Western Cape Government

FOR YOU

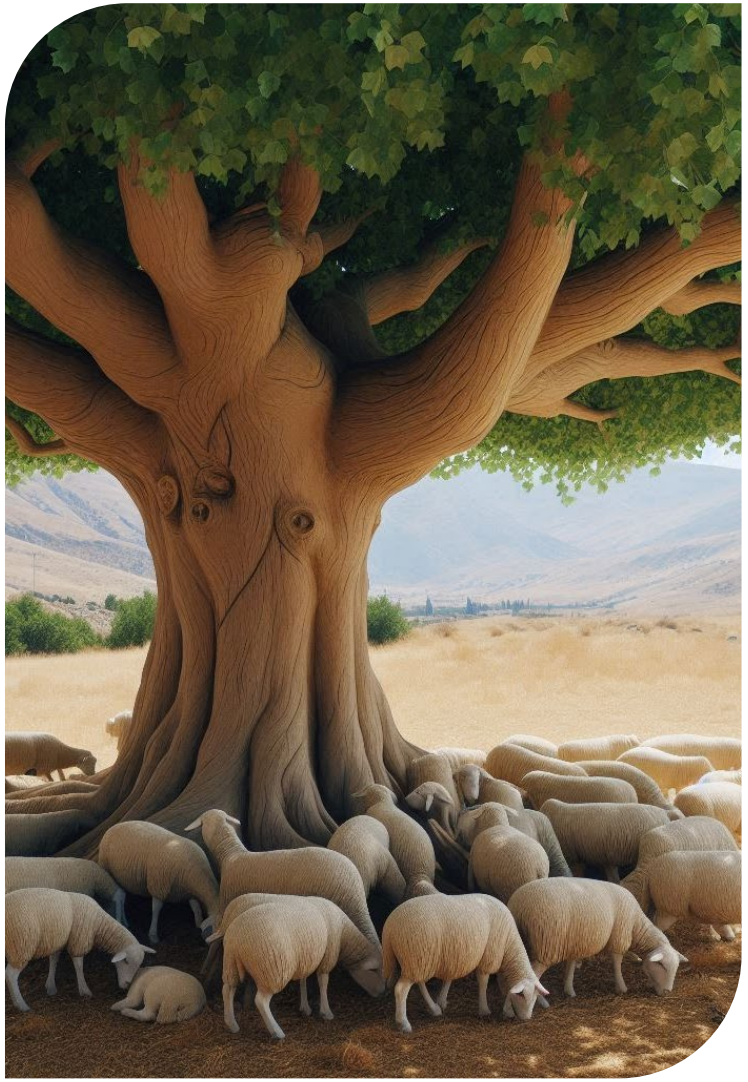
Tree shade reduces heat stress in pregnant ewes – preliminary results

K. Mafunga, A. J. Scholtz, K. Dzama, S. W. P. Cloete

EAAP: 01-05 September 2024

BACKGROUND

- In South Africa, sheep are mostly raised in harsh environments where they face challenges from extreme temperatures and intense solar radiation
  - ✓ *There are more incidences of heat stress during the hot summer*
- Several strategies of mitigating heat stress
  - ✓ *Change the environment or change the animal*
- Tree shade is one viable option: sustainable strategy



Study question

Does access to tree shade influence heat stress indicator traits in ewes during late pregnancy?

METHODOLOGY

Study site

- Study site: Elsenburg Research Farm, Western Cape, South Africa
- Warm temperate climate
  - ✓ *Hot, dry summer + Cool, wet winter*
- Research on sheep one of the mandates
  - ✓*Three sheep breeds: Merino, SA Mutton Merino, and Dormer*
- Sheep raised under extensive system, on irrigated pastures
  - ✓*Dedicated mating and lambing paddocks : 0.4 ha*
- There are two lambing seasons: Autumn (Mar and Apr) and Winter (Jun and Jul)

METHODOLOGY

Study animals

- Dormer and South African Mutton Merino (SAMM) late-pregnancy ewes
  - ✓*Both South African bred*
- The animals were selected from the flock at the farm
- Ewes were shorn before allocation to treatments
- Brought to lambing paddocks – at least 14 days before lambing

METHODOLOGY

Trial - A

- 50 Dormer and 33 SAMM ewes
  - ✓*50 ewes in paddocks with access to shade (SH*
  - ✓*33 ewes in paddocks with no shade (NS)*
- Data collected:
  - ✓*Pregnancy status (1; 2; 3)*
  - ✓*Rectal temperature (RT) and Respiratory rate (RR) – 12h00 to 14h00*
  - ✓*Data collected on three different days*

Trial - B

- 101 Dormer and 65 SAMM ewes
  - ✓ *88 in paddocks with access to shade (SH)*
  - ✓*78 in paddocks with no shade (NS)*
- Data collected:
  - ✓*Pregnancy status (1; 2; 3)*
  - ✓*Wool samples for cortisol extraction*
    - *Cortisol: - steroid hormone associated with stress*

METHODOLOGY

Weather data

- Microclimate - Tinytag® data loggers used
- Macroclimate – Elsenburg Weather Station
- Daily measurements of:
  - ✓ *Temperature*
  - ✓ *Relative humidity*
- Temperature humidity index (THI) calculated (Marai *et al.*, 2001):

$$THI = db°C - [(0.31 - 0.31RH) \times (db°C - 14.4)]$$

Where: *db°C = dry bulb temperature (°C)*
RH = relative humidity (RH%)/100

< 22.2	absence of heat stress
22.2 to < 23.3	moderate heat stress
23.3 to < 25.6	severe heat stress
≥ 25.6	extreme severe heat stress

Cortisol concentration estimation

- Cortisol concentration (CC) from the wool samples was estimated using:
  - *DetectX® Cortisol Enzyme Immunoassay Kit*
  - *MyAssays® Desktop software (version R10.2)*

STATISTICAL ANALYSIS

- Two-sample t-test for climatic data using R
- GLM for effects of fixed factors on RR, RT and CC (ASReml)

Fixed factors

- ✓ Breed
- ✓ Pregnancy status
- ✓ Shade treatment
- ✓ and Interactions

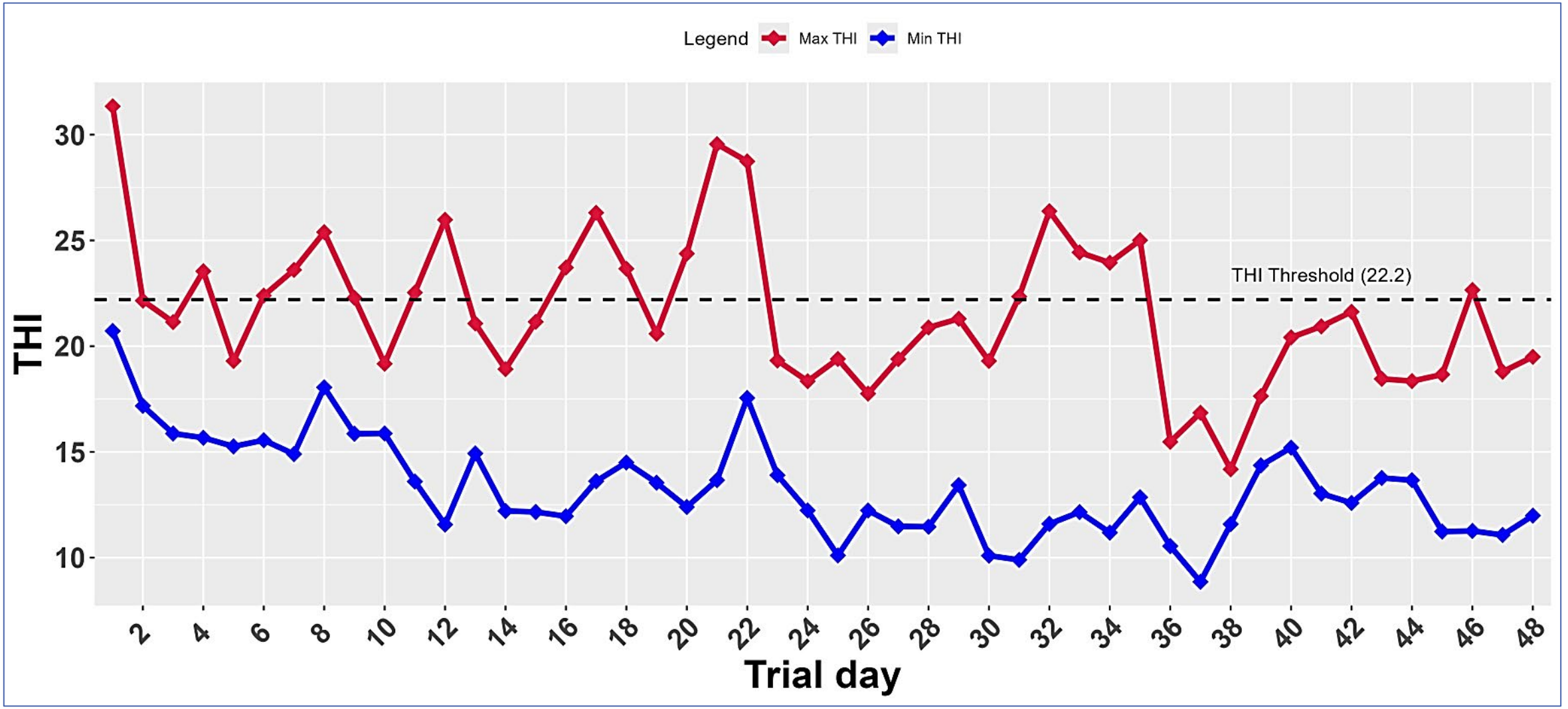
RESULTS : Two-sample t-test for micro-climatic data

Climate trait	Shade (mean)	No shade (mean)	T-value
Maximum ambient temperature (°C)	21.9 ± 4.1	23.6 ± 4.60	-13.40**
THI at maximum ambient temperature	20.7 ± 3.15	21.9 ± 3.45	-13.68**
Minimum ambient temperature (°C)	13.3 ± 2.10	12.9 ± 2.60	3.33**
THI at minimum ambient temperature	13.3 ± 2.05	12.9 ± 2.49	3.68**
Average temperature	17.2 ± 2.80	17.4 ± 3.00	-3.16**
THI at the average temperature	16.9 ± 2.43	17.1 ± 2.59	-3.10**

** p < 0,01

Western Cape Government

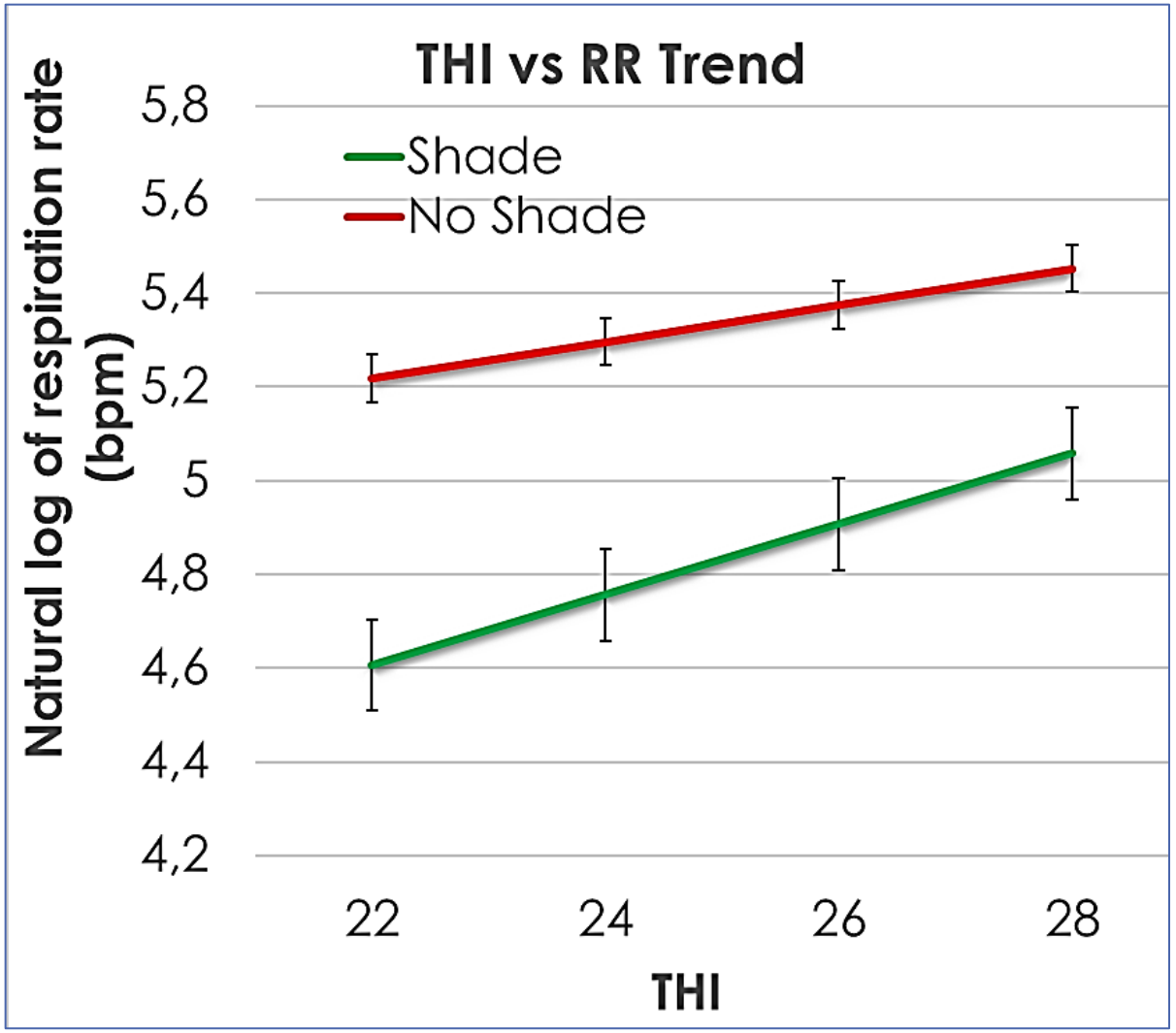
RESULTS : Ave THI pattern over the study period

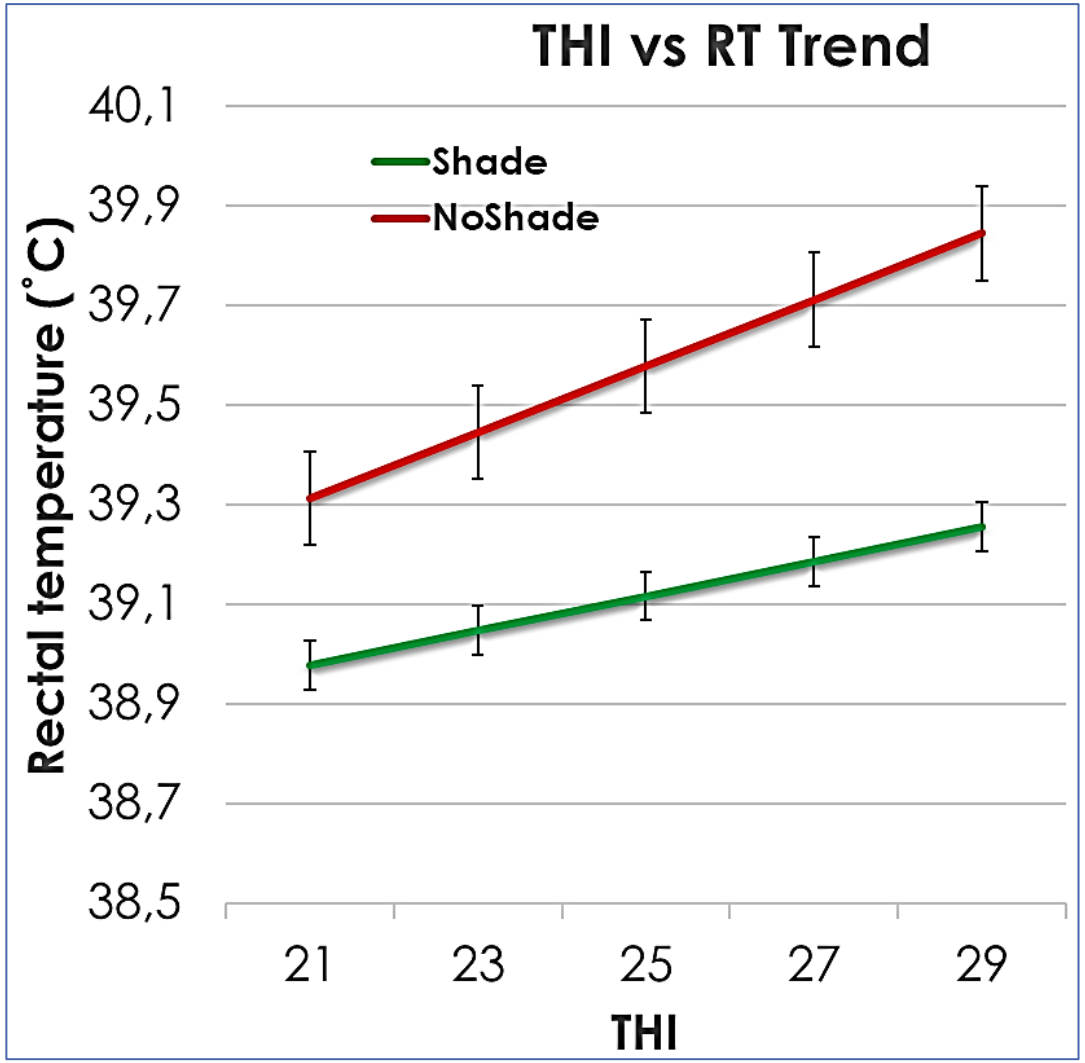


RESULTS : Effect of treatment, breed and pregnancy status on RT, RR, and CC

Effect	Rectal temperature (°C)	Respiratory rate (breaths/min)	Cortisol conc (pg/mg)
Treatment:			
Shade	39.1 ± 0.0	118 ± 4.4	2.80 ± 0.2
No shade	39.6 ± 0.1	204 ± 7.6	3.23 ± 0.2
P - value	***< 0.01***	***< 0.01***	***0.06***
Breed:			
Dormer	39.4 ± 0.1	168 ± 6.8	2.85 ± 0.1
SAMM	39.3 ± 0.1	149 ± 5.7	3.18 ± 0.2
P - value	*0.19*	***< 0.05***	0.13
Pregnancy status:			
Singles	39.4 ± 0.1	158 ± 6.5	2.81 ± 0.2
Multiples	39.4 ± 0.1	159 ± 6.1	3.22 ± 0.2
P - value	*0.18*	*0.99*	*0.19*

RESULTS : THI vs Respiratory rate (L) and Rectal temperature (R)





CONCLUSIONS & RECOMMENDATIONS

- Natural tree shade moderates the microclimate and reduces heat stress
- Wool cortisol has potential for use as a heat stress indicator trait
  - ✓ *The results indicate that the animals were exposed to some level of stress*
- Further research:
  - ✓ *Using larger sample sizes, and over longer time to increase precision*
    - *For estimation of repeatability values*
  - ✓ *Using automated monitoring tools*

Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT

Western Cape Government
FOR YOU

Wes - Kaap
LANDBOUNAVORSINGSTRUST

Western Cape
AGRICULTURAL RESEARCH TRUST

IT 4056/98
VAT/BTW nr 4660196397

P O Box/Posbus 80
Elsenburg 7607

Room/Kamer nr 13
Institute Animal Production/Instituut Diereproduksie
ELSENBURG

Tel: 021-8085233
Fax/Faks: 021-8085314

Thank you