A Greener World Technical Advice Fact Sheet No. 1

Welfare and Belgian Blue Cattle

Certified Animal Welfare Approved by A Greener World (AGW) has the most rigorous standards for farm animal welfare currently in use by any organization in North America. Its standards have been developed in collaboration with scientists, veterinarians, researchers and farmers across the globe to maximize practicable, high-welfare farm management.

The Belgian Blue is a relatively recently established cattle breed, characterised by extreme conformation – commonly known as 'double muscling'. While double muscling is not unique to the Belgian Blue, all pure bred Belgian Blues now exhibit this trait and the degree of double muscling is greater than in other breeds.

Double muscling is due to a mutation of the myostatin gene. Myostatin mutations are pleiotropic in their effects, meaning that they affect a number of different body systems. Some of these gene effects are known to negatively impact the welfare of cattle. The most widely known in Belgian Blues is the incidence of dystocia – calving difficulties, and the extraordinarily high level of caesareans that have to be carried out. Problems with deformities of the jaw and over-enlarged tongues (which affect the calf's ability to suckle and hence its survival) as well as respiratory, heart and reproductive problems, have all been documented within the Belgian Blue breed.

These issues are so well known and accepted that even those who promote the increased lean meat production of the breed for beef farming advise producers not to set up herds of pure bred Belgian Blues. Instead, they only recommend using the Belgian Blue as a sire to cross with other non-double muscled breeds.

Origin of the breed

Belgian Blue cattle originated in Belgium as the product of crossbreeding between local cattle and cattle imported from England in the late 1800s. The breed was only recently formally established with the founding of the Belgian Blue herd book in 1973.

Originally, the Belgian cattle population was characterized by the presence of a number of dual-purpose breeds: the Red of West Flanders, the White-Red of East Flanders and the White-Blue of Central and High Belgium. In the 1950s, attractive prices were offered

for the then rare double muscled beef animals. At this time, these animals appeared sporadically as a result of recessive inheritance, mainly from White and Blue parents of normal conformation.

The introduction of the caesarean section procedure around this time allowed the delivery of living double muscled calves which would otherwise have died if the cow attempted to calve naturally. Coupled with the higher price on offer, this made breeding double muscled animals more attractive to Belgian farmers. Belgium is a relatively small country and double muscled cattle were seen as an efficient way to increase the volume of beef produced.

By the 1960s, breeders had selected for bulls that were guaranteed to pass on the double muscling gene mutation. These were used for artificial insemination (AI), further increasing the frequency of birth of double muscled calves. By 1973, the Belgian Blue or 'Blanc-Bleu Belge' was established as a breed in its own right with its own herd book.

Double muscling

Double muscling arose as a natural mutation, reported in Belgium as early as 1807. The trait occurs in several other breeds, including the Piedmontese and the South Devon. However, the strength of the effect of the gene mutation varies from breed to breed and the other breed societies tend to address the issue of double muscling quite differently.

For example, although double-muscling has been recognized by South Devon breeders for many decades (Smith *et al* 2000), it is generally looked on unfavourably and animals showing this trait are not usually selected for breeding. Similarly, the British Charolais Society (2009) discourages double muscling, stating that

> *There can be two extreme types of Charolais which should be discouraged. One type would be the tall, flat sided bull which has a slack back and a poor hindquarter. This type has no place in modern day beef production and indeed never has. The second would be the double-muscled heavy shouldered bull which invariably has associated fertility and calving problems.*

In contrast, Belgian Blue and Piedmontese breeders actively selected for this trait and it has now become a characteristic of these breeds. The specific gene, the myostatin gene, was identified in the late 1990s. The genetic mutation prevents control of muscular growth, allowing it to continue in an uncontrolled manner – but at the expense of other bodily functions, including reproduction and normal fat and bone deposition. This translates into cattle that possess up to 20% more muscle mass than other beef animals, but which also often possess underdeveloped reproductive tracts, experience high rates of infertility, and are more susceptible to stress and fractures. The increase in muscle mass seen in double muscled cattle is due to an increase in the number of muscle fibres,

rather than an increase in the thickness of fibres (Arthur 1995). The Belgian Blue is the most extreme double muscled breed.

The myostatin gene becomes active during the embryonic stage, so calves with this mutation have excessive muscle development that starts in the womb. Belgian Blue calves are generally 10–38% heavier than calves of other breeds and calving difficulties are prevalent, requiring caesarean deliveries.

Caesarean sections

For Belgian Blue breeders, the problem of difficult calving associated with double-muscling was solved when elective caesarean section became more generalized. Caesarean section is now performed systematically in pure bred herds. In Belgium, multiple caesareans do not raise any ethical question and the breed society (Hansett 1998) says that caesareans ”bring minimum stress to the dam and to the fetus, as attested by the low perinatal mortality”.

However, a caesarean section is still a major abdominal operation and complications are not uncommon during and after the operation. The pure bred Belgian Blue has been bred for specific characteristics that unfortunately mean that it is unable to give birth safely and naturally to healthy calves. Indeed, the drive to breed an animal that produces a greater amount of lean beef has not taken account of the needs of the animal.

Data on the percentage of caesarians carried out on pure bred Belgian Blues vary according to the sources, but the estimates are always over 80% (Lips *et al* 2001) with several nearer 90% (Fiems *et al* 2001). Cross breeding Belgian Blue bulls with other breeds of cow can markedly reduce this figure to around 3–5%. However, supporting a cross bred program still requires the existence of some pure bred herds – at great cost to their welfare.

In pure bred herds a considerable number of caesareans are carried out for economic rather than biological reasons. Many farmers do not take the economic risk of losing a calf due to a difficult calving – or even losing a valuable cow – and so elect for a caesarean for every calving. This economic justification means that there is no longer a selection based on the possibility to calve without caesareans. Since the farmers do not wish to take any risks, it is often unclear whether one is dealing with animals that are able to calve without a caesarean section.

From an animal welfare perspective it is widely recommended – and even required – to perform an emergency caesarean when it is expected that either the calf or its mother would otherwise lose their lives. However, this is a very different validation to the ongoing development of a cattle breed where no selection is carried out on the ability to give birth and where caesarean section is almost a necessity. This will inevitably lead to

huge welfare implications as we have to assume that none of the pure bred cows of this breed can calve without caesarean.

There are two wider issues to consider. Firstly, why do so many commercial beef operations not recommend pure bred Belgian Blues – even those whose prime motivator is the production of the greatest amount of beef as cheaply as possible? Many of these beef operations are extremely extensive with little or no supervision at calving. While a certain degree of mortality is expected the 90% caesarean rate (or a percentage near to this of dead cows and calves) associated with the Belgian Blue is deemed unacceptable – even where welfare is largely discounted and only economics are taken into account.

Secondly, the number of caesareans that can be performed on a cow is physiologically limited. It is commonly accepted that five caesareans is a maximum that a cow can physically sustain (Kolkman *et al* 2007). When you consider that beef suckler cows such as the South Devon – who also carry the double muscling gene mutation but are not selected for it – can live over 20 years and produce up to 15 calves in that time, it is clear that systematically performing caesarean sections on a Belgian Blue cow is a severe curtailment of the animal's life.

Other welfare issues in Belgian Blue cattle

The welfare issue of caesarean sections in Belgian Blues is well known but many other problems can arise as a result of the gene mutation of the Belgian Blue. While these are far less well known – and occur less systematically – they can sometimes have a far greater impact on animal welfare at the individual level.

As mentioned before, the mutation of the myostatin gene which leads to double muscling can also affect other bodily functions. Macroglossia (or an over-enlargement or swelling of the tongue) can occur in Belgian Blue calves, interfering with his or her ability to suckle – and hence its ability to survive. Prognathism, where the maxilla or top jaw is shorter than the mandible or lower jaw, is also sometimes seen and this can similarly affect its ability to suckle (Radostits 2000)

Belgian Blue calves can also suffer from cardiac problems, sometimes leading to sudden death. In addition, reduced development of respiratory muscles can bring about respiratory distress or death due to insufficient oxygen intake. There is also a greater susceptibility than normal to laryngitis and bronchopneumonia in the breed (Gustin *et al* 1998; Lekeux and Art 1987).

Deaths of Belgian Blue calves within 48 hours of birth could also be due to heart or lung deficiencies. The selection for muscle mass has resulted in an animal that is cardio-respiratory underdeveloped and that has a heart which has a 10–15% smaller volume compared to conventional animals. It is relatively easy for such a calf to fall into a state

of dyspnoea or shortness of breath due to the high demand for oxygen in such a large body (Lips *et al* 2001).

Various limb problems are also associated with the breed. Congenital articular rigidity is a stiffness of the joints that makes it very difficult or impossible for the calves to stand up and also causes difficulties during suckling. Usually it is a problem that cannot be cured. The cause of congenital articular rigidity is believed to be a lack of intra-uterine freedom of movement for the foetus during the second stage of gestation (Lips *et al* 2001). This lack of space is in turn caused by the disproportionate size of the foetus and its mother during that stage of gestation.

There also seems to be a high incidence of inherited spastic paresis or Elso Heel in Belgian Blue cattle. The signs are stiffness of one or both hind limbs when the animal gets up with the stiffness passing after a few minutes. While this does not seem to be a major issue, farmers have tended to destroy the affected animals at about a year of age because of irreversible changes in the muscles of the affected limbs (Coopman *et al* 2000; Vlaminck *et al* 2000).

Although the Belgian Blue has more muscle than other beef animals this muscle does not appear to be functional. Even if we look at 'healthy' Belgian Blue animals they tend to shuffle rather than walk. On one farm with a cross breeding program the pure bred Belgian Blue bull could hardly walk across the field. When the farmer was asked how successful he thought this animal would be at finding and mating with the breeding cows, he replied that the bull spent his days next to the water trough as 'he knows every cow has to come and get a drink'. While we can appreciate farmers do not want bulls that leap hedges in search of on-heat heifers, we cannot condone the use of what are effectively crippled animals to bring so called 'desirable' meat traits into their herds.

In females, the mutation of the myostatin gene can also result in defects in the reproductive tract, affecting fertility. Puberty is late in both sexes, while testis size is often small. In programs where bulls were evaluated for breeding soundness, 93.7% of young Belgian Blue bulls failed compared to 59.3% of young Holstein Friesian bulls. This was mainly due to poor sperm morphology and small testicular circumference (Hoflack 2006).

Some reports also show an increased susceptibility to stress in Belgian Blue cattle, measured by an increase in blood lactate and fragility of red blood cells (Gustin 1987; Radostits 2000).

The Swedish perspective

The veterinary commissions of Sweden, Denmark and Finland submitted a resolution to the European Veterinary Commission that proposed a ban on the use of animals with undesirable genetics – they were explicitly referring to the Belgian Blue. Although the

resolution was defeated, Sweden imposed a ban on breeding Belgian Blue cattle and importing live animals or semen on the grounds that the characteristic double muscling should be regarded as a genetic defect which harms the animals – a view which could be well justified taking account of the evidence listed above.

In 1998, a Swedish farmer challenged this position in the European Court of Justice, which overturned the ban on the grounds that it was illegal under EU law. Swedish politicians, consumer groups and most farmers reacted to this with dismay and various appeals and other rulings rumbled on for several years. In 2000, the original farmer did start to sell beef from cows that were artificially inseminated with Belgian Blue semen. The Swedish Government then set conditions on the use of Belgian Blue genetics and, in 2001, a Swedish appeal court upheld an earlier decision by the National Board of Agriculture to stop a Swedish farmer from inseminating his cows with semen from the Belgian Blue as he had not met all of the conditions. However, by 2006, the European ruling meant that Belgian Blue genetics were being imported to Sweden and Swedish stores began to sell meat from the cattle.

Swedish Minister for Agriculture, Eskil Erlandsson, proposed that beef meat packaging should include a label containing breed details because consumers were not aware that they were potentially supporting a breed they had previously fought to keep out. However, EU legislation states that breed information is not mandatory on beef labels and this proposal was eventually abandoned.

The future for the Belgian Blue breed

From a purely economic point of view, as long as consumers continue to demand beef – particularly lean beef – then the Belgian Blue breeders will feel vindicated in their genetic selection.

However, animal welfare is gaining greater recognition among legislators in Europe and while they do not explicitly ban Belgian Blues, a number of European farm accreditation programs have now introduced standards that make the ongoing use of this breed much more difficult to justify. For example, the Soil Association – the UK's largest organic certifier – has a standard that requires farmers to use breeds or strains that 'avoid problems at birth' – something the Belgian Blue cannot claim.

As mentioned above, advisors and agents in Australia, Canada and parts of the US do not recommend pure bred Belgian Blues. While these people are seldom concerned with welfare, the economics of a cow that must go through an expensive veterinary procedure at every calving – resulting in a short productive life – simply does not stack up on extensive ranch systems; neither does the immobile bull that cannot follow and mount cows without injury to him or them. Nevertheless, these advisors do continue to recommend cross breeding, AI and embryo transfer with these genetics with all

offspring reared and sold for meat, which in itself promotes and supports those pedigree Belgian Blue breeders who supply the parent stock.

In an ideal world the selection of Belgian Blues needs to change. If breeders could be persuaded to select cows with wider pelvises (Murray *et al* 2001), and that could actually give birth to lower weight calves without the need for cesarean section, this would represent a huge step forward in terms of animal welfare. However, for pedigree breeders this would go against the selection criteria that they have followed since the 1950s. Without greater public awareness of the significant welfare implications of the Belgian Blue, and the subsequent consumer or legislative pressure, the breed is unlikely to change in the near future.

References

Arthur P.F. (1995). Double muscling in cattle: A review. *Australian Journal of Agricultural Research*, 46*:*1493–1515.

British Charolais Cattle Society – Breed Characteristics
http://www.charolais.co.uk/charolais_thebreed.html

Coopman F., Peelman L. , Van Zeveren A. (2000). Spastic paresis, normal and abnormal hocks in the double-muscled Belgian Blue beef breed: inheritance, correlation and control. *Vlaams Diergeneeskundig Tijdschrift* 69, 249–257.

Fiems, L.O., de Campeneerel S., van Caelenbergh W. and Boucqule Ch V. (2001). Relationships between dam and calf characteristics with regard to dystocia in Belgian Blue double muscled cows. *Animal Science*, Volume 72, part 2.

Gustin, P., Bakima, M., Art, T., Lekeux, P., Lomba, F., van de Woestijne, K.P. (1998). Pulmonary function values and growth in Belgian white and blue double-muscled cattle. *Research in Veterinary Science,* Volume 45 (3) pp. 405–410.

Gustin, P., Detry, B., Robert, A., Cao, M.L., Lessire, F., Gambier, C., Katz, V., Ansay, M., Frans, A. and Clerbaux, T. (1997). Influence of age and breed on the binding of oxygen to red blood cells of bovine calves. *Journal of Applied Physiology,* Vol. 82, No. 3, pp. 784–790.

Hanset, R. (1998). *Emergence and Selection of the Belgian Blue Breed*. Belgian Blue Herd-Book 1998

Hoflack, G., Van Soom, A., Maes, D., de Kruif, A., Opsomer, G. and Duchateau, L. (2006). Breeding soundness and libido examination of Belgian Blue and Holstein Friesian artificial insemination bulls in Belgium and The Netherlands. *Theriogenology*, Volume 66, Issue 2, pp. 207–216.

Kolkman, I., De Vliegher, S., Hoflack, G., Van Aert, M., Laureyns, J., Lips, D., de Kruif, A. and Opsomer, G. (2007). Protocol of the Caesarean section as performed in daily bovine practice in Belgium. *Reproduction in Domestic Animals*, Volume 42, Number 6, pp. 583–589(7).

Lekeux P and Art T (1987). Functional changes induced by necrotic laryngitis in double muscled calves. *The Veterinary Record,* Volume 121, Issue 15, pp.353–355.

Lips, D., De Tavernier, J., Decuypere, E. and Van Outryve J. (2001). Ethical Objections to Caesareans: Implications on the Future of the Belgian White Blue. *Preprints of EurSafe 2001: Food Safety, Food Quality, Food Ethics*, The Third Congress of the European Society for Agricultural and Food Ethics, Florence. pp.291–294.

Murray, R.D., Cartwright, T.A., Downham, D.Y., Murray, M.A. and de Kruif, A. (2002). Comparison of External and Internal Pelvic Measurements of Belgian Blue Cattle from Sample Herds in Belgium and the United Kingdom. *Reproduction in Domestic Animals*, Volume 37, Number 1, pp. 1–7(7).

Radostits, O.M., Gay, C.C., Arundel, J.H., Blood, D.C., Hinchcliff, K.W. (2000). *Veterinary Medicine: A Textbook of the Diseases of Cattle, Sheep, Pigs, Goats and Horses*. Edition: 9, Elsevier Health Sciences: Amsterdam.

Smith, J.A., Lewis, A.M., Wiener, P. and Williams, J.L. (2000). Genetic variation in the bovine myostatin gene in UK beef cattle: Allele frequencies and haplotype analysis in the South Devon. *Animal Genetics*, Volume 31, issue 5, pp. 306–309.

Vlaminck, L., De Moor, A., Martens, A., Steenhaut, M., Gasthuys, F., Desmet, P. and Van Branteghem, L. (2000). Partial tibial neurectomy in 113 Belgian Blue calves with spastic paresis. *The Veterinary Record*, Vol 147, Issue 1, pp. 16–19.

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