Lifetime Net Merit

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Introduction

When we select for more than one trait we use an index. Selecting for more than one trait means that we have to decide how much emphasis to give each trait. If we do not use a formal index we have a mental "index" to decide how much emphasis to give various traits. When selection goals are established, more genetic progress can be made when these goals do not change for several years. So, using an index helps to formalize the selection process and to provide consistency in the weight given to different traits. Lifetime Net Merit is the most comprehensive index, to date, that is available to all producers. Lifetime Net Merit is a measure of Lifetime Profit. It was necessary to use average values in the index, and as such, they are not the most precise for all incomes and costs. Lifetime Net Merit is the best available measure of profit on a national basis.

All indexes are compromises unless traits are perfectly correlated. Excellence in one or more trait makes up for other traits that are not as good. The two sires Orion and Swinger are an example. Both have NM$ of 590, but Orion's Predicted Transmitting Ability (PTA) for protein is 52, for fat 91, and for milk 1298. Swinger's PTA is 86 for protein, 49 for fat, and 2826 for milk. The daughters of these two bulls would be expected to make the same profit where milk is sold on the basis of protein, fat, and milk.

The Lifetime Net Merit index was derived by the joint efforts of USDA-AIPL group, that computes the sire and cow evaluations, and the S-284 regional research group whose title is "Improvement of Dairy Cattle through Selection," cooperation of breed associations, and personnel from the National Association of Animal Breeders. Members of S-284 are research scientists from universities. The Lifetime Net Merit index is based on an estimate of lifetime profit developed by the S-284 research group, which is as follows: Lifetime profit = milk value + salvage value + value of calves − rearing costs − feed energy − feed protein − health costs − breeding costs. Let's look at some of the details of how Lifetime Net Merit is calculated.

Materials and Methods

Dr. Paul VanRaden from USDA-AIPL wrote the final description of Lifetime Merit and a complete description can be found at http://aiplusda.gov/memeos/html/nm2000.html. The Lifetime Net Merit name will probably be changed later to Net Merit$ (NM$). For this article, I will use NM$ interchangeable with Lifetime Net Merit and follow Dr. VanRaden's description. NM$ can be visualized using three subindexes:

$$NM\$ = YIELD\$ + UDDER\$ + OTHER\$$$

Let's examine what is included in these components of NM$. YIELD$ is the value of the cow's milk, fat, and protein. These are measured on a lactation basis, but converted to a net lifetime value.

$$YIELD\$ = (MFP\$ - FEED\$) * LACTNS * actYLD.$$

The ratio of actual to mature equivalent yield (actYLD) converts yield back to actual milk. All PTA are computed on a mature equivalent - 2 times milked - 305 day basis, so this converts the PTA to actual yields. Number of lactations is abbreviated as LACTNS. YIELD$ published in the August sire evaluations use MFP$. For producers who sell their milk on a cheese yield (CY$) or on milk and fat (MF$) basis, these values replace (MFP$) in the YIELD$ formula. Milk prices are computed over recent years. Other costs like electricity to cool milk and bulk tank costs are included in the costs. The base price for milk used in Aug. 2000 evaluations was $12.70.

Average prices and costs have to be used when indexes are applied to all cattle in the United States. Net Merit$, fluid$ and cheese merit$ are computed as follows:

$$MFP\$ = .010 \; PTA \; milk + 1.15 \; PTA \; fat + 2.55 \; PTA \; protein$$

$$MF\$ = .087 \; PTA \; milk + 1.15 \; PTA \; fat$$

$$CY\$ = -.008 \; PTA \; milk + 1.15 \; PTA \; fat + 3.17 \; PTA \; protein$$

$$FEED\$ = .003 \; PTA \; milk + .35 \; PTA \; fat + .77 \; PTA \; protein$$

$$LACTNS = 3.0 + .12 \; productive \; life$$

The forerunner of productive life was called herd life and was developed by a cooperative effort of 21st Century genetics (now a part of GENEX) and Iowa State University. Linear type traits were used to predict how long sires' daughters would stay in producers' herds. When productive life was used on a national basis, the actual life experienced by sires' daughters that were in DHIA expanded this concept, and Holstein linear data were used because it was available nationally.

Selection for UDDER$ allows udder traits to improve and reduces somatic cell scores (SCS), which is a measure of mastitis resistance. Improvement of udder traits reduces labor costs and improves milk quality. When quality premiums are paid for low SCS, additional income is generated by keeping SCS low. UDDER$ is computed as follows:

$$UDDER\$ = \{10 \; PTAudder - 51 \; (PTAscs - breed \; SCS)\} \; LACTNS$$

PTAudder is the same as udder composite for the Holstein Breed. The value of −51 includes a premium of $41 plus $10 for labor, drugs, and discarded milk. The traits included in PTAudders are fore udder, rear udder height, rear udder width, udder cleft, udder depth, and teat placement.

PTAscs is a genetic estimate for somatic cell scores as PTAmilk is a genetic measure for milk. The PTAscs includes the breed mean, which for Hosteins is 3.1. All of this is put on a lactation basis by multiplying by LACTNS.

Many other traits that affect net merit are available through DHI and or breed associations. OTHER$ combines several of the important traits that affect Lifetime Net Merit and are given below:

$$\text{OTHER\$} = \text{LACTNS (Profit \$)} - \text{(Loss\$)} + \text{(5PTAf\&l)}$$
$$\text{LACTNS} -24 \text{ PTAsize [maint\$ (LACTNS * actWT)} +$$
$$\text{varrep\$} - \text{beef\$]}$$

Lactation Profit$ is the increased profit when a cow stays in the herd for an additional lactation. The profit from producing milk for three lactations about equals the beef loss (culling costs are less that replacement costs) so that the total profit is about 0. Loss$ = replacement$ − 1500 * beef$. PTAf&l (PTA for feet and legs) includes legs side view, legs rear view, foot angle, and foot/leg score. PTAsize uses the traits stature, strength, and body depth. The cost for maintenance (maint$) includes the increased feed for maintenance per lactation eaten by heavier cows. Mature weight is estimated by multiplying PTAsize by 24. The ratio of actual weight to mature weight (actWT) is 91%. ActWT = .91 + .0027 PTApl. Replacement costs are major cost to producers. Replacement cost is represented by varrep$ and after the costs of overhead, raising heifers to calving and accounting for the increase in weight from a first calf heifer to a mature cow the cost was estimated as $.56 per pound. Beef income (beef$) was $.35 per pound.

Final Thoughts

Lifetime Net Merit is an excellent tool to screen bulls for choices to use in your herd. You can make choices among bulls in a narrow range near the top of NM$ and be confident that you are getting bulls that will produce daughters that will be profitable.