



NET MERIT

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NET MERIT is a selection index that combines genetic evaluations for somatic cell score, productive life, and product value adjusted for feed costs. NET MERIT is more comprehensive than previous USDA indexes, because production, longevity, and health component PTA's are included. The combination of traits considered and economic values used makes the index useful for a wide variety of commercial herds. This guideline explains some background issues concerning genetic evaluations for somatic cell score and productive life as well as calculation and use of the NET MERIT index.

Economic Assumptions in NET MERIT

The formula for computing NET MERIT in Holsteins is as follows:

$$\begin{aligned} \text{NET MERIT} = & .7 (\text{MFP}\$) \\ & -229.4 (\text{SMP}) (\text{PTA SCS} - 3.29) \\ & +91.9 (\text{SMP}) (\text{PTA PL}) \end{aligned}$$

The formula above can be used to compute NET MERIT in Holsteins. Fortunately, USDA will do the computing and distribute NET MERIT as part of genetic evaluations. NET MERIT uses **economic weights of 10 to 4 to -1 for MFP\$, productive life (PL) and somatic cell score (SCS)**. Changes in milk prices are accounted for by "Standard milk price" or SMP in the above equation. SMP will keep the weights at 10:4:-1 for MFP\$ to PL to SCS regardless of milk prices used. In 1994, SMP was \$.12/lb of milk, reflecting a \$12.00/cwt price for milk containing 3.5 percent fat and 3.2 percent protein. The above formula is specific for Holsteins because 3.29 is the breed average SCS for Holsteins. The appropriate average from Table 1 must be substituted for 3.29 to calculate NET MERIT for other breeds.

Table 1. Average somatic cell score of first lactation cows born in 1985 by breed

Breed	Average SCS
Ayrshire	3.15
Guernsey	3.45
Holstein	3.29
Jersey	3.29
Brown Swiss	3.09

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Economic weights of 10:4:-1 should be appropriate for most dairy herds. The weights are based on extensive research efforts of recent years. The measure of production used, MFP\$, does include a value for protein. Some parts of the country, including the Southeast, receive no direct payment for protein. In a study of AI sires available in January 1994, replacing MFP\$ with MF\$, a production index that gives no value to protein and more value to lbs of milk, did not change the NET MERIT index enough to affect sire selection for replacement heifers very much. Sire selection on NET MERIT using MFP\$ appears appropriate for herds in the Southeast and other areas not receiving protein premiums.

lactation average somatic cell score as the basic information on which evaluations are based. Data are collected at USDA along with milk production records and the same standard edits for use in genetic evaluation apply. The genetic evaluation procedure used is the same animal model as is used for production (see VCE Publication 404-086). One major difference between genetic evaluations for SCS and milk production is the heritability of the trait. SCS is only 10 percent heritable, compared to 25 percent for milk production. This has an important effect on accuracy of genetic evaluations for progeny test daughters. Table 2 shows the impact of lower heritability on accuracy of genetic evaluations based on different numbers of progeny for milk, SCS, and for PL, which is only 8.5 percent heritable.

Genetic Evaluations for SCS

Genetic evaluations for SCS are one of the first attempts to control health costs through genetic change in dairy cattle. The evaluations use

Most AI sampled bulls have 50 to 100 daughters following graduation from progeny test. While Reliabilities of 80 percent or more are normal for milk production, expect Reliability for SCS or PL

Table 2. Approximate reliabilities of PTA for milk yield, SCS and productive life for different numbers of daughters.

Number of daughters	Reliability		
	Milk	SCS	Productive Life
20	67	40	30
30	73	48	39
50	81	59	52
100	89	73	68
200	94	84	81

to be 60 to 70 percent for most AI sampled bulls. This means that “first crop” information on individual bulls should not be expected to be as accurate for SCS and PL as for milk. Since less information will be available from “first crop” daughters about SCS and PL than milk, changes in PTA’s and SCS and PL should be expected to be larger as second crop daughter information becomes available.

The range of genetic evaluations for SCS and PL from active AI bulls in the January 1994 animal model are in Table 3. SCS evaluations range from about -.5 to +.5, but are coded before publication by adding them to the first lactation average SCS in Table 1. More desirable proofs are the lower ones, as the intent of selection would be to reduce SCS.

Genetic Evaluations for PL

PL or herd life is measured as months in milk by 84 months of age. DHI records are used to measure PL and are evaluated with the same statistical procedures and genetic base as for milk and SCS. The reliabilities given in Table 2 assume completed daughter records. A major problem with PL evaluations is the amount of time needed to complete one daughter record. For SCS and production a daughter will complete her record by the time she is 36 months old; by contrast we cannot

even project a PL record until the daughter is 36 months old. This means that PL evaluations for new AI graduates will include parent information and very few daughter records. The range of evaluations for active AI bulls in the January 1994 genetic evaluations is in Table 3 for each breed. The greatest range in evaluations was for Jersey bulls, 7.2 months, with Holsteins next at 6.7 months. Ranges were smaller for other breeds with limited numbers of AI bulls.

Predicting Herd Life from Young Cows

Estimating herd life on a young cow is difficult because of the large amount of unpredictable variation in how long she may live. Despite problems, we can’t wait until all of a bull’s first crop daughters have a chance to reach 84 months of age to decide if the bull is any good. USDA uses part records for PL to predict PL at 84 months of age, provided the cow was still alive when the last record was submitted. We have a great deal of confidence in projected production records. A lactation curve is usually pretty reliable in predicting how much milk a cow will produce in 305 days. Productive life is something else again. PL is lowly heritable (about 8 to 9 percent) even when measured on cows with opportunity to survive to 84 months of age. When only 36 months old cows are used to predict months in milk by 84 months of age, that heritability drops to 3 percent or a little less!

Table 3. Range of genetic evaluations for SCS and PL for active AI bulls in the January 1994 animal model.

Breed	PTA SCS		PTA PL	
	Minimum	Maximum	Minimum	Maximum
Ayrshire	2.93	3.57	-.1	2.7
Guernsey	3.28	3.61	-1.0	3.5
Holstein	2.92	3.76	-2.5	4.2
Jersey	3.25	3.82	-3.1	4.1
Brown Swiss	2.90	3.41	-1.9	2.7

Because many of the most important bulls on the stud lists are young bulls just out of sampling, we would like to improve our ability to evaluate these bulls for PL. One idea that has merit is to use information in addition to DHI records to predict PL. One of the more promising possibilities would be to include type data when predicting PL on young cows. We finished a research project at Virginia Tech in 1993 that sheds some light on how useful type data are in predicting PL. Some results are shown in Table 4.

Type data improve our ability to predict PL at 84 months. However, predicted PL based on what we

genetic evaluations of PL in Holsteins that include both DHI and type data.

Conclusions

New genetic evaluations for somatic cell score and productive life use the same procedures currently used for milk production.

These two traits contribute to our knowledge of the total merit of a cow for profit in a herd. Data are routinely collected as part of the DHI program and are readily available for use in national genetic

Table 4. Reliability of predicted months in milk by 84 months of age when different combinations of information on 36 month old cows are used.

Variables used to predict months in milk by 84 months of age	Reliability of predicted months in milk by 84 months of age with 80 effective daughters
Type	.31
Yield	.10
Yield + PMIM84 ¹	.18
Type + PMIM84	.37
Type + Yield + PMIM84	.42

¹ PM1M84 is months in milk at 84 months of age predicted from 36 months of age.

know about 36 month old cows isn't very reliable. The best we can do with 80 daughters spread out one per herd, all 36 months of age, is 42 percent reliability for productive life. We know nearly that much about a young bull for production when he is sampled! We need to remember that not all progeny test daughters are seen by the classifier. We might have 80 "effective" daughters with production records from some (but not very many) AI sampling programs, but they would not all be classified. Our ability to predict PL using type data would not be helped as much for the average bull as Table 3 indicates.

Despite limitations on its usefulness, type data do improve accuracy of prediction of PL, especially on bulls just out of sampling. An agreement between the Holstein Association and USDA has resulted in

evaluations. Both traits are lowly heritable and PTA's will be estimated with less accuracy from first crop daughters than milk yield. Type data are used in Holsteins to improve accuracy of evaluations for PL.

PL and somatic cell score (SCS) are economically important traits that can be changed (slowly) by selection. However, selection on SCS or PL only is not warranted. These evaluations are best used in a selection index. NET MERIT uses realistic economic weights to include these two traits in on-farm selection programs. Rank for active AI bulls within breed will be based on NET MERIT rather than MFP\$ as in the past. NET MERIT includes most economically important traits for most dairy producers and uses reasonable economic weights. It should be widely used.