Changes to Evaluation System - November 2003

Earlier evaluation of daughter pregnancy rate

By Melvin Kuhn and Paul VanRaden

Cow fertility is evaluated earlier in lactation. Records in progress (RIP) for daughter pregnancy rate (DPR) are used beginning at 130 days in milk (DIM) instead of requiring 250 DIM for completed DPR data. Projection factors, expansion factors, and reduced weights for incomplete records were developed analogous to those already in use for yield, somatic cell score, and productive life. Predicted days open are derived from current days open, age, lactation number, and calving ease score in the current lactation. Projected records have less variation and are slightly less accurate than complete records. Thus, expansion factors range from 1.7 at 130 DIM to 1.0 at 250 DIM, and weights range from .90 at 130 DIM to .96 at 250 DIM. A weight of 1.0 is assigned when last breeding date is verified by next calving date.

Genetic correlations of predicted and completed DPR records were above .90 for predictions after 130 DIM. Projection factors were applied only to the most recent record of cows calving since January 2000. Breeding dates are reported by 90% of DHIA herds, but cows in the remaining 10% of herds still must wait 18 months for subsequent calvings to be reported before contributing to the DPR evaluation.

Average reliability of DPR for recent progeny-tested bulls (born in 1997) increased from 50 to 56%. Gains for older bulls (born in 1995) were smaller, with reliability increasing from 59 to 62%. Inclusion of RIP for DPR caused reranking only for the most recent bulls and for bulls beginning to add second-crop daughters. Actual changes in bull evaluations were consistent with gains in reliability.

Repeatability of DPR was estimated as .13. This value is now used in calculating evaluations instead of the previously used value of .11 (obtained from literature estimates). The new repeatability estimate was obtained from records of >80,000 cows using an animal model with all relationships included and also from records of >500,000 cows using a model with only sire relationships. The assumed variance of permanent environmental effects increased to .08 of total variance. The variance of herd-by-sire interaction remains at .01, and heritability remains at .04.

Based on preliminary investigation, the reliability of early DPR evaluations could be increased by another 6% by including information from correlated traits that have higher heritabilities. A multi-trait DPR evaluation may be implemented in the future.

Fertility and calving ease in prediction of productive life

By Paul VanRaden and Melvin Kuhn

A prediction of productive life (PL) is valuable because culling information is the last trait recorded at the end of life. Multi-trait PL now includes the traits DPR, service sire calving ease (SCE), and daughter calving ease (DCE) in addition to the yield, somatic cell score, and type composites previously included. Genetic and phenotypic correlations are reported in Lifetime Net Merit - 2003 revision, and evaluation methods are reported in Multi-trait Productive Life. For the top 500 bulls ranked on Net Merit in August 2003, the average reliability of multi-trait PL was 57%; an advantage of 4% over single-trait PL (53%). When SCE, DCE and DPR (calculated as previously from only complete records) were included in the prediction, the reliability of multi-trait PL increased to 61%, increasing the advantage over single-trait PL to 8%. The additional information from RIP included in DPR beginning with the November 2003 evaluation increased the reliability of multi-trait PL another 1% to 62%. Gains in reliability of Net Merit were smaller, increasing from 80.7% in August to 81.0% with inclusion of more traits in multi-trait PL and DPR RIP. Overall advantage was only .3% because most emphasis in Net Merit is on other traits. In prediction of PL, the traits SCE and DCE receive less emphasis than most of the other traits, whereas DPR has the highest correlation with PL and is now the most important predictor until direct culling records become available.

Measure of pedigree completeness

By Paul VanRaden

Complete pedigrees allow mating programs to manage inbreeding more precisely and result in more reliable predicted transmitting abilities. A measure of pedigree completeness is now provided for all cows and bulls in bytes 359-361 of format 105 and bytes 303-305 of format 38. A pedigree is considered 100% complete if all paths trace back to an ancestor born before 1970 or if the animal itself is born before 1970. The base of 1970 for completeness was chosen instead of the 1960 base for inbreeding calculations because some pedigree data from the early 1960's is available only in printed herdbooks and not electronically. Based on the electronic files available, many purebred pedigrees would be only 95-99% complete if traced back to 1960. The choice of 1970 resulted in a completeness of 100% for most registered animals.

Pedigree completeness is 0% if both parents are unknown, and 50% if one parent is unknown and the other has a complete pedigree. Cassell et al. (2003 J. Dairy Sci. 86:2967) proposed a similar definition of pedigree completeness. Main differences are that we trace pedigrees to a constant year instead of a constant number of generations, known males get more credit than known females in Cassell's formula but equal credit in ours, and our goal is to measure completeness of calculating the progeny's inbreeding rather than the animal's own inbreeding. Also, in Cassell's formula, the absence of either parent causes 0% completeness, whereas our formula gives 0% completeness only if both parents are unknown. Our definition has an interpretation similar to the percentage of registered Holstein ancestry (RHA) calculated by Holstein USA, except that all ancestors contribute instead of just registered ancestors. Breeders can use this measure to monitor record-keeping at the herd level and compare the completeness of pedigree files available locally to those available nationally and internationally. Currently, pedigree completeness is calculated within breed of evaluation, and additional ancestors from other breed pedigree files aren't counted.

Inbreeding coefficients and expected future inbreeding (EFI) are now reported for all foreign bulls, whereas previously these fields were filled only for domestic bulls or foreign bulls with semen marketed in the US. Parent average fields also are now filled for all traits of foreign bulls. For foreign bulls whose dams are not evaluated in the US, the parent averages actually equal .5 sire PTA plus .25 maternal grandsire PTA plus .25 of the breed-year mean.

Preferred Interbull identification code

A code indicating which bull identification (ID) number is preferred by Interbull was added to format 38 in byte 363. The codes are 1 if the first ID is preferred by Interbull, 2 if the second ID is preferred, or 0 if neither is the preferred ID. For many bulls with breed code WW, the second ID is a USA HO number, whereas Interbull may prefer a foreign ID. This field may help foreign users of USDA evaluations in matching our files with theirs.
