

Effects of warm climatic periods on dairy cow behaviour and production in Scotland

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Introduction



- Global warming is resulting in increased average temperatures and an increase in extreme weather events
- Heat stress in dairy cattle is a serious production and welfare problem
 - Reduction in milk yield, fertility and health (West et al., 2003)
 - Negative experience of heat stress (Polsky and von Keyserlingk, 2017)
- Heat stress effects on cows typically assessed using the temperature humidity index (THI) where heat stress
- Cows likely to be heat-stressed when THI exceeds 72. Signs of heat stress include panting and drooling



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Introduction



- Heat stress is normally thought of as being an issue in countries experiencing high temperatures (e.g., southern Europe)
- **But is there any evidence of heat stress in Scotland?**
- Ambient temperature is not the only climatic factor influencing heat stress – humidity and windspeed are also important
- During the summer months, **housed** dairy cows may experience warm temperatures, high humidity and low air circulation which may create mild heat stress conditions



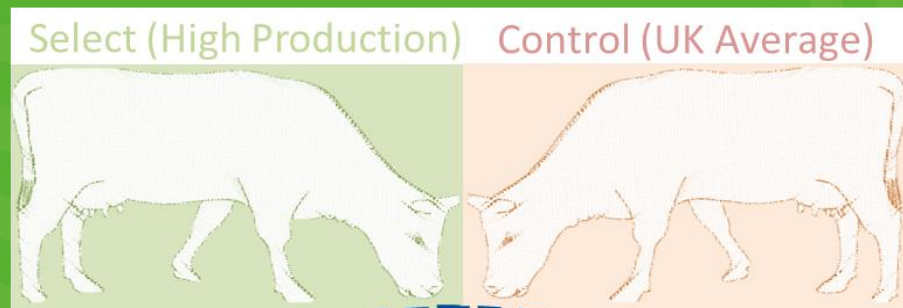
Aim

- The aim of this study was to determine whether behaviour, milk yield, and feed and water intake are affected by warm climatic conditions in housed dairy cattle in south-west Scotland (Dumfries: latitude=55°N)



Methods – animals

- Experiment run on SRUC Dairy Research Farm, Dumfries
- The Langhill Herd contains ~200 continuously housed Holstein cows
- Cubicle house, ad libitum access to feed and water.
- A long-term 2 x 2 experiment running on the farm
 - Two genetic lines: Select (high genetic merit for production) and Control (UK average genetic merit)
 - Two feeding treatments: High Energy and Standard Energy



Methods – monitoring technology

- We collected daily records of:
 - Feed intake: automated feed intake recording (Insentec)
 - Water intake: automated water intake (Insentec)
 - Behaviour: standing and lying times/bouts recorded used IceQubes (Peacock Technologies)
 - Milk yield: milked 3x/day through herringbone milking parlour
- Records taken daily from 05/2018 to 09/2022



Methods – climate measures



- A UK MetOffice weather station is situated outside the main cow housing at a distance of ~50m
- Station records dry and wet bulb temperatures (plus rainfall, soil temperature etc.) each day but **not** humidity



Methods – identifying cool and warm periods



- Extracted daily wet and dry bulb temperatures and calculated a THI value for each day according to the equation:

$$(T_{\text{dry bulb}} + T_{\text{wet bulb}}) * 0.72 + 40.6 \text{ (NRC, 1971)}$$

- Defined a warm period as THI > 65 and a cool period as THI < 60
- Created pairs of warm and cool periods so that similar sets of cows would be compared
- Each period 3 days
- Matched periods were 4–31 days apart
- Eight warm/cool pairs analysed

Date	TempDry	TempWet	THI
13-Jun-19	8.9	8.6	53.2
14-Jun-19	10.6	9.8	55.288
15-Jun-19	15.3	12.3	60.472
16-Jun-19	13.5	10.6	57.952
17-Jun-19	13.7	11.9	59.032
18-Jun-19	16.3	12.9	61.624
19-Jun-19	15.2	11.9	60.112
20-Jun-19	13.7	10.4	57.952
21-Jun-19	13.4	10.4	57.736
22-Jun-19	14.6	11.2	59.176
23-Jun-19	17.8	14.2	63.64
24-Jun-19	14.6	14.1	61.264
25-Jun-19	16.3	14.2	62.56
26-Jun-19	12.9	10.9	57.736
27-Jun-19	20.1	16.2	66.736
28-Jun-19	19.8	15.2	65.8
29-Jun-19	19	16.6	66.232
30-Jun-19	16.6	14.6	63.064
1-Jul-19	16.9	14	62.848
2-Jul-19	16.1	11.9	60.76
3-Jul-19	15.8	11.9	60.544
4-Jul-19	17	13.5	62.56
5-Jul-19	17.1	15	63.712
6-Jul-19	16.3	12.2	61.12
7-Jul-19	15.5	12	60.4

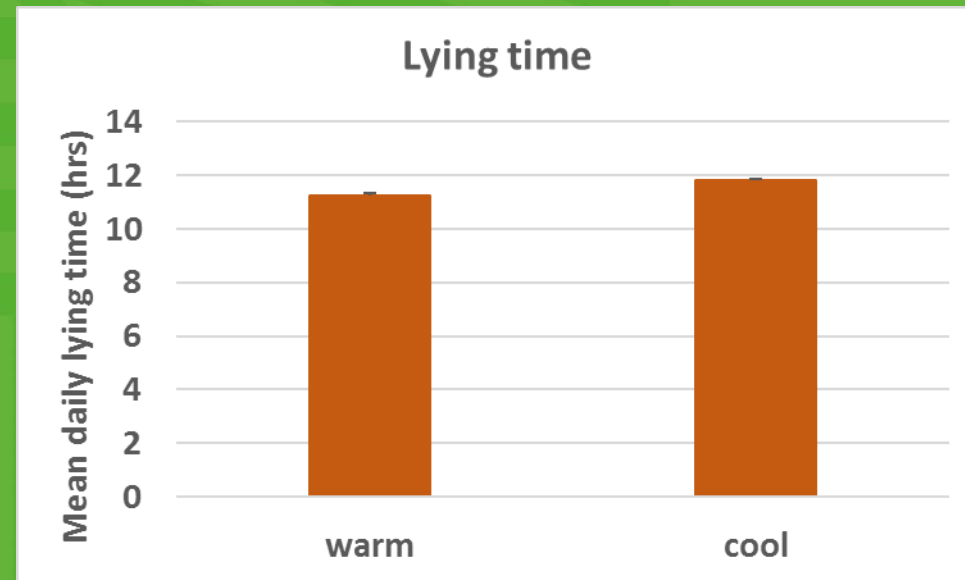
Methods – analysis

- Data extracted from the experimental database for each day of the warm/cool periods for
 - Milk yield (kg)
 - Feed intake (kg/day)
 - Water intake (l/day)
 - Lying time (hrs/day)
 - Frequency of lying bouts (n/day)
 - No. of steps (n/day)
- Statistics: used LMM to assess effects of warm vs cool periods
 - Accounting for age of cow, stage of lactation, genetic group, feed group and day within period



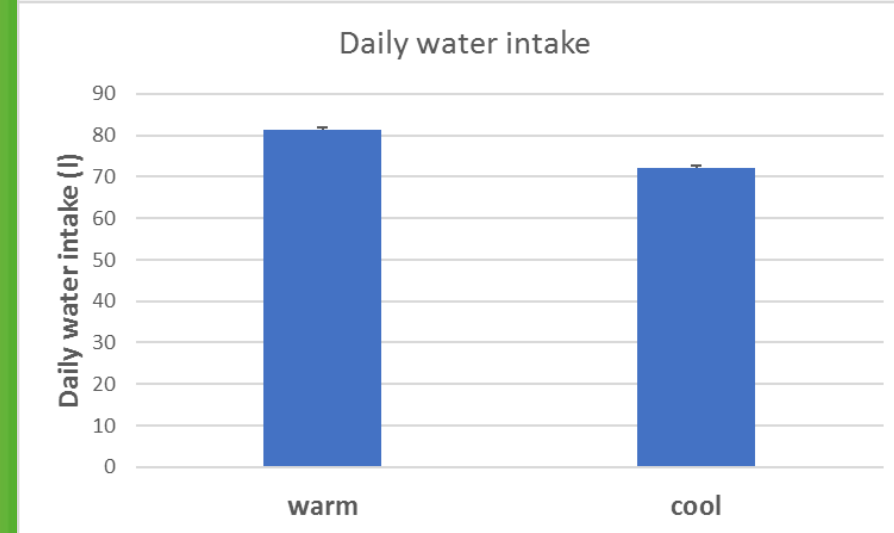
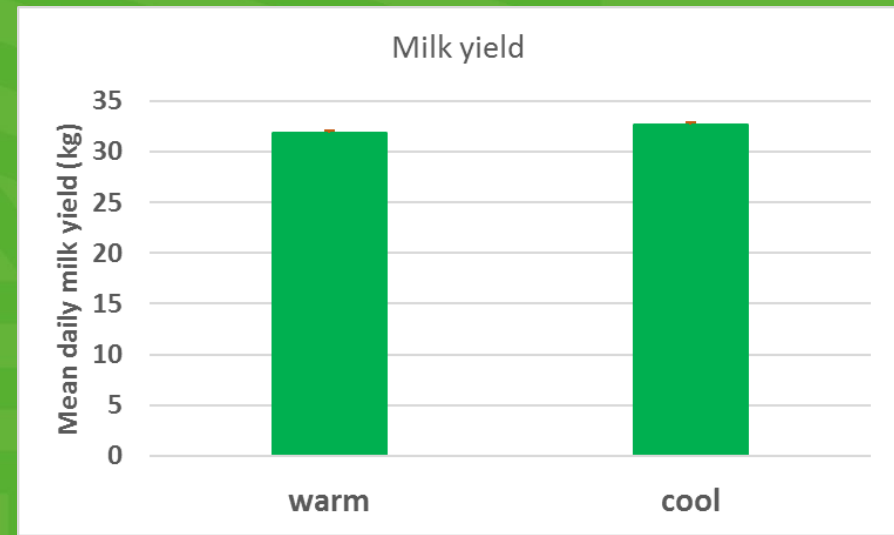
Results – behaviour

- Lying time shorter in warm vs cool periods ($P < 0.001$) by 33 mins
- No effect of climatic type (warm vs cool) on lying bouts
- No effect of climate type on number of steps taken



Results – milk yield and intakes

- Milk yield is lower in warm periods ($P < 0.001$) by 0.85l/day
- No difference in feed intake between climatic types
- Water intake higher in warm periods ($P < 0.001$)



Discussion



- In climatic conditions that are not generally considered to cause heat stress, cow lying time is affected
 - Temperatures at THI=65 are around 23°C (23–29°C in sample)
- Suggests that threshold of THI=72 is extreme, and that cows are experiencing some degree of discomfort at values lower than this
- Cows adjusting to hotter/humid conditions by drinking more water, but feed intake not affected
- Milk yield is affected, but by a small amount (less than 1l/day)

Conclusions and Implications

- Cows' behaviour and milk yield affected by mild heat stress conditions – to a certain extent
- Some evidence of discomfort
- Farmers might consider introducing measures to reduce thermally challenging conditions: increasing airflow through natural ventilation or use of fans
- Increased frequency of 'heat waves' or increase in overall temperature may make these interventions more important in the future



Thank you to the farm staff at Crichton Royal Farm
and to you for your attention

