Nighttime cooli… …es milk yield of … …te exposed to … heat stress

Cancelled
session finished

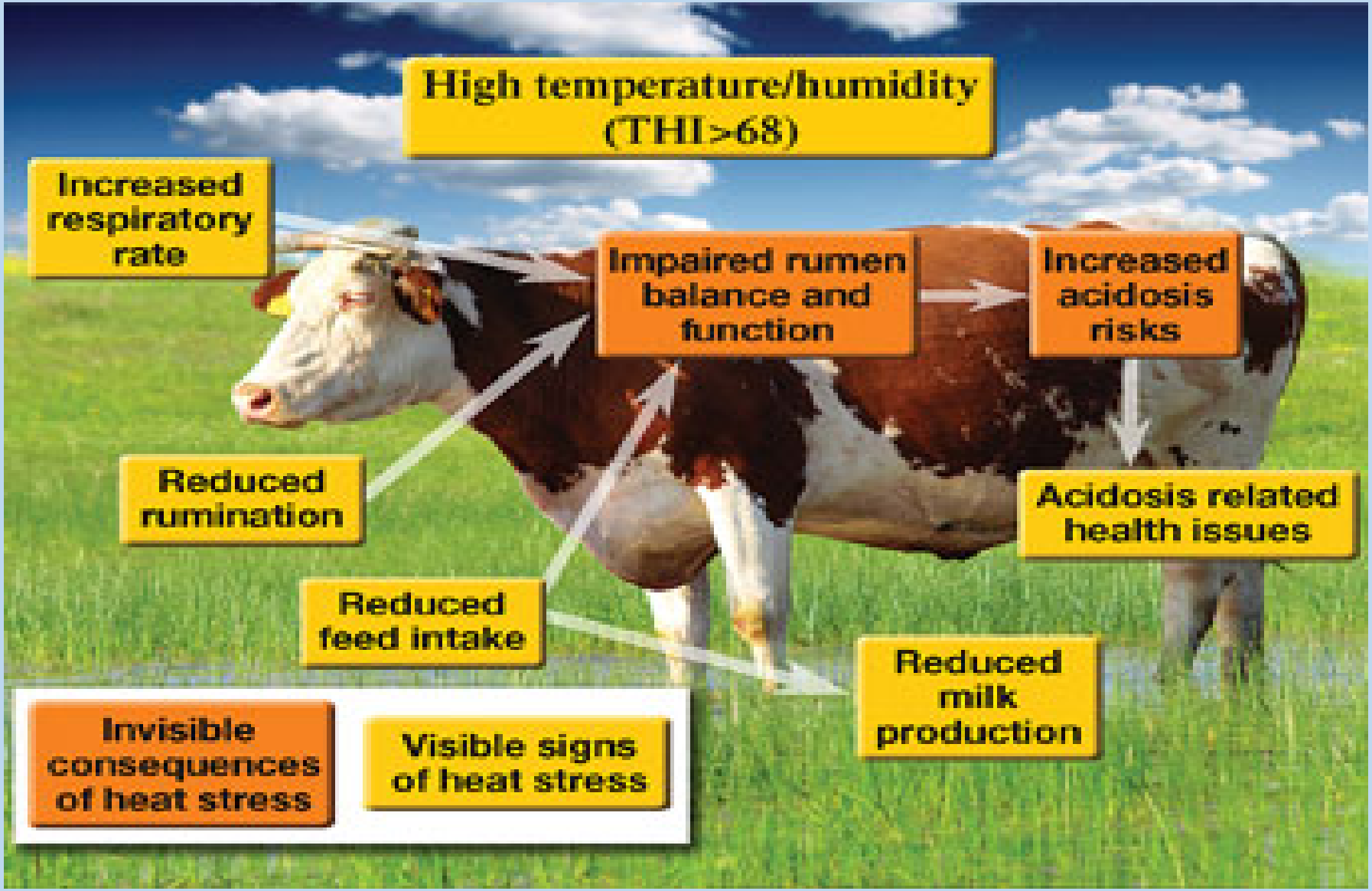
Ugur Serbester, Serap Goncu, Murat Gorgulu

Department of Animal Science Agriculture Faculty

Cukurova University, Adana, Turkey

Background

Effects of heat stress

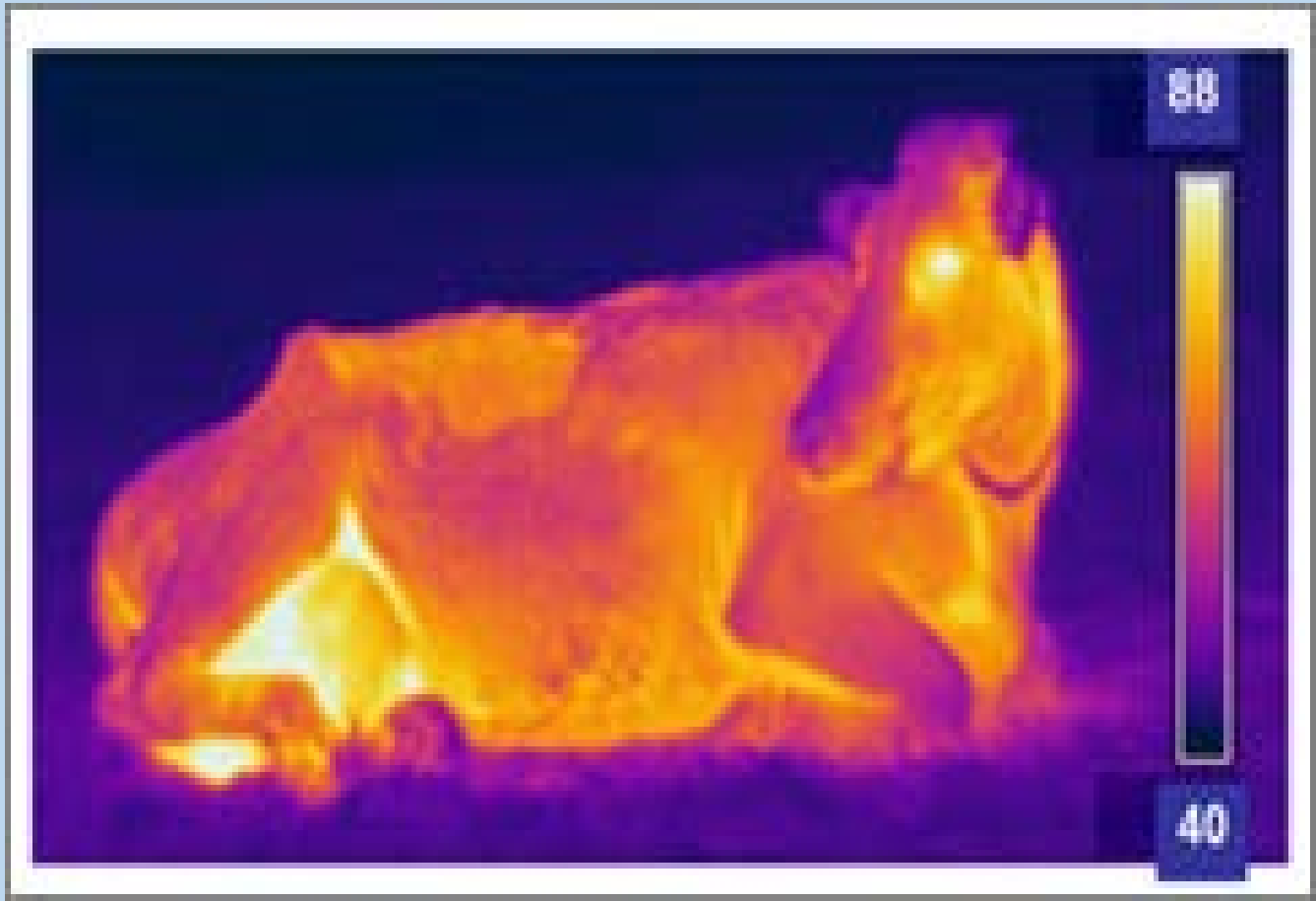


Basic management schemes for reducing the effects of heat stress;

- ✓Genetic development of breeds that are less sensitive to heat,
- ✓Nutritional management,
- ✓Physical modification of the environment (especially fans, sprinklers, etc.)

Fans, sprinklers and a combination of misters and fans, and nutritional modification have all been the focus of research on reducing heat stress and subsequent reductions in feed intake and milk production in lactating cows in a hot environment (West, 1999; 2003).

The body temperature of ruminants is higher during the day than at night (Sunagawa ve ark. 2015). The efficiency of body heat dissipation is dependent upon the difference in the temperature of the surface of the body and the ambient temperature.



It is thought that decreases in milk production of dairy cows in hot and humid environment may be reduced effectively by nighttime cooling when heat producing activity of the day is reduced and body heat is more readily transferred to the surface of the body for dissipation.

Objective

- In order to prove this hypothesis, this research compared the effects of both daytime and nighttime cooling periods on performance, milk composition and physiological parameters of dairy cattle.

Materials and methods

Two experiments were conducted.

Parameters	Daytime cooling (Experiment I)	Nighttime cooling (Experiment II)
Animals (head)	28 Holstein dairy cows	28 Holstein dairy cows
Parity (lactation)	2.6±0.84	2.9±1.24
Daily in milk (day)	123.9±37.64	141.3±52.51
Body weight (kg)	552.0±46.9	568.4±54.08
Milk yield	29.0±4.08	30.7±3.68

Treatments

- ✓Treatments were identical in both of the experiments;
  - ❑Control (without cooling)
  - ❑Sprinklers,
  - ❑Fans,
  - ❑Sprinklers + Fans.
- ✓However cooling was applied 10.00 a.m. – 5.00 p.m. in Experiment I whereas 10.00 p.m. – 5.00 a.m in Experiement II.

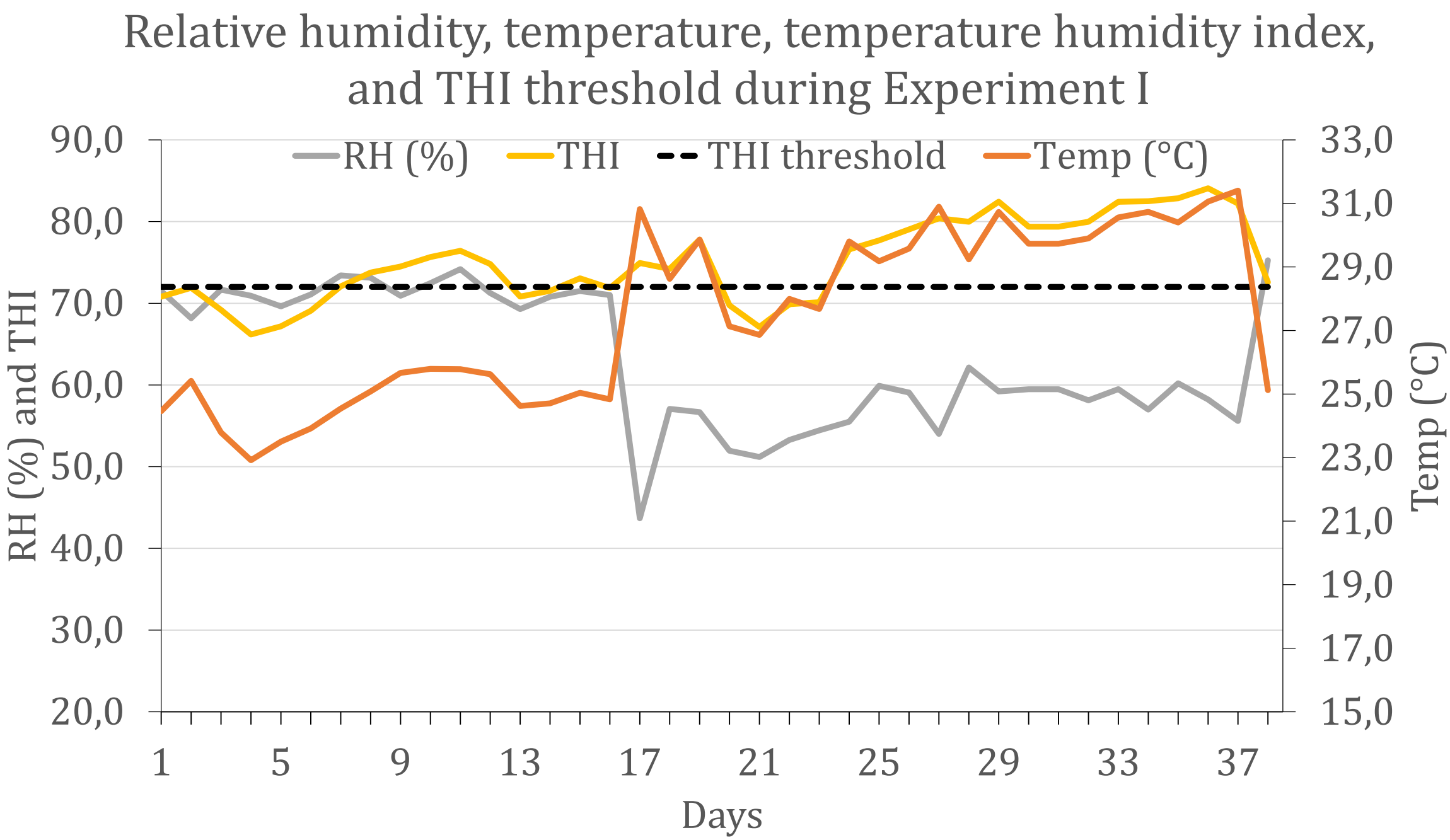
Feeding regime

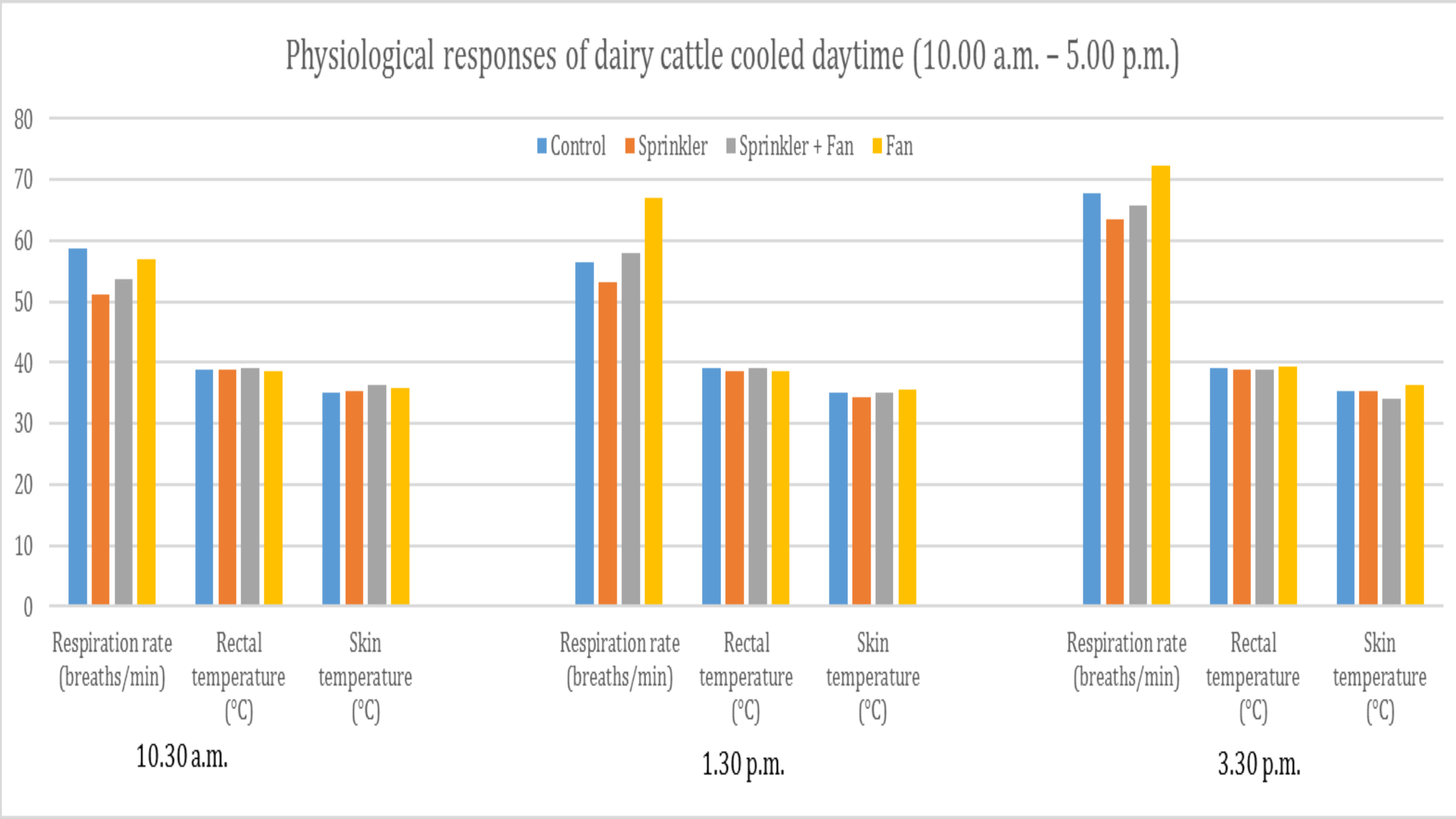
- ✓Total mixed ration
  - ❑Corn silage,
  - ❑Alfalfa hay,
  - ❑Wheat straw
  - ❑Concentrate (18% crude protein and 2650 kcal/kg metobolizable energy).

Measurements and statistics

- ✓Milk yield and dry matter intake; daily,
- ✓Milk samples; 2 times per week and analyzed for components,
- ✓Body weight; weekly,
- ✓Respiration rate, rectal temperature, skin temperature; 2 times per week (10.30 a.m., 1.30 p.m., and 3.30 a.m.),
- ✓PROC MIXED with repeated measurement (contrast statement)

Results

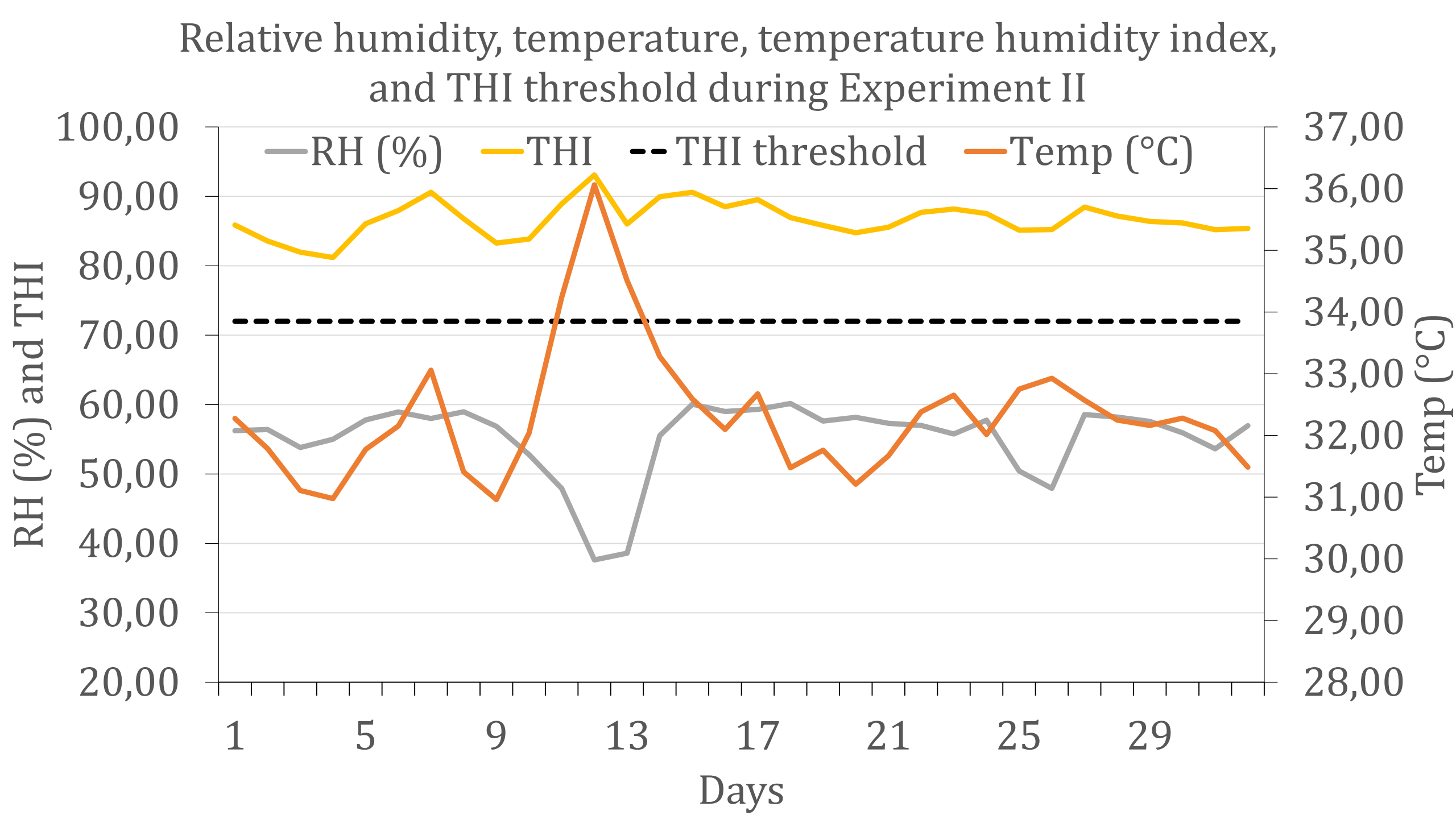

Relative humidity, temperature, temperature humidity index, and THI threshold during Experiment I
RH (%)
THI
THI threshold
Temp (°C)
90,0
80,0
70,0
60,0
50,0
40,0
30,0
20,0
RH (%) and THI
33,0
31,0
29,0
27,0
25,0
23,0
21,0
19,0
17,0
15,0
Temp (°C)
1
5
9
13
17
21
25
29
33
37
Days


Physiological responses of dairy cattle cooled daytime (10.00 a.m. – 5.00 p.m.)
80
70
60
50
40
30
20
10
0
Control
Sprinkler
Sprinkler + Fan
Fan
Respiration rate (breaths/min)
Rectal temperature (°C)
Skin temperature (°C)
Respiration rate (breaths/min)
Rectal temperature (°C)
Skin temperature (°C)
Respiration rate (breaths/min)
Rectal temperature (°C)
Skin temperature (°C)
10.30 a.m.
1.30 p.m.
3.30 p.m.

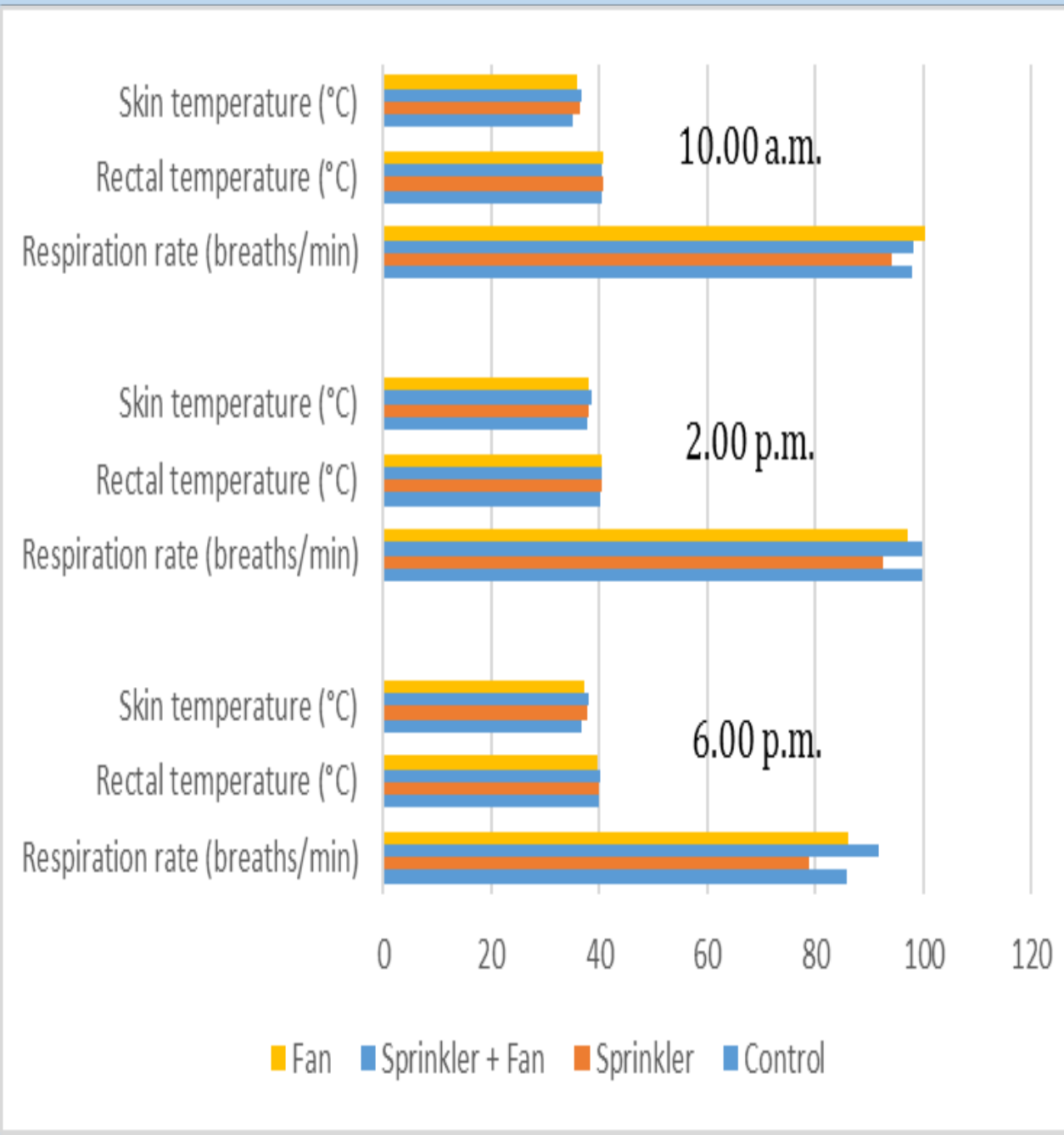
Effects of daytime cooling (10.00 a.m. – 5.00 p.m.) on performance of dairy cows

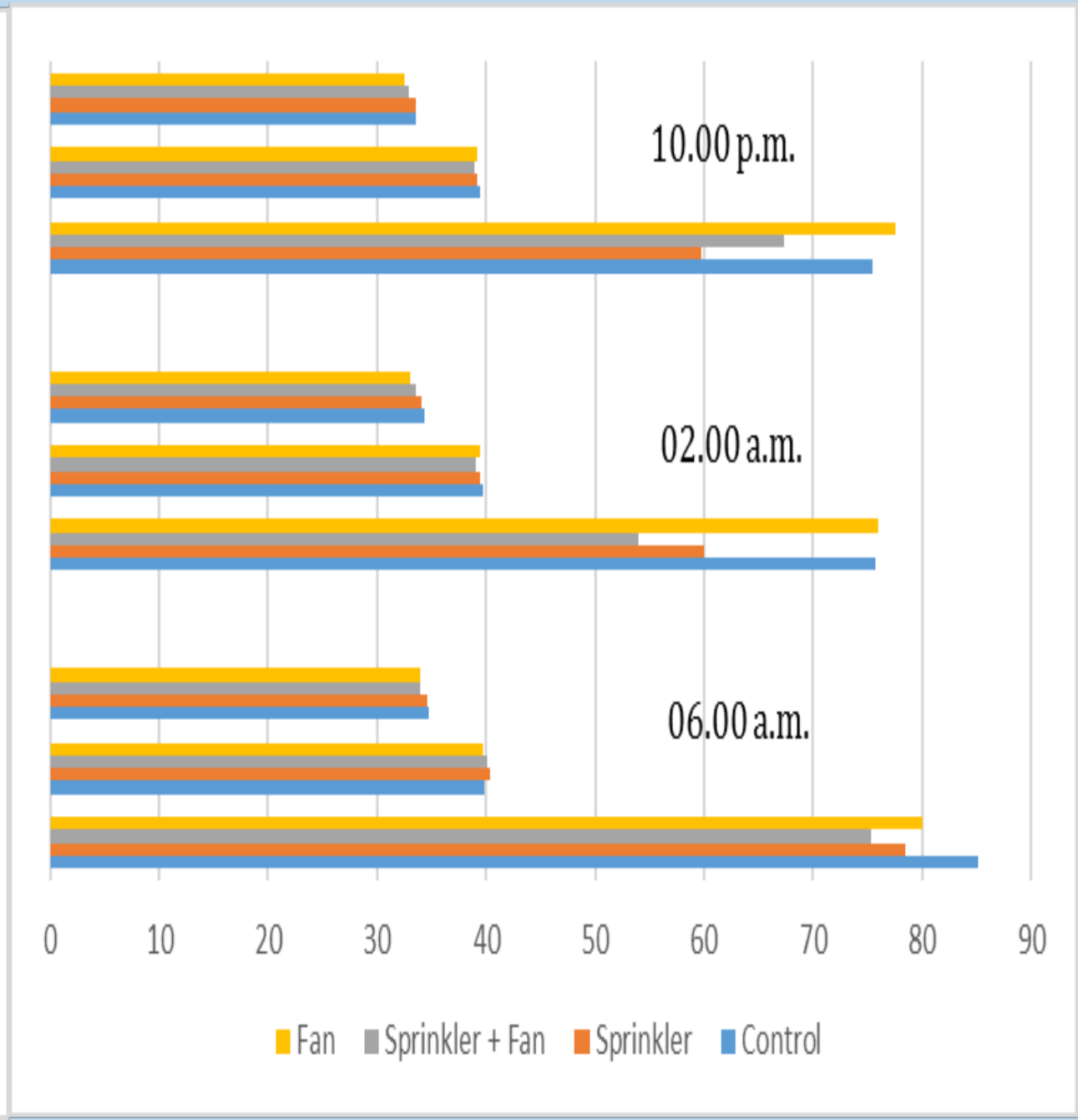
	Treatments				SEM	Contrast						
	Control	Sprinkler	Sprinkler + Fan	Fan		1	2	3	4	5	6	7
Milk yield (kg/day)	27.0	28.1	28.2	27.4	0.30	0.083	0.068	0.297	0.917	<0.01	<0.01	0.301
Dry matter intake (kg/day)	19.6	21.2	22.0	21.3	0.23	0.823	0.024	<0.01	0.013	<0.01	<0.01	0.200
Body weight (kg)	540.4	550.5	550.1	547.3	10.70	0.829	0.850	0.652	0.979	0.507	0.524	0.983
Total solids (%)	**11.9**	**12.0**	**12.4**	**11.6**	**0.21**	**0.597**	**0.057**	**0.355**	**0.141**	**0.133**	**<0.01**	**0.545**
Fat (%)	3.0	2.9	2.3	2.8	0.19	0.833	0.165	0.597	0.094	0.732	0.053	0.791
Protein (%)	3.1	3.2	3.2	2.9	0.05	0.082	0.239	<0.01	0.572	<0.01	<0.01	0.934
Lactose (%)	4.7	4.8	4.9	4.7	0.03	0.025	<0.01	0.582	0.316	<0.01	<0.01	0.054
Urea-N (mg/dL)	22.7	22.4	22.6	22.1	0.72	0.748	0.954	0.602	0.787	0.823	0.633	0.717

1: Control *vs.* sprinkler
2: Control *vs.* fan
3: Control *vs.* sprinkler+fan
4: Sprinkler *vs.* fan
5: Sprinkler *vs.* sprinkler+fan
6: Sprinkler+fan *vs.* fan
7: Control *vs.* cooling


Relative humidity, temperature, temperature humidity index, and THI threshold during Experiment II
RH (%)
THI
THI threshold
Temp (°C)
RH (%) and THI
Temp (°C)
Days
100,00
90,00
80,00
70,00
60,00
50,00
40,00
30,00
20,00
37,00
36,00
35,00
34,00
33,00
32,00
31,00
30,00
29,00
28,00
1
5
9
13
17
21
25
29

Physiological responses of dairy cattle cooled nighttime (10.00 p.m. – 5.00 a.m.)





Effects of nighttime cooling (10.00 a.m. – 5.00 p.m.) on performance of dairy

	Treatments				SEM	Contrast						
	Control	Sprinkler	Sprinkler + Fan	Fan		1	2	3	4	5	6	7
Milk yield (kg/day)	28.8	31.7	31.2	30.3	0.27	<0.01	<0.01	<0.01	0.206	<0.01	0.028	<0.01
Dry matter intake (kg/day)	18.4	19.7	19.6	18.7	0.18	<0.01	0.407	<0.01	<0.01	0.980	<0.01	0.070
Bodyweight (kg)	549.9	528.8	534.4	533.6	10.49	0.155	0.305	0.262	0.714	0.744	0.958	0.142
Total solids (%)	12.0	11.5	12.6	11.9	0.16	0.036	0.013	0.810	<0.01	0.062	<0.01	0.939
Fat (%)	3.3	2.7	3.6	3.3	0.12	<0.01	0.107	0.796	<0.01	<0.01	0.172	0.602
Protein (%)	3.2	3.1	3.3	3.1	0.04	0.061	0.092	0.047	<0.01	0.952	<0.01	0.381
Lactose (%)	4.6	4.8	4.8	4.6	0.04	0.040	<0.01	0.840	0.282	0.063	<0.01	0.025
Urea-N (mg/dL)	23.0	25.5	23.6	23.6	0.58	<0.01	0.482	0.469	0.040	0.032	0.994	0.077

1: Control *vs.* sprinkler
2: Control *vs.* fan
3: Control *vs.* sprinkler+fan
4: Sprinkler *vs.* fan
5: Sprinkler *vs.* sprinkler+fan
6: Sprinkler+fan *vs.* fan
7: Control *vs.* cooling

Overall

- ✓In the experiment I, cows received mild heat stress, on the other hand, in the second experiment, cows received moderate heat stress.
- ✓Daytime cooling did not effect performance and physiological parameters of dairy cows, whereas night cooling and especially sprinklers treatment increase daily milk yield while decreasing of dry matter intake

Thank you for your attention