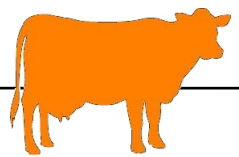
Feeding and drinking behaviour of dairy cows at heat stress



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Introduction

Heat stress in dairy cattle

Increased body temperature
Panting
Drooli
Profus
Letha stlessness
Searc
Increas e
Increased w ntake
Reduced dry matter/feed intake
Reduced rumination
Reduced milk production
Reduced reproductive performance

- over 400€ /cow/year

Introduction

Thermal Heat Index (T.H.I.)

Temperature		% Relative Humidity																		
°F	°C	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
72	22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71
73	23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72	72
74	23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73
75	24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74
76	24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
77	25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76
78	25.5	67	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76	77
79	26.0	67	68	69	69	70	70	71	71	72	73	73	74	74	75	76	76	77	77	78
80	26.5	68	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78	79
81	27.0	68	69	70	70	71	72	72	73	73	74	75	75	76	77	77	78	78	79	80
82	28.0	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81
83	28.5	69	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82
84	29.0	70	70	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83
85	29.5	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84
86	30.0	71	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84
87	30.5	71	72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85	85
88	31.0	72	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86	86
89	31.5	72	73	74	75	75	76	77	78	79	80	80	81	82	83	84	85	86	86	87
90	32.0	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88
91	33.0	73	74	75	76	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89
92	33.5	73	74	75	76	77	78	79	80	81	82	83	84	85	85	86	87	88	89	90
93	34.0	74	75	76	77	78	79	80	80	81	82	83	85	85	86	87	88	89	90	91
94	34.5	74	75	76	77	78	79	80	81	82	83	84	86	86	87	88	89	90	91	92
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
96	35.5	75	76	77	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93	94
97	36.0	76	77	78	79	80	81	82	83	84	85	86	87	88	89	91	92	93	94	95
98	36.5	76	77	78	80	80	82	83	83	85	86	87	88	89	90	91	92	93	94	95
99	37.0	76	78	79	80	81	82	83	84	85	87	88	89	90	91	92	93	94	95	96
100	38.0	77	78	79	81	82	83	84	85	86	87	88	90	91	92	93	94	95	96	98
101	38.5	77	79	80	81	82	83	84	86	87	88	89	90	92	93	94	95	96	98	99
102	39.0	78	79	80	82	83	84	85	86	87	89	90	91	92	94	95	96	97	98	100
103	39.5	78	79	81	82	83	84	86	87	88	89	91	92	93	94	96	97	98	99	101
104	40.0	79	80	81	83	84	85	86	88	89	90	91	93	94	95	96	98	99	100	101
105	40.5	80	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101	102
106	41.0	80	81	82	84	85	87	88	89	90	91	93	94	95	97	98	99	101	102	103
107	41.5	80	81	83	84	85	87	88	89	91	92	94	95	96	98	99	100	102	103	104

Adapted from: Burgos Zimbelman R. and. Collier R.J. Tri-State Dairy Nutrition Conference, April 19 and 20, 2011

THI between 72 and 78

mild stress

THI between 79 and 88

moderate stress

THI between 89 and 98

severe stress

THI above 98

DEAD COWS!

Adapted from: http://www.bom.gov.au/

Introduction

Heat stress in dairy cattle in Greece

- Period of Heat Stress risk: April to October
- 61.8% of Greek dairy farms located in Central Macedonia (Northern Greece)
- Rural area – Rice cultivation
- By 2021: av. Max Temperature (summer) +2.5°C
  +40 “tropical nights” per year
  (nights when av. temp.>20°C)

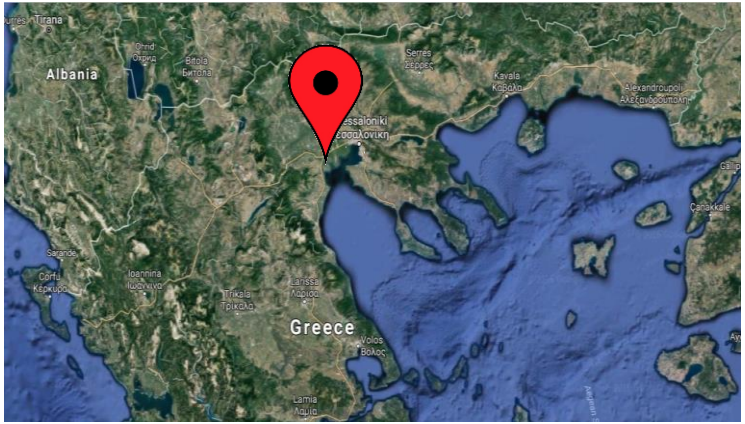
Adapted from: National Climate Change Adaptation Strategy (NCCAS), 2015

Objective

Effects of cows’ heat stress on nutritional behavior?

Materials and methods

- Free-stall system with individual beds
- 12 healthy Holstein cows
- 24h video recording for 5 months
  (March to August to cover HS crucial period)
- Temperature and relative humidity recorded at 5min. intervals
- Statistical analysis: SPSS® v.21 (a=0.05)

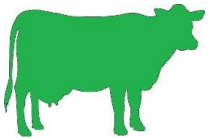


Materials and methods

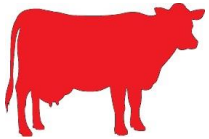
THI between 79 and 88 THI between 89 and 98

moderate stress severe stress

- Two experimental groups



Controls-C
n=12
Within the thermo-neutral zone
av. T.H.I.=54.6



Heat Stressed-HS
n=12
Under heat stress
av. T.H.I.=87.6

Materials and methods

- Two 24h recordings were evaluated
- Behavioral aspects of feeding and drinking

Materials and methods

- Analysis for 3 time zones:

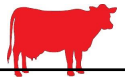
  (following feeding schedule and HS intensity)

M Morning:8.00-12.00,

A Afternoon:16.00-18.00 and

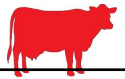
E Evening:19.00-20.30

Results

Time Zone	Activity (minutes)	Group				Significance
						
		Mean	±SE	Mean	±SE	
M + A + E	**Feeding**	39.28*	4.955	70.43*	11.993	**P≤0.05**
	Drinking	12.63	4.752	11.72	2.477	P≥0.05

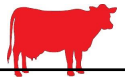
In all time zones HS animals spent significantly more time eating, while their drinking behavior did not differ to the controls'

Results

Time Zone	Activity (minutes)	Group				Significance
						
		Mean	±SE	Mean	±SE	
M	Feeding	60.62*	9.276	144.22*	39.69	**P≤0.05**
	Drinking	26.57	12.359	12.385	2.831	P≥0.05

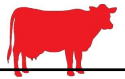
In the Morning, HS cows spent more than twice the time eating compared to the controls, while they spent half the time drinking

Results

Time Zone	Activity (minutes)	Group				Significance
						
		Mean	±SE	Mean	±SE	
A	Feeding	22.95*	6.093	4.78*	1.316	**P≤0.05**
	Drinking	3.86*	0.596	19.76*	5.968	**P≤0.05**

In the Afternoon, when HS is acute, HS cows spent significantly less time eating and significantly more time drinking

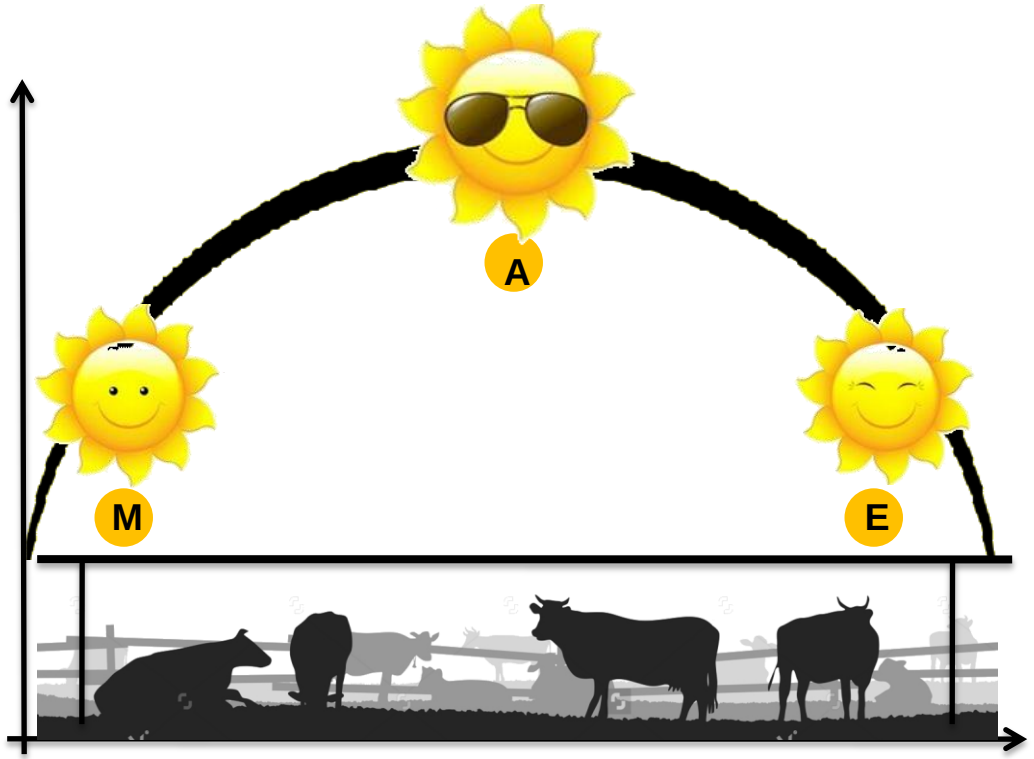
Results

Time Zone	Activity (minutes)	Group				Significance
						
		Mean	±SE	Mean	±SE	
E	Feeding	32.33	5.383	27.84	3.340	P≥0.05
	Drinking	4.57	0.785	2.97	1.005	P≥0.05

In the Evening, feeding duration was similar for both groups, with HS animals spending less time drinking water

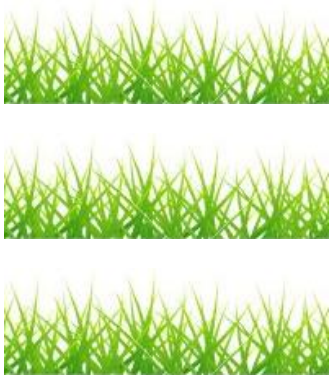
Conclusions

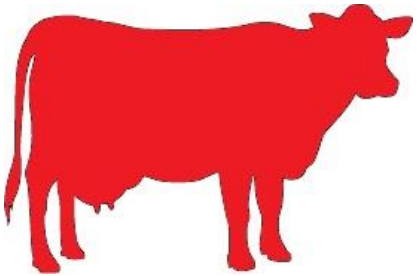
- HS cows spent significantly more time feeding in total, while their drinking activity was limited.
- HS cows compensate for low feeding activity during the day, by feeding at early morning.



Conclusions

M



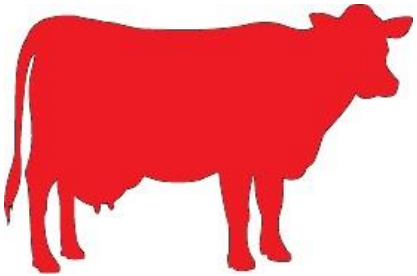


More feeding (P≤0.05)

53.4% less drinking

Conclusions

A

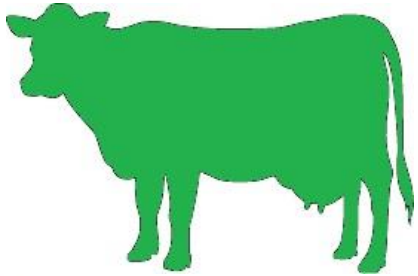


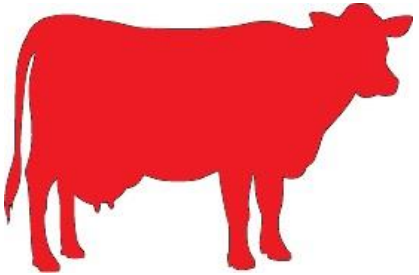
79.15% less feeding

80.45% more drinking (P≤0.05)

Conclusions

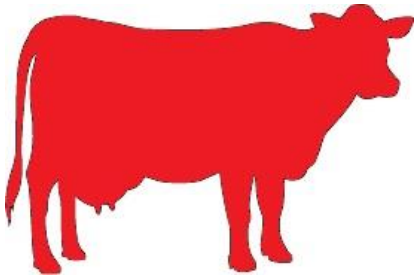
E

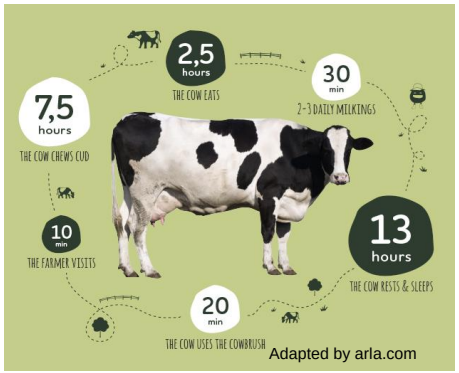




Similar eating and drinking time (P≥0.05)

Conclusions





Nutritional behavior and welfare are affected by Heat Stress and Microclimate

What nutritional management is suitable **at farm level**

Acknowledgements

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Thank you for your attention!

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