

8.2 Selection response

Below is shown a general formula for expected genetic changes by selection. The changes are proportional to the intensity of the selection, the accuracy of the estimated breeding value and the additive standard deviation, σ_A . The change takes place from one generation to the next, which means that the average breeding value of the parents corresponds to the mean value of the population in the next generation. If the changes are to be measured in time units, they are inversely proportional to the generation interval.

The generation interval is defined as the average age of the animals when they become parents. In the human population the generation interval is said to be 30 years. I.e. the parent is on average 30 years old when they give birth to a child.

The general formula for selection response is shown below.

$$\Delta G_{\text{year}} = \frac{i \cdot r_{AI} \cdot \sigma_A}{L}$$

i = Selection intensity
 r_{AI} = Accuracy
 σ_A = Genetic standard deviation
 L = Generation interval

The general formula for delta G fits well with the results for accuracy of individual selection, h , given in Figure 8.1. The general formula for selection response can be extended slightly when taking into account the different roles the two sexes play in forming the new generation. The formula is divided into two components, one for the sires' contribution and the other for the dams' contributions, see below.

$$\Delta G_{\text{year}} = \frac{i_{\text{♀}} r_{AI\text{♀}} \sigma_{A\text{♀}} + i_{\text{♂}} r_{AI\text{♂}} \sigma_{A\text{♂}}}{L_{\text{♀}} + L_{\text{♂}}}$$

The formula for delta G is important for predicting what will happen if a specific breeding program is decided upon. Thus the model studies can be performed with an eye on design of an optimal balance between the generation interval and the intensity and/or accuracy of the selection. At short generation intervals fewer individuals are born to select among. This influences both the intensity and the accuracy negatively compared to a situation where longer generation intervals occur.