

# **Galloway Breed Structure, Colors and Patterns, and Breeding Strategies**

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**The Galloway breed is an interesting and unique breed, but that could be said about nearly all breeds of livestock throughout the world. What makes the Galloway stand out from these is not only its unique character as a rugged, polled, long haired, well adapted beef breed, but also its history and character as a population of animals.**

**The Galloway is a very excellent example of a breed developed from a landrace, and it retains many landrace characteristics. Landraces are among the most interesting of breeds, because they arise in localities in response to local environments and local needs. In the case of the Galloway this region was the southwest of Scotland, and the need was for an efficient, environmentally resistant producer of beef. Landrace development uses animals locally available, and is undertaken by numerous local breeders. Landraces become unique due to local isolation and the chance occurrence of which specific individual cattle were present at the founding of the landrace.**

**The foundation of the Galloway traces back to the cattle of southwest Scotland. Originally there were a wide variety of colors and types in the region. We have records of polled and horned, black, red, brown, dun, brindle, silver, white (with colored points), belted, white faced, linebacked, and even roan or spotted. From this general pool of characteristics the breed fairly quickly narrowed down to polled instead of horned. As is typical of landraces, as the cattle moved from an unrecorded landrace to a recorded standardized breed the attempt was made to further restrict the variation in the landrace. Certain colors and patterns of white persisted, others were left behind. Left behind were the roans, the linebacks, the white faces, and the spots. Included were black, red, dun, belted, and (at least recently in the formal sense) white with colored points. The result of including these variants and excluding others has caused some interesting phenomena.**

**A further development in Galloway breeding is the gradual evolution of separating some of the color patterns as distinct populations. To put this another way, it became usual for certain color patterns (especially belted and white) to be mated within themselves, so that the breed began to segregate to varying degrees into three distinct populations. This is easy to envision because it involves color, although certainly there are also black strains that are mated in a similarly exclusive manner with respect to one another. The question then arises "when is an isolated population a distinct breed, and when is it only a variety?". This is a philosophical question with no single answer. It basically depends on whether or not one is a lumper or a splitter. Past work with other landraces has led me to the lactic of asking whether the distinct strains are more like one another than they are like any other breed**

resource. If the answer is "yes", then I consider the strains to be strains of a single breed. If the answer is "no", then the reality is that separate breeds are indeed involved.

It is normal for any breed to be composed of several individual strains, not all of which interbreed. This is actually healthy for breed structure, for it allows selection and improvement to occur on several fronts. Each strain very useful to the breed as a whole. A breed that maintains separate strains as well as a larger group of composite animals is usually viable and healthy from a genetic viewpoint. It is actually detrimental to a breed for the whole breed to be mated and pushed in a single direction, for the genetic base of the breed then becomes very narrow, and does so very quickly. In such a situation it becomes impossible to periodically revitalize strains with a linecross, or even to shift selection criteria as breed goals change over time.

The basic concept concerning the Galloway is that it is a breed developed from a landrace, and this affects the level of variability within the breed. What the breeders choose to do with the variability is an individual, as well as a corporate, decision.

Any time a breed is standardized from a landrace there are persistent vestiges of the landrace. In the case of the Galloway some things persist because they are recessive to the characteristics chosen for standardization. For example, it is possible for black to hide red and a few other colors, and these can pop out as surprises. The surprise is there only if the landrace heritage is ignored - otherwise these "surprises" are indeed expected, if unpredictable. Likewise, the white park pattern of the white Galloway can mask certain other white patterns. A look at color inheritance can educate the breeders as to what to expect, and why and how all of this interacts with the character of the Galloway as a breed.

## **Color inheritance**

The first important concept about color is to mentally distinguish between color and white. White is the absence of color, and in animals it is caused by the removal of pigment rather than the presence of pigment. As a result, the important factors in understanding color inheritance are to first concentrate on the color (in the strict sense, nonwhite), and then to consider the patterns of white which can be superimposed on any color.

Color arises from the interaction of many different genetic factors. As these factors interact the various combinations produce all of the colors in cattle. In Galloways the important colors are black, red, and dun. These are formed from the interaction of two factors. One of these is a choice between black and red. Black is dominant and red is recessive, so that red can occur as a surprise following black x black matings, and red x red matings only produce red.

The second factor is dun, and the choice here is somewhat complicated. The dun of Galloways appears to be dose dependent, so that one dose, two doses, and no doses are all distinguishable one from another. One dose is dun, two

doses are pale dun (silver, usually) and no doses are nondun. The reality is a little more complicated than this, since the duns vary in shade. The result is that the color classes blend into one another, and a very dark grey dun may be misclassified black, and very pale one misclassified silver, and a very dark silver dun might appear like a grey dun. Given that there are exception, it is still generally true that if the two color factors are combined, the following interactions explain the colors of Galloways.

<b>COLOR INTERACTIONS IN GALLOWAYS</b>			
<b>basic color</b>	<b>non dun (no doses)</b>	<b>dun (one dose)</b>	<b>pale dun (two doses)</b>
<b>black</b>	<b>black</b>	<b>brown or grey dun</b>	<b>silver</b>
<b>red</b>	<b>red</b>	<b>yellow dun</b>	<b>silver</b>

These are the basic colors. A very minor detail is that some reds are clear red, and some have vestiges of black on them. The reds with some black are especially interesting since the calves are born red and then darken later. Some few of these will be brindle, but the long hair of the Galloway obscures this somewhat. The red ones with a lot of black on them can be especially striking. The "red plus black" inheritance is complicated, but a simplified view considers it recessive to black and dominant to red. Expect the "red plus black" animal as an interesting occurrence from some black x red or black x black matings - and sit back and enjoy their subtle beauty!

Another detail is that other Celtic cattle breeds, such as the Kerry and Dexter, have a dun which is recessive instead of dominant. Has any Galloway breeder produced a dun calf from two black parents? Such an instance would demonstrate that there are two different mechanisms for the dun color in Galloways, and this would be consistent with the character and history of the breed.

The Galloway has two main spotting patterns. One of these is the belted pattern. The belt is a dominant gene, so that one or two doses of it result in a belt. The dominant gene answers only the question of whether or not the animal will be belted, but does not address the issue of the quality of that belt. It is important to remember that the question of whether or not the animal will have a belt is independent of the question of the characteristics of the belt if it is present.

The character of the belt is most likely controlled by modifying genes that are independent of the belting gene itself. All cattle have these modifiers, but they can only be visualized in cattle with the belt. It is easiest to classify belts into three categories: acceptable, too small (or incomplete), and too large. The acceptable ones are just what the breeder is shooting for. The ones that are too small include those that are incomplete. It is possible for an animal with the genetic mechanism for belt production to have such extreme modifiers that the belt is incomplete to the degree of not being present. These animals are especially interesting since they have no evidence of the belt, but could

produce belts if mated properly. These animals are no doubt rare, but could account for the occasional production of a belted offspring from two nonbelted parents. The other extreme is belts that are too extensive. These animals are simply "too white", and it is at least theoretically possible for an animal to be born completely white from this mechanism although this would be very rare.

The belt can also have spots of color within it. This is also most likely due to independent modifiers. The spotting can vary in extent, but the modifiers must be there for the spots to be. Most modification of belts is probably genetic, and therefore subject to selection. That means that by selecting away from poor belt characteristics and for good belt characteristics it is possible to eventually product a strain with fairly uniform belt characteristics. In addition to the genetic modification of the belt, there is also a small amount of modification due to more random effects that are nongenetic. These will occasionally cause mismarked belts, and in some cases these cannot be distinguished from the mismarked belts that result from a genetic mechanism. The importance of this is that even in the most well marked strains that have eliminated the genetic mechanisms for mismarking there may be an occasional mismarked calf born. While this calf is probably no genetic threat to the consistency of marking in the strain, it might be wisest to cull it anyway, since the genetic and nongenetic sources of mismarking are rarely distinguishable in practice.

It is important to realize that the belt is a white spotting pattern, and it can therefore be superimposed over any of the base colors. So, it is possible to have black belties, red belties, brown or grey dun belties, yellow dun belties, and silver dun belties. The silver dun belties would have very little contrast, since the base color and the white belt are nearly the same color.

The other main pattern of white spotting in the Galloway is the pattern called white park, from a cattle breed of that name. This pattern is actually widespread in cattle throughout the world (especially in landraces), and consists of a white coat with colored ears, eyerings, nose, and feet. This pattern is dominant, and is a very interesting pattern. The white park pattern is at one extreme of a group of patterns, and no one is really sure if these are all due to modifications of a single gene, or if the various patterns are caused by different but closely related genes. It is most likely that this is a single or a closely related groups of genes that cause a range of patterns. Understanding that there is a range to the pattern is important in explaining some surprises that can occur. The white park pattern is one extreme, and then the pattern goes through various speckled and roaned colorsided patterns, finally at the dark extreme to a linebacked pattern. A breed that has been selected for color at the dark end of the range is the English Longhorn, a beautiful brindle breed with lovely roan linebacks.

The white park pattern accounts for the white Galloway, and also for the riggitt Galloway. There is at least some tendency in many breeds for animals with two doses of the gene to be whiter than those with one, so that on average the riggitt animals are heterozygous (one dose) and the very white ones are (two

doses). Within each breed there are also modifiers that shift the expression toward the dark end or the light end. The Galloway is shifted to the light end, the English Longhorn towards the dark end. This is accomplished following long selection for the right balance of modifiers.

In some breeds it is usual to tinker with the expression of the white park pattern so that the specific degree of whiteness is attained. The Morucha of Spain, for example, consists of black and roany colorsided cattle (very roan and difficult to appreciate as colorsided, but a good illustration none the less). The breeders of Morucha cattle do not like the cattle too white, and have noticed that calves get paler and paler when the blue ones are mated together generation after generation. As a result they simply put the paler blues to black mates, and thereby avoid producing white calves.

The opposite is true of most Galloway breeders - the white is preferred and the riggitt is not. The mating of white to white assures reasonable degrees of whiteness in the calves, and indeed the experience of some breeders seems to be consistent that some of the calves from white x white matings come out "too white" with white ears. This reveals that in the Galloway, selection has resulted in the expression of the white park pattern at the white extreme. The result is that animals with only one dose of the gene are usually very white, with only minimal speckling. It must also be appreciated, though, that the riggitt pattern is part and parcel of the gene causing the whites, and so is no indication of outside influence in the animals. Well marked riggitts are indeed one of the most beautiful of cattle colors, and are expected to result from some white x colored matings where the colored parent brings in modifiers for limited expression of the white park pattern - modifiers that can only be expressed when the white park pattern is present, and therefore are ignored in solid colored animals.

As with the belt, the white and riggitt patterns can be superimposed over any of the basic colors of Galloways. Some have black points, some red points, some brown dun, and some yellow dun. The silver dun with these patterns would appear very white indeed.

Since the whites can be very white it is important to note that this pattern could hide other patterns of white spotting. For example, a white animal that was also belted would never be recognized as having a belt, but might be capable of producing a belted calf if mated the right way. There may be all sorts of patterns lurking in some whites, and undetected simply due to the whiteness of the animals. The way to discover these is to mate whites to solid colored animals, and since this is common in the production of white Galloways any hidden surprises have probably already been revealed.. Still, such matings could result in a few surprises, as well as a lot of the expected whites and riggitts.

There are other mismarkings in the Galloway that do not appear to be related to the belted and white park patterns, which are the two accepted patterns in Galloways. These mismarkings include white feet, white switches, white on the head, and any other white spotting that is not a belt or the white park pattern.

Hugh Crawford indicates that these mismarkings vary strain to strain. This indicates that they are probably independent of belting or white park pattern, and are due to separate genetic mechanisms. If they were somehow due to the belting gene itself then the mismarkings would be expected to be similar in expression throughout all strains with belting. One probable mechanism is that the mismarkings are due to a separate spotting gene, which is usually buried in the genetic mix of Galloways but sometimes expressed. Such a gene is probably recessive. An alternative theory is that this minor white is related to many different genes, each with a small effect, as is true of leg and face white in horses.

Regardless of which genetic mechanism is true of the white mismarks in Galloways it is important to realize that the same basic issues surround the mismarking as surround the acceptable markings. Basically, there are two questions: Are the marks present or absent? If present, how extensive are they? If they are due to genetic mechanisms, and the fact that they differ in different strains points to that conclusion, then the "present/absent" question is much more important than the "how much" question, for any animal that is mismarked to any degree has the genetic mechanisms for mismarking.

What to do about mismarking in the Galloway is a separate issue. The mismarking needs to be put into proper perspective. It is a holdover from the genetic heritage of the breed, and so is no indication, of itself, of contamination by other breeds. It does detract from the appearance of animals, though, and this will vary in importance to different breeders. Several strategies could eliminate the mismarking. One strategy would be to simply cull all mismarked animals as well as their parents. This is a very radical process, and has dangers for a relatively rare breed. Rare breeds face the problem of needing distinct lines of breeding within them in order to avoid too much inbreeding. If radical culling occurs some distinct lines may be lost, and this means the loss of favorable genetic variation in addition to the loss of the unfavorable mismarkings.

An alternative strategy is to cull mismarked animals but not their well marked progenitors. This will not completely eliminate the occasional mismarked calf, although it will assure continuation of more lines than the radical culling idea. In either strategy it is possible to use well marked animals from well marked lines as a cross into more frequently mismarked lines in an effort to control the mismarking. A risk then occurs that a few popular lines will swamp the less popular lines, and the result is once again narrowing of the genetic base of the breed. This needs to be done carefully, as all breeds need several lines within them. A compromise between this strategy and the previous one is to allow use of mismarked cows but not mismarked bulls. A further step would be to avoid saving bulls from mismarked dams.

It would also be possible to use nonbelted Galloways as outcrosses to help solve the mismarking problem, but this would result in the production of heterozygous animals and the percentage of belt production in the outcrossed animals would decrease. This strategy does, however, have some basis in the heritage of the breed.

## Scurs

Scurs are another off-type character that is discouraged in the Galloway. The inheritance of scurs is far from straightforward, and there is some question as to whether or not a scurred animal is likely to produce horns or not. Scurs are controversial, though, and one of the central images of a Galloway is that of a strongly polled beef breed. With that in mind scurred animals should probably be culled whenever they occur.

## Inbreeding, linebreeding, and crossbreeding

Inbreeding, linebreeding, and crossbreeding are terms that describe various ways to breed cattle, and these terms can be emotionally loaded for many cattle breeders. Each describes an approach to cattle production, and each has an essential place in any breed. Each has strengths, and each also has weaknesses. What are these approaches to cattle breeding, and what will each do for a herd?

Inbreeding is the mating of animals that have common ancestors. An extreme form is a father-daughter or son-mother mating, but less extreme forms include brother to sister, or any other combination where the resulting calf has occurrences of one or more ancestors on both the sire's side and the dam's side of the pedigree. Inbreeding, in and of itself, is value neutral. It is neither bad nor good - the quality of the result depends entirely on what goes into the inbred combination. Put good things in, and good things come out, but put in any weaknesses and very, very bad things can come out. Inbreeding generally has a negative connotation for most breeders, but in some situations it can be a very powerful tool. Since the breed base of the Galloway is relatively small it is safe to assume that some minimal inbreeding has already occurred. In the foundation of some breeds, such as the English Shorthorn, inbreeding was very close and very successful.

One inescapable consequence of inbreeding is that it tends to make the resulting animals more consistent. That is, the resulting calves are expected to be uniform. If good cattle went into the inbreeding, good cattle uniformly come out. If weak or deformed cattle went into the inbred combinations, then weak or deformed cattle come out. Also, and very importantly, if good cattle that are hiding weaknesses go in, these weaknesses will be exposed by inbreeding. As a result, any inbreeding needs to be coupled with culling for excellence in conformation, viability, and fertility. Inbreeding can be a useful technique - but cannot be undertaken without close attention to detail.

The difference between linebreeding and inbreeding can be subtle. One good quote is that "it is linebreeding if it works and inbreeding if it does not". This comes very close to the thinking of most people: linebreeding is good, inbreeding is bad. In a more technical, animal breeding sense, linebreeding is a form of inbreeding that concentrates only one given ancestor. The goal with linebreeding is to concentrate the one excellent animal in an attempt to recreate it throughout a population. The most usual example of linebreeding is a half brother to half sister mating. Various sorts of cousin matings also are

a form of linebreeding. Linebreeding can usually be considered to be a more moderate form of inbreeding. Most of the same remarks made about inbreeding are also true of linebreeding, although the degree is somewhat less with linebreeding in most cases. As a result linebreeding is less extreme than inbreeding, and the benefits can be enjoyed with less risk.

The major strength of inbreeding and linebreeding is that they both tend to narrow the range of variation. Another way to say this is that the resulting populations are more uniform. One philosophy of animal breeding is that this should be the goal of every purebred breeder: a uniform, predictable, high quality herd. The major weakness of inbreeding and linebreeding is that in some lines these techniques can result in a loss of vigor and reproductive traits. This weakness is not true of all lines, and also need not be true if wise culling and selection take place along with the inbreeding or linebreeding. These strategies of breeding can be used to good effect for the breeder trying to concentrate on specific colors or patterns, where consistency may be desirable.

Crossbreeding is the other extreme of an approach to animal breeding. This is usually used in reference to the crossing of different breeds. It is a very useful and fascinating phenomenon. The initial results of crossbreeding are usually fantastically good. The good results come from the blending and hybrid vigor of the breeds of the cross. Mules are the ultimate example! The initial results of crossbreeding are also very uniform. However, this initial uniformity comes from the combination of unlike things. This means that these initially uniform animals will in their own turn produce very nonuniform animals.

An example of this phenomenon is the very common crossing of Angus and Hereford cattle. The initial results are the very uniform black baldy cattle. If these are then used for mating among themselves, the results are black cattle, red cattle, white faced blacks, white faced reds, horns on some, others polled. A very, very nonuniform group. Not only will the colors and horns vary, but also the body type and performance will vary between the Angus extreme and the Hereford extreme. So, crossbreeding results in an initially uniform population that in its own turn produces increased variability.

Linecrossing is a step back from crossbreeding, and involves the crossing of different lines within a single breed. Linecrossing is less extreme than is crossbreeding. Linecrossing does yield much the same result as crossbreeding; initial uniformity but then increased variability. This is an advantage in some situations, a disadvantage in others.

The choice of using inbreeding, linebreeding, or linecrossing in a herd is an individual, philosophic choice that the herd owner needs to make. If the goal is an excellent herd with decreased variability and high predictability, the choice should be linebreeding (or even inbreeding for a while). This choice generally implies a long term commitment to a line of cattle, and can produce excellent long term results. The animals produced in a linebred or inbred herd are also useful for other breeders with other programs, largely due to the predictability that these animals offer. If the goal is excellent individuals, then linecrossing



may be the approach to take. This will, even in the long term, produce some very excellent individuals. What linecrossing fails to produce is a uniform population of such individuals. Along with the excellent ones are the more marginal ones. Linecrossing does work well, though, for certain programs with certain goals.

If a breeder is specifically concerned about color and pattern, then linebreeding is probably the answer. Linebreeding allows the eventual establishment of predictability, which can be very useful. Another tool available for the color pattern breeder is to use test mating. This can establish the identity of homozygous versus heterozygous animals (especially bulls), and this can also contribute to uniform production of pattern in calves. The finer points of the pattern, though, such as completeness, extent, and mismarks, will probably still respond better to linebreeding than to testmating schemes.

The characteristics of linebred, inbred, and linecrossed individuals also have consequences for the selection of new individuals for a breeding program. Consider the situation in which two bulls are being considered for addition into a herd. One is linecrossed, the other linebred. If the quality and subjective appeal of the bulls is similar it is usual for the linebred individual to outproduce the linecrossed individual. This is due to the fact that the linebred bull is more genetically uniform. The advantage of the linebred or inbred individual is that it is more true that "what you see is what you get". In fact, inbred or linebred individuals generally outproduce themselves, especially if they are being used for linecrossing. By contrast, the linecrossed individual is the result of certain favorable combinations and some hybrid vigor. It is likely that "what you see is not what you get". They will produce some animals like themselves, but will not do this as uniformly as an inbred or linebred animal.

When it is necessary to add a new animal into a linebred herd to improve some characteristic, or to slightly broaden the genetic base, then it makes more sense to add a cow than a bull. By this method, a son of hers that is produced within the herd can eventually be used as a herd sire, and the resulting matings will be linebred instead of linecrossed, but with enough of *aboost* from the new cow to impart new vigor, or improvement to some specific trait.

The careful reader will have already made the jump from these phenomena within a breed to the situation with using a breed for crossbreeding. When comparing breed to breed, each is like a line of cattle within a breed. For a breed to succeed in crossbreeding it should be kept pure and also should be unique. The purity and uniqueness of a breed then allow for maximum consistency and hybrid vigor to pop up in crossbreeding systems. This is an important issue for Galloway breeders, as breed purity can only help and not hurt. The status of the colors and patterns in the breed, though, is a separate issue. The concept of breed purity does not in itself imply uniformity for color, even though color is frequently used as a uniform hallmark of cattle breeds. Many pure breeds of cattle successfully encompass multiple colors and patterns.

**The choice of a breeding system will always boil down to the philosophy of a breeder, and whether uniformity or individuality is desired in a breeding program. There is no right or wrong answer to this, just individual choice. It is healthy for a breed to have linebred, inbred, and linecrossed herds all contributing to the overall breeding of cattle. In the Galloway this might translate into specific lines of each type (solid, belted, white), and also into some lines of a composite or mixed type that allow recombinations to occur which can be pulled out and used to good effect in some of the more isolated lines, whether these be based on color, ancestral strain, or some other factor. Couple this with the need to select for beef characteristics and forage use, and it is obvious that the task of breeding good cattle will last a lifetime!**

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*Paper submitted to 'Belties Down Under'  
International Belted Galloway Conference  
February, 1995*