Session 3: Breeding for Resilience to Climate Change: Adaptation strategies.

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MODELLING OF GENETIC HEAT TOLERANCE IN ITALIAN HOLSTEIN COWS

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Heat stress is one of the limiting factors in dairy production in hot climates. The combination of ambient temperature and relative humidity might be above the thermo-neutral zone of the dairy cattle causing heat stress. The interest of our study is to investigate if heat stress results in different effects on Italian Holstein performance due to genetic differences in heat tolerance. Heat stress was modelled by using data from 137 weather stations, distributed across the national territory. Daily maximum temperature and relative humidity were collected from 1994 till now. Geographical coordinates and altitudes from all weather stations and from the community of the farm were available. Distances between weather stations and farms were computed. Milk test day records were linked with the nearest weather stations within 80 km. Weather stations more than 500 m above or below the farm were omitted. Weather estimates for the farm were computed as a weighted average for the geometric center of the chosen weather stations accounting for the distance from the farm. The average distance between the weather stations and the farms was 13.5 km. The aim of this study was to determine if a threshold of temperature-humidity index (THI) is evident for several production and udder health traits including, milk, fat, protein production (kg/d) and somatic cell score, in Italian Holstein dairy cows. Because longer periods of heat stress might have a more severe effect than shorter periods an average of 7-days weather data measurements has been considered (THI-$_{7D}$). For this study we sampled 3 times from the whole Italian population 100 herds with average of 609011 records belonging to 40009 cows in the period 2003-2021. Using a single trait repeatability model, a heat threshold was determined for each trait based on the point that the average adjusted yields started to decrease, which were 75, 55, 61 and 68, respectively for milk, fat, protein, and somatic cell score. Fixed regression analyses were based on a model that included herd-year season of recording, days of milk, parity, age at first calving, year by season of calving and THI as fixed effects. Random effects were the permanent environmental effect of the cow, the animal additive genetic effect of general production and heat tolerance and the residual error. Additive genetic components of general production and heat tolerance were estimated together using the same model as above except for the interaction between the animal and the THI-$_{7D}$. The last algorithm is the one determining the antagonism between the animal and the environment. Correlations between the general genetic merit of “performance” (in the absence of heat stress) and heat tolerance genetic merit of performance traits were moderate and negative. Results highlight that selecting only for genetic merit with no consideration of heat tolerance might negatively affect performances in hot and humid environments. Based on these results a selection index for heat tolerance is now available for the Italian Holstein population..