Protein |
| Milk Production Sub index (MSI) | | | | | | | | |
| Milk (kg) | 446 | 0.08 | 0.28 | | | | 0.14 | 0.52 |
| Fat (kg) | 16.64 | 1.5 | 0.19 | | | | 0.10 | 0.36 |
| Protein (kg) | 13.11 | 5.22 | 0.53 | | | | 0.28 | 1.00 |
| | | | | | | | 0.52 | |
| Fertility & Survival Sub Index (FSI) | | | | | | | | |
| Fertility (CI days) | 6.58 | 7.09 | | 0.55 | | | 0.19 | 0.68 |
| Survival (%) | 3.6 | 10.77 | | 0.45 | | | 0.16 | 0.57 |
| | | | | | | | 0.35 | |
| Calving sub index (CSI) | | | | | | | | |
| Direct Calv. Diff.(%) | 2.84 | 2.96 | | | 0.42 | | 0.03 | 0.12 |
| Maternal Calv Diff. (%) | 1.13 | 1.48 | | | 0.08 | | 0.01 | 0.02 |
| Gestation Length (days) | 1.68 | 4.47 | | | 0.38 | | 0.03 | 0.11 |
| Mortality (%) | 0.94 | 2.58 | | | 0.12 | | 0.01 | 0.04 |
| | | | | | | | 0.08 | |
| Beef production sub index (BSI) | | | | | | | | |
| Cull Cow wt (kg) | 14 | 0.04 | | | | 0.04 | 0.00 | 0.01 |
| Carcass wt (kg) | 9 | 0.92 | | | | 0.62 | 0.03 | 0.12 |
| Carcass conformation | 0.51 | 3.93 | | | | 0.15 | 0.01 | 0.03 |
| Carcass fat | 0.41 | 6.14 | | | | 0.19 | 0.01 | 0.04 |
| | | | | | | | 0.05 | |

## Response to section on the dairy objective

An analysis of the expected response to selection on the overall and sub indexes was carried (Table 4) which shows the expected gain after ten years with selection based on the optimum and alternative indexes (Berry, et al., 2005). The optimum index is define as the one with all the component traits (i.e. production, fertility and survival, calving and beef traits) while the base index is defined as the index based on the production and fertility/survival set of traits only. (MSI+FSI). The result indicates that selection on the optimum (complete) index will yield the highest gain in profitability to farmers in ten years. If selection was based on the optimum index, the cumulative gain after ten years was €55.77 compared to a correlated gain of €54.34 if selection was based on the base index. This represents a loss of about €1.43 per lactation which, for about 1.15 milking cows, amounts to a total loss of €1.6 million potential increase in income after ten years of selection. This amount represents the potential gain to the industry after ten years if selection is based on the optimum index now.

If selection was based on the production index alone, correlated response on the optimum index will be €30. Milk yield will increase by 174kg, while fat and protein yield will increase by 8 and 10 kg respectively. However the negative trend in fertility, survival and calving difficulty means that the dairy industry will loose about €25/lactation more in costs after 10 years which for 1.15million cows amounts to a loss of about €29 million in potential profit. Most of this will be due to a combination of loss in revenue and increased costs.

## Genetic evaluation.

The success of any breeding program depends on timely and accurate genetic evaluation of animals on test so as to decrease generation interval and increase response to selection. A good and reliable evaluation system complements and justifies investment in data collection and resources like a centralised database. Prior to the establishment of ICBF, genetic evaluation in Ireland was conducted by officials of the Department of Agriculture (DAF). Milk production evaluation was conducted once a year based on extended lactation yield for lactations over 150 days in length for the black and white population only. Beef evaluation was conducted separately for different sets of data/traits such as performance test station data, progeny test data and the annual calving survey data. Each analysis was within breed and the frequency of evaluation varied.

Table 4. Expected response to selection with selection on total or sub indexes

| | Selection on Total index[1] | | | | Selection Sub Indexes[2] | | | |
|---|---|---|---|---|---|---|---|---|
| Trait/Index | EBI Base[3] | +Calv[4] | +Beef[5] | +Beef & Calv[6] | MSI | FSI | CSI | BSI |
| $EBI_{Base}$ | **51.70** | 50.88 | 50.85 | 50.50 | 27.50 | 30.89 | 11.95 | 5.57 |
| +Calv SI | 54.47 | **55.46** | 52.99 | 54.83 | 27.77 | 33.22 | 22.62 | 4.72 |
| +Beef SI | 51.67 | 50.61 | **52.35** | 51.44 | 29.70 | 28.66 | 11.04 | 13.58 |
| +Calv&Beef | 54.34 | 55.19 | 54.49 | **55.77** | 29.97 | 31.00 | 21.72 | 12.72 |
| **Response on sub indexes** | | | | | | | | |
| Prod (MSI) | 23.35 | 23.02 | 26.03 | 23.87 | **43.15** | -16.8 | 1.15 | 12.04 |
| Fert &Suv (FSI) | 28.45 | 27.86 | 24.82 | 26.63 | -15.66 | **47.63** | 10.79 | -6.47 |
| Calving (CSI) | 2.67 | 4.58 | 2.15 | 4.33 | 0.28 | 2.34 | **10.68** | -0.85 |
| Beef (BFI) | -0.13 | -0.27 | 1.50 | 0.94 | 2.20 | -2.23 | -0.90 | **8.01** |
| **Response on individual traits** | | | | | | | | |
| Milk (kg) | -1.48 | -10.59 | 13.69 | 1.26 | 173.67 | -218 | -50.7 | 113 |
| Fat (kg) | 4.62 | 4.43 | 5.07 | 4.57 | 8.04 | -5.11 | -0.46 | 2.26 |
| Protein (kg) | 3.12 | 2.98 | 3.73 | 3.28 | 9.60 | -4.43 | -0.18 | 3.30 |
| Calv Int. (d) | -2.22 | -2.16 | -1.95 | -2.08 | 1.69 | -4.3 | -1.0 | 0.69 |
| Survival (%) | 1.18 | 1.16 | 1.02 | 1.10 | -0.34 | 1.61 | 0.34 | -0.15 |
| Dir. C. Diff | -0.61 | -0.93 | -0.44 | -0.81 | -0.11 | -0.56 | -1.80 | 0.34 |
| Mat. C. Diff | 0.12 | 0.19 | 0.08 | 0.16 | 0.0 | 0.08 | 0.32 | -0.05 |
| Gestation (d) | -0.21 | -0.44 | -0.19 | 0.44 | 0.02 | -0.18 | -1.17 | 0.05 |
| Calf Mort (%) | -0.06 | -0.08 | -0.05 | -0.09 | -0.02 | 0.00 | -0.24 | -0.11 |
| Cull cow wt | -0.96 | -1.56 | 0.84 | -0.01 | 2.51 | -4.51 | -2.07 | 8.86 |
| Carcass wt (kg) | -0.08 | -0.22 | 1.42 | 0.94 | 2.38 | -2.36 | -0.81 | 7.36 |
| Carcass Conf. | 0.03 | 0.06 | 0.01 | 0.03 | -0.10 | 0.18 | 0.09 | -0.11 |
| Carcass Fat | 0.02 | 0.04 | -0.02 | 0.01 | -0.05 | 0.10 | 0.07 | -0.21 |

1.Expected response after 10 years based on a current rate of genetic gain €5.20/yr
2. Expected gain with selection on sub indexes based on genetic gain of 0.89 genetic SD per year
3. Base EBI is sum of production (MSI) and fertility (FSI) sub indexes.
4 Base EBI plus calving sub index
5 Base EBI plus beef sub index
6 Base EBI plus beef and calving sub indexes

With the establishment of ICBF, efforts was concentrated in setting up a genetic evaluation system that would facilitate routine genetic evaluation at least 4 times a year and allow early proofing of progeny test bulls. To facilitate this, a method of projecting records in progress to compute 305-day yields was introduced (Olori and Galesloot, 1999). Initially this process was tedious and time consuming as test-day records had to be obtained from numerous sources for the computation of 305-day yields as well as preparation of a pedigree file. With the establishment of the central database, the task of a routine genetic evaluation became easier with turnaround time reduced from of about 2 months to about 1 week. Apart from the savings in time and human resources, data from the database is more accurate, complete and up to date. The net effect is that young progeny test bulls now get their first breeding values estimates within 3 months of obtaining the first milk test records from the first daughter.

The 'Animal events' recording system has yielded that allowed the introduction of more accurate and sophisticated models for the evaluation of more traits in Ireland. Presently across breed genetic evaluation for production, calving and beef sets of traits have been implemented. Plans are also under way to move to an across breed genetic evaluation system for fertility and survival traits based on herd life and predicted lifespan (Pool, et. al., 2005). The animal evaluation unit of the ICBF has now been set up to compute breeding values for all these traits at a moment's notice. Future plans are to perform national evaluations up to 6 times a year to support the national progeny testing.

## National progeny testing scheme

Previous sections on data collection and management, development of the breeding objective and genetic evaluation sets the stage for a scheme that allows the best animals to be selected and utilised widely in order to ensure the achievement of the breeding objective. In cattle production, progeny testing and subsequent use of proven bulls' semen via AI has been the traditional route for the genetic improvement of dairy and beef cattle. Progeny testing is an essential component of the national breeding program because of the naturally low fecundity and long generation interval ofcattle. Also some of the traits of economic interest are sex limited or can be measured only at the end of the animals' life.

In Ireland Veerkamp (2002) showed that an optimum dairy breeding program based on the progeny testing of 100 bulls with 100 daughters per bull could result in annual gains of €23/cow/year in ten years. This is over 4 times more that the gain achieved in the last 10 years. If inaugurated in 2005, such a program could deliver substantial income to the Irish dairy industry through savings in cost and improved earnings.

### *Before the national program*

The national progeny testing program was inaugurated in the spring of 2005 in Ireland. Before then, progeny testing was carried out by several AI companies, who under the terms of an ICBF Animal evaluation license, were expected to distribute test bull semen (not exceeding 1000 doses per bull), provide a list of their test herds and facilitate collection of data from these herds. There was no universal compliance with the terms of the license resulting in massive inefficiencies. For example, of the 84 beef bulls approved for progeny testing between 2001-2003, only 27 bulls (32%) had sufficient progeny to attain 50% reliability in their calving performance evaluation. The effect of this is even longer generation intervals (due to carry-over of bulls), reduced genetic gain and increased costs for AI organizations.

Further more only about 25% of the progeny tested bulls (2001-2004) were sourced from with Irish herds. 55% of the bulls were sourced from the Netherlands, 7% from the US, 5% from Germany and 3 % from France. The rest were from other countries. In 2002, about 169,000 doses of semen were imported into Ireland at a total cost of about 1.5 Million Euro. In an efficient testing system, this amount could be sufficient to test 100 bulls with 100 daughters per bull.

The establishment of the cattle-breeding database gave the Irish dairy industry the opportunity to develop a new progeny test program for the Irish dairy and beef industries with the potential for early accurate proofing of young bulls at lower costs.

### *Gene Ireland progeny testing scheme*

In the spring of 2005, the national cattle breeding centre (NCBC) was formed through the amalgamation of some of the independent AI companies in Ireland, with a view to facilitating a new national progeny test scheme. The principle of the scheme were as follows;

1. The "National Progeny Test Program for Dairy and Beef Cattle" is under the technical direction of ICBF.
2. The program is open to all organizations wishing to progeny test bulls in Ireland including private breeders.
3. ICBF AI members are required to sign a progeny test license agreement but will not be required to pay a progeny test license fee. This is a reflection of the equity that they have invested in the central cattle-breeding database.
4. Non AI members of ICBF are required to sign a license agreement and pay a progeny test license fee for access to the cattle-breeding database, unless the organization has a commercial arrangement with an AI member of ICBF.
5. All organizations (with a valid progeny test AI license) pay the same unit cost for services from the database (e.g., cost of the progeny test service) and have access to the same facilities from the database.
6. The National Progeny Test Program target and contracts specific herds to progeny test bulls.
7. Based on number of herds in the scheme, the National Progeny Test Program could invite interested parties to progeny test bulls through the scheme.

8. The National Progeny Test Program will give a commitment to ensure full progeny test at end of pre-defined period for bulls taken into the scheme, with graduates from the program given a National program brand.

The general aim of the programs is to test 100 dairy and 30 beef bulls yearly using about 500 targeted dairy herds and 300 beef herds. Table 5 illustrates the structure of the test program. This was expected to result in at least 100 male and 100 female progeny per bull. Incentives are paid for the retention of female progeny as replacements while carcass data is also collected from the male progeny that may be finished and slaughtered in the factories. With this plan, calving survey information will be available from 200 offspring per bull at the time of first evaluation with the opportunity to cull extremely difficult calving bulls from the first year of testing.

The National progeny test program was name 'G€N€ IRELAND'and kicked off with 25 test bulls late spring 2005. So far 150 herds that were asked to participate in the scheme responded favourably. Based on pedigree index information, 25 top bulls were acquired by the NCBC and put on test. Only herds that agreed to use a high percentage of test bull semen were recruited. Each herd got a batch of 50 straws of semen from 10 bulls (5 straws per bulls) and it is expected that at least 80% of first AI will be to test bulls.

## *Progeny testing incentives.*

In addition to the supply of high index bulls (Ave. EBI= €80) with high reliability guaranteed by the 'team of ten bulls' approach, participating farmers get breeding advice to help avoid close relationship mating and additional financial incentives. It is hoped that these herds will become elite herds serving as sources of potential bull dams for future young bulls

**The financial incentives**

- Each herd gets 50 straws of semen worth 15 Euro each for free (€750).
- There is a direct payment of 50 Euro for each test bull daughter that calves in 2008 (€500).
- Each of the 10 heifers will be linear scored for free worth €8.5/cow (€85).
- This result in a total cash incentive of 1335 Euro for each 10 test bull daughters produced in the herd.

Preliminary analysis indicates that such a targeted herd approach could reduce the cost of progeny test in a 100 cow herd by 63% from €5188 to €1398.

Table 5. Structure of progeny test program for dairy and beef bulls

| | Dairy | Beef |
|---|---|---|
| Number of test bulls | 100 | 30 |
| Total progeny per bull | 200 | 200 |
| Number of daughters per bull | 100 | 100 |
| Total test daughters | 10000 | 6000 |
| Total replacements required (test bull dtr/0.8) | 12500 | 3000 |
| Total number of cows (replacement/0.2) | 62000 | 12000 |
| **Average herd size** | **125** | **40** |
| Total number of herds required | 500 | 300 |

## Conclusion

Setting up a breeding program involves the definition of a breeding objective and the selection of elite animals as parents of the next generation. In practice, and especially for cattle, it also involves the coordination of people and management of resources to facilitate participation from all sectors. It requires the establishment of infrastructure for purposeful data collection and management. Setting up a testing scheme guarantees the availability of useful data for early proofing of bulls. A genetic evaluation system capable of utilising all available data to estimate accurate breeding values for all animals in the population and for all traits of economic importance is a necessity. Our experience in Ireland show that this is a difficult but achievable task. What is most important is total focus on the ultimate goal which should be, to increase the profitability of farmers and all sectors of the cattle breeding industry.

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