



Effect of Herd by Sire Interaction Variance

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Genetic evaluations from USDA have given reduced weight to multiple daughters of a bull in the same herd since June 1967 by adjusting for herd-by-sire interaction. Henderson (1974) showed that this interaction is equivalent to assuming that daughters in the same herd have correlated errors (c^2). Plowman and McDaniel (1968) estimated that herd-by-sire interaction accounted for 14% of phenotypic variance, but stated that "It is planned to re-estimate both h^2 and c^2 after the new age adjustment factors that account for region and season are put into application." However, the initial value of 14% was retained in the modified contemporary comparison (Norman, 1974) and in the animal model (VanRaden and Wiggans, 1991) until August, 1997 when c^2 was reduced to 10% and h^2 was increased from 25% to 30% (Van Tassell et al., 1997). For Jerseys and Brown Swiss, c^2 was further reduced to 8% when h^2 was increased from 30% to 35% for those two breeds in November 2000 (Wiggans et al., 2000). Several studies reviewed by Van Tassell and Berger (1994) estimated lower interaction variance.

Animal models including either 5% or 10% interaction variance were compared using the November 2004 national protein dataset for Holsteins. Predicted transmitting abilities (PTA) were correlated by .9992 for active AI bulls and by .9987 for cows born 1998 or later. Reliabilities increased from 88.6 to 89.2 for bulls and from 49.3 to 49.4 for cows. Mean PTA decreased slightly from 40.5 to 40.2 pounds for active bulls and from 18.0 to 17.9 for cows. Standard deviation (SD) of PTA changed little for bulls but decreased from 16.1 to 15.8 for cows. As a result, PTA's of the top cows decreased slightly as compared to the top bulls.

Individual PTA changes were very small for active bulls. Of the top 100 bulls for protein, 59 had no change, 39 changed by 1 pound, and 2 bulls changed by 2 pounds. Non-AI bulls with high ratios of daughters to herds tended to have larger changes, up to 11 pounds. These changes tended to be upward for the best non-AI bulls and downward for the worst bulls. Of the top 100 cows for PTA protein, 30 decreased by 2 to 4 pounds, whereas only 2 cows increased by 2 to 3 pounds. None of the 2 million recent cows decreased by more than 7 pounds, but 20 cows increased by 8 to 10 pounds. These cows were sired by non-AI bulls with many daughters in one herd or a few herds. These results are also summarized in an ADSA [abstract](#) (VanRaden and Tooker, 2005).

A reduced herd-by-sire interaction variance of 7% for yield traits was submitted in the March 2005 Interbull test run and is planned to be implemented in May. This change will allow AI companies to obtain more daughters per herd in large cooperating herds and will improve cow evaluations slightly, but also will provide somewhat less protection against chance or fraud when sampling is limited to a few herds. The herd-by-sire interaction variance used for daughter pregnancy rate (DPR) was 1% but an increase to 4% is planned for May to make daughter weights more consistent across traits.

References:

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