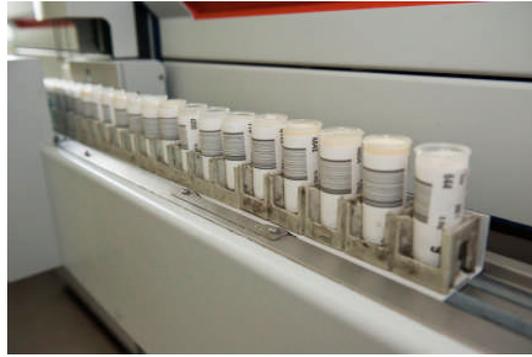


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National breeding objective and breeding programmes for dairy and beef cattle in Ireland



Key external stakeholders:

The Irish Cattle Breeding Federation (ICBF)
(Inter)national breeding industry
Dairy and beef farmers
INTERBULL and INTERBEEF
International genetic evaluation bodies
International geneticists

Practical implications for stakeholders:

This study

- Generated novel and more accurate measures of carcass quality measured using video image analysis and implemented into national genetic and genomic evaluations for dairy and beef cattle
- Generated the first ever national genetic evaluations for animal price for dairy and beef cattle
- Revised the statistical model for genetic evaluation of animal live-weight in dairy and beef cattle
- Revised the national dairy breeding objective, the EBI
- Revised the national dairy and beef genetic evaluations for female fertility
- Undertook the first ever national evaluation for male fertility in Irish dairy and beef cattle
- Undertook the first ever (inter-)national genetic and genomic evaluation for linear type traits in Irish dairy cattle using parameters estimated using only Irish dairy data
- Undertook the first ever national genetic evaluations for management traits in Irish dairy cattle
- Extensively revised the national genetic evaluations for animal health in Irish dairy cattle
- Optimized further the national breeding programme for Irish dairy cattle
- Concluded that further genetics research on including feed efficiency in Irish beef breeding objectives is currently not justified
- Concluded that reported international genetic parameters for methane intensity are being mis-interpreted

Main results:

- Large impact of inclusion, in the national dairy and beef cattle genetic evaluations, video-image analysis of carcasses routinely available on all carcasses slaughtered in Ireland
- Exploitable genetic variation in animal price information collected routinely in livestock marts can be used in national breeding objectives to increase genetic gain in profit
- Use of national genetic evaluations for a wider range of suites of traits in dairy and cattle breeding can be used to augment genetic gain in a balanced overall breeding objective

Opportunity / Benefit:

Increased genetic gain in dairy and beef cattle through more pertinent weighting factors in the national breeding objectives on a wider suite of traits accurately evaluated using Irish data

Collaborating Institutions:

Swedish University of Agricultural Sciences, Irish Cattle Breeding Federation, University of Alberta

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1. Project background:

Successful breeding programmes require breeding objectives that include all traits influencing profitability optimally weighted to generate a single index value on which to rank animals. For a trait to be included in a breeding objective it must be: 1) either economically, socially or environmentally important, 2) express genetic variation, 3) be (ideally easily) routinely measureable or correlated with measureable traits that exhibit genetic variation. The economic values on traits in a breeding objective must be constantly reviewed in light of changes in economic and social policy, as well as, world markets and pricing strategies. Several new potential data sources exist which could provide new traits for possible inclusion in national breeding strategies. Genetic evaluations for linear type traits in dairy cattle for Ireland has, to-date, been undertaken in a joint Great Britain-Ireland genetic evaluation using genetic parameters derived using data from Great Britain – such a joint evaluation will no longer be possible. The large national uptake of DIY milk recording provides routine access to an objective measure of milking characteristics. Data collected as part of the national Dairy Efficiency Program offers a source of lameness and mastitis data for inclusion in national genetic evaluations.

2. Questions addressed by the project:

In this study we attempted to undertake all the necessary research to successfully implement a national breeding strategy for a wide range of traits in dairy and beef cattle. Such research included:

- Trait definition and editing criteria
- Development of appropriate and parsimonious statistical models
- Estimation of the necessary genetic and phenotypic parameters
- Estimation of economic values
- Evaluation of alternative breeding schemes

3. The experimental studies:

- This study was desktop based and involved the analysis of datasets from the ICBF and Teagasc as well as a review of the literature
- DIY milk recording data was used to generate novel milking characteristics traits
- Data on mastitis, lameness and temperament from the national dairy efficiency scheme was used
- Parameters from video image analysis of carcasses was related to carcass dissections to derive carcass cut prediction equations and subsequently genetic parameters for the predictions were estimated
- Animal price and live-weight data from marts as well as on-farm recorded data were estimated to estimate variance components for animal price and live-weight
- Genetic parameters for linear type traits in Irish dairy cattle were estimated using Irish data
- Variance components were estimated using animal linear mixed models that account for all genetic relationships among animals; covariance components were estimated using sire linear mixed models
- Economic values were estimated using a bioeconomic model and profit functions

4. Main results:

- Carcass primal cuts can be accurately predicted from video image analysis of carcasses and exhibit exploitable genetic variation which can increase genetic gain in profit further than selection on carcass EUROP classification
- Exploitable genetic variation in animal price routinely collected in marts exists which can be used in national dairy and beef breeding objectives to more accurately reflect total profitability
- Genetic parameters for linear type traits estimated using Irish data were similar (albeit slightly lower) to estimates previous used in the joint evaluations; heritability estimates varied from 0.01 to 0.45. Little re-ranking existed between sire genetic evaluations estimated in the joint analysis and estimated using the revised genetic evaluation. The revised genetic evaluation passed the INTERBULL test run and will therefore be used in international genetic evaluations
- Considerable genetic variation in milking duration (from DIY milk meters) existed after adjustment for milk yield and udder health; the heritability of this trait was 0.17.
- Heritability estimates of 0.02 to 0.04 were estimated for lameness and mastitis estimated using the data

generated as part of the dairy efficiency programme which, along with the genetic correlations with somatic cell count and linear type traits corroborate international estimates thereby signifying that the data collected as part of the dairy efficiency program is sufficiently accurate to be included in national genetic evaluations.

- Heritability of female fertility was low which is consistent with international estimates but significant genetic variation existed to merit inclusion in a revised national separate genetic evaluation for dairy and beef
- Significant differences in male fertility as well as efficiency of AI technicians existed
- An extensive review of the literature concluded no benefit of including residual feed intake directly in a national breeding goal or selection index and in fact doing so could actually reduce genetic gain. Selection index theory analyses from a completed meta-analysis of 39 studies in growing animals clearly showed 90% of the genetic variation in feed intake could be explained by routinely recorded traits in Irish beef cattle signifying little marginal benefit of research in attempting to capture the remaining variation (i.e., residual feed intake) while other important traits in the index require more immediate attention
- Simulations undertaken suggest that most of the heritability reported to-date for methane intensity are primarily a function of the denominator in the derivation of methane intensity (i.e., feed intake). More appropriate phenotypes to elucidate the exploitable genetic variation in environmental footprint were derived

5. Opportunity/Benefit:

- All research results for trait definitions, data editing criteria, genetic parameters and economic values (where available) are now implemented in national genetic evaluations for dairy and beef cattle for: 1) carcass cuts, 2) animal price, 3) live-weight, 4) female fertility, 5) male fertility, 6) linear type traits, 7) animal health, and 8) management traits.
- Gene Ireland breeding programme has been optimised further

6. Dissemination:

International conferences: Presented at many international conferences, invited and contributed, such as the European Association of Animal Production, INTERBULL, ICAR, American Dairy Science Association Annual meeting, and the World Congress on Genetic Applied to Livestock Production.

National Conferences and seminars: Presented at the Agricultural Research Forums through the duration of the project and at national farmer conferences (e.g., Irish Grassland Conference, Teagasc national dairy farmers conference) including GENE IRELAND® days.

Open Day: Presented at all Moorepark open days.

Industry consultation days: Presented and discussed at several industry meeting days with representatives from the different AI organisations, breed societies, Teagasc extension service, farmer groups and farmers.

Farmer discussion groups: Discussed at many farmer discussion groups and seminars.

Press: Results regularly presented in the Irish Farmers Journal, Farming independent, Today's Farm, TRResearch, and Moorepark News.

Main publications:

Berry, D.P., J. Coyne, B. Coughlan, M. Burke, J. McCarthy, B. Enright, A.R. Cromie, and S. McParland. 2012. Genetics of milking characteristics in dairy cows. *J. Dairy Sci.* (In Press)

Berry, D.P., and J. J. Crowley. 2012. Genetics of feed efficiency in dairy and beef cattle. *J. Anim. Sci.* (In Press)

McHugh, N., Evans, R.D., Amer, P.R., Fahey, A.G. and Berry, D.P. (2011). Genetic parameters for cattle price and body weight from routinely collected data at livestock auctions and commercial farms. *Journal of Animal Science* 89 : 29-39

Pabiou, T., Fikse, W.F., Amer, P.R., Cromie, A.R., Nasholm, A. and Berry, D.P. (2011). Genetic variation in wholesome carcass cuts predicted from digital images in cattle. *Animal* 5 (11) : 1720-1727

7. Compiled by: Dr Donagh Berry

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