Aspects of Selection

for Economic Merit

in Dairy Cattle

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ABSTRACT

Economic merit of dairy cattle is an important consideration in dairy cattle breeding. In this thesis, genetic and economic aspects were combined to quantitatively derive an aggregate genotype with the aim to improve the economic merit of New Zealand dairy cattle.

Relative economic values for production traits, liveweight and survival rate were estimated. A profit function was defined for a pasture based milk production system. The effects of changes in several genetic, biological and economic parameters on various components of farm profit were simulated with a bioeconomic computer model.

The economic value for protein yield was $ 4.64/kg and $ 4.58/kg for Holstein-Friesian and Jersey cows, followed by $ 1.84/kg and $ 1.75/kg, respectively, for milkfat yield. Liveweight had a negative economic value of $ 0.49/kg and $ 0.53/kg for Holstein-Friesian and Jersey cows. An increase in survival rate by 1% had a positive economic value of $ 9.25 and $ 9.29 for Holstein-Friesian and Jersey cows. A sensitivity analysis showed that declining returns for milk reduced economic values for all milk components and simultaneously increased economic values for liveweight.

The effects of several traits on survival rate were quantified. An increase in survival rate increases a cow's profitability as cows contribute to net farm income only during their lactation years and constitute a cost during the rearing period. After production traits, the farmer's overall opinion of the cow and the traits udder support and udder overall had the greatest impact on survival rate. These traits were used as selection criteria for survival rate in the selection indexes.

Variance and covariance components were estimated with multitrait REML procedures for all production, management and conformation traits used in the current selection index. Heritabilities were 0.25 for protein yield and 0.21 for milkfat yield for Holstein-Friesians and 0.17 for both traits in Jerseys. Generally, parameter estimates did not differ substantially from other populations.

An aggregate genotype as well as selection indexes for Holstein-Friesians and Jerseys were constructed and weighting factors calculated based on the economic values and genetic parameters estimates.

The aggregate genotype included the traits protein yield, milkfat yield, volume, liveweight and survival rate.

The selection index for Holstein-Friesians included the traits protein yield, milkfat yield, volume, liveweight, udder overall, overall opinion, temperament, milking speed and udder support.
The selection index for Jerseys included the traits protein yield, milkfat yield, volume, liveweight, udder overall, overall opinion, temperament, milking speed and fore udder.

These selection indexes improve the economically important trait survival rate included in the aggregate genotype through indirect selection using traits which can be measured in the first lactation. This allows the current generation interval to be maintained when selection for survival rate is incorporated in the aggregate genotype.

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