

Lifetime performance of crossbred ewes in the hill sheep sector

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Introduction Hill sheep flocks in the UK are dominated by purebred ewe genotypes, with the Scottish Blackface being the most common. However a long term decline in economic returns, combined with recent changes to the Common Agricultural Policy, has lead many hill sheep producers to consider keeping crossbred ewes to exploit the benefits of hybrid vigour for lamb survival and to introduce beneficial traits for prolificacy, ease of lambing and carcass quality. In 2001, a major on-farm research programme was initiated to evaluate the performance of a range of crossbred ewe genotypes for the Northern Ireland hill sheep sector. Provisional data has already identified that retaining Lleyn X Blackface and Texel X Blackface ewes can improve lamb output at weaning by up to 10% relative to purebred Blackface ewes (Speijers *et al.*, 2007). However, ewe longevity is a major issue for hill flocks, where the annual replacement rate often exceeds 20%. Therefore it is inappropriate to evaluate crossbred ewe genotypes based on average annual performance alone, and the aims of this study were to investigate the lifetime performance of a range of crossbred genotypes under hill conditions.

Materials and methods This study was carried out on six hill farms, representative of the main hill farming regions of Northern Ireland. From November 2001-2003, 200 purebred Blackface ewes per farm were allocated to one of five mating groups, balanced for ewe live weight, body condition score and age. Each year, ewes were mated with Blackface (B), Cheviot (CH), Lleyn (LL), Swaledale (SW) and Texel (T) rams. In 2001, single sire mating groups were used on each farm while in 2002 and 2003, a team of rams was used across all farms using artificial insemination. A total of 15 rams from each of the five sire breeds were used to produce the crossbred progeny. Where possible, rams were selected on the basis of their genetic indices to represent the top 10% of recorded animals for the breed. The female progeny from these crosses were retained for breeding, which commenced at approx. 18 months old. Over a 4-year period (November 2003-2006), the crossbred ewes were mated in single sire mating groups to a range of sire breeds, which were balanced across all genotypes. Ewes were weighed prior to mating, 6 weeks pre-lambing, 6 weeks post-lambing and at weaning. Pregnancy was diagnosed each year by ultrasound scanning at day 80-100 of gestation. Ewes that were barren as hoggets were retained until the following year; however barren ewes >2 years old were culled after scanning. Ewes with functional abnormalities at weaning were also culled. Lambs were weighed at birth, 6 weeks of age and at weaning. Total lifetime output per ewe was calculated for each breed as the product of the proportion of productive ewes and the mean productivity per ewe lambled. The proportions of productive ewes at each lambing were estimated from a binomial regression analysis using a model with fixed effects for farm and breed. Mean productivity per ewe lambled were estimated using Repeated Measures Analysis of Variance. The model included fixed effects for farm, breed, parity and the breed x parity and breed x farm interactions.

Results Longevity of all crossbred ewe genotypes, in terms of the proportion of ewes remaining at the 4th parity, were similar to that of purebred Blackface ewes. However, over a 4 year period, the total number of lambs born ($P<0.05$) and the total weight of lambs born ($P<0.05$) per ewe were significantly higher in SWXB, LLXB and TXB ewes than BXB and CHXB ewes. These genotype effects remained at weaning, with SWXB, LLXB and TXB ewes successfully rearing a greater total number ($P<0.05$) and total weight ($P<0.05$) of lambs. These genotypes were also superior in terms of output efficiency, achieving a higher total lamb output/kg metabolic live weight ($W^{0.75}$) than BXB and CHXB ewes due to their greater weaned lamb output.

Table 1 Effects of hill ewe genotype on ewe productivity over a 4-year period

Ewe genotype	BXB	SWXB	CHXB	LLXB	TXB	s.e.d	Sig
Prop. ewes surviving to 4 th parity	0.59	0.61	0.51	0.57	0.62	0.076	NS
Total no. lambs born/ewe	4.63 ^a	5.32 ^b	4.64 ^a	5.23 ^b	5.01 ^{ab}	0.199	*
Total lamb birth weight (kg/ewe)	17.6 ^a	20.4 ^b	18.8 ^a	20.3 ^b	20.7 ^b	0.804	*
Total no. lambs weaned/ewe	3.93 ^a	4.61 ^b	3.96 ^a	4.48 ^b	4.34 ^b	0.191	*
Total lamb weaning weight (kg/ewe)	116 ^a	136 ^b	123 ^a	138 ^b	136 ^b	5.8	*
Total weaning weight/kg $W^{0.75}$	5.60 ^a	6.62 ^b	5.55 ^a	6.59 ^b	6.19 ^b	0.281	*

BXB, Scottish Blackface; SWXB Swaledale X Blackface; CHXB, Cheviot X Blackface; LLXB, Lleyn X Blackface; TXB, Texel X Blackface; $W^{0.75}$, metabolic live weight (W = live weight at mating). Means sharing the same superscript are not statistically significant ($P>0.05$)

Conclusion The results of this study demonstrate that adopting a crossbreeding strategy on hill flocks to produce crossbred replacement ewes is unlikely to have any adverse effects for ewe longevity and flock replacement rate. However lifetime lamb output of hill ewes could be increased by up to 20% by crossing Blackface ewes with Lleyn, Swaledale or Texel sires to produce flock replacements, rather than maintaining a purebred status. Therefore crossbreeding has a key role to play to help ensure that the UK hill sheep sector remains economically viable in the future.

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References Speijers, M. H. M., Carson, A. F., Irwin, D. and Dawson, L. E. R., 2007. Proceedings of the British Society of Animal Science, p117