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Genetic Studies on Heat Stress in Friesian Dairy Cattle in Kenya Using Test-day Milk Yield

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Abstract

Climate change at global level is considered a major threat to the viability of livestock production systems. Of particular importance is the effect of heat stress and its influence on livestock production. The importance of heat stress is the negative effects it impacts on productivity, reproductive performance, animal welfare and ultimate profitability of these systems. In dairy cattle, environmental conditioning, feeding modifications, and genetic selection for heat tolerance remain the main strategies for alleviating the effects of heat stress Investigation of the genetic sensitivity to absolute and changing heat stress and genetic evaluation for heat tolerance in cattle is of great importance for improved food security. In this study we investigated individual cow's genetic and environmental components as a function of climatological data in Kenya. We applied both repeatability and random regression models (RRM) to infer the genetic aspects of the lactation curve. By modelling the cow performance as a function of temperature and humidity data, highly productive individuals with low sensitivity to heat stress potentially could be identified and selected. Data on milk performance and pedigree records for different breeds were obtained from the Kenya Livestock Breeders Organisation and Livestock Recording Centre. For the Friesian breed, a total of 38,216 first lactation test-day milk yield records distributed across 189 herds were used. The study herds' locations were characterised into agro-ecological zones (AEZ) which provide a standardised characterisation of climate, soil and terrain relevant to agricultural production. The herds were distributed across high potential (AEZ II), medium potential (AEZ III) and semi-arid (AEZ IV) zones. Cows in the different zones exhibited significantly different lactation curves. In general, 76.75 % of the study period had temperature humidity index (THI) above 72 in the herd locations. We compared repeatability models with RRMs with Legendre polynomials. From the REML log-likelihood lower order polynomials were preferred to more complex models. Identification and selection of well adapted cattle will not only improve production under heat stress conditions but will also require fewer inputs and environmental interventions.

Keywords: Dairy cattle, Heat stress, Test-day milk yield

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