

25. Importance of restrictions in optimum contribution selection

Tobias Niehoff^{1*}, Jan ten Napel¹, Mario Calus¹

¹Animal Breeding and Genomics, Wageningen University & Research, Postbox 338, 6700AH Wageningen, The Netherlands

[*tobias.niehoff@wur.nl](mailto:tobias.niehoff@wur.nl)

Selection towards a predefined breeding goal in animal breeding programs, may result in undesired increases in inbreeding across generations. Optimum contribution selection (OCS), is a well-established method that is used to balance genetic gain and inbreeding in breeding programs. With OCS, the optimal contributions of selection candidates to the next generation are calculated so that the increase in inbreeding is restricted while the genetic gain is maximized or vice versa. In animal breeding, the number of parents is typically restricted by the capacity of the breeding farms. However, the traditional OCS theory does not consider the number of parents as a restriction. Our aim was to raise awareness and explain how to consider the restriction of the number of parents in the OCS framework. We implemented the consideration of number of parents by calculating optimum contributions and removing animals with the lowest contribution iteratively. To show the conceptual differences, we simulated small populations and implemented different selection strategies. Contributions were calculated such that the achieved genetic gain was equal to one genetic standard deviation per generation for all methods considered. The average rate of inbreeding was lower by 22% ($p < 0.001$) in populations that have been selected with a restriction of number of parents considered in OCS compared to populations in which the number of parents was limited, but not restricted in OCS, while the genetic gain was not affected. Our method resulted in a slower increase in inbreeding than all other tested methods. We tested our approach on a small population with moderate genetic improvement but it can also be applied to large breeding populations or zoo populations.