

# Genetic analysis of heat tolerance in crossbred dairy cattle performing in sub-Saharan Africa

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## Background

- ❖ Climate change-induced heat stress significantly impacts dairy production in Sub-Saharan Africa (SSA)
- ❖ Studies on genetic improvement for resilience in dairy cattle to rising temperatures are limited
- ❖ Specific indicators for heat tolerance in animals raised under SSA's production systems have not yet been established

**Objective:** To investigate the response of milk production of crossbred cows to high heat loads as a measure of their tolerance to changing climates

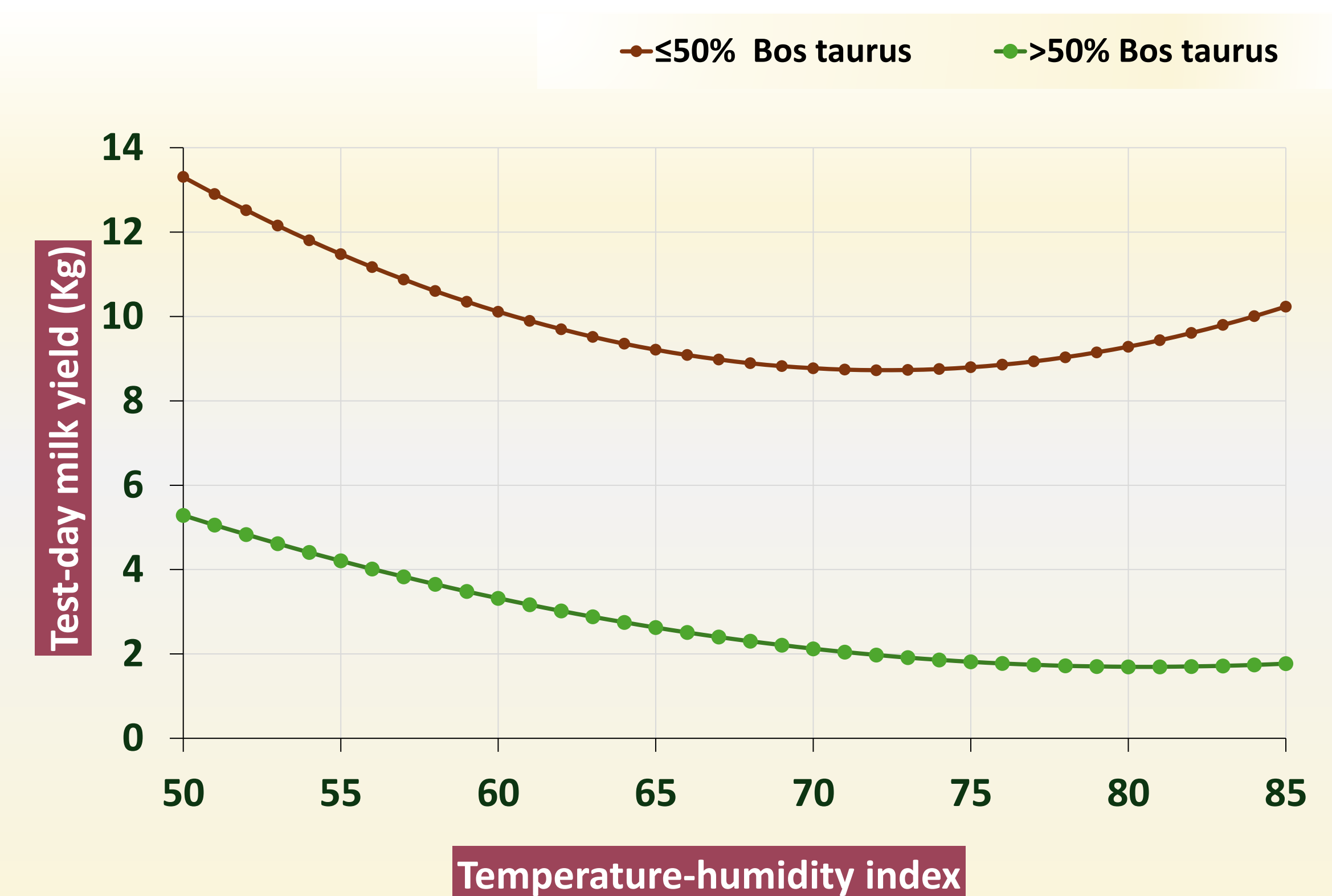


## Methodology

- ❖ Temperature-Humidity Index (THI) was used to measure heat stress
- ❖ 65,261 first-parity test-day milk yield records were obtained from 1,547 crossbred cows in Kenya
- ❖ Random regression models with reaction norm functions were used to evaluate heat tolerance
- ❖ The intercept of the reaction norm model represented the mean milk production of each cow
- ❖ The reference THI value for heat stress was set to THI 80 and two resilience indicators defined as:
  - 1. Slope:** Directional change in milk yield due to heat stress
  - 2. Absolute:** Stability of milk production during heat stress
- ❖ Genetic parameters for resilience indicators were estimated using animal models

## Results

- ❖ Cows with  $\leq 50\%$  *Bos taurus* genes showed the highest thermotolerance
- ❖ Heritability estimates for Intercept, Slope and Absolute were  $0.20 \pm 0.05$ ,  $0.25 \pm 0.05$  and  $0.12 \pm 0.05$ , respectively
- ❖ A high negative correlation between Slope and Intercept ( $-0.93 \pm 0.02$ ) showed that higher milk producing cows have a higher decline in milk yield under heat stress
- ❖ A moderate positive correlation between Intercept and Absolute ( $0.63 \pm 0.19$ ) revealed that lower milk producing cows have a more stable production profile under heat stress conditions



The population reaction norm showing the change in test-day milk yield in response to the temperature-humidity index for different breed groups of cows in the study

## Conclusions

- ❖ *Bos indicus* genes confer heat tolerance advantage in dairy cattle
- ❖ Heritability estimates indicate that the slope of the reaction norm and its absolute value have the potential to quantify heat tolerance in cattle
- ❖ These results suggest the potential for improving heat tolerance of dairy cattle through genetic selection

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