Mismarking in Belted Galloways

Hugh R. Crawford, Carmangay, Alberta

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I. Forms of Mismarking

Mismarking in the Belted Galloway appears in three forms;

1. No Belt

Animals with no belt. Animals with no belt can have white elsewhere on their bodies.

2. Extra Colour

Animals with extra colour (or lack of white) in the belt area. Extra colour can make the belt narrow, irregular, incomplete (broken), or put coloured spots in the belt. Those spots can include both the hair and the skin or just the skin. Animals with extra colour in the belt area can also have extra white elsewhere on their bodies.

3. Extra White

Animals with extra white on their bodies. Extra white can make the belt wide and/or appear as extra white elsewhere on the body. Animals with extra white can also have extra colour in the belt area.

II. Causes of Mismarking

1. No belt: No belted gene(s) expressed.

Non-belted offspring from Belted Galloway matings can result when:

a.) the offspring do not inherit any (or enough) belting genetics.

b.) the offspring inherit (enough) belting genetics but also enough modifying genetics to reduce the belt to zero.

Both causes are hereditary. Either or both could be present in any non-belted individual with belted parents. Only a breeding test could differentiate between the two.

2. Extra Colour: Belted gene(s) expressed but expression reduced.

The belted cattle population is small and the belted colour pattern is of little economic importance. As a result, the amount of genetic work done with the belted colour pattern is slight. Thus, although belting is generally considered to be caused by a single autosomal dominant gene, there remain other possibilities. In fact, the very frequency of mismarked animals could indicate that the genetics is more complex.

There would appear to be at least three possible causes of extra colour. Again, only a breeding test could differentiate between the three.

a.) Rather than being a single dominant gene, belting could be a small group of closely linked genes and/or be incompletely dominant- In either case, extra colour could result from a lack of sufficient belting genetics.

b.) Several observers have postulated the existence of recessive belt

modifying genes. In this case extra colour could result from the action of genes reducing the expression of the belt.

c.) Belting requires the exact embryonic 'on-off-on' of pigment or mylocyte production at an appropriate stage of development. If that 'on-off-on' is even slightly out-of-time the belt will not be exact. Slight irregularities in timing could be chance occurrences or have environmental causes. Thus the amount of colour could be influenced by non-hereditary factors.

3. Extra White: Belted gene(s) expressed and expression not reduced. Extra white present on the body.

This problem is probably caused by genetics for other colour patterns--most likely some other form of white spotting. There are three problems associated with extra white:

a.) Some of the genetics causing other forms of white spotting is recessive and thus difficult to identify and virtually impossible to eliminate.

b.) Some wide belts could be caused by the additive effect of belting plus the genetics for other white spotting colour patterns. Thus some breeders could be inadvertently propagating the genetics for other white colour patterns and therefore extra white.

c.) Although extra white may tend to frequent particular areas of the body, the amount and location of extra white is not strictly genetically determined. In other words, if a breeder permits extra white in the breeding herd (e.g. white below the level of the dew-claws) that extra white could appear elsewhere and in greater amount on any individual offspring (e.g. white legs).

III. Possible Solutions

1. Mismarking in the belted Galloway thus probably involves five different phenomena. Three are hereditary:

- **i) insufficient belting genes**
- **ii) presence of reducing modifier genes**
- **iii) presence of extra white spotting colour pattern genes.**

And two involve some genetics but with an element of chance and/or environmental influences:

- **i) the exact embryonic 'on-off-on' of pigmentation**
- **ii) the amount and distribution of extra white.**

2. There are at least three different approaches to the reduction and/or elimination of mismarking in Belted Galloways:

a.) Amend the definition of the desired colour pattern to include the animals now considered to be mismarked. A simple semantic maneuver thus removes the problem by redefining a Belted Galloway. This approach may appear naive but it is effective and has been repeatedly exploited. Unfortunately, the genetic component of the problem remains.

b.) Initiate a consistent, severe, long term identification and discrimination breeding program within the present Belted Galloway population.

c.) Create a new Belted Galloway using a carefully planned and executed breeding program.

3. Any breeder attempting either genetic approach to controlling mismarking in the Belted Galloway should be aware of four major complications:

a.) The breed population is small. Given rarity and costs it is both difficult to locate a desirable animal and difficult not to use a less desirable animal in the meantime.

b.) Many Belted Galloway herd books are, or have been, open. In fact, given that the original Belted Galloway herd book in the United Kingdom is not closed, all Belted Galloway herd books are, at least indirectly, open. Unfortunately during up-breeding little attention was paid to two important genetic points:

i.) Belting is dominant. Thus only a breeding test will identify heterozygous belted animals, i.e. animals that are belted but that carry the genetics for no belt. There is no magical percentage at which all up-bred animals will be homozygous for belting.

ii.) The genetics for some other white spotting colour patterns is recessive. In some Belted Galloway herd books breeds with other white spotting colour patterns have been used in up-breeding. Thus, recessive genetics for other white spotting colour patterns is now distributed in the Belted Galloway population.

c.) In most cases the birth of a mismarked animal from well marked parents will indicate that both parents are carriers of a mismarking problem. For a breeding program to make significant progress toward control of mismarking all mismarked animals and all of their parents should be avoided in the breeding program.

d.) To eliminate mismarking from a herd it would be necessary to go one step further and attempt to identify all carriers of mismarking genetics through breeding tests. Such tests are never 100% certain to identify all carriers.

4. Thus to significantly reduce the incidence of mismarking in Belted Galloways working only from within the breed could be very difficult. The numbers of animals and breeders are few. The problems involved are complex, numerous, and widespread. And the time, money and commitment involved would be significant. To make any progress without serious inbreeding would require coordination from the breed registry level. Strict mismarking identification and registration policies would be essential. Further, those policies would have to be consistent with sound genetic principals and be applied over the long term.

5. To significantly reduce the incidence of mismarking by using uncontaminated outside genetics would be quicker and cheaper. To be effective the breeding program should meet three cnteria:

a.) The second breed used should be free of other white spotting colour pattern genetics and have conformation and other characteristics similar to the Belted Galloway (e.g. Galloway).

b.) The program should include a breeding test to identify animals homozygous for belting.

c.) The sex of, and the percentage of the original 'Belted Galloway' breed in, individual animals should be ignored.

From a genetic viewpoint all three criteria are absolutely essential. Compromise to anything less could propagate and/or complicate the present mismarking problems.

6. In both genetic approaches to the reduction of mismarking, all individual animals should be selected on three criteria:

- **a.) Beef conformation**
- **b.) Correctness of colour pattern**
- **c.) Lack of mismarking genetics**

The first two are obvious. It is the third that is often ignored and/or misunderstood. Mismarking cannot be significantly reduced unless the genetics causing mismarking are understood, identified, and discriminated against.

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