

The Inheritance of Horns and Scurs

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The inheritance of horns and scurs is much simpler than other genetic traits such as growth, fertility, feed conversion and carcass traits because so few genes are involved. However, there have been few research resources allocated to defining the specific inheritance of these traits. We know a lot about them but we are not absolutely sure about all aspects of their inheritance.

In this article, I will discuss the inheritance of horns and scurs (or the lack of them) and list specific ideas that might be used in your selection and mating decisions. I will identify some areas of the inheritance that we are not sure about, but emphasize the most likely inheritance where there is doubt.

Classification

Errors in classification have impeded research efforts as well as limited progress in selection programs. On one end of the spectrum, you must differentiate between smooth polled cattle and cattle that have very small, almost undetectable scurs. At the other extreme, we must distinguish between heavy scurs and horns. Errors in classification include:

- Scurred animals mislabeled as smooth polled
- Heavy scurred animals mislabeled as horned
- Horned animals mislabeled as scurred

Cattle can not be scurred unless they are hornless because the horned condition covers up scurs. Horned animals can have zero, one or two scur genes but we never see the effect of the scur gene until we produce a hornless animal.

Scurs are defined as horny tissue which are generally loose and moveable but may become attached to the skull in older animals. There is great variation in the size and growth rate of both scurs and horns, but males generally develop scurs and horns faster than females.

At pre weaning ages, horns are also loosely attached, especially on heifers. Consequently, breeders or researchers that classify calves at young ages are likely to make mistakes. Those mistakes can be corrected if you leave the scurs intact rather than removing them. If they are really horns, it will usually become clear as they get older. Seedstock producers should be trying to identify genetic differences in their cattle. In my opinion, breeders should not remove scurs but let them develop so that you know what you really have. Some females don't even show scurs until they are 18 months of age or older, and only a small percentage of scurred heifers have prominent scurs at weaning time. Most heifers that have horny tissue that is prominent enough to justify removing it at weaning are horned, not scurred.

Bulls generally show more prominent scurs than heifers but there are times when scurs on bulls are so small, like a small scab, they are hard to see even on close examination. Careful examination at 12 months of age or older will usually reveal scurs on bulls if they are going to have them. "Careful examination" means that the bull is restrained, the lighting is excellent and that you either clip the head or spread the hair to make sure there are no scabs.

Polled Inheritance

In the simplest explanation, the polled gene is dominant to the horned gene, and the horned gene may just be the absence of the polled gene. A cow or bull with one polled gene would be hornless but might have scurs. These animals are categorized as heterozygous polled. When a heterozygous polled bull is mated to horned cows, 50% of the progeny will be polled (heterozygous) and 50% will be horned. If a heterozygous polled bull is

mated to heterozygous polled cows, 75% of the calves will be polled (25% homozygous polled, 50% heterozygous polled) and 25% of the calves will be horned. Cattle with two polled genes would be classified homozygous polled and should produce only hornless calves (some of the calves may have scurs).

A horned animal has zero polled genes and when mated to horned cows will produce 100% horned calves.

Inheritance of Scurs

The inheritance of scurs is more complicated than that of the polled gene because of sex differences, the possible existence of other genes that modify the size of scurs and the suggested existence of incomplete penetrance which would mean some animals might have the genes for scurs but not express them. The expression of the scur gene is also affected by the presence of the horn gene since horned animals cannot show scurs and heterozygous polled cattle (which have one horn gene) are more likely to be scurred than homozygous polled cattle.

Several geneticists think it is likely that all scurred animals are heterozygous for the polled gene but this has neither been proven nor disproved by research. Theoretically, homozygous polled bulls and females could have scurs if they have two scur genes, but no one has reported a scurred animal that proved to be homozygous polled. Proving the existence of one bull that is scurred and disputedly homozygous for the polled gene would establish that scurred animals could be homozygous polled. From a practical standpoint, breeders may be able to eliminate the horn gene faster by assuming that all scurred cattle are heterozygous for the polled gene.

Scurred females must have two scur (Sc) genes and most likely have a genotype of PpScSc, but might be homozygous polled with a genotype of PPScSc. Scurred bulls that are heterozygous for the polled gene need only one scur gene to be

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scurred (genotype of PpScsn, where sn indicates the absence of the scur gene). Again, some people believe that all scurred bulls are heterozygous for the polled gene but there is no data that proves it. Homozygous polled bulls (PP) can carry the scur gene and be smooth polled while have a genotype of PPScsn. Theoretically, a homozygous polled bull could be scurred if he had two scurred genes (PPScSc).

An important fact is that any bull that has one scur gene but is not scurred must be homozygous polled. Further, any bull produced by a scurred cow must have the scur gene as does any bull that sires a scurred heifer.

Practical Applications for Polled Selection

Many breeders are selecting for the polled trait, and one of the problems they have is determining whether a smooth polled animal carries the horn gene or not. Identifying homozygous polled bulls is especially important because each calf crop sired by a homozygous polled bull will have a frequency for the horned gene that is half that of their dams'.

Identification of homozygous polled bulls has historically followed a breeding program of mating these prospect bulls to horned cows as described below. New DNA technology has emerged, testing for Horned/Polled genes, which offers a shortcut for young herd sire prospects. One challenge with this technology is the occurrence of inconclusive test results. In these cases the best option to prove homozygous polled status is by mating homozygous polled bulls to horned cows. If you breed a bull to five horned cows and get all polled calves, you have a 96.9% chance that your bull is homozygous polled.

This clearly shows that you don't need to breed to a lot of horned cows to prove a bull homozygous polled, but more than five is recommended. Ten polled calves from horned cows gives you a confidence level of 99.9 percent, and 13 calves gives you a confidence level of 99.99 percent. You can also prove a bull homozygous by mating him to heterozygous polled cows, but it takes more than twice as many matings to reach the same confidence level. **It is important to note that one horned calf proves the parents to be heterozygous polled.**

As previously discussed, you must consider possible mistakes in classification and possible mistakes in parentage with horned bull calves. A horned heifer calf can only be explained by a mistake in

POLLED/SCURRED CONDITION AND POSSIBLE GENOTYPES		
Appearance	Bull Genotype	Female Genotype
Horned	pp, (all possible scur gene combinations)	pp
Smooth polled	Ppsnsn, PPScsn, possibly PPScSc	PpScsn, PPScsn, possibly PPScSc
Scurred	PpScsn, PpScSc, possibly PPScSc	PpScSc, possibly PPScSc

Gene Abbreviations: P=polled p=horned Sc=scur sn=no scur

parentage or by the calf getting a horned gene from both parents. Newborn calves are difficult to accurately classify, and so it is best to wait until the calves are at least a couple of months of age before declaring them polled and then only after handling their head.

In closing, it is important to remember that the polled trait is a convenience trait that is desirable when combined with profit-making traits. An inferior polled animal is no more valuable than any inferior animal.

Planning for Polled

The following tips and ideas will help identify the genotype of polled cattle. These are not guarantees but a compilation of steps you can practice based on the factors I have discussed, and they should at least improve your odds of locating homozygous polled cattle. Tip #4 and Tip #6 assume that any scurred animal is heterozygous polled, which has not been proven.

1. The label double-polled is applied to cattle when both their parents are polled, and is useful only if there is no doubt in the accuracy of how their parents were classified. Doublepolled cattle that produce horned calves have the same genotype as polled animals that have one horned parent.
2. Cattle with two polled parents have a one-third chance of being homozygous polled, and double-polled bulls that are not scurred have greater than a one-third chance of being homozygous polled.
3. A double-polled, non-scurred son of a scurred cow will be homozygous polled

and will carry at least one scur gene. To count on this, you must be sure the bull does not have even a scab scur.

4. A double-polled female that produces a scurred calf by a homozygous polled bull is probably heterozygous for the polled gene (Pp).
5. Any bull, horned or polled, that sires a scurred heifer carries at least one scur gene.
6. Scurred cattle are probably heterozygous polled with a genotype of PpScsn or PpScSc.
7. Breeding homozygous polled bulls to heterozygous polled females should produce all polled calves, and 50 percent of these calves should be homozygous polled.
8. Breeding homozygous polled bulls to double-polled females should produce all polled calves, and two-thirds of the calves should be homozygous polled.
9. Breeding homozygous polled bulls to polled females that are daughters of homozygous polled bulls should produce all polled calves, and three-fourths of the calves should be homozygous polled.
10. Breeding homozygous polled bulls to homozygous polled females should produce all homozygous polled calves and no scurs.

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