



Changes in USDA-DHIA genetic evaluations (July 1991)

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USDA adjusts for herd variance

Research has shown that genetic evaluations can be improved by adjusting records for herd variance, which measures how much the cows within a herd differ (or vary) from the herd average. In some herds, individual cows differ greatly in yield, whereas in other herds yield is more uniform. Herds with higher yields often have higher variance, presumably because superior management allows superior cows to express their genetic merits more completely.

Herd variance affects genetic evaluations by altering the degree of expression of genetic differences. Daughters of two bulls that differ by only 1,000 pounds in a low variance herd might differ by 2,000 pounds in a high variance herd.

Differences in herd variance generally averaged out and were of little consequence for bulls progeny tested in national sampling programs. However, bulls that were sampled mostly in herds with low variance had less chance to be listed as a top bull because their daughter differences from herd average were smaller.

In USDA genetic evaluations, genes are assumed to have the same effect on all lactations in which they are expressed. Several adjustments are made so that records conform to this assumption. Adjustment for age substantially increases the size and variance of first lactation records but makes comparisons fairer. Short records are projected to 305 days. Deviations of these records from herd average are expanded so that they will have the appropriate genetic variation.

Adjustment for differing herd variance is another example of the practice of adjusting the data to meet the requirements of the evaluation procedure. Beginning with July 1991 evaluations, records are adjusted to standardize genetic variance.

The adjustment increases or decreases the difference between the management group average and the lactation record (deviation) depending on the variance in each herd. The adjustment factor is 1.0 (no adjustment) if the herd's variance is the same as the variance for base cows born in 1985 (first lactations starting in 1987, later lactations starting in 1988). Deviations are reduced in high variance herds and increased in low variance herds.

The factors for Holsteins are in Figure 1. Most herd-years were adjusted by a factor greater than 1.0 because of the recent base. The evaluations included lactations back to 1960 calvings, when variance was much lower.

In addition to adjustment of the size of deviations, there is an adjustment to the weighting that a lactation receives. Lactations from high variance herds are given more weight in the evaluation than those from low variance herds. The difference in weighting reflects the greater heritability found in high variance herds. The combined effects of the adjustments are small for most animals.

Herd variances are estimated for each calving year because conditions within herds may change and because variance has increased over time. Variation in the cow's calving year, variation in adjoining years, and average herd variance in the region are combined in a weighted average to produce each estimate.

Differences in herd variance led to the formation of the three regions in Figure 2. Region 1 has the lowest average variance and region 3 the highest. In a herd with 21 first lactation cows being evaluated, the region would contribute one-third of the information. However, with 101 first lactation cows, the contribution is 9 percent. This blending provides more accurate estimates of the herd variance, especially for small herds.

The biggest changes in evaluations are for cows in high variance herds. Yield deviations of such cows may be reduced by more than 20 percent. The elite list now includes more cows from herds with low or average variance and fewer cows from those with high variance.

Differences among bulls sampled in low variance herds or areas are increased. Top bulls had higher PTA's, whereas those of low bulls decreased. Average PTA of all currently active A.I. bulls increased slightly.

The genetic evaluation system reevaluates all animals semiannually, including animals born 30 years ago. PTA's of these older animals now average about 200 pounds less because the genetic differences expressed in early years are stretched out to estimate effects those genes would have if expressed in a current environment.

PTA continues to rank animals on the average merit of the genes they transmit. Rankings are slightly more accurate with the herd variance adjustment. Predictions computed from data in both the high and low variance regions are improved.

Genetic differences are larger in high variance herds and smaller in low variance herds. PTA predicts differences among hypothetical progeny milking in average herds in the base year. Cows born in 1985 now serve as the base for genetic variance as well as for the genetic average.

Prediction of actual production differences in other years or for a herd that is not average requires knowing the

herd's variance at that time. In a high variance herd, the difference in production between the averages of two bulls' daughters will be greater (assuming mates with equal genetic merit) than the difference in the bulls' PTA's.

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