

# Color Genetics in Soay Sheep

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Soay Sheep are an interesting breed resource due to their antiquity and isolation to a feral existence on a remote North Atlantic Island. Color varies in Soay Sheep, and is one of the interesting aspects about the breed. Soay color is determined mainly by two separate genetic mechanisms, with one more that contributes to some interesting, if rare, variants. Color genetics of the Soay is consistent with the genetics of most of the other Scandinavian Shorttailed breeds, even though the breed has a much reduced variation from that of many of the other breeds in this group. The genetic mechanisms interact to give a fairly narrow array of colors.

The main color control in the breed is the result of the instructions at two genetic sites: *Agouti* and *Brown*.

The main mechanism for color variation is the *Agouti* locus (locus is Greek for address, and just means a specific site), which controls the distribution of light (white to tan) and dark fibers (black to brown) over the body of the animal. The *Agouti* patterns in the Soay are limited to two choices. The first of these is the common and familiar “Soay pattern”, which results in a dark sheep with lighter tan trim on the belly, legs, over the eyes, and the muzzle. The naming of this pattern is somewhat controversial. Some experts consider that this is analogous to the wild type pattern in sheep, or Mouflon pattern. I think that the Soay pattern is much more like the *black and tan* pattern, with a generally black top and the light trim. Whatever the truth is, the controversy can somewhat be avoided by referring to this distinctive pattern as “Soay.”

A second *Agouti* choice in the Soay Sheep is the *no pattern* allele, which results in a solid black sheep. This allele varies in frequency among the different flocks, and is relatively more common in some than in others. This allele usually results in black lambs without the distinctive pale areas of the soay pattern. In most situations the black sheep are born black, but then fade to some shade of dark brown or grey with age. This fading is controlled by other, poorly characterized, genetic factors. The short, haired areas of face and legs usually remain a strong black color.

A second locus, *Brown*, interacts with the *Agouti* locus to give the final color of most Soay sheep. Options at *Brown* include black, which is dominant, and brown, which is recessive and can therefore occur as a surprise among black-based matings. The combination of the black choice here with the various *Agouti* patterns includes both the soay pattern which yields the common black body with light trim, and “no pattern” which is black and lacks the light trim. With the brown choice at this locus, the *Agouti* choices become pale soay, with a brown body and light trim, and uniform brown if the *no pattern* allele is expressed at *Agouti*. The browns are usually called moorit in wool parlance. Moorits vary from a dark chocolate brown through fairly warm honey colors, to beige.

Rarely are Soay Sheep spotted with white. This appears to be due to the recessive *spotted* allele at the *Spotting* locus. The fact that these are recessive means that they can pop out as surprises in matings of nonspotted carriers. The spotting varies from minor white trim, all the way to a predominantly white sheep.

Breeders interested in the color variation of the breed can manipulate the colors to assure variation in the lamb crops. The general rules are that the soay pattern dominates its absence, black dominates brown, and nonspotted dominates spotted. This means that the most recessive combination is a spotted brown sheep that lacks the soay pattern. In contrast, the soay patterned sheep on a black background, without spots, are the most dominant. In practice this means that mating to a brown, nonpatterned, spotted sheep is a good test cross to see what recessive genes lurk in a flock.