RESPONSES TO A HEAT STRESS EPISODE IN LACTATING SAANEN AND ALPINE GOATS

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INTRODUCTION

- Heat stress is now a global issue
- European breeds are facing unprecedented heat waves
- Wide range of physiological responses to heat
- Marked breed differences

OBJECTIVE

- To evaluate the response of Saanen and Alpine lactating does to a natural heat episode that occurred in France (June 2010)

MATERIALS AND METHODS

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- 8 Alpine and 8 Saanen does, 160 DIM
- TMR, milking and feeding twice daily.
- Two periods:

June 17-22, 2010 vs. June 26-July 1, 2010

- Data collected: Feed and water intake, milk production, milk fat and protein, blood chemistry and gas composition, THI (West, 1994).

RESULTS & DISCUSSION

Table 1. The temperature humidity index during the control (Period 1) and heat stress (Period 2) period.

	Period 1	Period 2	SEM	Period effect
THI9	61.9	**68.0**	0.81	0.0007
THI13 30	63.1	**71.9**	0.77	<0.0001
THI17	64.5	**73.9**	0.62	<0.0001

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- THI in period 2 at upper limit of comfort zone (THI =72, West 1994)

Table 2. Changes in physiological parameters of lactating goats during the control (Period 1) and heat stress period(Period 2) .

	Period 1	Period 2	SEM	Period (P value)
Rect. Temp. °C	38.6	**38.9**	0.04	<0.0001
Water drunk (mL/kg BW)	105	**146**	2.0	<0.0001
Urea (g/L)	0.249	**0.269**	0.0059	0.02
Na+ (mmol/L)	142.3	143.0	0.04	0.06
pCO2 (mmHg)	**43.6**	40.6	0.10	0.03
HCO3- (mmol/L)	**27.6**	25.5	0.08	0.04

- RT & water intake higher in period 2 ⇒ heat stress
- Higher Urea & Na^+ in period 2 ⇒ some dehydration
- Water probably lost to evaporative cooling
- Lower pCO_2 and HCO_3 period 2 ⇒ hyperventilation for cooling

Table 2 ctd. Changes in physiological parameters of lactating goats during the control (period 1) and heat stress (period 2) period.

	Period 1	Period 2	SEM	Period (P value)
Dry Matter Intake (g/kg BW)	46.7	47.4	0.33	0.16
Glucose (g/L)	**0.582**	0.569	0.0040	0.03
NEFA (μmol/L)	149	134	1.2	0.07

- Feed intake maintained in period 2
- ↘Glucose ⇨ energy intake deficiency

⇏

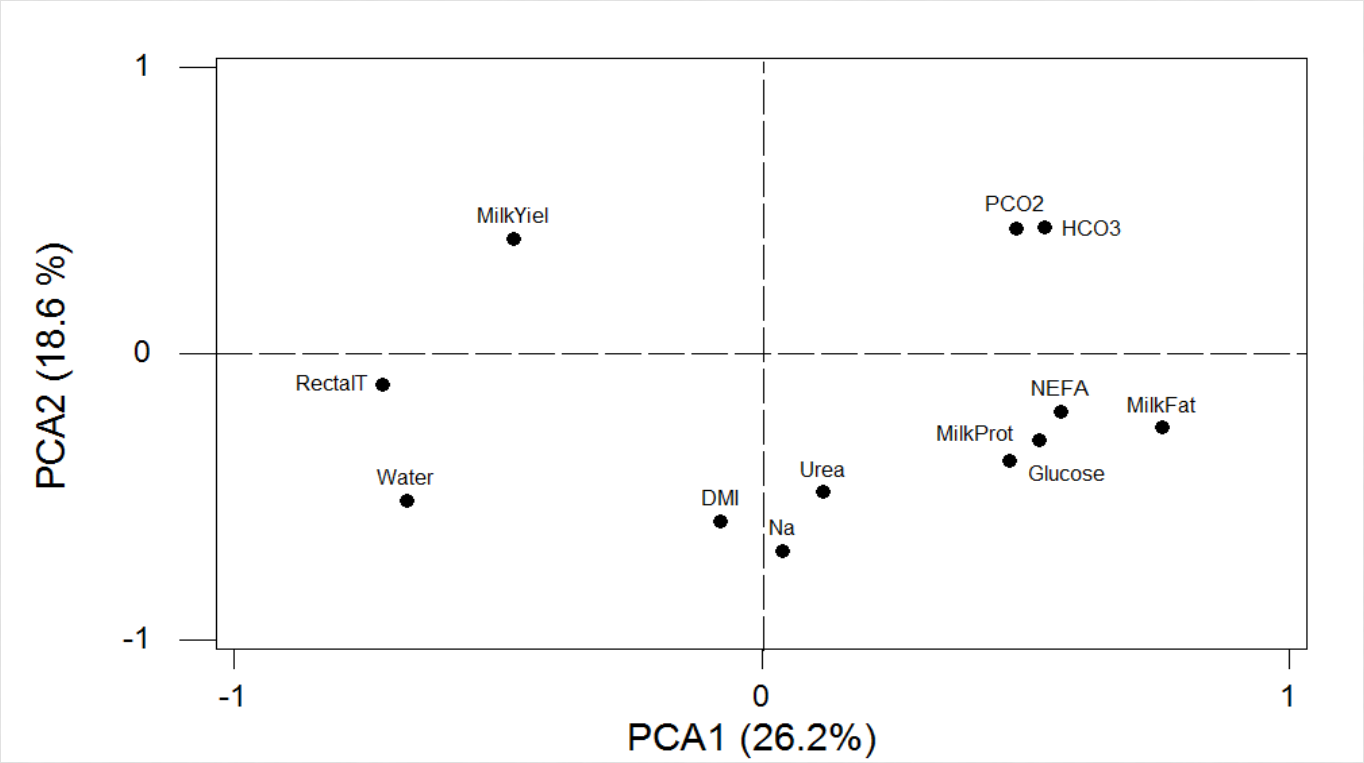
- ↘NEFA ⇨ positive energy balance
- All values within normal range ⇨ individual variability and natural fluctuations

Table 3. Changes in milk production and composition of lactating goats during the control (Period 1) and heat stress (Period 2) period.

	Period 1	Period 2	SEM	Period (P value)
Milk yield (kg/d)	3.62	3.69	0.029	0.10
Fat content (g/kg)	**33.5**	30.3	0.09	0.04
Protein content (g/kg)	**31.6**	31.2	0.07	0.0002

- Milk production was maintained probably due to the availability of *ad libitum* water
- Milk fat and protein dropped as in literature (Hamzaoui et al., 2012)

Figure 1. Results of a principal component analysis based on the mean values per goat-period combination for 12 variables.



- 45% of variance explained by the first 2 components

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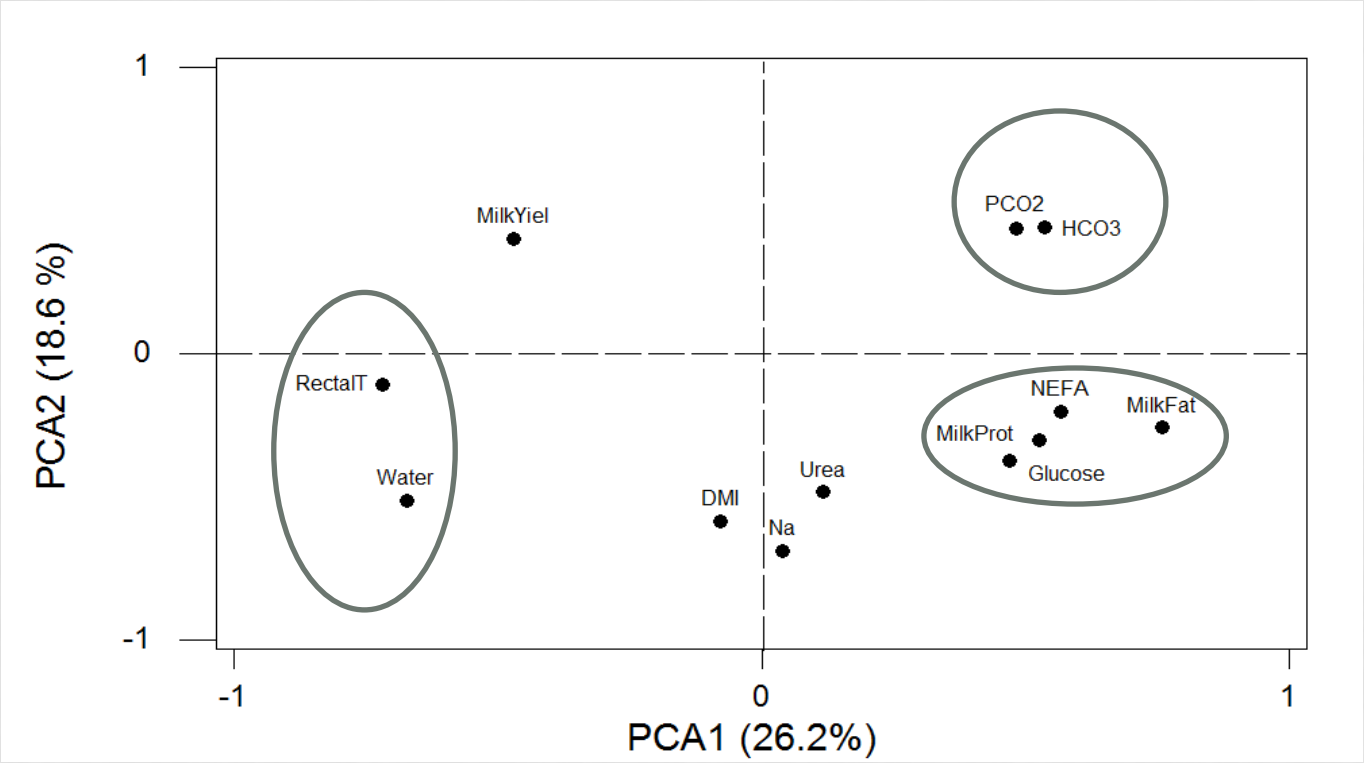
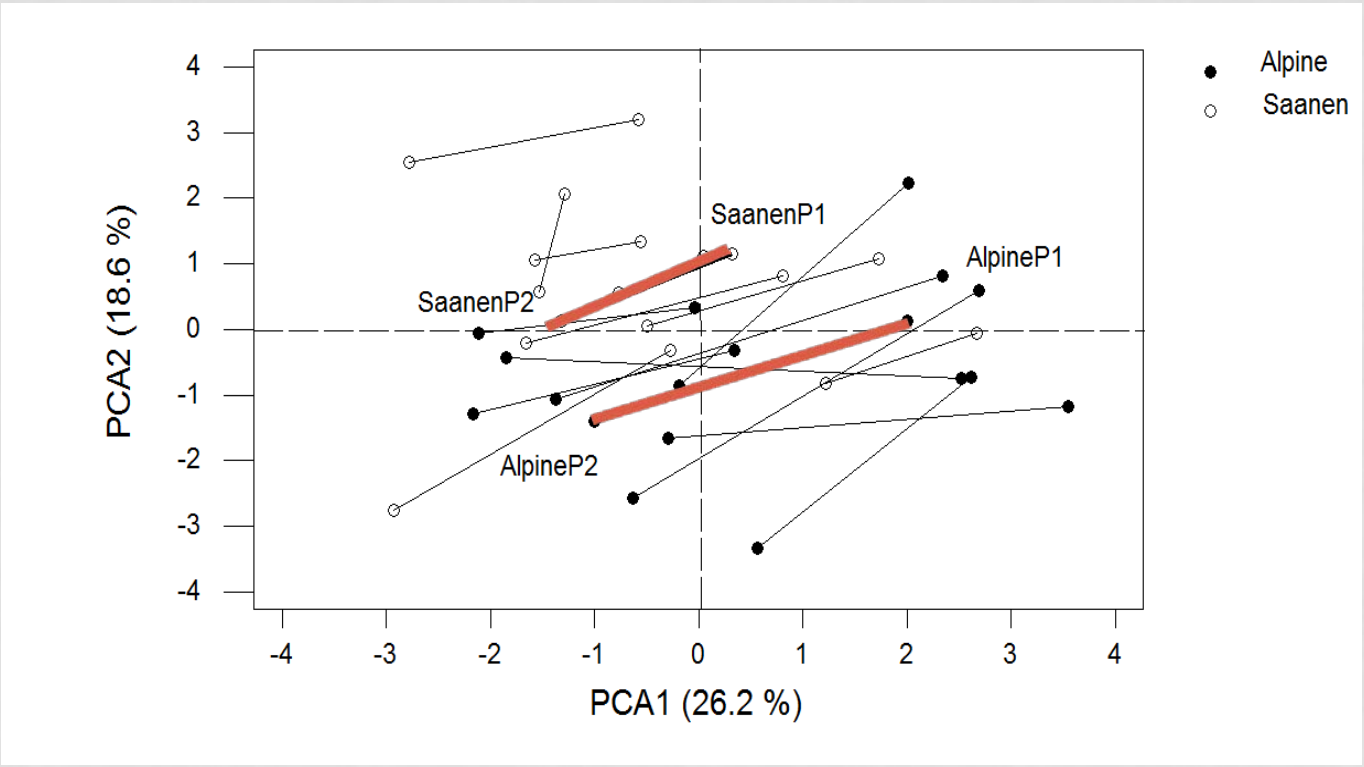


- 45% of variance explained by the first 2 components
- ↗ Ambient temperature ⇒ ↗ RT & water intake
  ↘ milk components & PCO_2

Figure 2. Results of a PCA based on 12 variables presented as a score plot of 16 mid-lactating dairy goats from either Saanen or Alpine breeds.



- The breed x period effect was not significant
- Two parallel lines for the breeds ⟹ different values but similar response pattern

CONCLUSION

- Although the animals were born and raised under a temperate climate, they could handle a short heat wave with minimal physiological disturbances.
- The effect of longer heat stress episodes on such breeds warrants further research.

THANK YOU!

STATISTICAL MODEL

- Mixed procedure for repeated measures (SAS, 2000) including the main effects of the period and goat as well as their interaction.
- For temperature and humidity only the effect of period was tested.
- PCA: relative effect of period (control vs. heat) and breed (Saanen vs. Alpine) over 12 variables

REFERENCES

- West, J.W. Interactions of energy and bovine somatotropin with heat stress. Journal of Dairy Science 1994; 77:2091-2102.

- Hamzaoui, S., Salama, A.A.K., Caja, G., Albanell, E., Flores, C., Such, X. Milk production losses in early lactating dairy goats under heat stress. ADSA-AMPA-ASA-CSAS-WSASAS Joint Annual Meeting, July 15-19,2012, Phoenix, Arizona, Oral presentation #684.