

## **Genetic Testing Service available for Members**

Occasionally white fleeced Ryeland sheep will produce coloured fleeced lambs.

The Society offers members a genetic testing service, carried out by Cardiff University, to test white fleeced Ryeland sheep to determine if they have the genetic ability to produce coloured fleeced lambs.

## **Coloured Ryelands**

White fleeced Ryeland sheep have the ability to produce coloured fleeced Ryeland sheep due to the expression of a recessive coloured gene. Not all white fleeced Ryelands carry the recessive coloured gene, when they don't they are referred to as homozygous and cannot produce coloured fleeced lambs. White fleeced Ryeland sheep that carry the coloured recessive coloured gene are known as heterozygous and can sometimes produce coloured fleeced lambs if mated with another heterozygous Ryeland.

The Ryeland Flock Book Society promotes the breeding of both white fleeced and coloured fleeced Ryelands and has separate flock books to record "White" and "Coloured" Ryelands.

## **Background**

Flock Book Members, at the 2008 AGM, set up a Genetics Sub Committee with the objective to investigate "DNA profiling" in line with stated objects of the RFBS Articles of Association to keep abreast of modern and scientific developments in breeding of sheep.

In January 2013 an MRes Research Project was undertaken at Cardiff University department of bioscience under the direction of Professor Bruford. The study aim was to identify the genetic basis of coat colour within the ryeland breed and to explore genetic variation within the national flock. The study was completed in August 2013 and identified that a gene called the ASIP gene was responsible for coat colour in ryeland Sheep. Significantly a genetic test was established which identifies the presence of the recessive 'coloured' allele (part of a gene) and therefore distinguishes between a homozygous ryeland (white fleeced Ryelands which does not carry the recessive coloured gene) and heterozygous ryeland (white fleeced Ryelands that does carry the recessive coloured gene) by DNA analysis alone.

Simon Donovan, member of the Genetics Sub Committee, carried out an additional study, in parallel with the Cardiff University Masters Project, to investigate the genetic diversity within the national flock using 30 years of registration data held in the flock books. This analysis ensured that the sheep selected for genetic testing in the university project were representative of all the most prolific and distinct bloodlines within the national flock. This provided confidence that the findings from the MRes Research Project would be consistent throughout the ryeland breed. The flock book analysis concluded that virtually all ryelands born today have a coloured carrier in their 4 generation pedigree, indicating that it is virtually impossible to breed for homozygous ryelands by pedigree analysis alone. A full report on this study can be found in the 2013 flock book.

## Introducing the Test

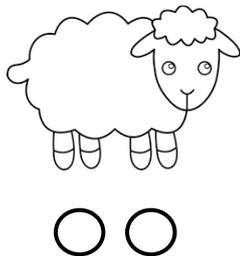
The Genetics Sub Committee devised a practical testing programme that could be used by members to test sheep in their own flock. The rules and protocols for the testing programme were finalised after consultation with the full membership of the society. Member's views along with advice from Cardiff University were incorporated into the final version. It was agreed that these would be reviewed after three years. The testing programme offers members the opportunity to identify, through genetic testing, whether a white fleeced Ryeland is homozygous or heterozygous to the dominant 'white' allele, and therefore establish if it is possible for that animal to produce coloured ryelands. A copy of the testing rules and protocol can be found in the flock books (2014 onwards).

The whole project including the research carried out by Cardiff University, the genetic diversity analysis and the development of the testing programme has been completed at a very modest cost to the society of £700.

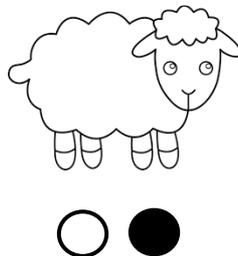
### Why and how do some Ryelands have a coloured fleece?

The agouti signalling protein (ASIP) gene is responsible for controlling the coat colour in ryeland sheep. A variant of a specific gene is called an allele. In the ryeland breed there are two variations of this ASIP gene, the dominant allele associated with white fleece and a recessive allele associated with colour fleece. Alleles occur in pairs, one being inherited from the sire and one from the dam. When a gene contains two copies of the same allele it is denoted homozygous, when the alleles differ it is denoted heterozygous. In the ryeland there are three genetic types for this gene.

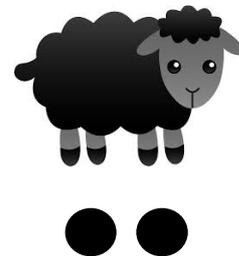
Homozygous Ryeland



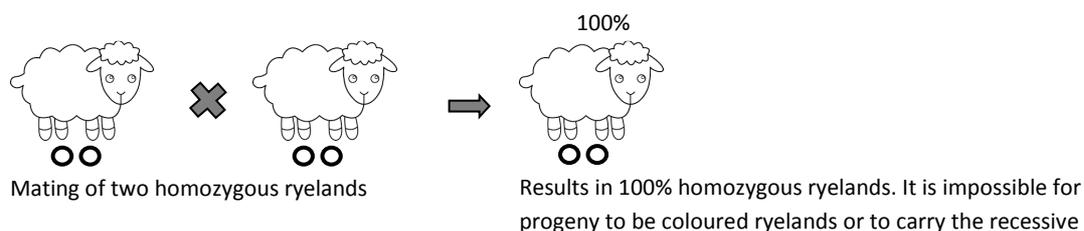
Heterozygous Ryeland

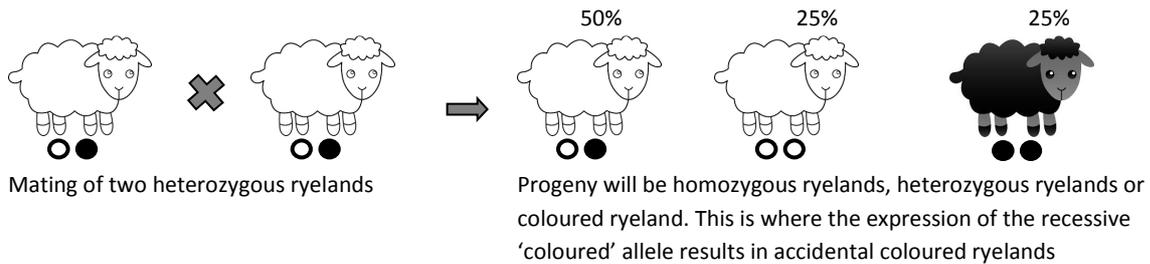
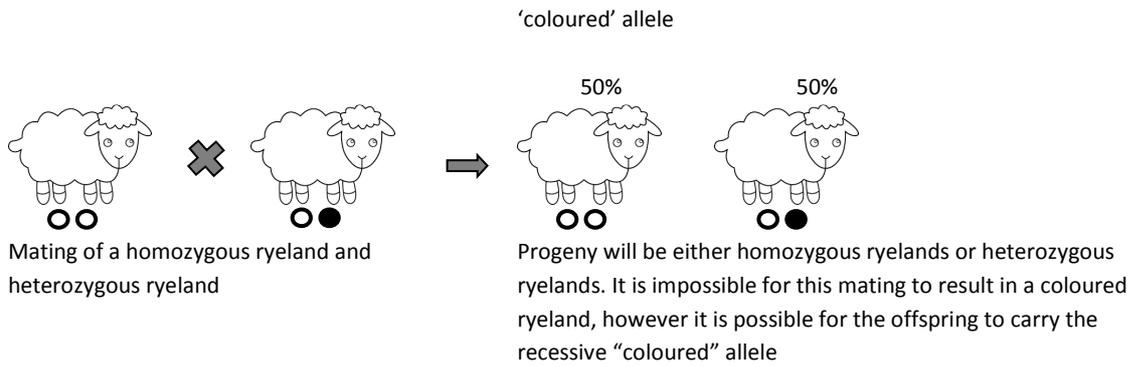


Homozygous Coloured Ryeland

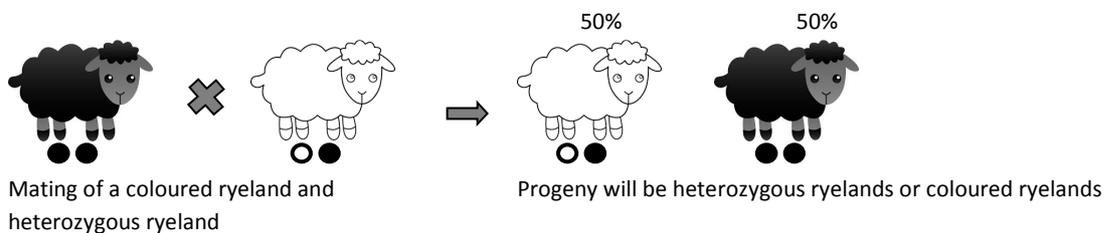
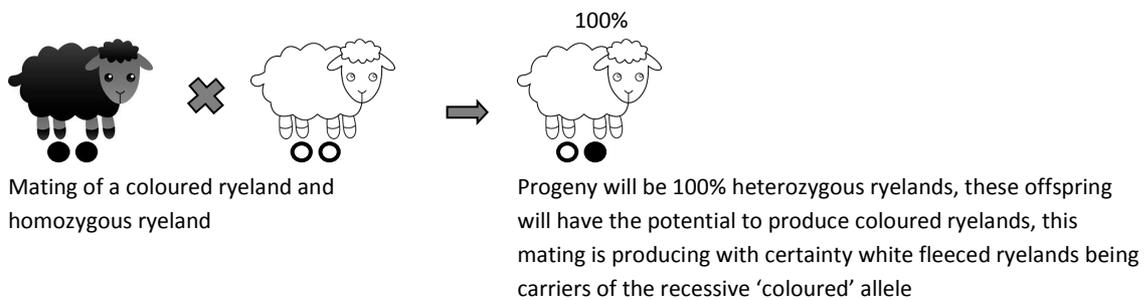
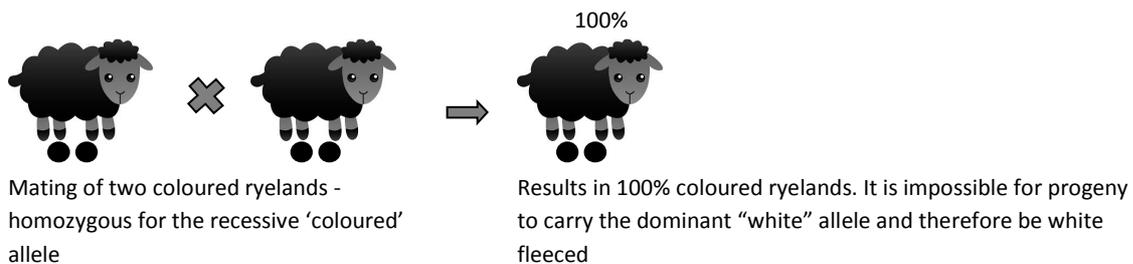


The heterozygous ryeland is white fleeced because the white allele is dominant and expressed. However the heterozygous ryeland can pass either the dominant 'white' allele or recessive 'coloured' allele to its offspring. The table demonstrates all the variations on the ASIP gene with the mating of two ryelands. The percentages detailed are an indication of the statistically likely progenies, these are the expected probabilities but deviations from these numbers are expected to be observed. The unlikely occurrence of a genetic mutation influencing coat colour is excluded from this article.





### Mating involving Coloured Ryelands



The test was initially made available to members for testing lambs born in 2014 onwards but the scope of the testing has now been extended to include any age sheep.

The testing involves on farm blood sampling by a Veterinary Surgeon and submission of those samples to the laboratory at Cardiff University. The blood sampling window each year is normally from March to May with results reported to the individual member during July. The cost per test has been in the order of £12.50 per sample but this is confirmed each year by the Society for that years testing, this does not include the cost of the blood sampling by the Members Veterinary Surgeon.

Any breeding strategy should not select on one character but take into account various characteristics such as sheep correctness, carcass size, breed character and wool quality, so that an adaptive management programme can be developed, not based on one single desirable trait. Being homozygous to the 'white' dominant allele is just another trait to consider. This test allows homozygous and heterozygous ryelands to be distinguished with certainty, this has significant advantages when incorporated into a balanced breeding strategy, allows more informed breeding decisions and ultimately reduces the frequency of coloured ryelands born to white fleeced ryelands.

Further details and application forms are available from the Society office.

Genetics Sub Committee.

