

Genomic Selection – the future of animal breeding

Dr. Nóirín McHugh

Animal & Grassland Research and Innovation Centre, Teagasc

Summary

- Genomic selection is a new tool which can increase the accuracy of identifying genetically elite animals at a younger age
- It utilises DNA information which remains the same for an animal across its lifetime
- It can also accurately assign parentage to lambs and identify major genes such as scrapie
- Genomic selection will not work without accurate on the ground recording
- The OVIGEN project will offer all Irish Texel, Belclare, Suffolk, Charollais, Vendéen and Beltex performance recording flocks the opportunity to genotype all ewes within their flocks free of charge.

Introduction

The genome is the core genetic structure in every living species and is composed of DNA strands. DNA is the building blocks for genes. Every animal contain billions of pieces of DNA that generate genes that in turn control all functions throughout the body and therefore are one of the drivers of animal performances (capacity to grow rate, to lamb every year...). Since the 1980's, genetic evaluation of farm animals was solely derived from performances recording and pedigree structure. Recently, advances in bio-technologies made it possible to read animal DNA and place genetic markers at specific position on the genome to act as sign-posts to locate genes.

Genomic selection

Genomic selection is the new breeding technology that uses tens of thousands of genetic markers associated with genes. This genetic marker information along with performance records allow for more accurate estimates of the genetic merit of the sheep. As DNA remains the same for an animal across its lifetime, the increase in accuracy from genomic selection can be achieved from birth. The technology is currently available to measure over 50,000 genetic markers in sheep and is similar to the technology used currently in beef and dairy cattle.

The benefits

The main benefits of genomic selection are:

1. Accurate assignment of parentage to lambs
2. Identification of major genes
3. More accurate indication of inbreeding levels
4. Increased accuracy's for Euro-star indexes especially on young animals
5. Increased rates of genetic gain

Genomic selection has recently become very popular, especially in dairy cattle and has been shown to increase genetic gain by 50% with an appropriate genomic selection breeding program. Expected response to selection from genomic selection may actually be greater in Irish sheep since the current accuracy levels are low and therefore the potential scope for improvement is considerable.

OVIGEN



The OviGen project, funded by the Department of Agriculture, is a new 4 year research project exploring the possibility of genomic selection in Irish sheep. This is a hugely exciting project which will need the collaboration of several industry bodies including Teagasc, Sheep Ireland and UCD to insure its successful completion. DNA samples will be collected from all performance recorded sheep in the Texel, Belclare, Suffolk, Charollais, Vendeen and Beltex breed societies. All DNA samples from these animals will be genotyped.

This project will at a minimum deliver parentage verification, major genes and better inbreeding reports which will all help deliver higher more reliable EuroStar evaluations, and hopefully the outcome will demonstrate that genomics is currently possible for some of the largest breeds in the Irish Sheep industry.