Changes in USDA-DHIA genetic evaluations (February 1999)

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Best prediction

Lactation records for milk, fat, protein, and somatic cell scores **(SCS)** are now computed from test-day data at the Animal Improvement Program Laboratory **(AIPL)**. A new editing system stores all test-day data received, and then a best prediction (selection index) method is used to calculate the 305-day record. This method replaces both the test interval method, which calculated lactation total to date, and the projection factors, which estimated the remaining yield. Because test-day data are incomplete for earlier years, best prediction was applied only for cows that calved during January 1997 or later.

Advantages of best prediction are small for most 305-day lactations but larger for lactations with infrequent testing or missing component samples. Records for SCS are more precise because best prediction uses test days adjusted for stage of lactation whereas a simple, unadjusted test-day average was used previously. The SCS data from owner-sampler testing now receive about 25% less weight in the animal model than do data from supervised testing in the animal model. For yield traits, lactation records have slightly reduced standard deviations because best prediction regresses estimates toward the herd average. For SCS, breed averages are used instead of herd averages.

Multitrait data collection ratings **(DCR's)** are provided at the AIPL web site (http://aipl.arsusda.gov) and by other industry cooperators to indicate the accuracy of lactation records obtained from multitrait best prediction. Multitrait DCR's differ slightly from single-trait DCR's and best predictions now used in animal model calculations. Single-trait DCR's measure the information from just one trait, whereas multitrait DCR's add the correlated information from other traits. In the future, a multitrait animal model is expected.

Labor efficient tests, which are averages of several days of milk, can now produce a DCR as high as 104 compared with 100 for traditional monthly testing. Since 1980, monthly half-day (AM-PM) testing had received a weight of 98 compared with 100 for full-day testing, but the new DCR is 95. When a cow changes herds during lactation, a separate yield is estimated from the tests in each herd. Those separate yields ensure similar managements for the cow and her group mates when compared in the animal model.

For more about best prediction, see the following articles: Journal of Dairy Science 80:3015 (1997), Proceedings of the 6th World Congress on Genetics Applied to Livestock Production 23:343 (1998), and Journal of Dairy Science 82:438 (1999).

Milking frequency adjustment

Yields of cows milked three times per day **(3X)** are adjusted to a twice daily **(2X)** basis with new factors that indicate less advantage for 3X milking. Previous factors estimated in 1953 indicated an advantage of 20%, 17%, and 15% for cows milked 3X during first, second, and mature lactations,

respectively. New factors estimated by Karaca and Freeman at Iowa State University (M.S. thesis, 1997) differed by yield trait and indicated that the response to 3X milking is smaller although greater for later lactations:

	Percentage increase from 3X milking		
Lactation	Milk	Fat	Protein
1	12	9	10
2+	14	10	11

The new factors will be phased in from 1997 through 1999. One-third of the difference was implemented for cows that calved during 1997, and two-thirds for calvings during 1998; the new factors will be used fully for calvings during 1999 and later. If factors were changed during just 1 year, large differences would have occurred in 3X adjustments for December versus January calvings compared within some management groups, which would have caused less accurate comparisons at that point in time.

The new factors are applied to each test-day yield instead of to lactation yield. This approach is more accurate when the milking frequency changes within a lactation. The previous lactation adjustments depended on the number of days milked 3X but not the lactation stage at which the 3X milkings occurred.

Only small changes in predicted transmitting abilities **(PTA's)** are expected for most 3X herds. Current adjustments for herd average and variance already account for the effects of 3X milking if all cows in the herd have the same milking frequency. Improved 3X factors are most valuable for herds that switch from 2X to 3X or that have some cows milked 2X and others 3X at the same time. Accurate 3X factors are also valuable to herd owners when comparing yields from different herds or when deciding whether 3X milking is worth the effort. About 6% of U.S. herds and 20% of dairy cows are milked 3X.

Fluid merit and cheese merit

For producers who sell milk in fluid or cheese markets, two new indexes similar to net merit **(NM$)** are available for bulls. Economic values of productive life and SCS were added to net values of milk-fat dollars **(MF$)** and cheese yield dollars **(CY$)** to obtain fluid merit **(FM$)** and cheese merit **(CM$)**, respectively. Subtraction of feed cost resulted in a negative net value of protein in FM$. Instead of two cheese yield formulas, the formula for Jerseys and Guernseys was applied to all breeds.

The new FM$ and CM$ indexes replace the previous dollar values in the bull evaluation record (format 38) and occupy positions 261-264 and 269-272. At the next genetic base change, the dollar value of milk-fat-protein **(MFP$)** will also be discontinued or will change to a net value.

Protein premiums can indicate which index is best suited to a particular market:

Protein differential (cents/.1%)	Suggested merit index
0 to 9	FM$

10 to 25	NM$
26 and higher	CM$

Producers should use the protein premium expected a few years in the future when buying breeding stock and 5 years in the future when buying semen. Elite breeders should select for national or global markets instead of local market needs.

Revised editing system

Cow test-day data submitted to AIPL are edited to ensure the quality of the data. Because lactation records used in genetic evaluations are calculated from those test-day data, usable test days are required for a lactation to be included in the evaluations.

The first requirement for test-day data is that a cow's test date must match its herd test date already submitted in the herd-average record (format 14). If no corresponding herd test date is found, that cow's test-day data are not stored. Similarly, if a cow's number of sampled milkings does not match the herd's number of sampled milkings, the component values are not stored. If no component information is found, the record is not used.

Other restrictions that are imposed on test-day data include valid supervision, status, and milking frequency codes. A record must also have a valid number of weighed milkings, number of sampled components, and number of milk-recorded days. The production variables are also edited to remove erroneous data. For a complete list of errors associated with test-day data, see the Complete Error Documentation.

Revised programs and a modern relational database on a faster workstation computer now fully accommodate American identification **(ID)** and international ID numbers. All information for an animal is connected by its internal sequential number (key). Changes in ID or multiple ID's are much simpler to manage because only the animal ID table is affected. Other tables need less space because the animal's 4-byte key is stored instead of a 17-byte ID. As information becomes available, the pedigree table will be corrected to include foreign parents that could not be represented previously.

Foreign dams of bulls

Evaluations of bull dams from countries other than Canada are now used in calculating parent averages of artificial-insemination **(AI)** bulls. The dam's previous evaluation was obtained from the country of origin indicated by the National Association of Animal Breeders (Columbia, MO). If the dam's foreign evaluation had more information than her U.S. evaluation, the dam's converted evaluation was used to update the bull's parent average and PTA. This procedure is an extension of the practice used since July 1995 for Canadian dams.

Expected future inbreeding

New reference samples for each breed caused slightly lower values for expected future inbreeding. Previous samples included 300 males and 300 females but now include 600 females chosen at random from birth year 1996. A new sample will be chosen each February from the cows born 3 years earlier to update average relationships.

Sorted bull lists available

In response to industry suggestions, AIPL made two sets of sorted lists of AI bulls available to users with the February genetic evaluation.

The first set includes bulls with semen available in the United States. Those lists are available for each breed sorted by NM$, CM$, and FM$. Each list includes bulls above 80 percentile with at least 30 bulls listed when possible. Included in this set of lists is the option to obtain the list of all active AI sires. The AIPL web-site menus for this set of lists are located at http://aipl.arsusda.gov/dynamic/sortnew/current/index.html.

The second set of lists are for bulls regardless of semen availability in the United States. Those lists are available sorted by NM$, PTA protein, and PTA milk for Ayrshires, Brown Swiss, Guernseys, Holsteins, and Jerseys. For each list, 200 bulls are included when possible. The AIPL web-site menus for this set of lists are located at http://aipl.arsusda.gov/dynamic/sortnew/current/index.html.

All lists are available or mailed on the Friday following quarterly release of genetic evalutions at the same time that the active AI and available foreign bull lists become available.