

Scurs – Reference & Examples

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Now that we have learned about 'Polled' and 'Horned' animals and distinguished between homozygous and heterozygous terminology, let's discuss 'scurs'. This can get a complicated but there are some takeaways and examples below that summarize the research on the subject. Note that there is no 'scur' gene identified that we can send a test away to test for like the polled/horned trait. It has been hypothesized that scurs are a separate gene to the poll/horn gene on Chromosome 19, it interacts with the poll/horn gene, and that gender also has a possible influence on this trait. It has also been theorized that scurs are simply a condition of the poll/horn gene that is gender influenced (J. Decker and J. Taylor; University of Missouri). It has been shown that, regardless of the cause, the scur condition can only happen in heterozygous polled cattle, of either sex (Asai-Coakwell and Schmutz 2002; Wiedemar, et al. 2014).

The first question that gets asked is what is a scur and how is it different from a horn. Scurs are incompletely developed horns that are generally attached only to the skin. They range in size from tiny scab-like growths to large protrusions almost as large as horns. Therefore, polled cattle can be smooth-polled or scurred-polled (polled but expressing scurs). This designation is noted in the Canadian Charolais Association herdbook. However, due to the fact, that scurs are not always noted or present at birth, some 'scurred' cattle are not identified in the herdbook as scurred, but rather as polled. This is no fault of the breeder and further complicates our discussion. Labelling these scurred cattle as 'polled' is not false as they are heterozygous carriers of the polled gene, but also carriers of the scurred condition.

Many breeders have the mistaken idea that scurs prove that the horned gene is dominant to the polled gene. That's not the case – they are not the same! Scurs are genetically transmitted, but the mode of transmission is different from the polled gene. In males, it appears the gene for scurs only requires one copy for expression in a heterozygous polled animal. Or in other words if a bull has scurs, he might be either heterozygous (Ss) or homozygous (SS) for the scurred condition. In females the genes for scurs requires both copies for expression. This means only 'SS' females will be scurred. 'Ss' and 'ss' females will both be smooth polled and not have scurs. This explains why in the fall you will see more bull calves develop scurs, and less heifer calves. **Scurs can only be seen in polled cattle.** In horned cattle, the horn hides or masks the scurred condition. Horned animals can be carriers of the scurred gene but scurs will never dominate over a horn and be expressed. Not all polled cattle are free of scurs and it appears that **only cattle that are heterozygous for the polled/horned genes (Pp) will express the scurred trait.** Which means that both homozygous horned and homozygous polled animals will be visually free of scurs.

Examples will help us learn more about the trait. The scurred trait works in combination with the horned/polled gene, so we now have to look at both traits in combination which adds to the complexity.

Example #1 We have a scurred cow - PpSS (she would be heterozygous for the horned/polled gene 'Pp' and homozygous for the scurred gene 'SS') is mated to a homozygous smooth polled bull who does not carry the scurred trait (PPss).

Cow – Scurred = Heterozygous polled (remember a homozygous polled animal will not express scurs) Pp
Scurred gene = Homozygous Scurred (remember a female will only express scurs if they have 2 copies of the scurred gene) SS

The cow will pass one copy of her genes to her offspring resulting in 4 combinations (note 2 genotypes are the same):

PS PS pS pS

The bull will also pass one copy of his genes to his offspring resulting in 4 combinations (which in this example are all the same as he is homozygous polled (PP) and is not a scur carrier (ss)):

Ps Ps Ps Ps

Use a square to help you sort through the various results – put the cow combinations on the top and the bull combos on the side on your square:

		PS	PS	pS	pS
Cow					
Bull	PS	PPSS	PPSs	PpSS	PpSs
Ps					

Remember that bull calves only have to be heterozygous scurred to have the scurred trait appear while, heifer calves need 2 copies of the scurred trait to develop scurs in heterozygous polled cattle.

The resulting progeny will be 50% homozygous polled (PPSs) and 50% heterozygous polled (PpSs). In this example, all of the heterozygous polled bull calves (PpSs) will be scurred. The bull calves that are not scurred will be homozygous polled (PPSs) remembering that a homozygous polled animal will not express the scurred trait. There is a 50% chance the resulting bull calf will have scurs and 50% chance they will not. However, the homozygous polled bull calves will receive a dominant copy of the scurred gene from their mother and will pass this on in future generations 50% of the time. All females in this example would be smooth polled and not have scurs but would also carry one dominant gene for the scurred trait. All the calves of both sexes would be either smooth polled or scurred/ polled because they would all receive a dominant gene for polled from the homozygous polled bull we used.

Example #2: Lets take a Heterozygous polled scurred bull calf resulting from the previous example (PpSs) bred to a heterozygous smooth polled female with the scurred gene (PsSs).

The cow will pass one copy of her genes to her offspring resulting in 4 combinations:

PS Ps pS ps

The bull will also pass one copy of his genes to his offspring resulting in 4 combinations:

PS Ps pS ps

Lets use a table to help us sort through the results – again cow on top, bull on the side:

		PS	Ps	pS	ps
Cow					
Bull	PS	PPSS	PPSs	PpSS	PpSs
Ps					
pS					
ps					

There are a total of 16 potential outcomes! This is the most complicated example!

It does not matter to us whether or not the bull or cow contributes the polled or scurred gene so lets add up the same genotypes

- PPSS – 1/16 (Homozygous Polled, Homozygous Scurred)
- PPSs = 2/16 (Homozygous Polled, Heterozygous Scurred)
- PpSS = 2/16 (Heterozygous Polled, Homozygous Scurred)
- PpSs = 4/16 (Heterozygous Polled, Heterozygous Scurred)
- PPss = 1/16 (Homozygous Polled, No Scurred Gene)

Ppss = 2/16 (Heterozygous Polled, no Scurred Gene)
ppSS = 1/16 (Horned, Homozygous Scurred Gene)
ppSs = 2/16 (Horned, Heterozygous Scurred Gene)
ppss = 1/16 (Horned, no scurred gene)

9 different genotypes result from this cross in varying likelihoods. However we can breakdown the odds a little further as we know scurs are not expressed in homozygous polled animals regardless if they carry the Scurred gene or not. Also scurs do not dominate over horns, so we can determine the following:

- **4/16 (25% of the time, we will get a homozygous polled offspring that will not be scurred)**
- **4/16 (25% of the time, we will get a horned offspring)**

The remaining 8/16 combinations is a heterozygous polled offspring like both parents. Remember that females require 2 copies of the scurred gene (SS) for it to be expressed so lets continue to add to what we learned above and complete our analysis for a female offspring:

- **2/16 (12.5% of the time we will get a scurred female offspring – PpSS)**
- **10/16 (62.5% of the time we will get a smooth polled female offspring – PPSS, PPSs, PpSs, PPss, Ppss)**
- **4/16 (25% of the time we will get a horned female offspring – ppSS, ppSs, ppss)**

The remaining 8/16 if the resulting progeny is a bull calf will have different outcomes as a male only requires a single copy of the scurred gene for it to be expressed.

- **6/16 (37.5% of the time we will get a scurred male offspring – PpSS, PpSs)**
- **6/16 (37.5% of the time we will get a smooth polled male offspring – PPSS, PPSs, PPss, Ppss)**
- **4/16 (25% of the time we will get a horned male offspring – ppSS, ppSs, ppss)**

Summary

The scurred gene is not an easy thing to predict!!! As demonstrated above, there are several combinations that can and do occur. However, it is important for breeders to have some take aways from this analysis.

- 1) To emphasize the difference between scurs and horns, cattle should be classified as smooth-polled, scurred-polled or horned. Remember that all smooth-polled and scurred polled cattle have at least one gene for the polled condition. Horned cattle can never carry a polled gene.
- 2) Number of generations polled is not a substitute for a polled/horn test. These tests are readily available and are a great starting point for a breeder in breeding decisions.
- 3) If you want to rid your program of the scurred gene, efforts should be concentrated on the polled gene. When the herd becomes homozygous polled there will no longer be any animals exhibiting the scurred condition. However, these homozygous polled animals can still carry the scurred gene and when crossed with a heterozygous polled animal, the scurred gene may reappear as in example 1 above
- 4) Only cattle heterozygous for the polled trait (Pp) are able to express scurs.
- 5) The scurred gene is sex-linked and only requires one copy in bulls (Ss or SS) and two copies in females (SS) to be expressed in heterozygous polled (Pp) cattle.
- 6) Animals may not express the scurred gene but they may carry a copy of the dominant scurred gene and pass it on to their offspring.
- 7) A homozygous polled herd will be free of scurs
- 8) A trade off occurs when a breeder selects for only one trait (ie. homozygous polled) and they will no doubt lose something valuable an excluded animal could add to their program.

Hope this helps!!!