

Haplotypes Impacting Fertility

With our growing knowledge about the bovine genome, experts have predicted for some time that we'd likely discover numerous cattle genetic defects. Human genetic researchers estimate that we each carry four or five genetic defects. It's reasonable to expect that these exist at a similar level in cattle.

USDA researchers along with international collaborators have now identified nine haplotypes that appear to cause embryo loss or stillbirths when these haplotypes exist in the homozygous state. These were discovered by taking the full SNP50 genotype database of cows and bulls used for genomic evaluations and studying the frequency of the various haplotypes. Those haplotypes that meet two conditions, 1) there are no live individuals that are homozygous for this haplotype and 2) there is an observed reduction in conception rate or increase in stillbirths when carrier sires were mated to cows sired by carrier bulls are added to the list of haplotypes that are labeled and tracked.

These genetic conditions have not been directly observed and we do not know the exact genetic or biological cause of why the embryos or fetuses are not viable. Because of this, they've been given simple names of Holstein Haplotype 1 (HH1), Holstein Haplotype 2 (HH2), Holstein Haplotype 3 (HH3), Holstein Haplotype 4 (HH4), Holstein Haplotype 5 (HH5), Jersey Haplotype 1 (JH1) and Brown Swiss Haplotype 1 (BH1), Brown Swiss Haplotype 2 (BH2) and Ayrshire Haplotype 1 (AH1). These haplotypes appear to have a recessive mode of inheritance where animals with zero or one copy of the haplotype are completely normal. Those that inherit two copies of the haplotype are lost as embryos or are stillborn.

The impacts of these haplotypes vary and are dependent on their frequency in the population and at what stage of gestation the pregnancies are lost. JH1 has a frequency of 23.4%. BHI exists at a frequency of 14 percent and BH2 exists at a frequency of 20.5 percent. Only one haplotype has been discovered in the Ayrshire breed (AH1) and it exists at the highest frequency of 26.1 percent. HH1, HH2, HH3 and HH5 all have similar frequencies (4.5%, 4.6%, 4.7% and 4.8%, respectively). HH4 exists at a much lower frequency of 0.7 percent. Haplotypes with a higher population frequency and those that cause pregnancy loss later in gestation lead to larger losses of profitability. It's important to realize that the negative impact of these haplotypes is already accounted for in the routinely published sire conception rate (SCR) evaluations and daughter pregnancy rate (DPR) genomic evaluations. So, if you are using these traits in selecting your A.I. sires, you're already avoiding or compensating for these new genetic conditions.

The haplotypes each represent a distinct and unique genetic condition. They are not related to each other. The haplotypes have no impact when a bull that is heterozygous for HH1 is mated to a cow that is heterozygous for HH2. The risk is only experienced when animals are heterozygous for the same haplotype.

Select Mating Service (SMS) is an excellent tool for managing these genetic conditions. By using the SMS program, herds with at least one generation of pedigree information on their cows can use heterozygous bulls with less than 1 percent chance of lost pregnancies from known conditions.

250HO12589	Jacoby	HH5C1	7HO12797	Legendary	HH5C1
250HO13261	Missle	HH5C1	7HO12943	Curry	HH5C1
507HO13576	Knight	HH5C1	7HO13022	Tatum	HH2C1
7AY117	Samson	AH1C1	7HO13250	Jedi	HH5C1
7BS852	Bosephus	BH2C1	7HO13251	Jett	HH5C1
7BS866	Damian	BH2C1	7HO13328	Yale	HH5C1
7BS871	Advisor	BH1C1	7HO13398	Superfly	HH5C1
7HO10723	Spur	HH3C1	7HO13461	Remington	HH5C1
7HO11283	Mayfield	HH3C1	7HO13521	Compass P	HH5C1
7HO11383	Morgan	HH5C1	7HO13551	Amazing	HH5C1
7HO11395	Mystic	HH5C1	7HO13592	Cam	HH5C1
7HO11402	Tavir	HH3C1	7JE1038	Valentino	JH1C1
7HO11488	Branson	HH5C1	7JE1251	Metalica	JH1C1
7HO11617	Diamond	HH3C1 HH5C1	7JE1385	Moore	JH1C1
7HO11777	Snowmobil	HH3C1			
7HO12131	Mcgirt	HH3C1			
7HO12533	Hotshot	HH5C1			
7HO12541	Comet-P	HH3C1			
7HO12597	Lylas	HH2C1			
7HO12726	King Tut	HH5C1			
7HO12778	Mitchell	HH2C1			
7HO12782	Bonjour	HH5C1			