# Genetic studies on heat stress in dairy cattle in Kenya

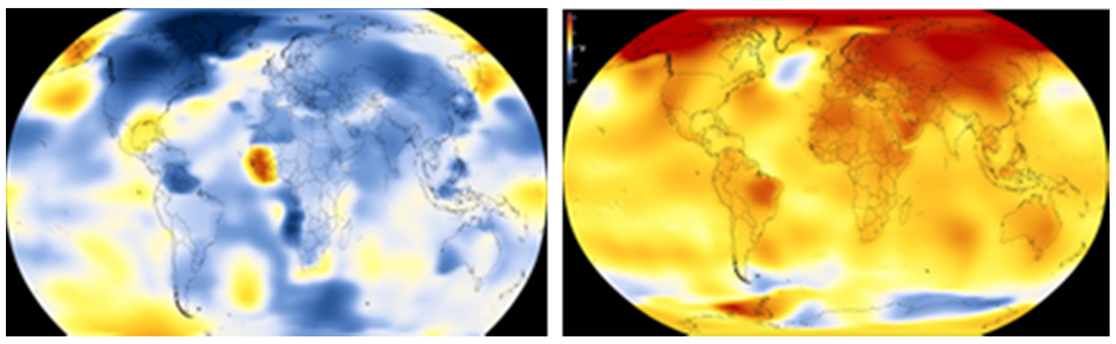
**Jackson M. Mbuthia, Manfred Mayer and Nobert Reinsch**

FBN / Wilhelm-Stahl-Allee 2 / 18196 Dummerstorf / www.fbn-dummerstorf.de

Institute of Genetics and Biometry

## Background

Heat stress has become a global issue



*Source: NASA's Scientific Visualization Studio

Progression of global surface temperatures from 1884-2017 indicate increasing heat

Meteorological factors influence the performance, welfare and health of livestock

Environmental and diet modification in heat stress management are expensive

Genetic selection for heat tolerance is long term and sustainable

Accurate estimates of genetic parameters are a prerequisite for genetic improvement of milk yield

## Materials and Methods

Data on milk performance and pedigree records were obtained from the Kenya Livestock Breeders Organization and Livestock Recording Centre

38,216 first lactation test-day milk yield records for Friesian cows distributed across 189 herds

Herds' locations characterized into agro-ecological zones which provide a standardized climate, soil and terrain

Weather information was obtained from the NASA Prediction of Worldwide Energy Resource (POWER) Project (https://power.larc.nasa.gov/data-access-viewer/)

Temperature Humidity Index (THI) as the indicator for heat stress was calculated as;

$$\mathrm{THI} = (1.8\ \times \mathrm{T} + 32) - (0.55 - 0.0055 \times \mathrm{RH}) \times (1.8 \times \mathrm{T} - 26)$$

where; T is temperature ($^0$C) and RH relative humidity (%)

The effects of THI for each of the 4 days before the test-day record was investigated

Data were analyzed using Random Regression Models;

$$y_{ijklmo} = \mu + HYM_i + CS_j + THI_k + \sum_{n=1}^{3} Z_n AEZ_l + \sum_{n=0}^{3} Z_n a_m + e_{ijklmo}$$

where; $\mu$ = the intercept; $HYM_i$= herd-month-year of test day; $CS_j$ = calving season (j=1-4); $THI_k$ = Temperature Humidity Index; $AEZ_l$ = agro-ecological zone (l= 1-3); $Z_n$ = the $n^{th}$ order Legendre polynomial corresponding to DIM at test; $a_m$ = random regression coefficients of animal effects; $e_{ijklmo}$ = residual error

## Objectives

To investigate individual genetic and environmental variations of heat stress for test-day milk yield of Friesian cattle in Kenya

## Results

| | Mean | Minimum | Maximum |
|---|---|---|---|
| **Average daily temperature** | 18.5±1.8 | 13.2 | 25.8 |
| **Temperature Humidity Index** | 63.8±2.4 | 55.9 | 72.1 |

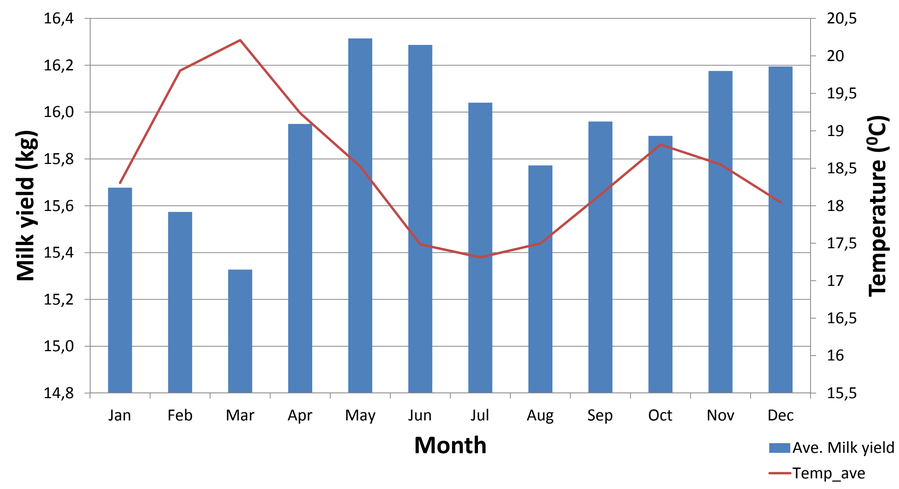



Figure 1. Average milk yield and average daily temperature across months were generally negatively correlated

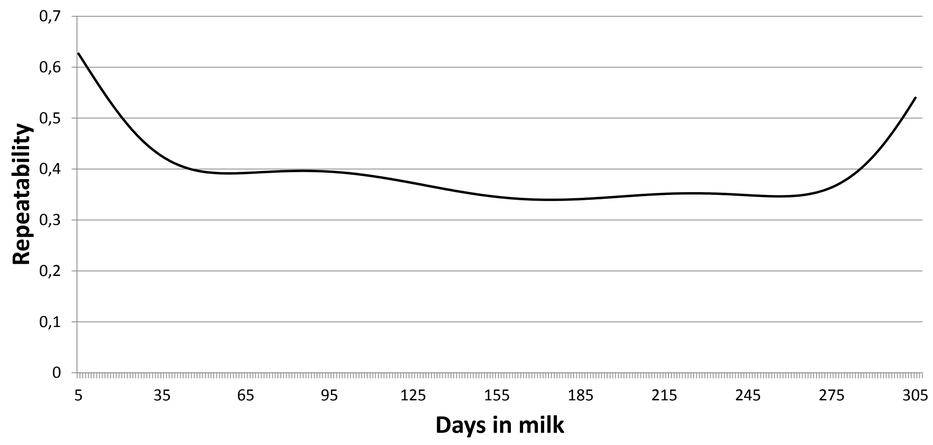



Figure 2. Repeatability estimates for first lactation milk yield of Friesian were not influenced by inclusion of THI

## Conclusions

Repeatability estimates ranged from 0.34 to 0.63

Average daily temperature and THI do not reach heat stress thresholds that can impact milk yield of Friesian cows at national evaluation level

Inclusion of THI as indicator of heat stress did not improve the estimation of genetic effects that affect milk yield

It is expected that Friesian cows in Kenya with an average 16kg/day milk have lower metabolic processes and therefore suffer less heat stress

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