

Modelling the effect of genetic improvement programmes on greenhouse gas emissions in the Welsh sheep industry

A model has been developed to predict the expected changes in methane emissions that could result from the widespread use of genetic improvement for production efficiency within the Welsh sheep sector. This model has been used to identify the role that breeding can play in helping sheep farmers to reduce enteric methane emissions, (emitted as a result of rumen digestion), without negatively impacting on livestock numbers or profit margins.

Currently greenhouse gas emissions from primary agricultural production contribute around 9% of total annual Welsh emissions; a significant proportion of this is attributed to enteric emissions of methane from ruminant livestock, including sheep. The Welsh Assembly Government has given clear signals that the livestock sector needs to develop emission reduction strategies.

Genetic improvement can provide a long term, cost effective strategy as it brings about permanent and cumulative changes. This strategy, used in-conjunction with other management practices, that also seek to address emissions may bring additional benefits particularly if improvements in nutrition and forage utilisation lead to better expression of superior genetics.

The model was used to predict genetic changes in individual traits in hill, crossing sire and terminal sire breeds and the influence these would have on flock outputs in hill, upland and lowland flocks in Wales. The information was then used to model the energy requirements of all stock on such farms, and in turn to predict the methane emissions on an individual animal basis.

The study has shown that, if adopted across the whole industry, current genetic improvement programmes are expected to result in an annual reduction in methane emissions of 0.03% per tonne of carcase produced. A reduction of 0.08% per year could be expected if correlated changes in ewe weight in hill and crossing sire breeds, and thus crossbred ewes, were restricted.

The greatest predicted reductions in methane emissions were associated with genetic improvement in lowland flocks in which methane emissions per tonne of carcase produced could be reduced by 1.8% over a ten year period if the weight of the crossbred ewe did not increase. Genetic improvement in both terminal and crossing sires made a significant contribution to this reduction.

In hill breeds the expected reductions in methane emissions were very small. This is partly due to an expected increase in ewe size resulting from selection for lamb growth. Purebred hill ewes make up approximately half of the Welsh ewe flock and this has contributed to the relatively low expected reduction across the industry as a whole.

Of the traits examined in this study, those that are most likely to have a beneficial effect on methane emissions through genetic selection or breed substitution are ewe prolificacy, ewe longevity, muscle depth (through its correlated effect on carcase weight) and lamb growth (if changes in ewe weight are restricted). Genetic improvement of these traits, through within breed selection programmes or breed substitution, could lead to substantial reductions in methane emissions per tonne of carcase produced.