Main areas for discussion regarding the ethics of organic and low input sheep breeding

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1. Mismatch between genotype & environment is of concern. E.g. as we can't 'control' the environment outdoors, then making sure the right breed does the right job is critical for animal and human welfare. The introduction of inappropriate breeds or crosses without corresponding modifications to the environment (e.g. more prolific breeds in extensive environments will have smaller birth weight offspring and hence potentially higher levels of mortality). Key management steps need to be in place to mitigate the consequences of such practises and it is certainly questionable whether or not the use of some prolific breeds, (some with associated congenital defects) is morally right[1].
2. On the same note – having larger number of sheep looked after by one shepherd inevitably means less individual attention per sheep. Using breeds that require little human intervention to lamb unaided is critical to both animal welfare and flock efficiency. Using 'easy care' breeds that have been created specifically for this purpose has been the solution to the low (human) inputs that has been brought about by the relatively low product value of sheep. Simply using the same genotypes but reducing labour inputs is not acceptable. Ways to breed such sheep are possible without compromising sheep welfare if undertaken in a controlled way – not the way they developed the Marshall Romney breed in NZ (survival of the fittest – i.e. lots of sheep died in the process which is unacceptable).
3. Breeding for disease resistance is a sustainable way forward particularly for organic systems and low-input sheep systems where they are only gathered from extensive hills once or twice during the lambs' lifetime and so implementing treatments is difficult. More resistant sheep are healthier, require less human intervention and are cheaper to keep, and are better for the environment. HOWEVER, in order for conventional methods of animal breeding practices to take place, it's more efficient if this is undertaken in diseased environments, i.e. when the prevalence of a disease is high. All evidence to date suggests that there is greater genetic & phenotypic variance for resistance to disease when the prevalence is high, leading to higher heritabilities and more efficient selection strategies. This means that usually, animals are not routinely treated (e.g. with anthelmintics) - or at least they may suffer a period when treatments may be withheld, in order for such expression of resistance and/or

[1] An example of this is the Inverdale gene where homozygous ewes have streak ovaries and are infertile but heterozygous ewes are more prolific with ovulation rates about 1.0 units higher than non-carriers. Davis et al., 1992. Infertility due to bilateral ovarian hypoplasia in sheep homozygous (FecXI FecXI) for the Inverdale prolificacy gene located on the X chromosome. Biol. Reprod. 46:4 636-640.

susceptibility to take place before phenotypes are collected and selection takes place. Coupled with (often) large between year variation in the prevalence of certain diseases, conventional selection for disease resistance is a relatively difficult, long-term commitment. Hence the development and use of molecular tools and information to aid selection for disease resistance should be encouraged for conventional, low-in put and organic sheep breeding systems.

4. Using molecular genetic information in sheep breeding for disease resistance potentially overcomes the limitations that exist using the conventional selection method. New robust tools and more efficient ways to implement these are needed for the sheep industry. Potentially the use of the ovine SNP chip could be the solution but for this to work effectively for multitude of breeds, a far denser SNP chip (800K+) than that which is currently available (50K) is required for the diversity of breeds that exist in Europe. Needless to say, there still needs to be large training populations for all breeds with detailed phenotypes for the diseases of interest, in order for the use of SNP technology to be realised. As it is far easier to measure milk yields and growth, the danger exists that SNP technology will accelerate selection response for these traits. Unless disease traits are included alongside them, they will get left behind and potentially undesirable correlated responses to selection for production only will be manifested in increases in susceptibility to some diseases.
5. Some other concerns for sheep breeding
    1. Use of laparascopic AI to maintain genetic connectedness in geographically diverse sub-populations e.g. ram circles in Norway, Sire Reference Schemes in the UK
    2. Breeding for aesthetic qualities (e.g. horn size, broad shoulders) often contributes to greater levels of dystocia. This is not conducive to low-input sheep production and should be discouraged.
    3. Introducing fertility genes into populations of sheep where the management of the outcomes of so doing is not adequate. Higher levels of mortality is the consequence of increasing litter size, without corresponding emphasis on ability of sheep to rear larger litters.