Physiological and production responses of Tunisian Holsteins cows under heat stress conditions

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Dairy sector

- Genetic resources: majority Holsteins 95%

- Low adaptive capacity of high-yielding breed

(Rekik et al., 2003; Hammami et al. 2008)

- No practical routine genetic evaluation

Climate conditions

- Temperature above the thermo-neutral zone (5 months: 24°C in average)
- Climate change: Increase in average T °

(GTZ, 2007)

→ Adaptation strategies are needed

- ✓ Including resilience to HS in breeding programs
- ✓ Phenotypes related to HS

Objective

- ✓ Describe HS response for production and physiological traits in commercial farms
- ✓ Identify resilience phenotypes to HS

Experimental site

Thermo-neutral
20 cows/farm
T (°C): 7 to 17
HR (%) : 44 to 94

Heat stress
20 cows/farm
T (°C) : 24 to 35
HR (%) : 21 to 64

Recorded parameters


Temperature and relative humidity : Data logger


Respiration rates (breaths/min) : visually counting


Skin temperatures (°C) : infrared temperature gun


Rectal temperatures (°C) : digital thermometer


Milk yield and samples

Statistical analysis

- Population response: Mixed models
- Individual response: Reaction norm model

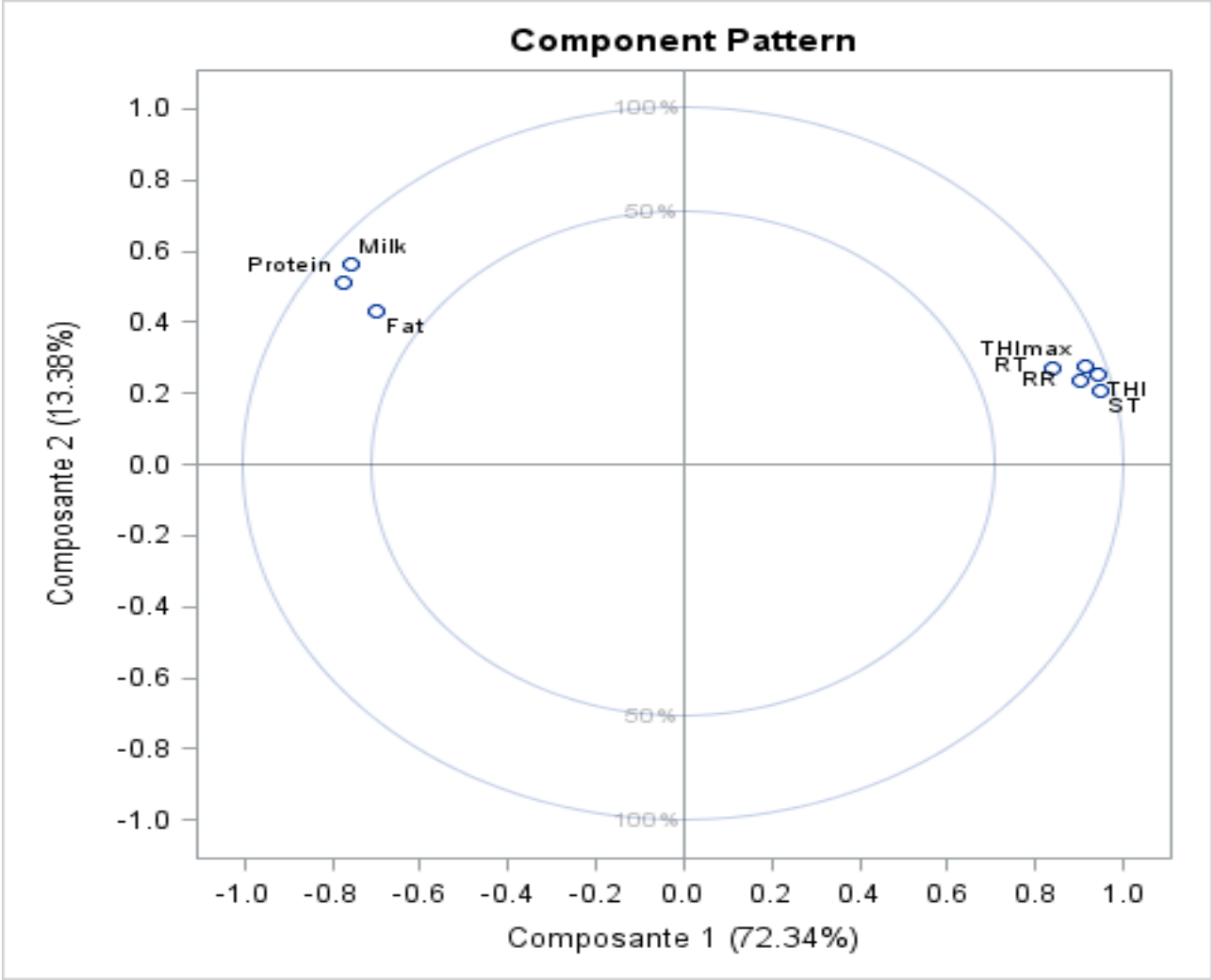
Results

❖ Population Response

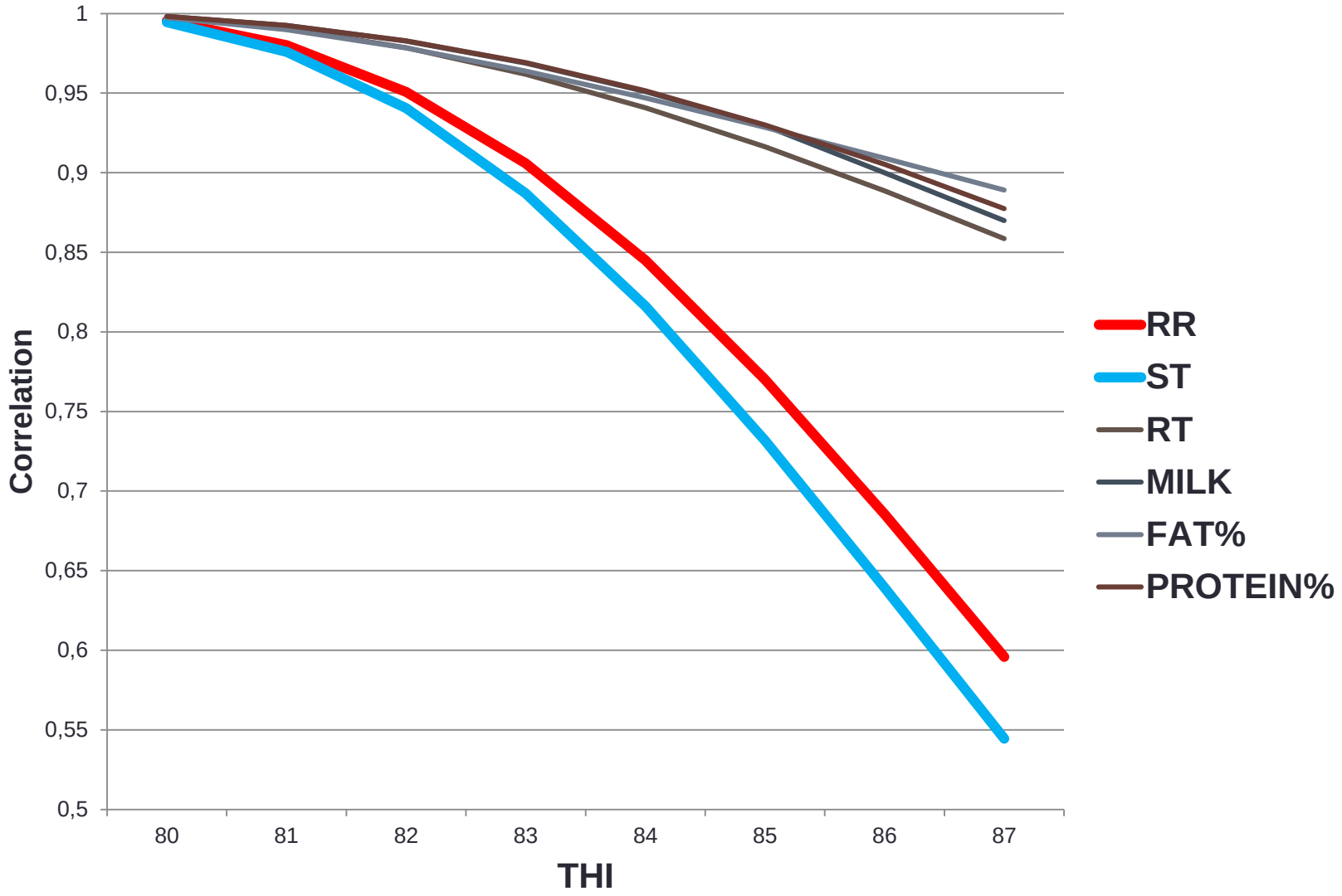
Least squares means values of production and physiological traits for dairy cattle

Traits	Thermo-neutral	Heat stress
Physiological traits		
Respiration rate (breaths/min)	26.2[a]	61.0[b]
Skin temperature (°C)	28.5[a]	37.7[b]
Rectal temperature (°C)	38.3[a]	39.3[b]
Milk trait		
Milk (kg)	8.4[a]	6.5[b]
Fat (%)	30.3[a]	17.9[b]
Protein (%)	27.5[a]	19.6[b]

❖ Population Response

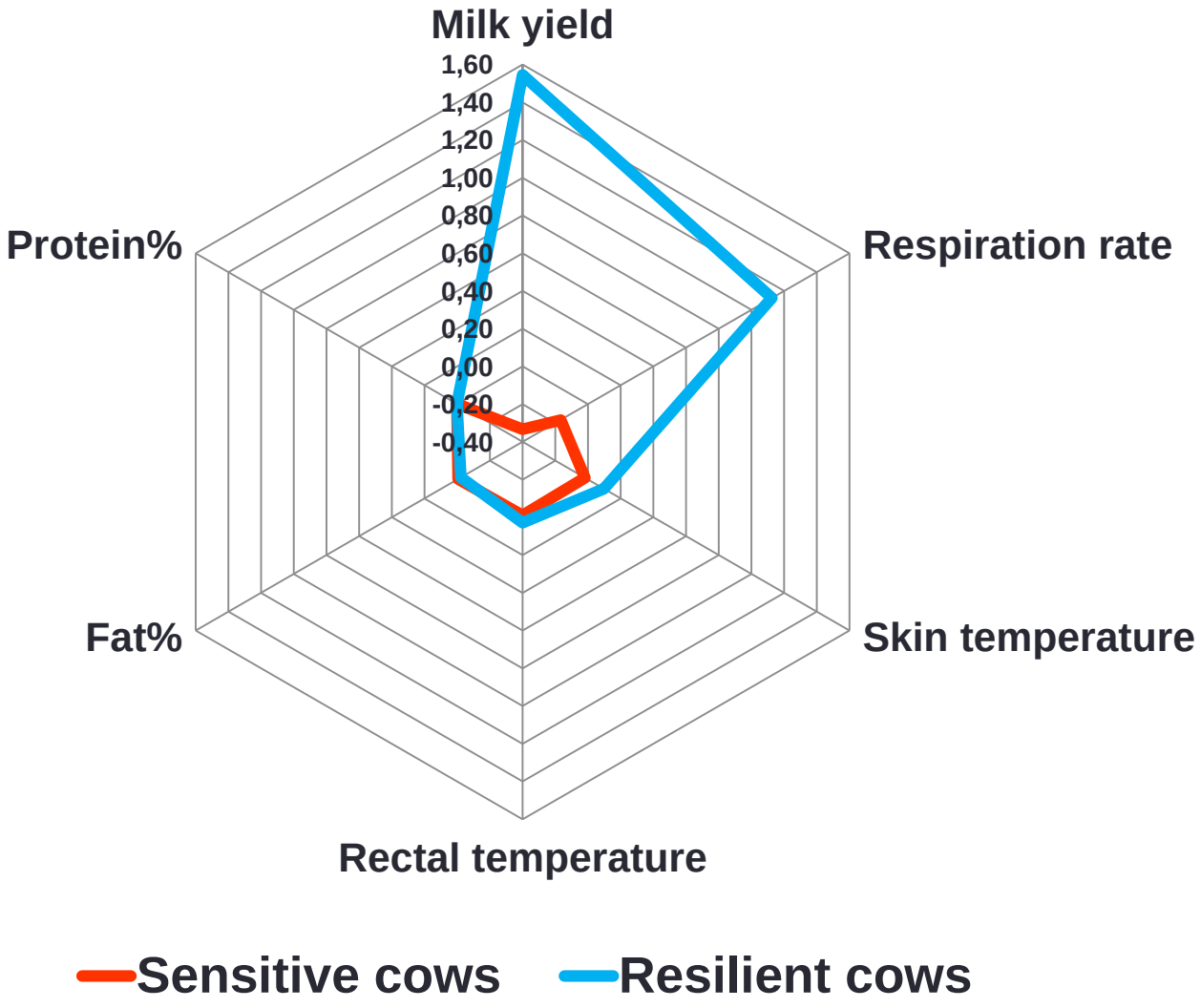


❖ Individual Response



❖ Individual Response

Individual deviations of slope from the overall population response



Conclusion

- Physiological traits ST and RR should be considered as good indicators to quantify the HS level of dairy cows in Tunisia
- At certain extreme level of THI, the RR becomes a good indicator for the ability of animals to dissipate heat
- In the perspective, this study will be continued to identify novel biomarker in milk that could be highly correlated to RR and ST.

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Thank you for your attention

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Statistical Analysis

- Population response to heat stress

$$Y = \text{Fixed effects} + P + \text{Anim} + e$$

- Principal component analysis (PCA)

- Individual responses to heat stress

$$Y = \text{Fixed effects} + a_0 + a_{hs} f(j) + e,$$

Where a_0: intercept (TN) a_{hs}: slope (HS)

- Hierarchical classification analysis (HCA)