Reporting of haplotypes that affect fertility

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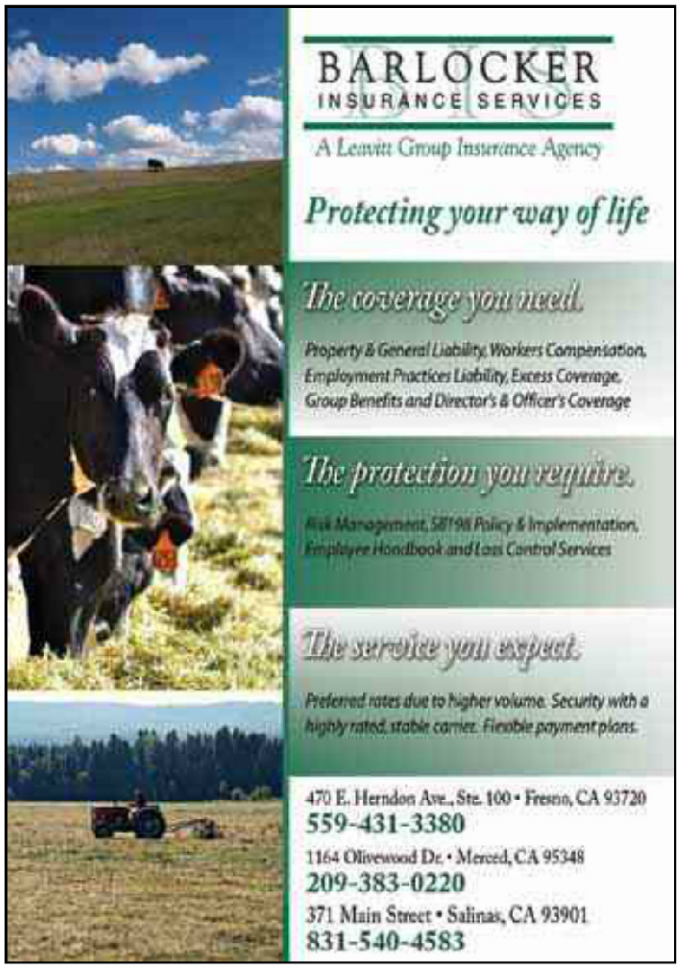
Five haplotypes were recently discovered that appear to cause embryo loss when homozygous as indicated by fertility records from thousands of matings where daughters of heterozygous sires were bred to heterozygous sires. The XML files now provide information about the status of these haplotypes for all genotyped animals. Because the conditions are not directly observable and exact genetic or biological cause is not known, simple labels of Holstein Haplotype 1 (HH1), Holstein Haplotype 2 (HH2), Holstein Haplotype 3 (HH3), Jersey Haplotype 1 (JH1) and Brown Swiss Haplotype 1 (BH1) are used for these haplotypes that impact fertility. Test files containing the July data plus the 5 new fields were made available in July. The new fields contain a "1" for animals that have one copy of this haplotype, a "0" for animals that have no copies of the haplotype and blank for haplotypes that do not occur in the animal's breed (e.g., HO animals have only HH1, HH2 and HH3 reported). Another new field JH1_PC, reports pedigree confirmation of the JH1 haplotype. Animals with one copy of a haplotype impacting fertility that traces back to a genotyped ancestor that also has the same haplotype within the first four generations of pedigree are coded as "C" for confirmed, whereas others with this haplotype are coded as "N" for not confirmed. An N code may result from missing pedigree, non-genotyped ancestors or being the source animal. The haplotype test does not require confirmation by pedigree, but that field provides supporting information. All genotyped animals in the XML file have their status reported. Genotypes based on the low-density Bovine 3K BeadChip and those for imputed dams are less accurate, and at each evaluation a few of those ani-

Haplotype name	Earliest genotyped heterozygous ancestors	Frequency of heterozygotes (%)	Impact on conception rate (%)
HH1	Pawnee Farm Arlinda Chief	4.5	-0.35
HH2	Willowholme Mark Anthony	4.6	-0.36
HH3	Glendell Arlinda Chief,		
Gray View Skyliner	4.7	-0.36	
JH1	Observer Chocolate Soldier	23.4	-2.22
BH1	West Lawn Stretch Improver	14.0	-0.98

Table 1. Frequency of heterozygotes, impact on conception rate if heterozygous bulls are mated randomly within breed, and earliest genotyped heterozygous ancestors for the five haplotypes.



mals may change status. Haplotypes of animals tested at 50K are usually stable from month to month, but changes will occur between July test files and August official files because the new marker edits (explained below) cause shifts in the positions of haplotype segments.

These haplotypes affecting fertility have small economic effects and their expected losses are already included to some degree in released rankings for sire conception rate (SCR), cow conception rate (CCR), heifer conception rate (HCR), and daughter pregnancy rate (DPR). Of those, net merit includes only DPR and thus does not fully account for economic effects of the haplotypes. Current frequencies of heterozygotes range from 4.5 to 23.4% for these five haplotypes. A heterozygous sire mated at random to females in the breed would reduce average conception rate by conception rate multiplied by the frequency of heterozygotes divided by 4. For example, if average conception rate is 31% and the frequency of heterozygotes is 5%, the average loss from using a heterozygous sire is 31%(0.05)/4 = 0.39%, which is fairly small compared with normal variation among animals for conception rate. Standard deviations of total sire effects or transmitting abilities are 2.3% for SCR, 2.9% for CCR and 2.4% for HCR, and many heterozygous bulls have positive fertility evaluations due to other favorable genes. Population conception rates would increase by less than 1% by eliminating any of the haplotypes below from the population. Therefore continued selection for net merit with some attention to SCR, CCR and HCR is recommended instead of direct selection against these haplotypes. Because inheritance appears to be recessive and an animal's status is reported for genotyped bulls and cows, avoidance of mating heterozygous cows to heterozygous bulls using computerized mating programs will be an effective and economical method to improve fertility. A more complete report is being reviewed by *Journal of Dairy Science*, and the abstract is available.