

## Heterosis and Effect of Breed Proportion for Milk Production Traits in Crosses Between Danish Holstein, Danish Red and Danish Jersey

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During the last decade the use of systematic crossbreeding in dairy cattle herds has been increasing in Denmark. The aim of this study was to estimate the effect of breed proportion and heterosis on milk production traits. The study was based on records on milk yield (MY), protein yield (PY) and fat yield (FY) from 52,165 first lactation cows born in 2004 or later from 104 herds using systematic crossbreeding. More than 50% of the cows were crosses between Danish Holstein (DH), Danish Red (DR) and /or Danish Jersey (DJ) and the remaining were pure DH, DR or DJ. Cows with less than 45 DIM and/or a calving age below 18 or above 40 months were omitted. The statistical model included a fixed effect of herd-year and calving month, a regression on calving age, a regression on the proportion of DH, DR and DJ genes, a regression on the degree of heterozygosity between DH and DR, DH and DJ and DR and DJ, a random genetic effect of the cow and a residual. Data was analyzed using AI-REML in the DMU package. The effect of breed proportions was estimated relatively to a pure DH. For MY, a pure DR was estimated to give 259 kg less than a pure DH, while a pure DJ gave 1838 kg less than a pure DH. For PY there was no significant difference between DH and DR. Danish Jersey produced 40 kg less PY than DH and 35 kg less than DR. There was no significant effect of breed proportion for FY between the three breeds. Heterosis was significant in all combination of breeds for all three milk production traits. Heterosis for crosses between DH and DR was estimated to 177 kg, 5.8 kg and 8.4 kg for MY, PY and FY, respectively. Corresponding figures for crosses between DH and DJ was 320 kg, 13.4 kg and 17.5 kg, while crosses between DR and DJ gave heterosis estimates of 380 kg, 14.3 kg and 20.2 for MY, PY and FY, respectively. The results obtained in this study demonstrate the existence of heterosis on milk production traits in crosses between the three Danish dairy breeds.



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