Beef up your breeding – Get the balance right

By Nigel Gould, CAFRE Beef and Sheep Adviser

The majority of traits we select for in cattle are controlled by many different genes as opposed to individual genes. These traits include fertility, growth and carcass traits. A smaller number of traits are controlled by individual genes. Polled-ness and double-muscling fall into this category. These traits usually have dominant and recessive forms of the gene called alleles and it is the combination of these alleles which determines the phenotype of the animal (what the animal will look like). For example, in most cattle, the polled form of the gene is dominant and the horned form is recessive. If the animal carries two polled forms of the gene (PP), it will be polled. If it carries two horned forms of the gene (pp), it will be horned. If it carries one of each form of the gene (Pp), it will be polled because the polled form is dominant. An animal carrying two identical forms of the gene is said to be homozygous for that trait. If the animal carries two different forms of the gene, it is said to be heterozygous. Since the horned form of the gene is recessive, horns on an animal mean that the animal is homozygous for the horned trait (two copies of the horned form of the gene). However, if an animal is polled, we don't know if it is homozygous (PP) or heterozygous (Pp) because both types express the polled trait.

Double muscling

'Double muscling' as it is known is caused by the 'myostatin gene' which influences the production of a protein controlling muscle development. Double muscling occurs in a similar way to the polled-ness trait however, there are different variations of this myostatin gene (nine known variations in cattle). The four most common variants found in cattle in the UK and Ireland are nt821, F94L, Q204X and E226X. Similar to the horned gene in cattle, just because the animal isn't showing the effects of the double muscling gene itself, this doesn't mean that it isn't carrying a copy of the double muscling gene. The myostatin gene can be successfully used to improve carcass traits such as conformation, kill-out percentage and meat tenderness. However, depending on which of the myostatin types is present, the extent of this additional muscling and the possibility and extent of associated negative

traits will vary. These negative traits include a possible increase in direct calving difficulty, reduced fertility, delayed puberty, reduced milk yield and calving ability in females. Sometimes, higher respiratory problems and enlarged tongues in newborn calves is possible. Also bones are sometimes shorter, thinner and less dense.
Variant F94L, often called the 'profit gene', which is present in most frequency in the Limousin and Aubrac breeds and to a lesser extent in Charolais, has been found to increase muscle mass with no associated increase in calving difficulty or reduced fertility. Variant nt821 is most commonly found in Belgian Blue cattle with most pedigree Belgian Blue cattle having two forms or copies of the gene. It is also found, albeit to a lesser frequency in the Angus, Limousin, Parthenaise and Shorthorn breeds. Variant Q204X is most common in the Charolais, and to a lesser extent in Limousin breed. Variant E226X is most frequent in the Beef Shorthorn breed.

Make informed breeding decisions

Careful consideration when matching a bull to a particular cow can help maximise the benefits of the myostatin gene while reducing any possible negative associated traits. There is a growing awareness of myostatin within breed societies with increasing numbers of pedigree bulls being offered for sale with their myostatin status known. AI companies are also increasingly displaying myostatin status for their bulls. If you do not want myostatin in your herd, use non-carrier animals (+/+). If you wish to make the most of the benefits of myostatin, while limiting the negative traits, use heterozygous (e.g. nt821/+) or homozygous (e.g. nt821/nt821) bulls on non-carrier females. In addition, only use these bulls on cows with a proven ability to calve unassisted but extra vigilance at calving time may be required. Also be aware that although the cow may not appear muscular, she may be a carrier of the gene. For example, as most Belgian Blue bulls are homozygous (i.e. nt821/nt821), when mated to non-carrier females, the progeny will be heterozygous (nt821/+). For example a Belgian Blue X Friesan cow is likely to have one copy of the nt821 gene. Even though she may not appear very muscular herself, if crossed to a Belgian Blue bull (nt821/nt821), the resultant calf could potentially carry two copies of the gene which could potentially result in an extreme muscled calf which may increase incidence of dystocia (difficult calving).

Table 1: Probability of a mating resulting in progeny carrying the myostatin gene:

	Bull	**Cow**	**Progeny**
Number of copies of gene	1	0	50% no copy, 50% 1 copy
	1	1	25% no copy, 50% 1 copy, 25% 2 copies
	2	0	100% 1 copy
	2	1	50% 1 copy, 50% 2 copies
	2	2	100% 2 copies

In Summary:

• Myostatin status is an additional piece of information which can be used to make informed breeding choices
• Myostatin can be used to improve carcass traits but care needs to be taken to minimise associated negative traits
• Ideally, know the myostatin status of the AI or stock bull being used
• Don't assume your cow is a non-carrier based on appearance , particularly with purchased females

With the current circumstances surrounding Covid-19, re-evaluate procedures on farm where AI is being carried out. Give careful consideration to the current expert advice and to ways you can reduce the risk to yourself and your AI technician.