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Heritability in Relation to Selection Differential in Cattle

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Abstract

The concept of heritability as generally used, involves the assumption that additive genetic variance is a constant proportion of total variance over the entire range of phenotypes. If this assumption holds, selection response will be linearly related to selection differential. If not, prediction of selection response will not be possible from a knowledge of the phenotypic selection differential and the average proportion of additive genetic variance. Thus the validity of this assumption has a bearing on the design of efficient selection schemes for many situations. In the field of applied animal breeding, for example, this will affect such important questions as the increase in rate of genetic improvement to be expected from the use of artificial insemination.

Milk production records from 5740 first lactation dam–daughter pairs were studied to determine if the heritable fraction of total variation is related to selection differential. Heritability was essentially constant over the entire range of phenotypic variability, there being no evidence for curvilinearity of the offspring–parent regression line. Thus at least short-term selection response is predicted to be linearly related to selection differential, and also to be independent of direction of selection. The estimate of heritability from the total data was .43 ± .03, substantially higher than many published estimates for this trait. The estimate by the paternal half-sib method from the proportion of the data provided by artificially sired daughters (2568) was .25, while the daughter–dam estimate from the same subsample was .44. Possible reasons for the difference between the two estimates are discussed.