

CASE STUDY 19

Value of the Dutch Holstein Friesian germplasm collection to increase genetic variability and improve genetic merit

Leading IMAGE partner: WR

Other IMAGE partners involved: none

Other non-IMAGE partners and actors involved: the Dutch-Flemish cattle improvement co-operative (CRV)

IMAGE WP and Task: WP6.2/WP2

Objectives

National gene bank collections for Holstein Friesian (HF) dairy cattle were set up in the 1990s. The aim of this case study was to assess the value of cryobank bulls from the Dutch HF germplasm collection to increase genetic variability and improve genetic merit in the current bull population (bulls born in 2010–2015).

Material and methods

In total 5,783 HF bulls were used. Genetic variability was defined as 1 minus the mean genomic similarity (SIM_{SNP}) or as 1 minus the mean pedigree-based kinship (f_{PED}). Genetic merit was defined as the mean estimated breeding value for the total merit index or for 1 of 3 subindices (yield, fertility, and udder health). Using optimal contribution selection, relatedness was minimized or genetic merit was maximized at restricted levels of relatedness. Breeding schemes with only bulls from 2010 to 2015 were compared to schemes in which cryobank bulls were also included.

Results/output

When relatedness was minimized, inclusion of genotyped cryobank bulls decreased mean SIM_{SNP} by 0.7% and inclusion of both genotyped and non-genotyped cryobank bulls decreased mean f_{PED} by 2.6% (in absolute terms). When genetic merit was maximized at restricted levels of relatedness, inclusion of cryobank bulls provided additional merit at any level of relatedness. Additional merit from cryobank bulls depended on (1) the relative emphasis on genetic variability and (2) the selection criterion. Additional merit was higher when more emphasis was put on genetic variability. Additional merit was low to nonexistent for the total merit index and higher for the subindices, especially for fertility. In conclusion, Dutch HF cryobank bulls can be used to increase genetic variability and improve genetic merit in the current population, although their value is very limited when selecting for the current total merit index.

More information



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