Conservation and usage of the FecX g mutation or the "desirable" Prolificacy Gene.

At least two gene mutations which increase ovulation rate and thus prolificacy are traditionally present in Lleyn sheep (and hence Belclares in Ireland). The autosomal FecG h mutation and the FecX g mutation, which is present on the X chromosome. The presence of a copy of the FecG mutation in a ewe is of dubious benefit since as a consequence prolificacy can rise up to an unmanageable 420% from a +1.7 increase in ovulation rate . In addition carrier rams will only hand on the gene to half their progeny so that one sees an uneven "all or nothing response". However with a single copy of the FecX mutation, that is a heterozygote ewe, the increase is to a more interesting 210-250% from a 0.6-0.8 rise.

In the absence of these mutations in a flock the Lleyn prolificacy is probably around 1.7 or 170%, (John Adams). It maybe even as low as 160% which is clearly very unambitious not to say commercially inadequate for a lowland flock. A recent survey carried out on 333 hogget rams presented to Arfon in the ram inspections in the UK and Ireland, in 2010, showed only 3 with the X-chromosome linked FecX g mutation (cf. 9 with the FecG h mutation). This implies a level of only some 2% in the ewe population (cf circa 3% for FecG h). Comparison with previous studies on ewes carried out 10 years ago on Welsh Flocks reveal significant breed declines, including some present-day Welsh Flocks. In addition the proportion of singles presented for ram inspection seems to be on the increase (John Adams). However since many of us have lambing percentages exceeding 200% it follows that a smattering of either genes is still present in our ewes and this 2-3% is very probably an underestimate.

A ram (XY) carrying the FecX mutation will hand this on to all his daughters (XX) via the X chromosome he provides; so there is an even response. These carrier ewes will in turn hand on the FecX mutation to 50% of their lambs , both male and female. In contrast ram lambs from the carrier ram will not inherit the prolificacy gene since they have received the Y chromosome from their sire. Carrier rams can thus only be produced from carrier ewes. The Health Warning vis-à-vis both the mutated genes is that ewes already carrying a copy of FecX g , (or FecG h) go to a carrier ram, 50% of the daughters, that is the homozygotes, (ie FecX g/FecX g or FecG h/FecG h) will be sterile due to disruption of ovarian follicular development (overstimulation?). The other 50%, the heterozygotes, (Wild-type FecX/FecX g) will be fine and inherit the increased prolificacy. This indicates that genotype of rams in particular, ie whether they are carriers or not, should be known and their usage carefully controlled.

On one hand the mode of inheritance and the sterility of the occasional homozygote implies that in the absence of selection pressures and in particular the occasional usage of a carrier ram the prolificacy of a Lleyn flock will drift down. Since in Ireland, in contrast to France or New Zealand, we have a "pedigree" selection system very biased in favour of the "Show Animal" a more modest carrier triplet or occasional quad ram is unlikely to get precedence over a well fed non-carrier single. This will aggravate the drift downwards and is likely to be a contributory factor towards the underestimate in Arfon's survey. On the other hand carrier ewes will produce doubles and a very significant % of triplets so that commercial breeders who routinely selectively retain these ewe lambs will tend to retain the gene, and thus maintain their flock prolificacy. The mathematics are clearly complex.

I believe that the Group should make a careful effort to genotype rams to conserve and even expand the presence of the FecX g mutation, call it the Prolificacy Gene, in the Lleyn Flock here. On the contrary we should get rid of the litter-producing and unpredictable FecG h mutation I don't believe that the potential problem of the sterile homozygote ewes will loom large since Arfon's 2010 ram survey implied only around 2% of ewes are presently likely

to be heterozygote carriers. Although as stated this is probably an underestimate because of a significant residual carry-over of the gene in Lleyn ewes from more prolific times and the bias towards singles in the rams presented. In any event the consistant and reproducible increase in prolificacy should quickly compensate for this ocasional first generation problem. Confining usage of the carrier to a Lleyn flock's small minority of single lambs or ewes producing mainly singles and doubles should greatly decrease the risk. More important, repeated usage of carrier rams on prolific (carrier),double/ triplet ewe lines is not desirable or necessary. All this indicates strongly that the genotype of a ram we are buying in a Society Sale should be known. It would also be useful to know which hoggets or ewe lambs are the immediate progeny of an FecX carrier ram.

Clearly carrier ram usage should be careful and geared to how much the Lleyn breeder thinks he needs to improve his prolificacy over the inadequate 170% (even maybe 160%). The aims of a hill farmer would differ from an ambitious young lowland stockman looking for maximum profits. We are all conscious of the crucial importance of prolificacy to profits and of the present disastrous production levels in Ireland (1.3 per ewe). As with cattle, low ewe fertility is costing the country a lot of money. A very high % of farmers are eating into their premia. Certified FecX carrier Lleyn rams to use on our underperforming low fertility commercial cross-bred flocks would be very sellable. Some preliminary experiments with TEAGASC on the effect of FecX "Prolificacy Gene" on these low fertility crossbreds would be of interest.

It is noteworthy that Innovis in the UK have successfully developed the Aberdale ram for the production of prolific half-bred commercial ewes, mainly from hill sheep. This is basically a Texel but one selected for commercial usage rather than for "Show-type" characteristics. Thus a smaller head, narrower shoulders and a better pelvis. However the key commercial trait is that they carry the Inverdale prolificacy gene. Last year over 7,000 half breds were sold and demand is increasing very rapidly; with 5,000 more requested this next year. The Inverdale gene is very similar in effect and inheritance to our FecX g mutation.

In France, the Lacaune Viande, the breed whose marketing has a significant effect on lamb prices because of numbers (320,000), is engaged in a programme to greatly expand the presence of an autosomal prolificacy gene (one with Lac-3 as a marker). Current prolificacy is by Irish standards already a laudable 1.76+. The aim is that half the ewes will be heterozygous carriers of the mutation (prolif.2.17) and half non-carriers to take the overall prolificacy to just over 2. Last year 1,623 ewe lambs from the recorded elite base were tested.

All this focus on profit from prolificacy indicates that it would be a great error for Lleyn breeders to ignore the FecX gene which historically has been such a basic feature of the breed.

I thank John Adams for the information and discussion.

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