

# Keeping cows cool next summer

Draft – 28 Oct 22

Set up phones with survey app



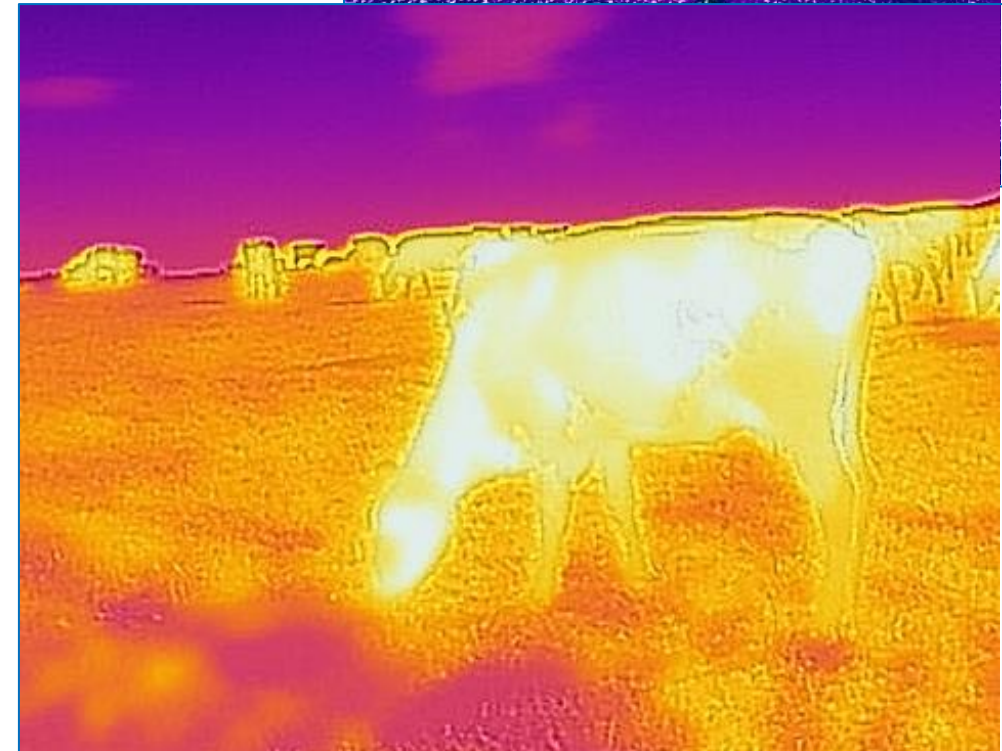
# Seminar Structure and timings

- Intro Mark
- What is heat stress, what effects does it have? Tom 10
- Is it a problem in Britain? Tom 10
  - Results from Lallemand research in 2022
- Heat Stress in housed systems Nico 20
  - Is it a problem
  - What can we do about it – short, medium and long term
- Role of Levucell SC Mark 10
- Heat Stress when grazing Tom 20
  - Why is it a problem
  - What can we do about it – short, medium and long term
- Summary, discussion, Q+A Mark et al 20

# What is heat stress?

## Excessive heat accumulation

- Balance between
  - Heat production and heat inputs
  - Animal's ability to lose heat
- Problem for both  
Grazing and Housed cows



# Heat stress – sources of heat

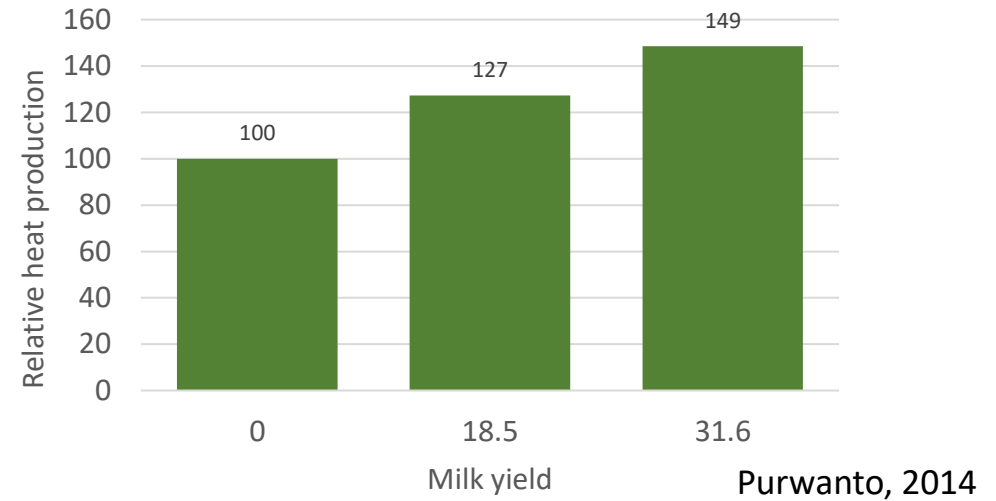
## Metabolic activity (FiM, 2004)

Activity	KW heat output
20 l/day	1.22
40 l/day	1.61
60 l/day	2.00
40 weeks pregnant	1.27
Human	0.09

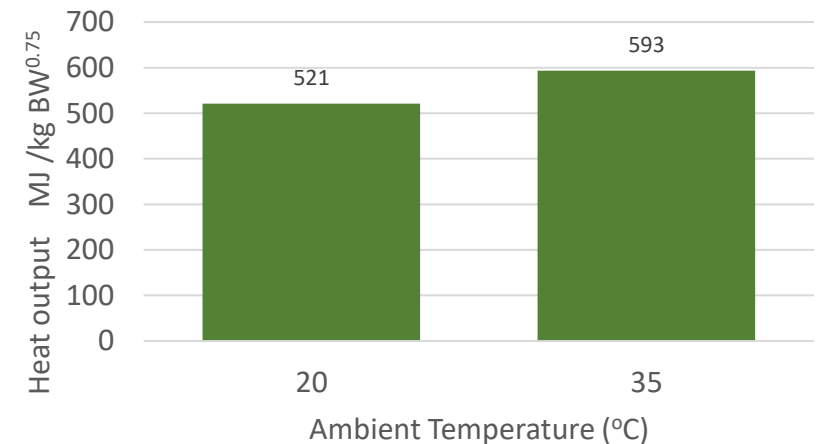


- Milk yields are increasing
- Affects milking and dry cows
- Hot conditions further increase heat production

Effect of milk yield on heat output



Effect of ambient temperature on heat production

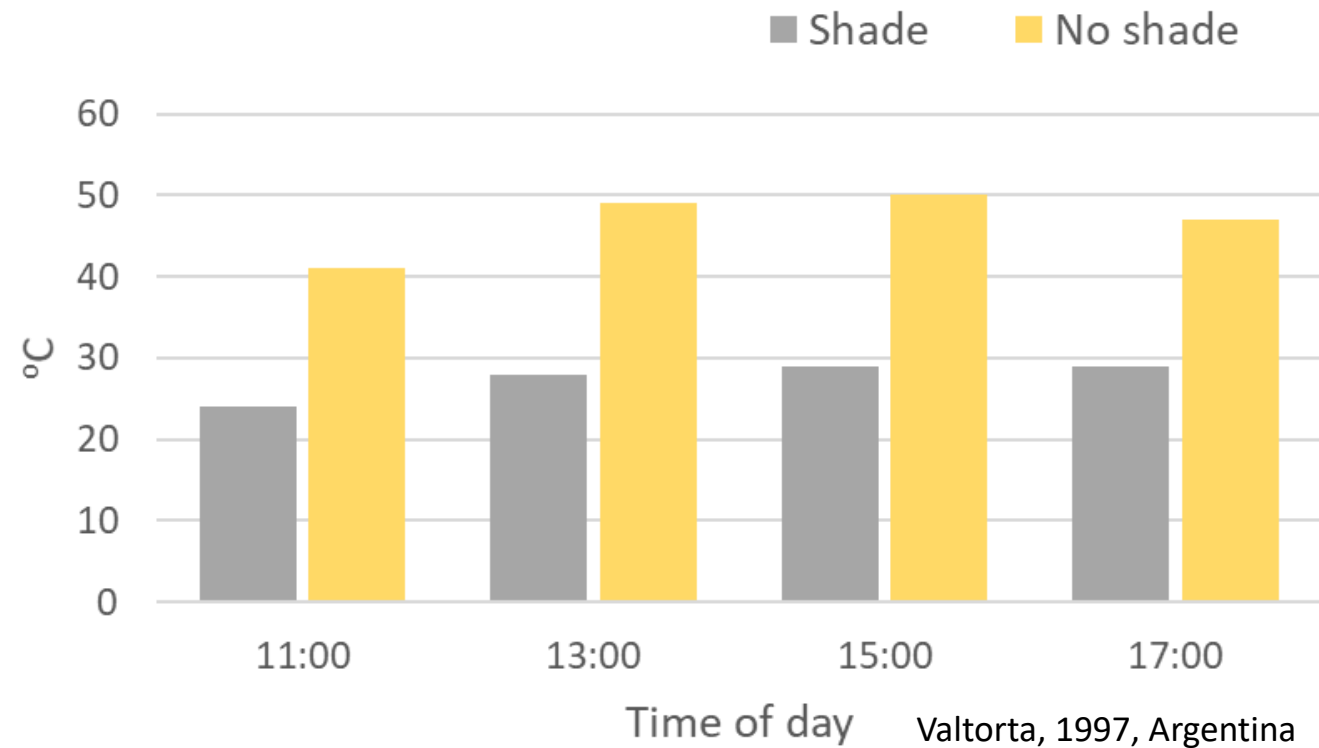


# Heat stress – sources of heat

- Radiant heat (sunshine)
- Major source of heat when grazing
- Measured using 'black globe'

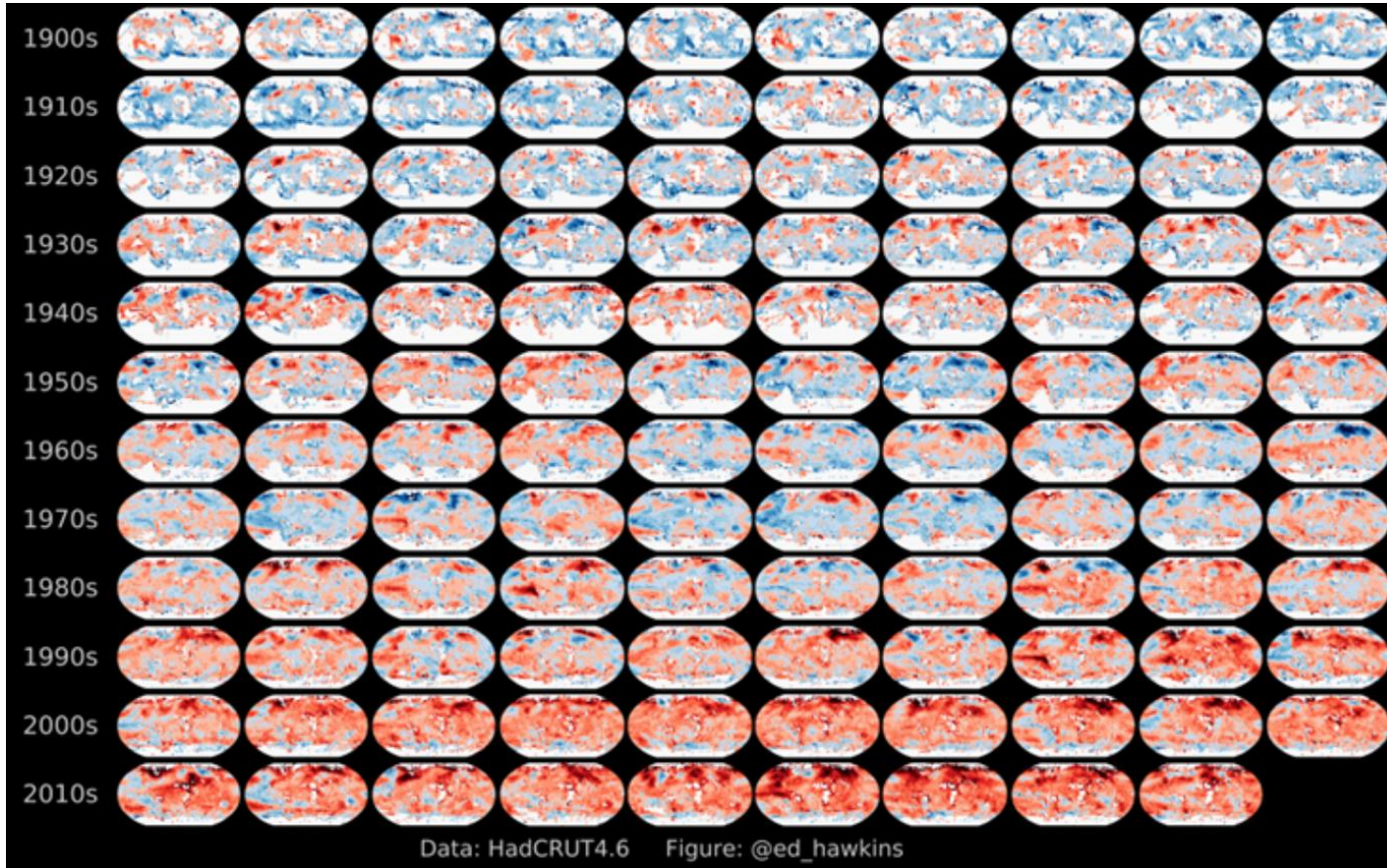


Temperatures in shaded and non-shaded concrete holding pens



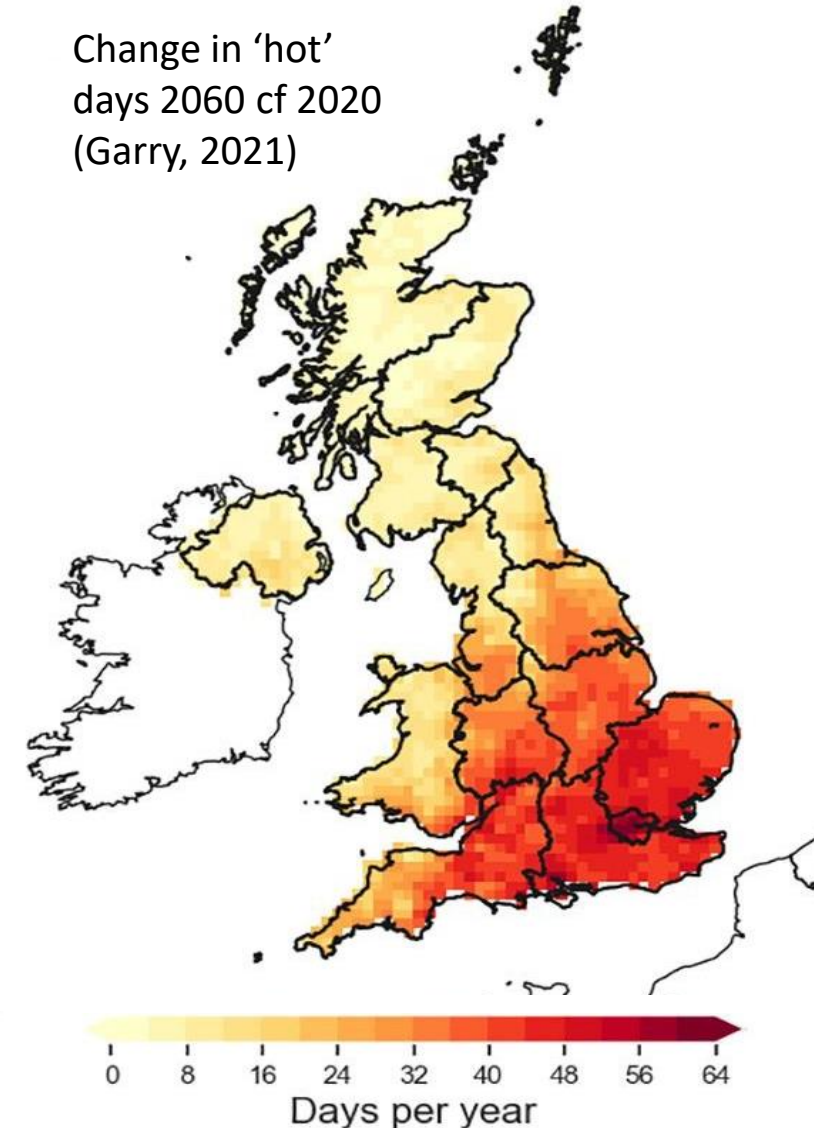
# Global warming

- Rising average temperatures
- Rising numbers of 'hot' days
- More extreme events
- Heat Stress is a global, growing problem
- Even if we hit +1.5'C problem will grow



Mapping changes in temperature: every year from 1850 to 2018

Change in 'hot'  
days 2060 cf 2020  
(Garry, 2021)



# How does the cow loose heat?

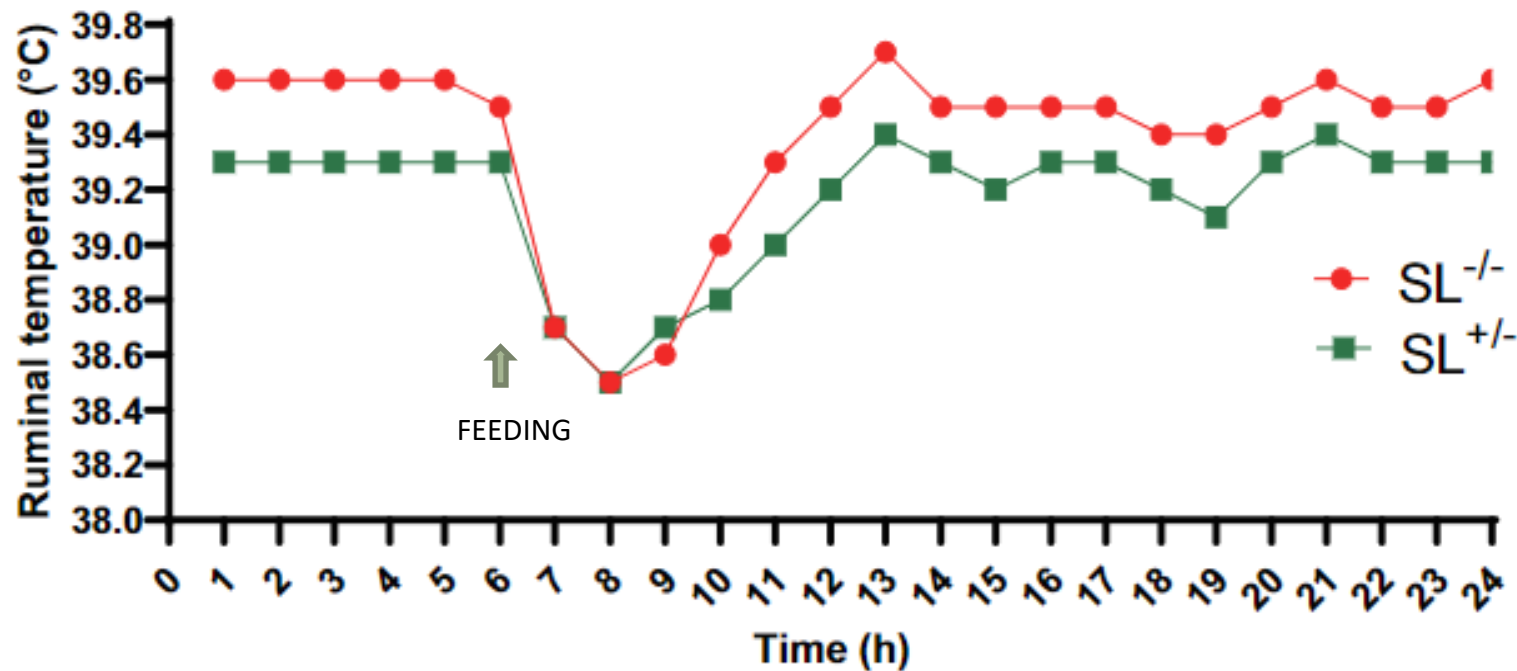
- Ability to lose heat
  - Temperature and humidity of surrounding environment
  - Panting – respiratory rate
  - Area of cow exposed to air
    - Standing or lying down
  - Blood supply to skin
  - Sweating and evaporation - minor
  - Cows will acclimatise (months-years)





# Genetic adaption

- Slick gene – improves animals ability to cope with heat
- Results from heifers in Florida
  - Control – wild type – Slick Gene -/-
  - Treatment – heterozygous Slick gene +/-
- In medium term will be integrated into AI studs



# How is heat stress measured?

- THI - Temperature Humidity Index
  - USA NRC 1971
  - Based on shed temperature and humidity
  - Developed in hotter regions of USA
    - Florida, Arizona, Georgia
  - THI thresholds vary with underlying climate
    - Cows acclimatise over several months
- Derive thresholds for moderate, high, severe

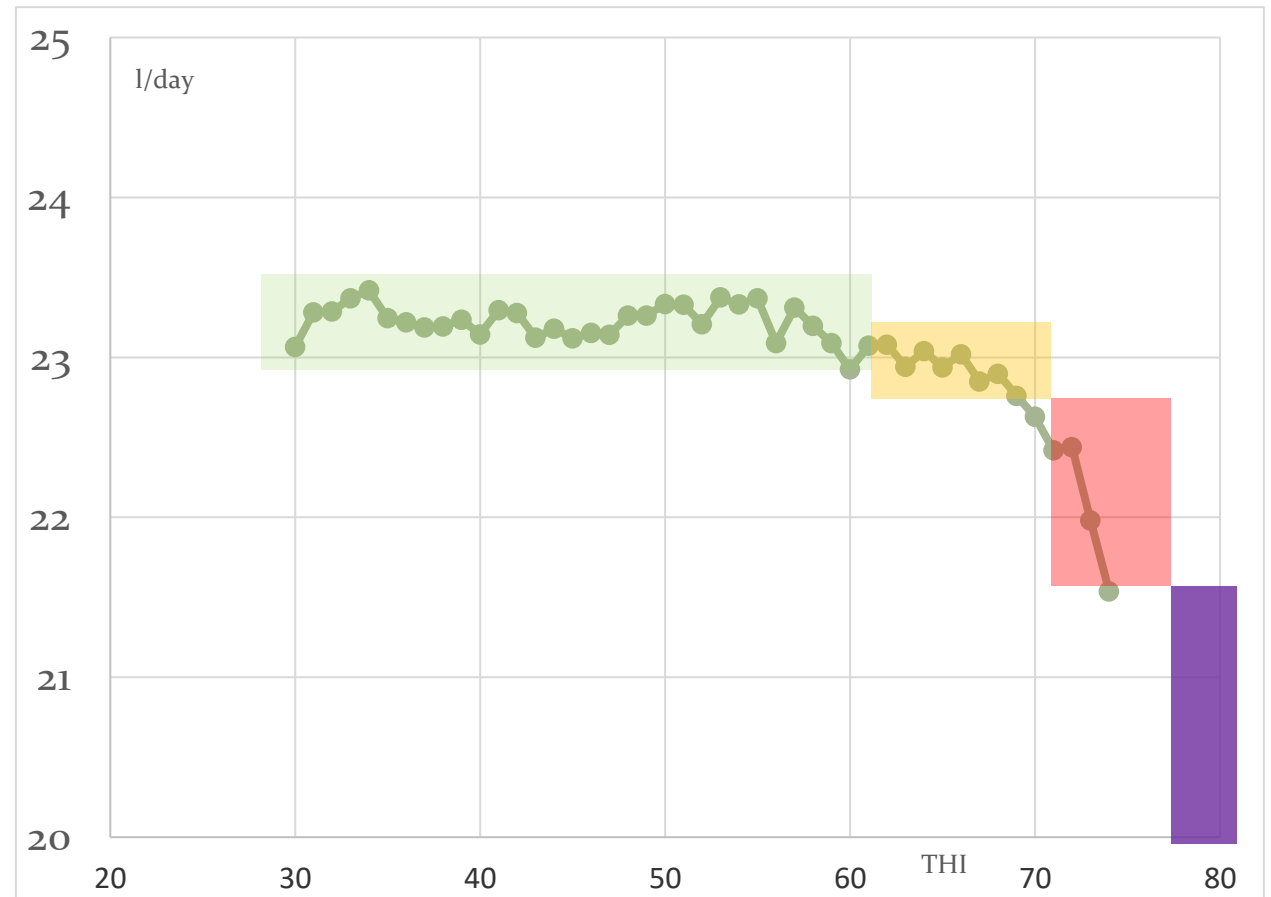


# Effect of THI score on dairy cow production

- Yield data from heifers in Northern Europe

Assessment	Est. milk yield loss (l/day)	THI Scores
None	0	under 62
Moderate	0 to 2	62 to 72
High	2 to 4	73 to 79
Severe	over 4	over 79

- Losses start lower than USA thresholds would suggest
- Start at 18<sup>0</sup>C – 20<sup>0</sup>C  
(%RH dependent)



# Heat Stress at Grass

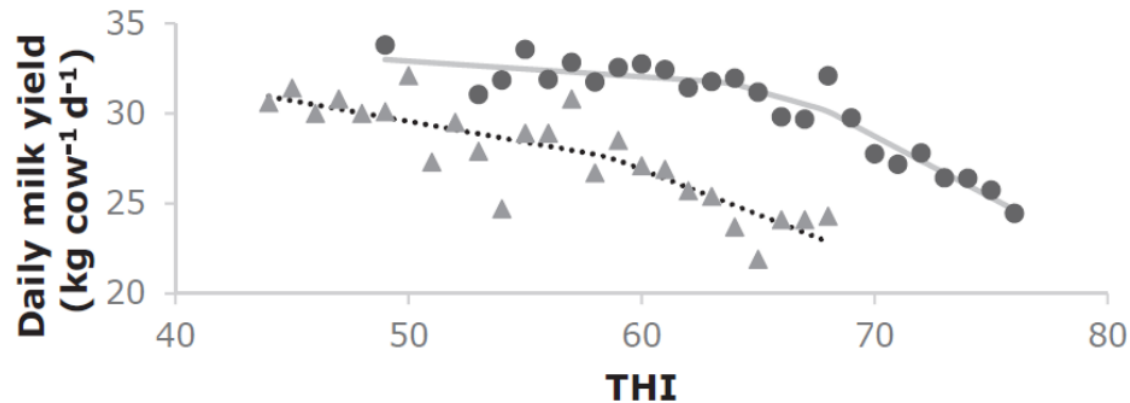
- Radiant heat (sunshine)
  - Major source of heat
  - Not captured by THI
  - Use Black Globe temperature to represent cow
- Measured with DHLI index (Aust)
  - Dairy Heat Load Index



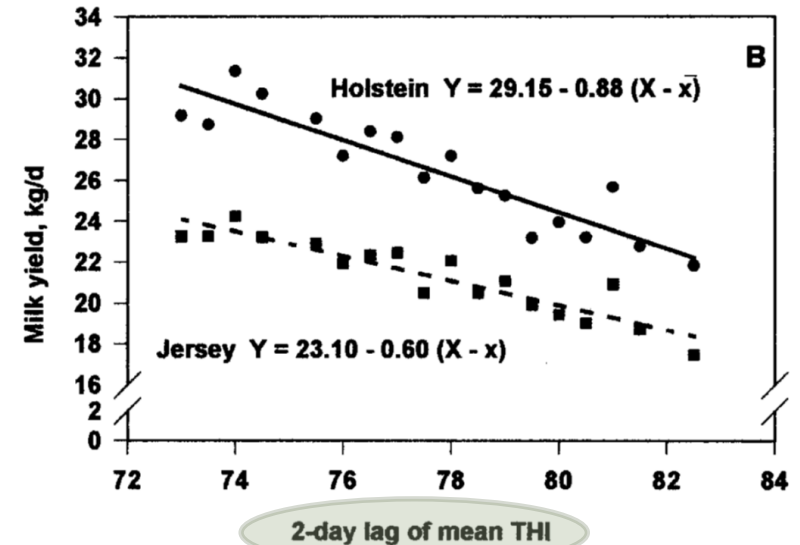
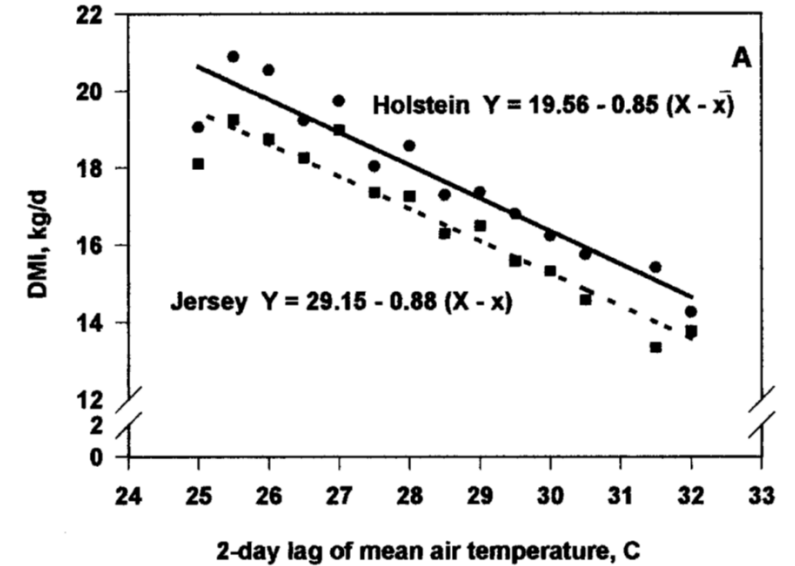
# Effects of heat stress

## Reduced feed intake – reduced milk output

- Fall in intake only accounts for 50% of milk yield drop
- ~1 kg glucose 'lost' in balance trials (Baumgard,2020)
  - intestinal inflammatory response



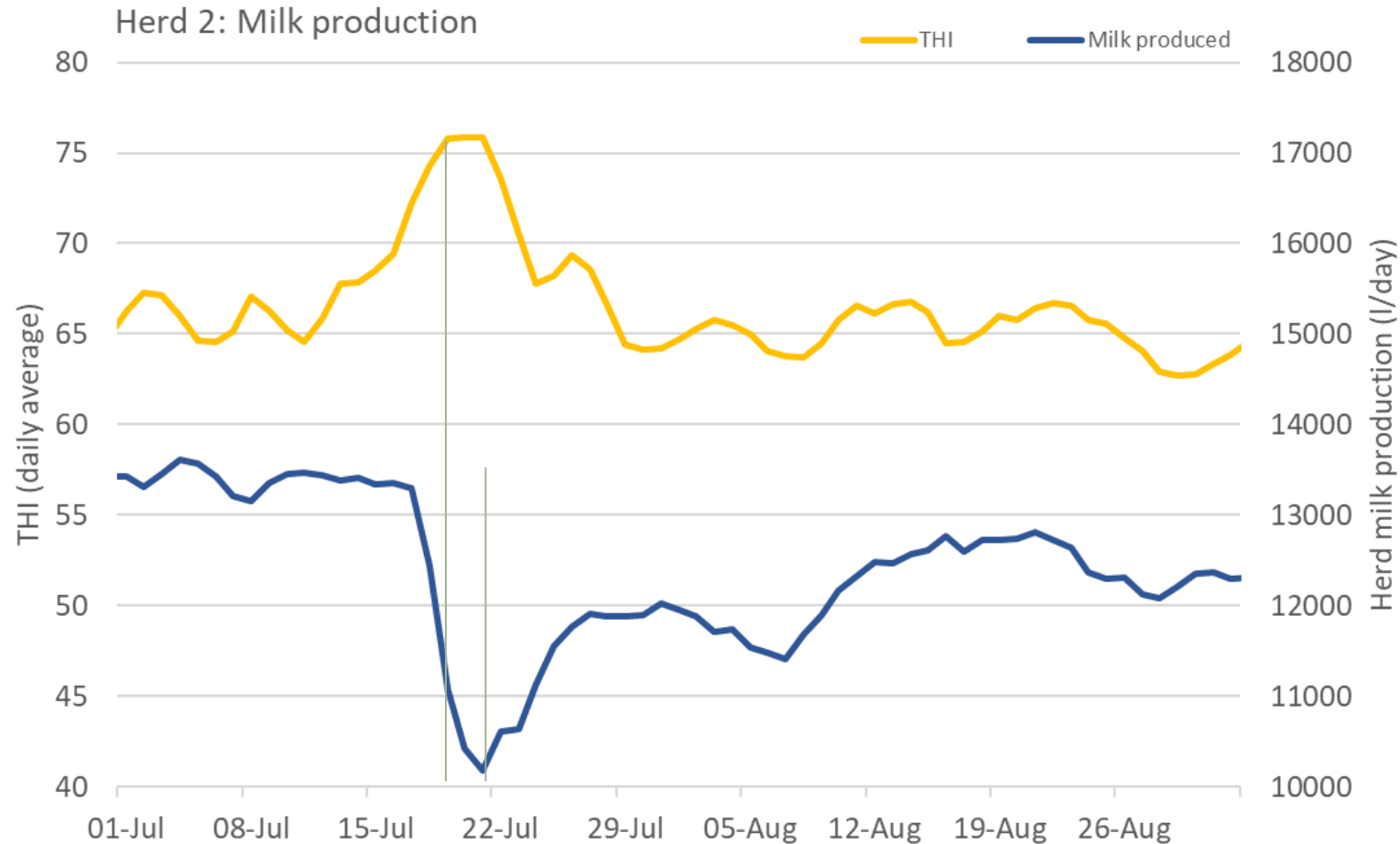
Li, 2019, QLD, AU



West, 2003, GA, USA

# Effects of heat stress

Reduced feed intake – reduced milk output

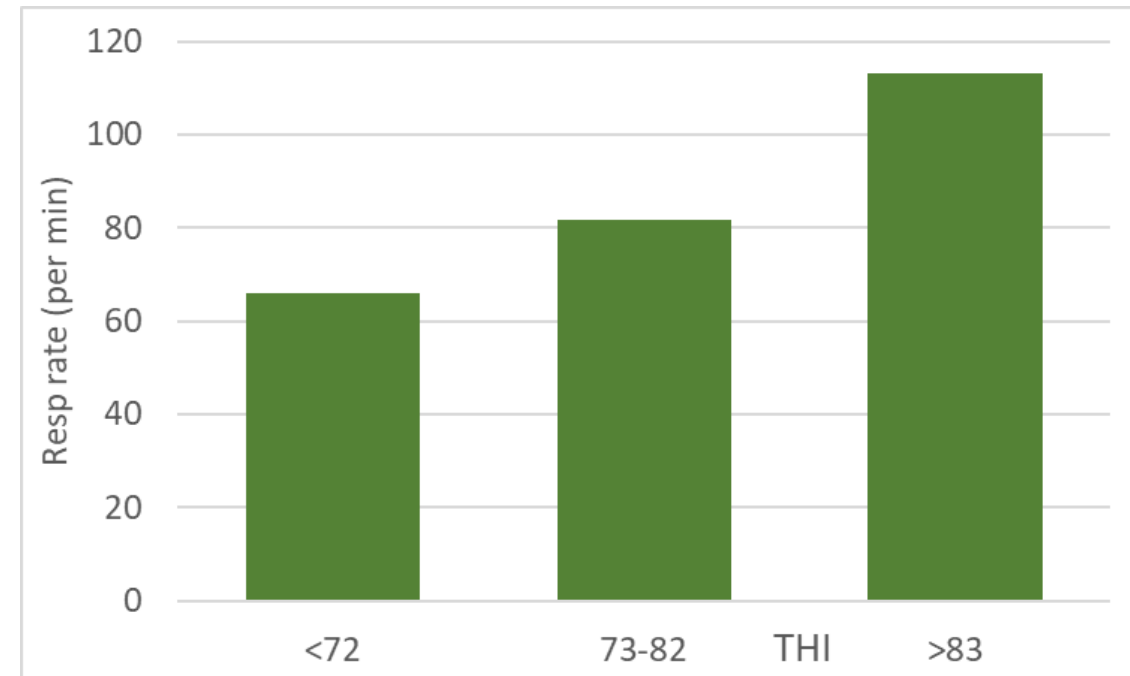


- UK data
- Summer, 2021
- 2 day lag in milk drop
- Lost 3,000 l/day
  - (400 cows)
- Forage supply issues after heat stress event

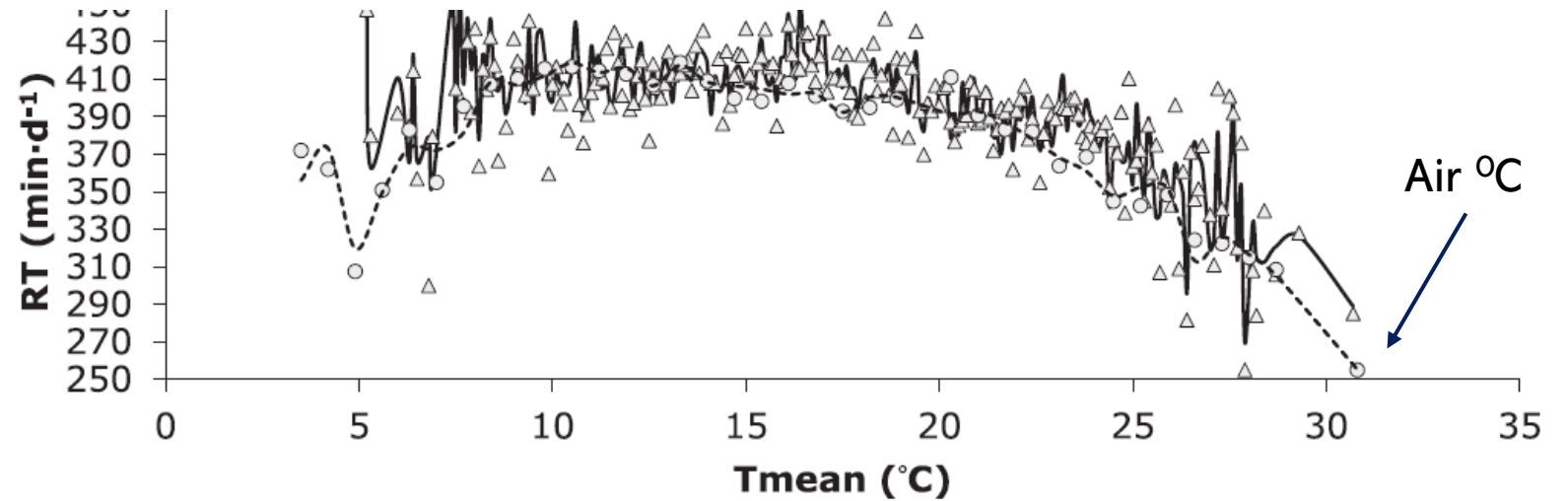
# Effects of heat stress

## Increased panting

- Cow pants to get rid of heat
- Blows off carbon dioxide
- Kidneys shed bicarbonate to compensate
  - Cow becomes acidotic
- Panting animal
  - Fewer, bigger eating bouts
  - Less rumination



# Effects of heat stress - Digestive upsets



- Metabolic acidosis
    - Due to panting
  - Increased salivation / drooling
    - Saliva loss – reduced buffering
  - Reduced rumination time
  - Fewer, bigger eating bouts
  - All cause ruminal acidosis
- = Sick rumen**

Li, 2020, QLD, AU





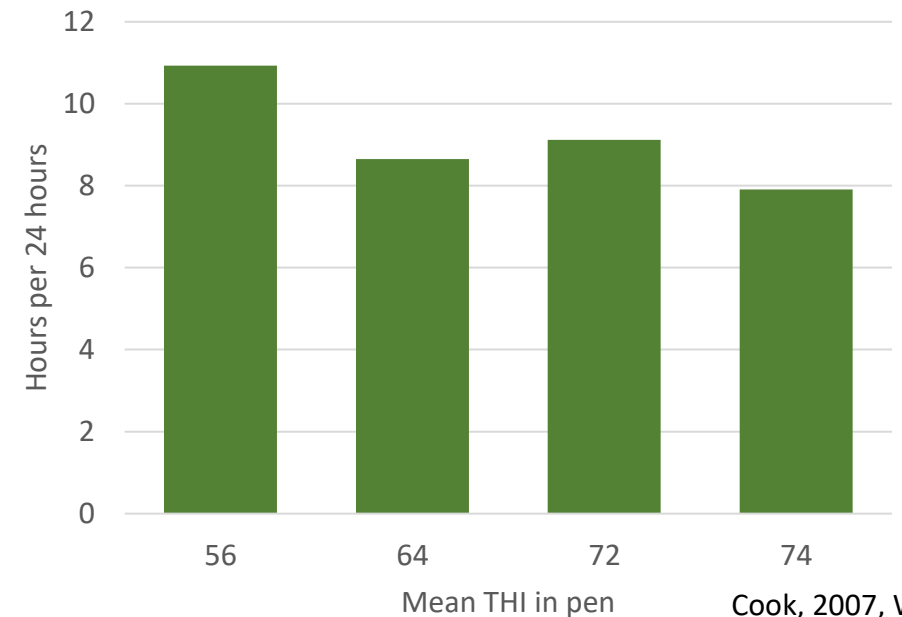
# Effects of heat stress

## Lameness problems

- Increased standing time
  - Increases skin area exposed
  - Increases heat loss
- Reduction in lying times
  - Falls 3 hours a day
- Reduced blood circulation in foot
- Pathology to solar area
- Increase in solar ulcer issues 2-3 months later



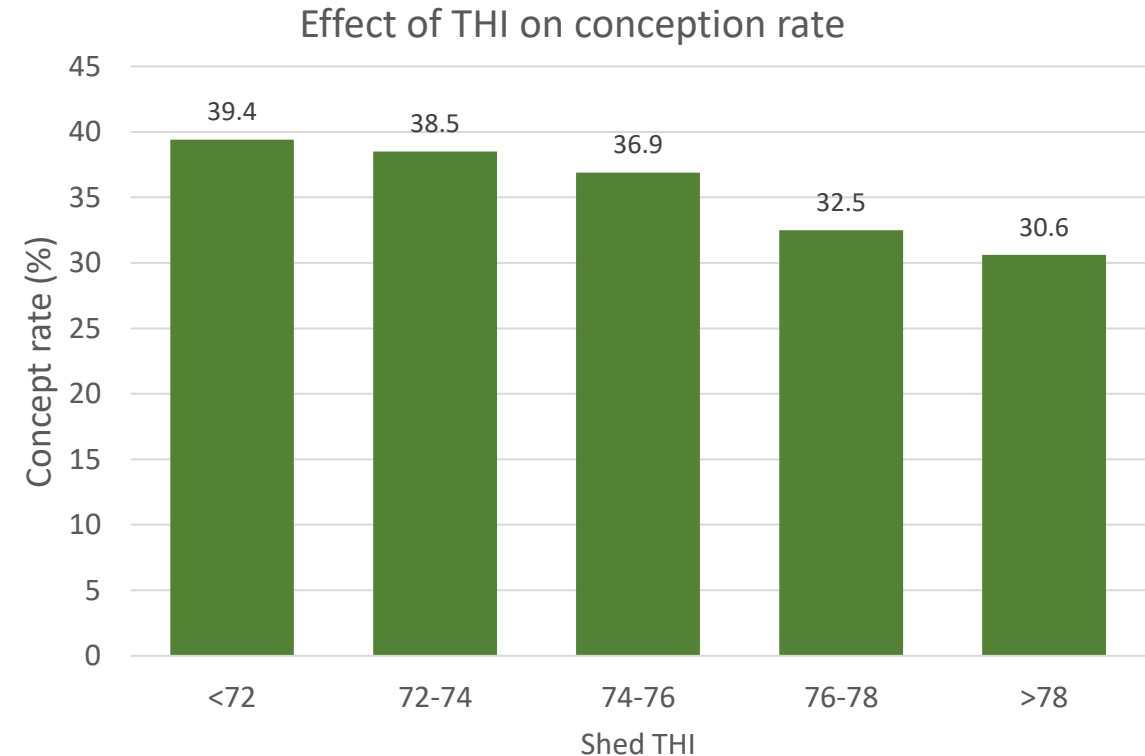
Changes in lying times



# Effects of heat stress

## Fertility problems

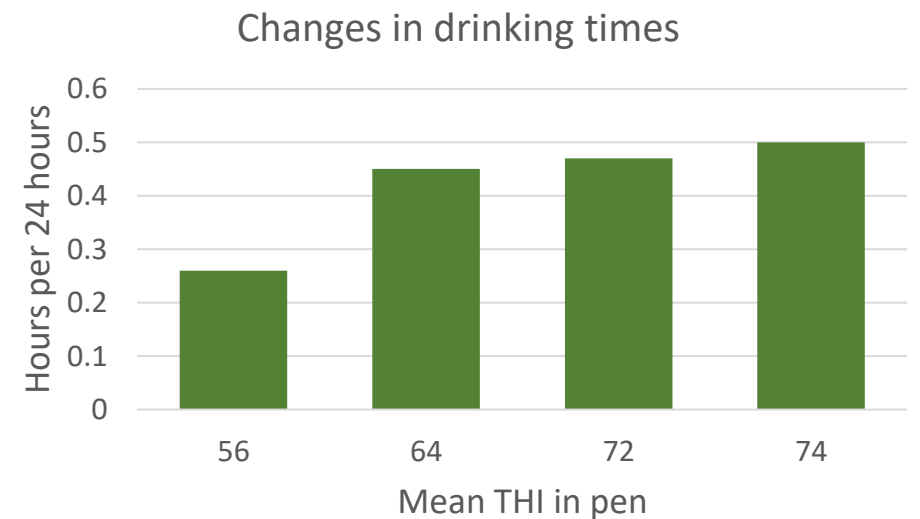
- Poorer energy status
- ?Inflammatory component
- Reduced oestrus signs
- Poorer conception rates
- Increased EED



# Effects of heat stress

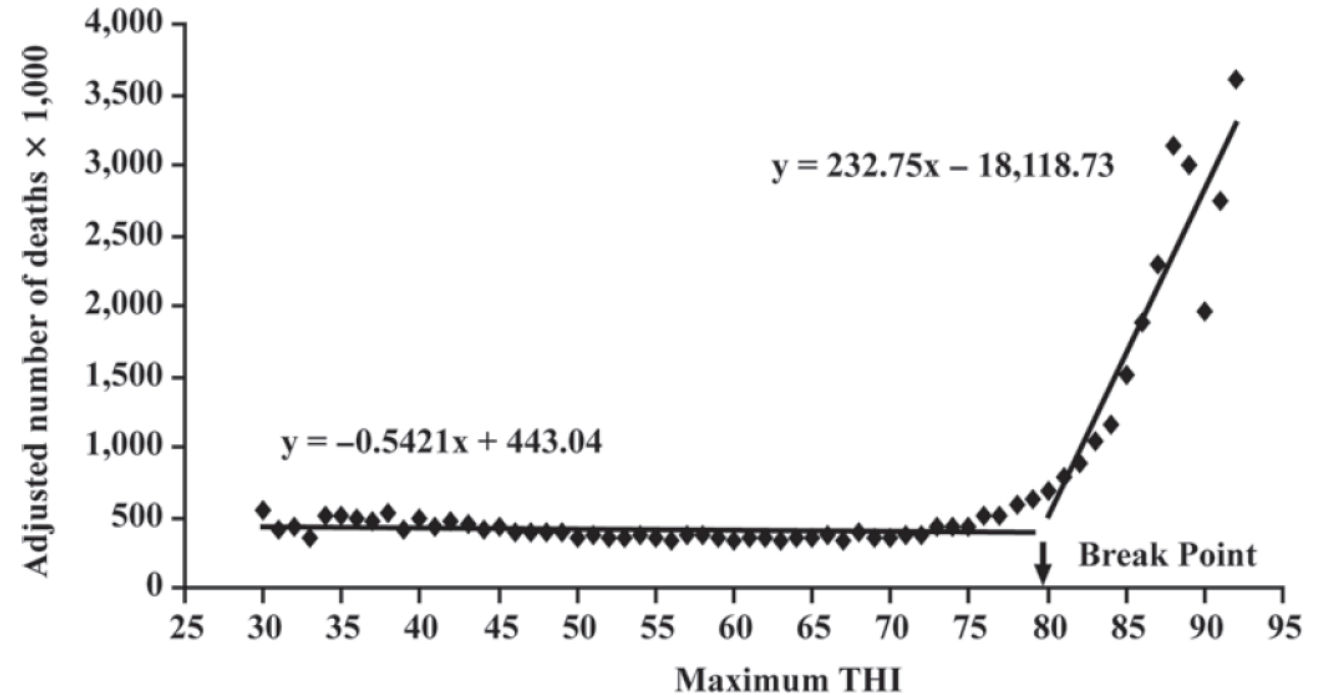
## Water intake

- Increased panting
- Increased salivation
- Increased sweating
  
- Cows will drink more water
  
- Higher peak demands
  - When come out of shade



# Effects of heat stress Mortality

- Max THI – 80
  - Average daily THI 75
- Deaths have been seen on UK farms (SE England)



Vitali, 2009, JDS, Italy



# Effects of heat stress

## Effects on dry Cows

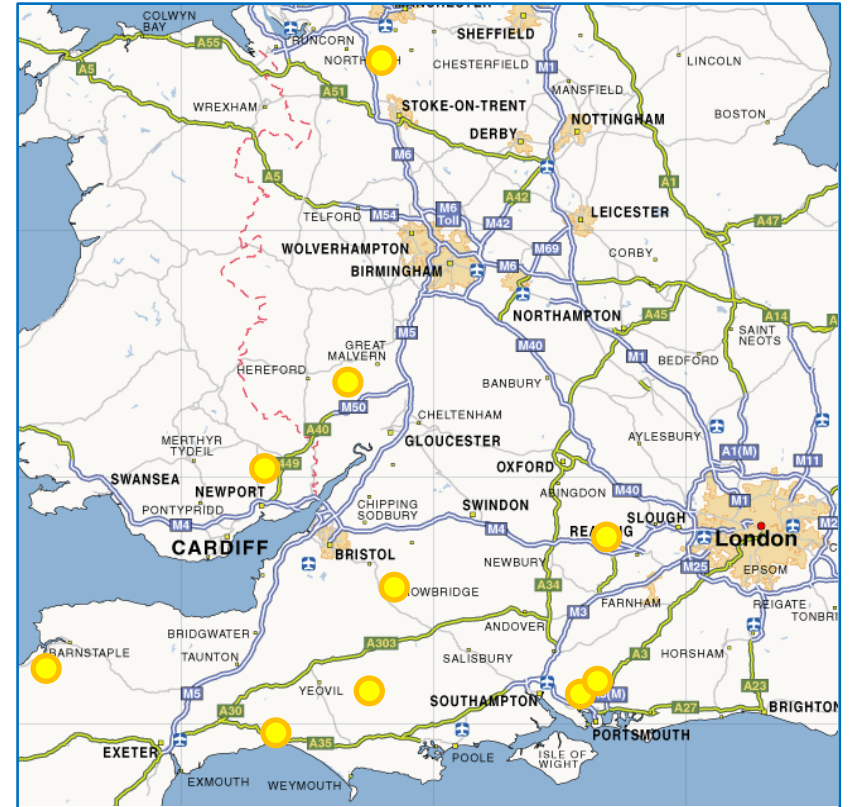
- Raises resp rate (74 vs 48/min,  $p < 0.01$ )
- Reduces milk production in first 8 weeks  
(30.3 vs 33.1 kg/d,  $p < 0.01$ )
- Reduces DMI post partum ( $r = 0.33$ ,  $p = 0.01$ )
- Reduces gestation length ( $r = 0.24$ ,  $p = 0.08$ )
- Reduces calf birth weight ( $r = -0.20$ ,  $p = 0.09$ )

**NOTE – Florida – Extreme THI values**

# Is heat stress a problem in Britain

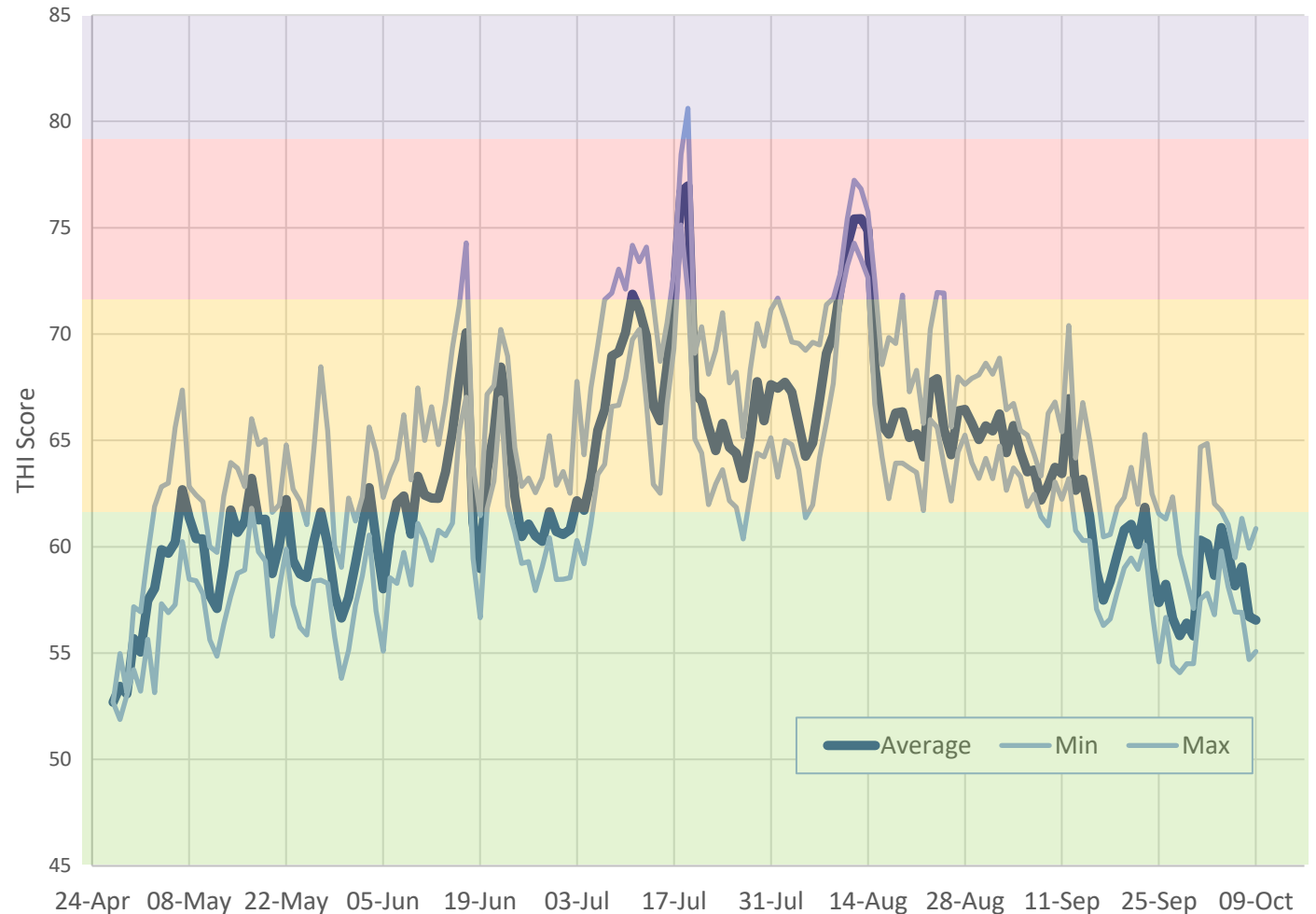
## Lallemand Farm Monitoring

- 9 farms monitoring in England
  - THI – inside cow shed
  - DHI – outside cow shed
- Results streamed in real-time
  - On Lallemand website
  - On dedicated project website
  - Reported weekly via Linked In posts



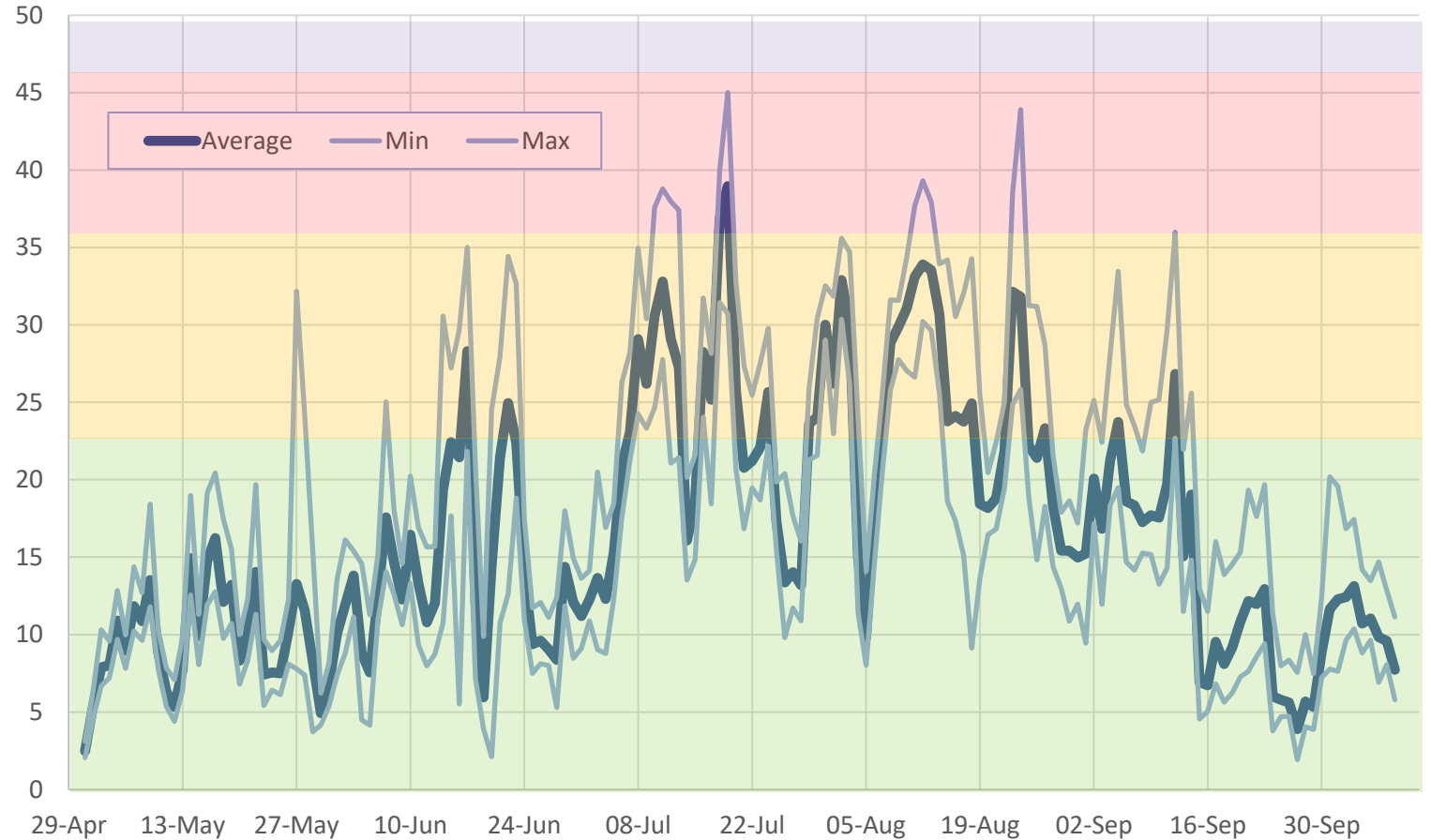
# On farm THI scores: summer 2022

- Four heatwaves
- Heat stressed on 99 days (57%)
  - Mild 85 days
  - High 7 days
  - Severe – None
- Heat stress season
  - Early May
  - Mid September



# On farm DHI scores: summer 2022

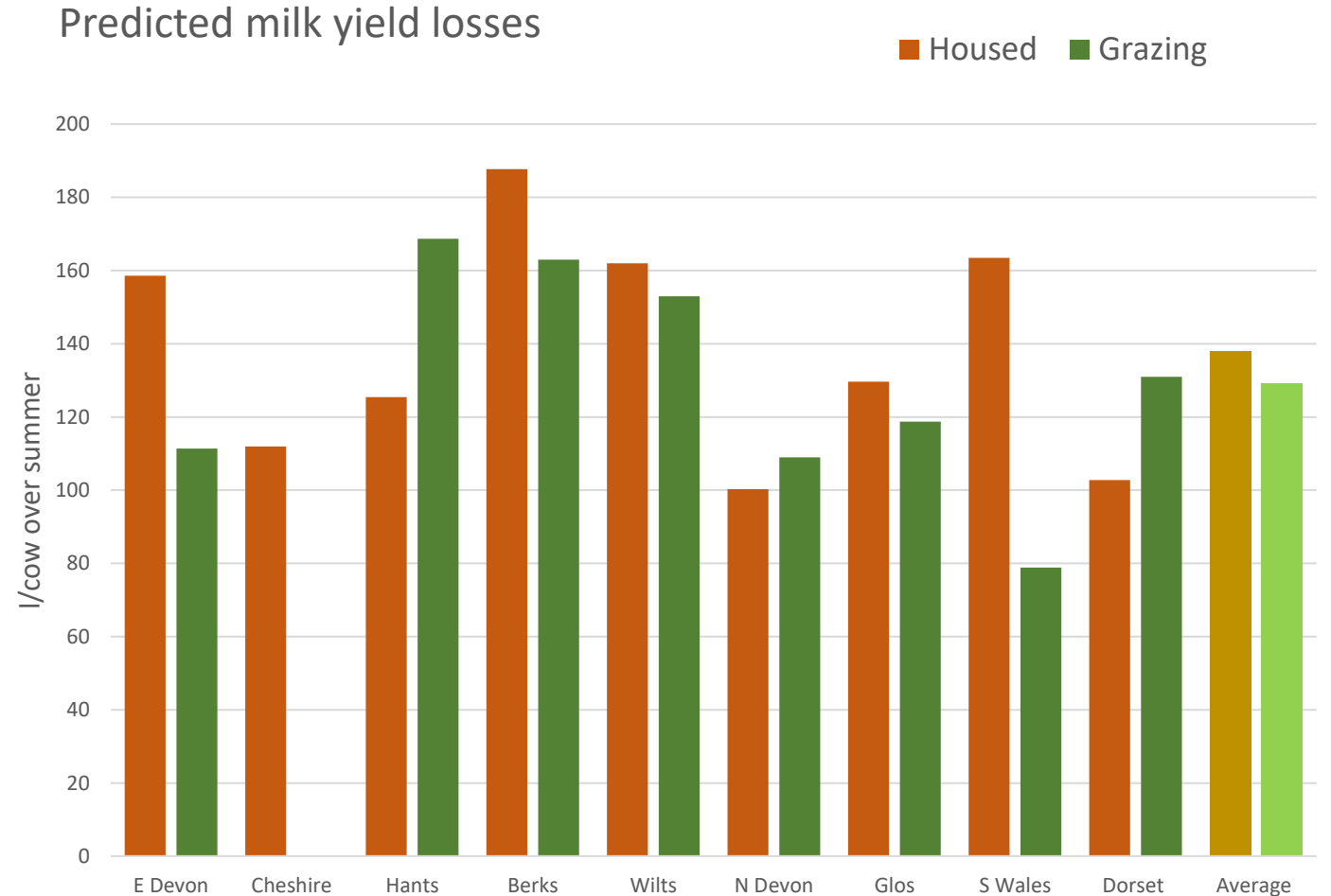
- Far more 'heat waves'
- More erratic in pattern
- Heat stressed on 37 days (22%)
  - Mild 35 days
  - High 2 days
- Heat stress 'season'
  - Mid June
  - Mid September





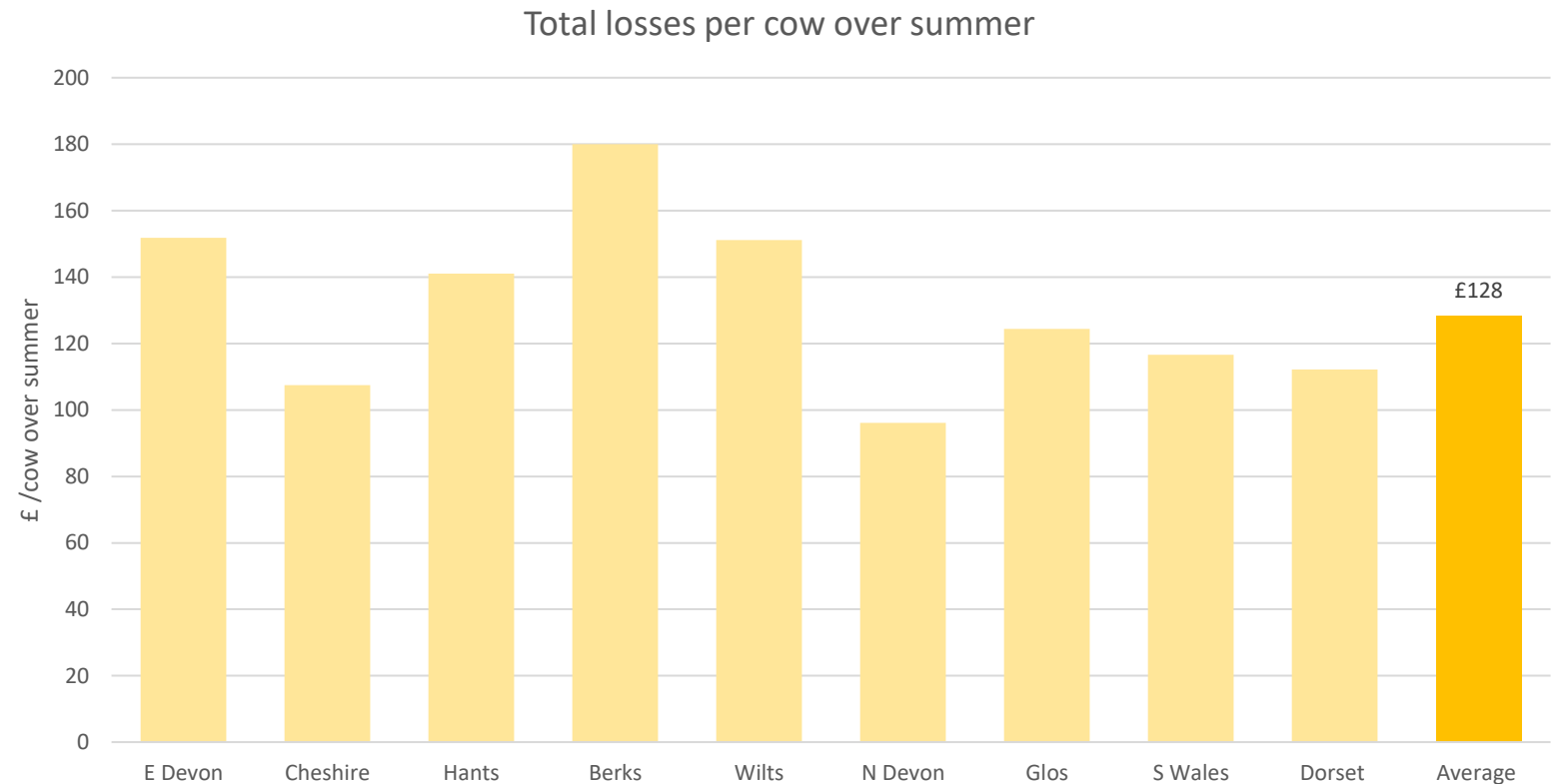
# Impact on milk yield

- Housed losses
  - 138 l/cow
    - Range 100 – 187
- Grazing losses
  - 129 l/cow
    - Range 79 - 169



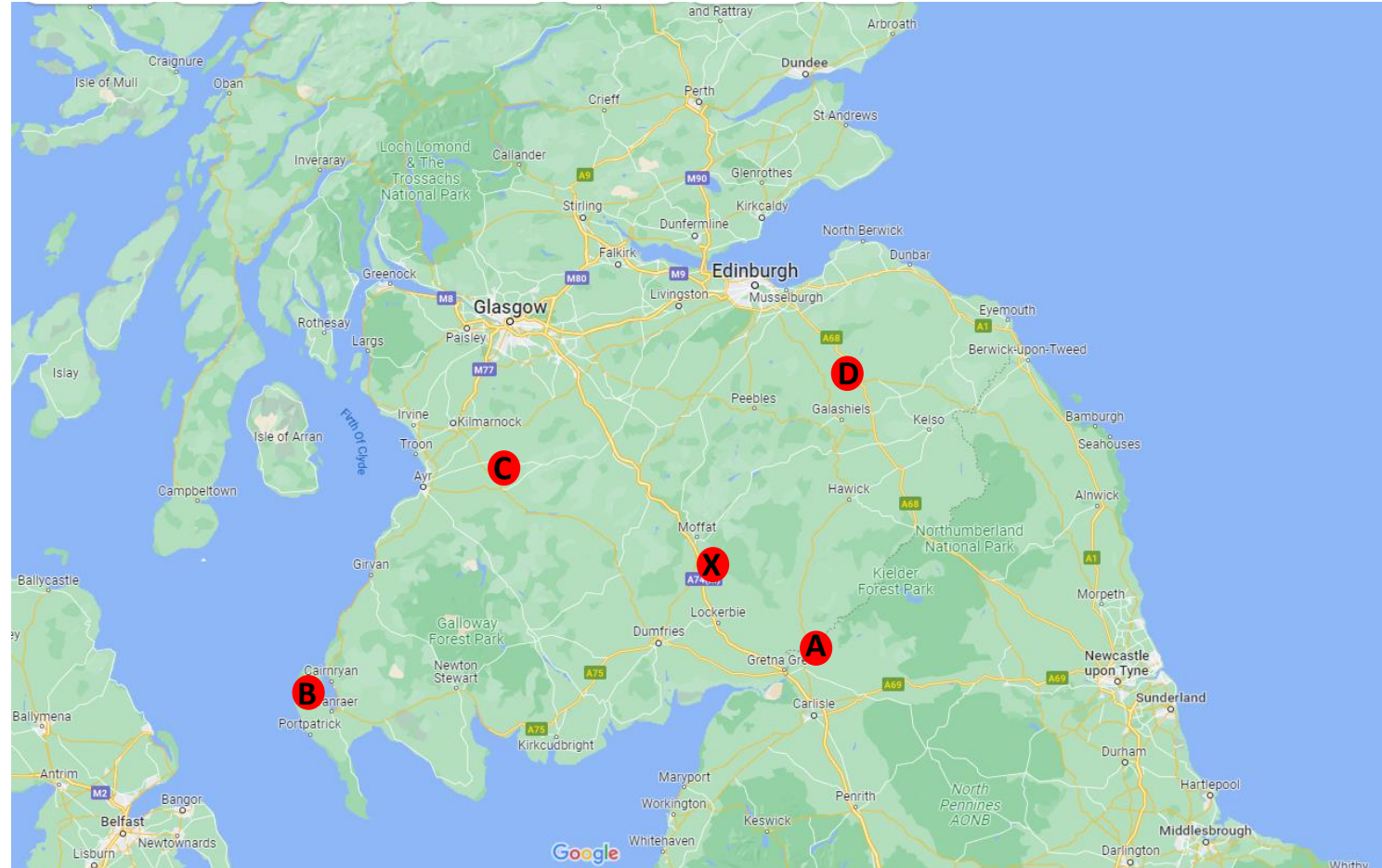
# Financial effect of heat stress

- No savings as milk yield falls
- Total cost is twice milk loss cost (Cook, 2020)
- Average loss £128  
Min £96/cow  
Max £180/cow
- Herd losses  
£24k to £90k



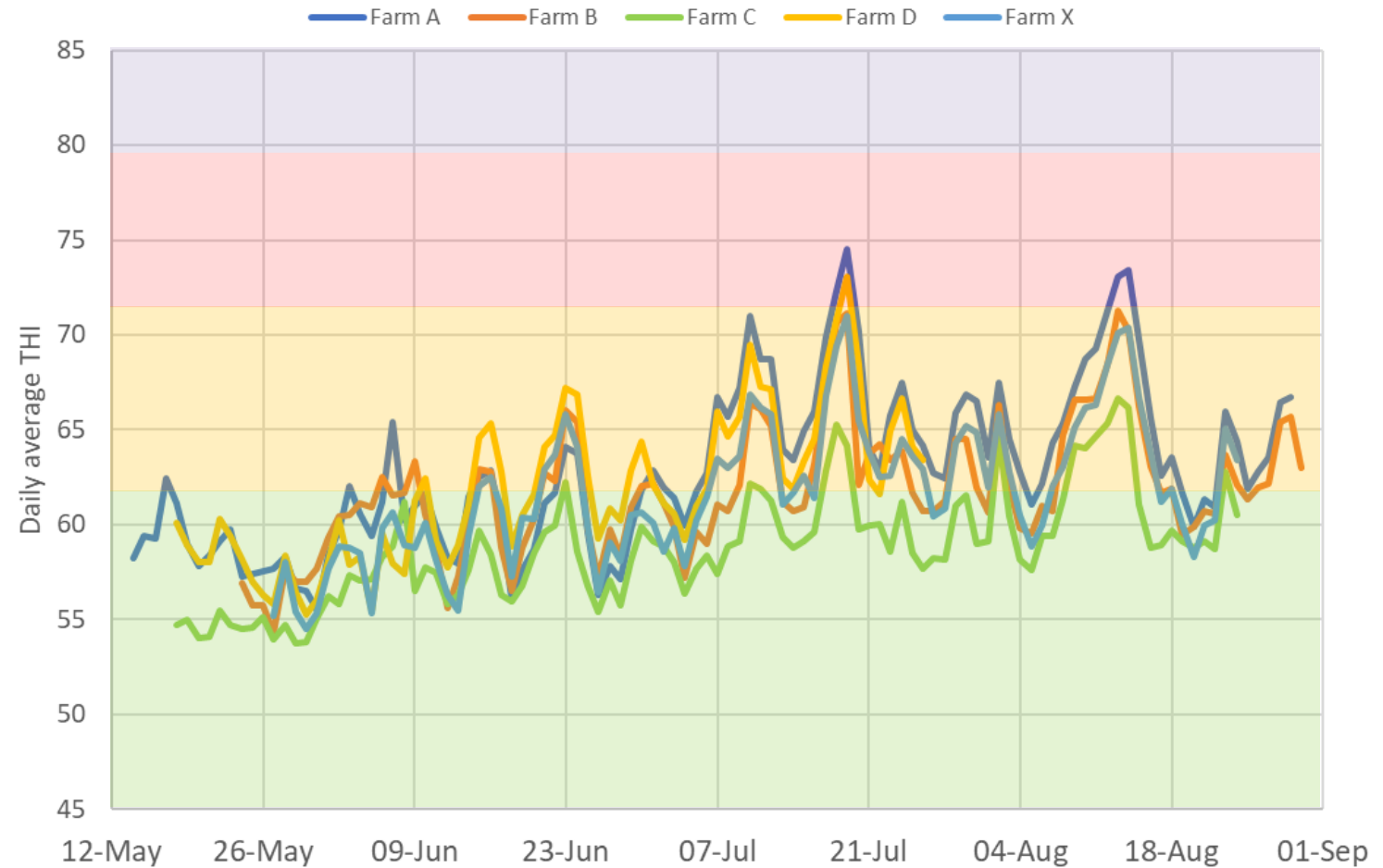
# Heat Stress in Scotland

- 5 Farms
- Csaba Adamik
- B – Grazing
  - Collecting yard
- A,C,D,X
  - Fully housed



# Results from Scotland

- Four heatwaves
- Heat stressed on 46 days (50%)
- Mild 45 days
- High 1 days
- Severe 0 days
- Heat stress season
  - Early June
  - Early September



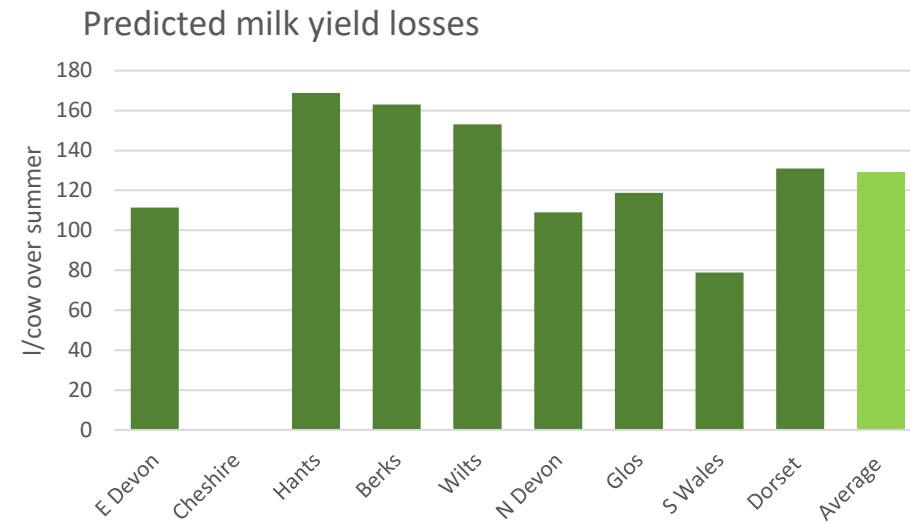
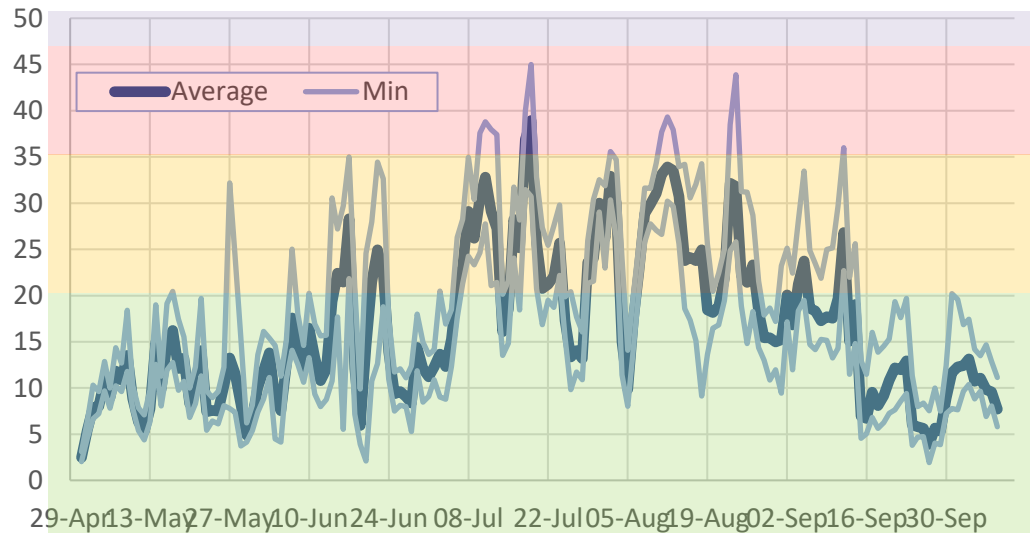


# **HEAT STRESS IN HOUSED SYSTEMS - NICO**



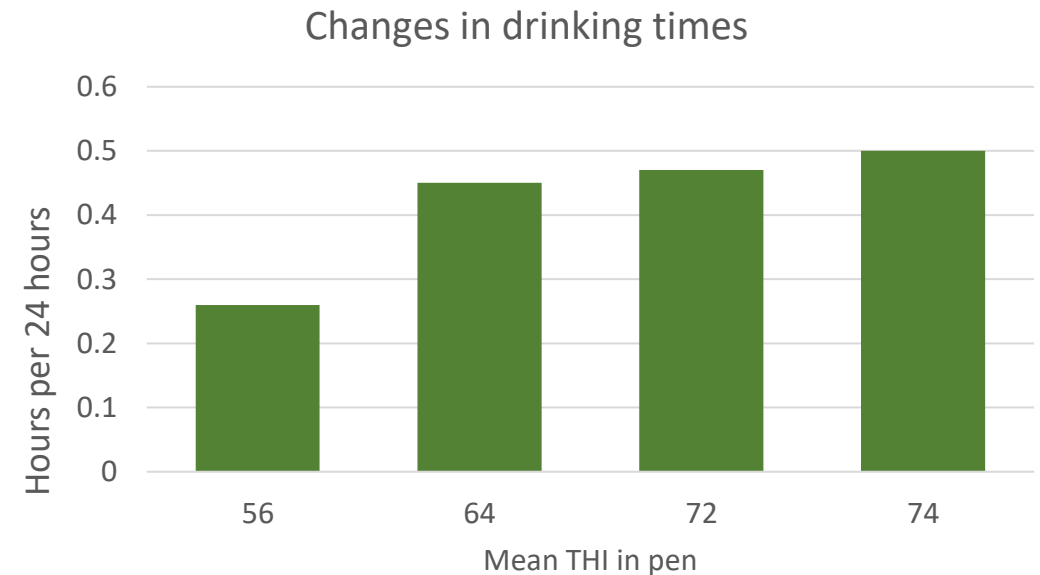
# **ROLE OF LEVUCELL SC - MARK**

# Heat stress at grazing - what can be done?



# Water

- **Critical**
- Clean and cool (<20°C)
- Ample linear space
- Near grazing area
  - Under 100m walking
- Avoid troughs emptying
  - Thirsty cows
  - Damaged troughs
- High flow or high volume



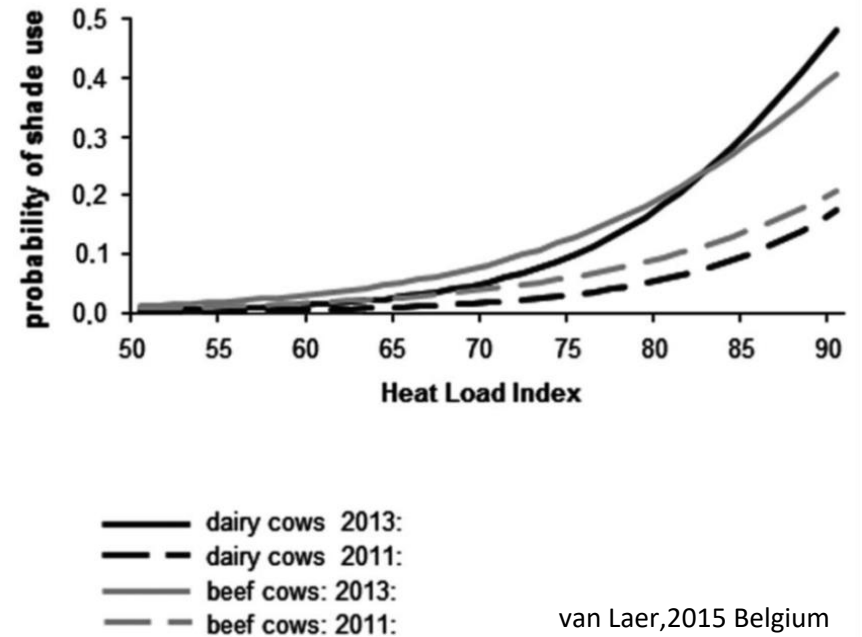


# Shade management



# Shade

- Biggest risk factor = direct sunlight
- Provide shade
  - housing, awnings, trees etc
- Target 4 m<sup>2</sup> to 6 m<sup>2</sup> shade per cow
- Shade in grazing paddocks
  - not easy to achieve required areas
- Maximise eating time / opportunities in evening
- ?? 'Siesta' management
- Cows with shade (Palacio, 2015, Canada)
  - At water trough less (x6.4)
  - Lying down more (x1.7)





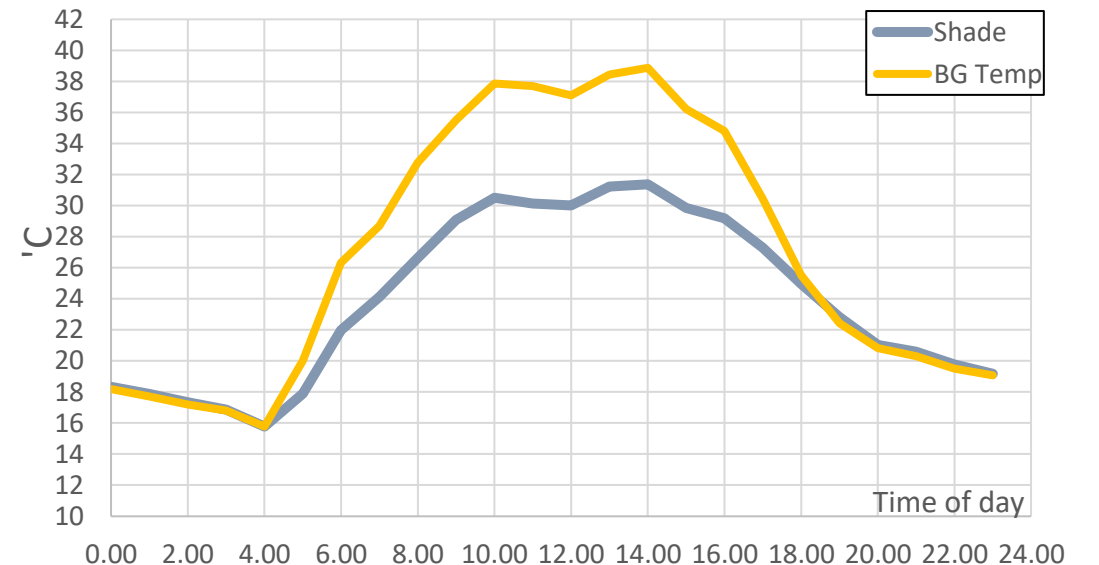
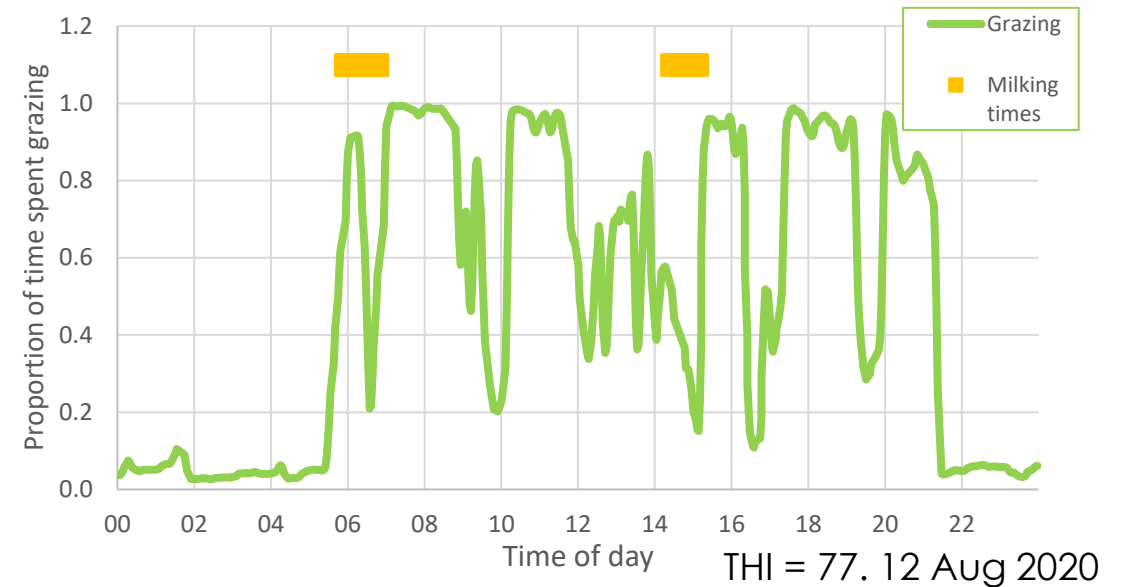
# The need for shade

MaGo shed was empty/partially stocked in this period but has best/highest data.



# Siesta management

- Temperature peaks at 10:00am
- Starts to fall after 4:00pm
- Cows have 4-5 grazing bouts a day
  - Evening bout is longest in high summer
- Proposed daily schedule
  - Graze after am milking
  - House at 10am
    - Buffer feed if necessary
  - Turn out after pm milking
- Would only miss one grazing bout



Average for w/b 9 Aug 2022

# Sunday 13 August 2018

- 83 cows, autumn calving, low yields (approx. 20l/day)

8:30am 14'C  
All grazing



10:00am 18'C  
27% grazing



1:00pm 21'C  
Huddled



# Grazing platforms on UK dairy farms

## Intensive grazing systems

- Many semi-permanent paddocks
- Often subdivided for grazing bouts
- Many day grazing paddocks will have no shade.
- Cows huddle



Grazing platform on dairy farm in S Hants

# Providing shade at grazing

- Trees are best
  - Water movement through tree generates evaporative cooling
- Plant as many boundaries as possible
  - To get  $\sim 4^2$  m/cow
- Not currently grant eligible
- Maybe difficult to establish
  - cows browse trees





# Actions to reduce heat stress at grazing

## Short term

1. Make sure water troughs are working
2. Leaks, pipes, flow rates
3. Identify paddocks with best shading
  - Use for hot days
4. Feed additives in buffer feeding

## Medium term

1. 'Siesta' management
2. More water troughs
3. Better pipework
4. Milking times
5. Shade and fans in holding yards

## Long term

1. Plant trees
2. Genetic selection
  - Slick Gene
  - Heat tolerance in future genetic indexes





**SUMMARY, DISCUSSION, Q+A**  
**MARK ET AL**