Lleyn genetics are playing a part in breeding hill sheep to meet future economic, environmental and climatic challenges

At SRUC's Hill and Mountain Research Centre in Crianlarich, Lleyn genetics are being combined with those from the Scottish Blackface to try to find the best breeding strategies to reduce environmental impact, whilst increasing profitability, on hill sheep farms. This new Scottish Government funded project will build on previous research comparing the Lleyn and Blackface breeds in harsh hill environments and will use new technologies to measure additional traits that could contribute to reducing carbon footprint.

We know that selective breeding works, even in harsh hill environments. Clear benefits of within-breed genetic selection for maternal and lamb production traits, to meet current hill sheep system economic drivers, have been shown by previous research adopted by industry. In the SRUC Scottish Blackface flocks, selection on an economic genetic selection index resulted in increased overall profitability (by around £3 to £5 per ewe per year, after 8 years of selection).

However, SRUC hill sheep research has also identified some limitations within traditional hill breeds for traits related to greenhouse gas emissions and feed efficiency. Genetic selection on the current hill sheep index is expected to increase greenhouse gas (GHG) emissions, mainly as a result of an increase in ewe mature size (2.8–3 kg difference after 8 years of selection). There are also differences both within and between breeds for individual feed intake, feed efficiency (amount of growth relative to amount of feed eaten) and carcass quality, that could increasingly affect resilience and efficiency of production in future.

Additionally, rumen size and function differ, with hill breeds having larger rumens, which helps in digestion of poor quality, fibrous vegetation on the hill, but results in higher methane emissions. Traditional hill sheep are adapted to survive and reproduce over winter on rough hill ground, eating poor-quality vegetation. This enables high-quality animal protein for human consumption to be produced from these land areas that are unsuitable for many other forms of agricultural production, reducing competition for good quality land suitable for cropping, or potentially for initiatives to increase biodiversity.

Despite originally being bred as a lowland / upland breed, results from previous research suggest that the Lleyn breed shows promise to thrive in hill systems. The Lleyn showed performance in maternal traits, lamb growth and quality that was equal to or higher than that of the high index Scottish Blackface line in most years, when run together at SRUC's challenging Kirkton hill farm in West Perthshire. However, when pushed high out on the hill for more of the year, the superiority of the Lleyn was less pronounced and in years of extreme bad weather, Lleyn maternal performance was severely depressed, unlike that of the traditional Blackface breed. When finished indoors on concentrates there was some evidence that Lleyn lambs were more feed efficient – eating less per unit of live weight gain to slaughter.

Against this background, the new phase of research will consider combining the benefits of these two, well-recorded breeds, to widen the gene pool in a way that could benefit production and environmental footprint of hill sheep systems, without losing the hardiness and resilience of the traditional hill breeds. The most suitable management strategies to promote productivity and biodiversity whilst reducing carbon footprint from these systems will also be tested.

A flock of 600 breeding ewes at SRUC Kirkton farm will form the livestock platform for this research. This will be comprised of crossbred ewes (including Scottish Blackface and Lleyn genetics), and ewes from the previously-established high index Scottish Blackface selection line for comparison. In order to breed for highly resilient sheep, suitable for a high hill environment, the flock will be recorded for: maternal traits; ewe longevity and lamb survival; health and welfare traits; production and product quality traits; feed efficiency and GHG predictors (e.g. using individual feed intake recording

equipment and CT scanning); and resilience to climate change, by combining environmental and flock production data. The relationships between these traits will be tested, to identify any trade-offs or win-wins. To assess grazing patterns and resource use, a number of strategies will be employed to track animal locations at different times during the year and monitor grazing resources, including GPS collars and drones. This will be related to weather and environmental data collected routinely by sensors from different parts of the farm and carbon-footprinting will also be performed to compare different outcomes.

The aim of this 5 year programme is to produce the most appropriate hill genetics for harsh Scottish hill environments, to meet new and emerging challenges relating to climate change, economics, biodiversity etc., and to define the optimal feeding and management strategies to enable sustainable hill sheep production systems.

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