

Project number: 6890
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Phenotyping strategies for difficult-to-measure traits



Key external stakeholders:

Dairy, beef & sheep farmers
International genetic evaluation bodies
National and International scientists
University and Teagasc lecturers and extension officers
Breeding companies (e.g., NCBC, Bova, Dovea, Eurogene/ LIC Ireland)
Breed societies
Bord Bia
Irish Dairy Board
Meat processors

Practical implications for stakeholders:

This was a feasibility study to investigate the potential of large-scale collection of difficult-to-measure phenotypes for genetic improvement.

Project outcomes include:

- A publicly available generic excel file to calculate the expected return on investment for genotyping
- A SWOT of alternative tools to collect feed intake and methane emission data from cattle and sheep
- Evidence of improved reliability of estimated breeding values for difficult to measure traits when (international) data sets are combined
- Quantification of the impact on other performance traits if either feed intake or health were included in the national breeding indexes

Main results:

- Green feed systems were identified as optimal to record methane emissions of large ruminants in grass based systems of production owing to their favourable characteristics of portability, automatic data upload and low maintenance.
- Databases should be shared between countries to improve accuracy of genetic evaluations for difficult to measure traits. In some situations, where the accuracy of the trait of interest in one participating country is very high, the benefit of sharing data is less than when data are lacking and EBV reliability is low.
- Selection on the current dairy breeding objective (EBI) will yield cows with higher residual energy intake (undesirable) but with a lower prevalence of liverfluke-damaged livers (desirable) and lower mortality (desirable).

Opportunity / Benefit:

The requirement for collecting large quantities of expensive phenotypes is reduced through sharing of data bases and more informed decisions on numbers of phenotypes required to achieve high selection accuracy

Collaborating Institutions:

ICBF
UCD

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External collaborators:

1. Project background:

Traits missing, or poorly represented, in Irish (and global) dairy, beef and sheep breeding goals include feed intake, methane emissions, and animal health. Limited data already exists for these traits and genetic parameters are currently under investigation. Strategies to achieve long-term high accuracy of selection, however, are less well investigated. Such strategies must achieve a good return-on-investment. Therefore both the costs (and approaches) of procuring such phenotypic data as well as the (economic) benefits of generating such data must be undertaken in a feasibility analysis deciding what phenotypes are to be researched further.

2. Questions addressed by the project:

- What is the cost benefit of procuring feed intake and animal health data?
- What is the optimal method of collecting feed intake and animal health data?
- What impact would the inclusion of either feed intake or animal health have on other performance traits if included in the national genetic selection indexes

3. The experimental studies:

A comprehensive report for dairy, beef and sheep outlining the cost:benefit of alternative strategies for the generation of accurate genetic evaluations for difficult-to-measure traits was compiled. Alternative family-based phenotyping strategies with or without genomic information were evaluated considering the cost of generating gold standard measures of feed intake to achieve near unity accuracy of selection. The potential of international collaboration in the exchange of phenotypes to augment the accuracy of selection at minimal cost was explored. The benefit of an incremental improvement in the difficult-to-measure traits for inclusion in cost:benefit and SWOT analyses of alternative strategies was quantified.

4. Main results:

- The length of the feed intake trial period as currently operated at the Tully performance testing station may be reduced from 10 weeks to 6 weeks with minimal impact on the quality of the feed intake estimates obtained.
- GreenFeed systems were identified as the optimal system to record individual animal methane emissions since they 1) are portable, 2) can collect data from grazing and housed cows, 3) can collect data from large numbers of animals, 4) are low maintenance and 5) automatically upload data.
- Health data shared between Ireland and the UK demonstrated the benefits of combining international animal health phenotypes on improved accuracy of Irish animal health genetic evaluations and resulted in the set-up of pipelines for joint international evaluations.
- The reliability of breeding values for bovine tuberculosis resistance of bulls with both an Irish and UK proof, increased, on average, by 2 percentage units when data were shared between countries
- The dairy genetic selection index, the EBI is currently selecting for cows with higher residual energy intake (undesirable) but this could be reversed if residual energy intake was included in the EBI with the appropriate economic weight. However, selection on the EBI is having a favourable effect on the prevalence of *F. hepatica*-damaged livers owing to the favourable correlation between fertility traits and *F. hepatica*-damaged liver and the large emphasis on fertility in the EBI.

5. Opportunity/Benefit:

The feasibility of collecting data for any new trait identified in dairy, cattle and sheep populations can be

tested using the generic tools developed in this project. This includes the accuracy of selection given known or estimated genetic parameters of the new trait as well as the cost: benefit of collecting data on the trait. The pipelines for joint international genetic evaluations of bovine tuberculosis now exist between the UK and Ireland.

6. Dissemination: Conferences

Presented at the international World Congress on Genetic Applied to Livestock Production as well as the national Irish Cattle Breeding Federation annual conference

Public Events

Presented at all Teagasc Moorepark National 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.

7. Compiled by: Dr. Sinead McParland
