Dairy Australia

Australian Government
Department of Agriculture

Dairy Futures CRC

Economic Development, Jobs, Transport and Resources

Responses of dairy cows to short-term heat-stress in controlled-climate chambers

Josie Garner, Meaghan Douglas, Richard Williams, Bill Wales, Leah Marett, Brian Leury, Kristy DiGiacomo, Ben Hayes

AGRICULTURE VICTORIA

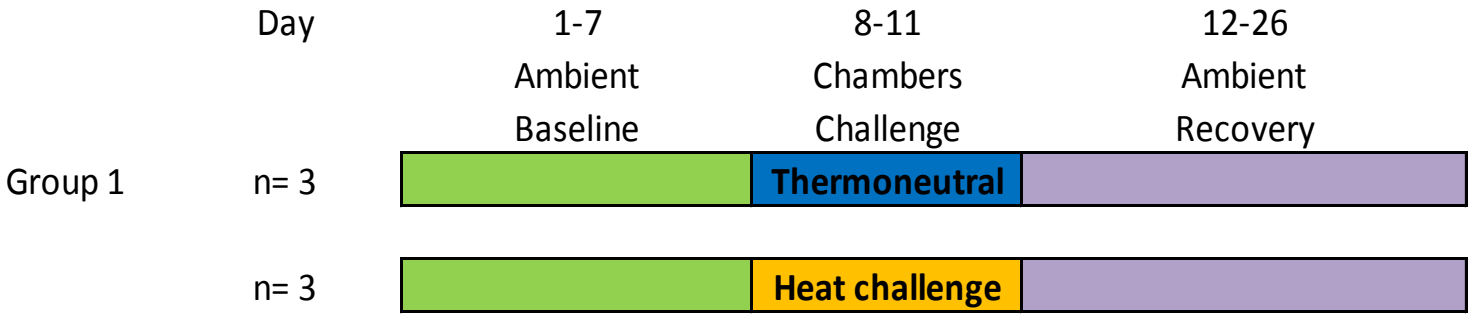
Background

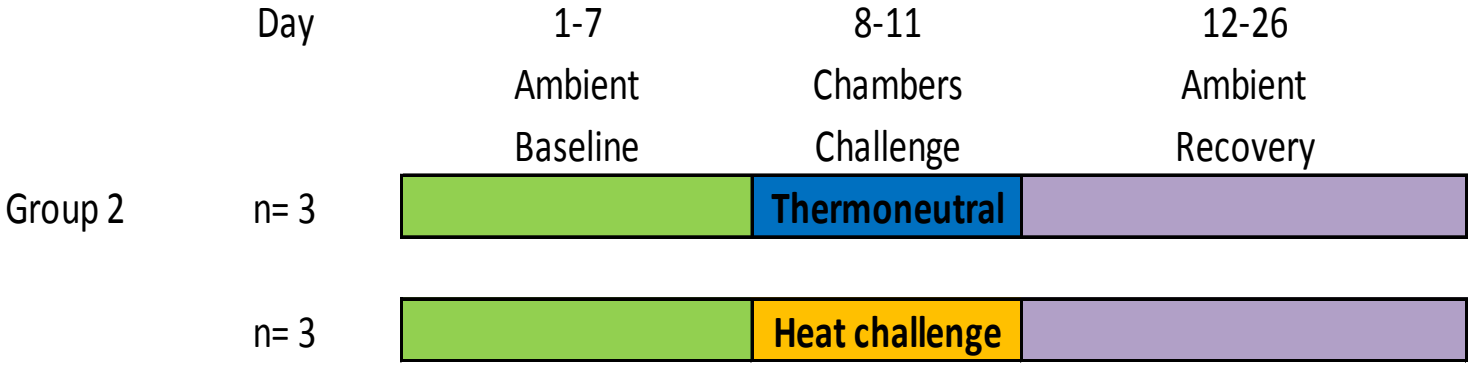
- The susceptibility of dairy cows to heat stress in an Australian temperate environment is not well understood
- Heat waves cause significant declines in milk production and there incidence is predicted to increase
- How do dairy cows in a temperate climate respond to sudden changes in temperature and humidity?
- The recovery period after heat stress events has not been well described for dairy cows

Objectives

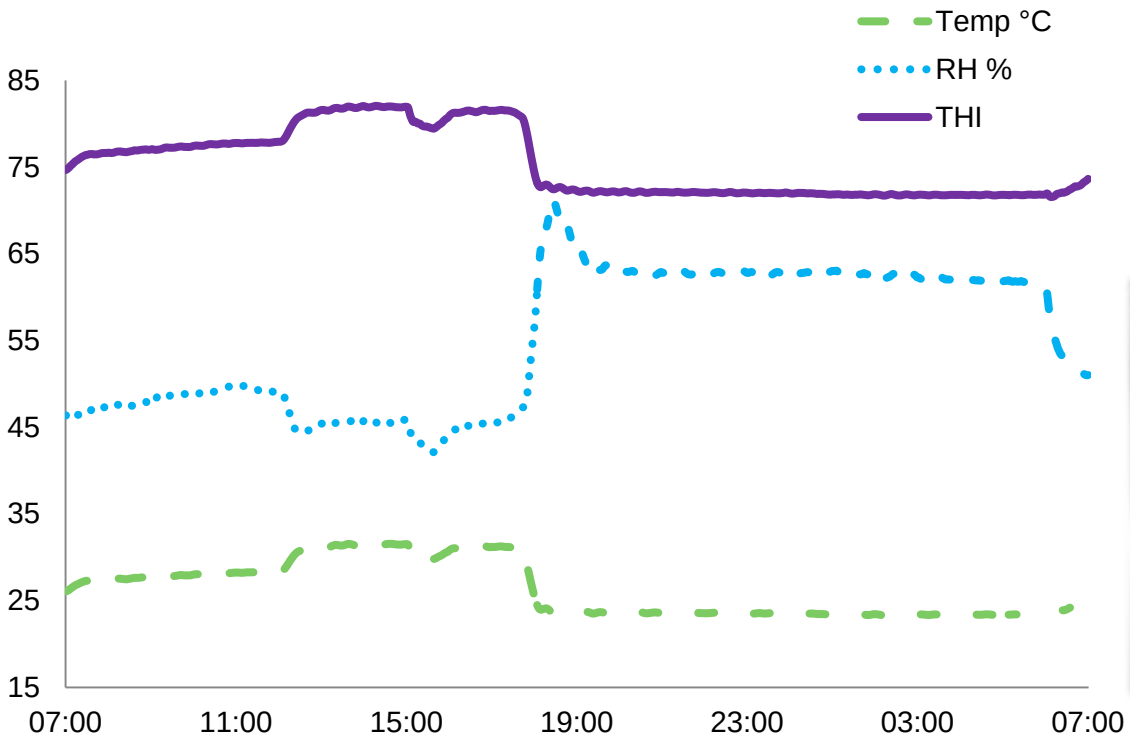
- To induce moderate heat stress in controlled-climate chambers
- To measure the production and physiological responses during the heat challenge
- To measure physiology and production after the heat challenge

Experimental design





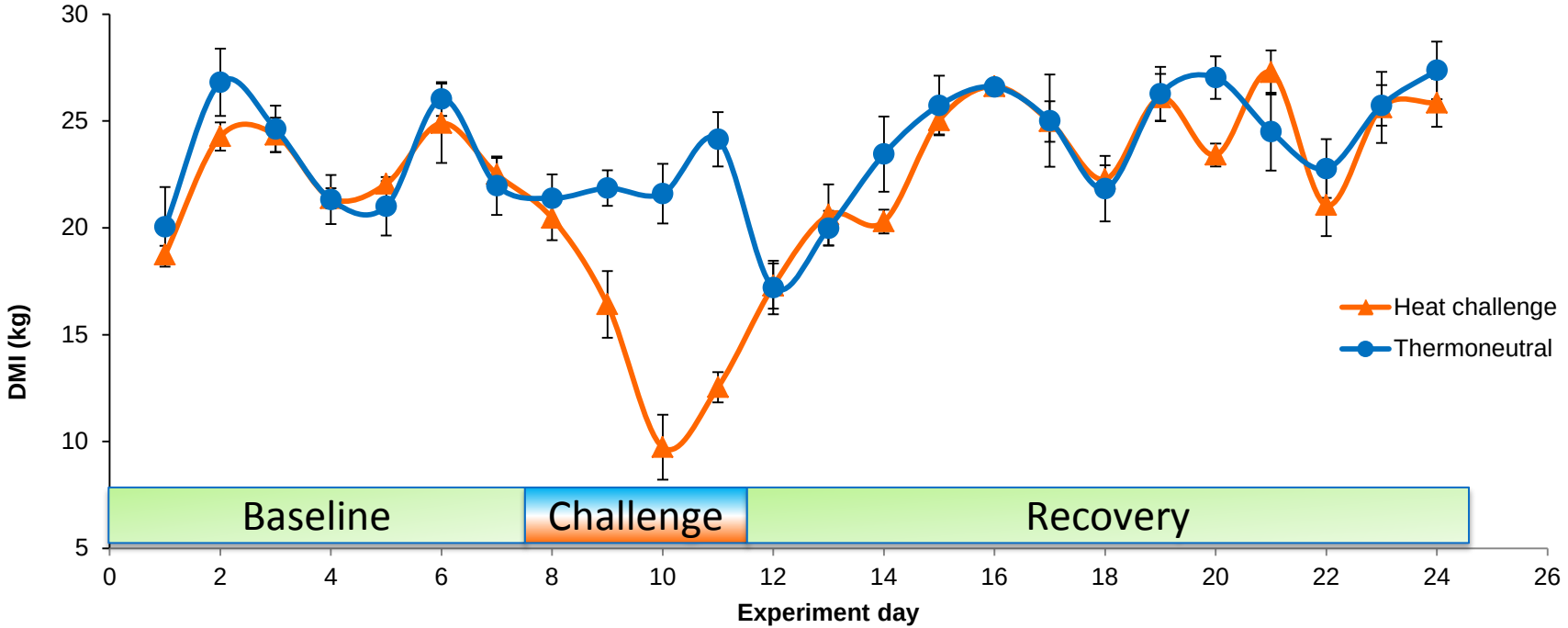
Heat challenge conditions



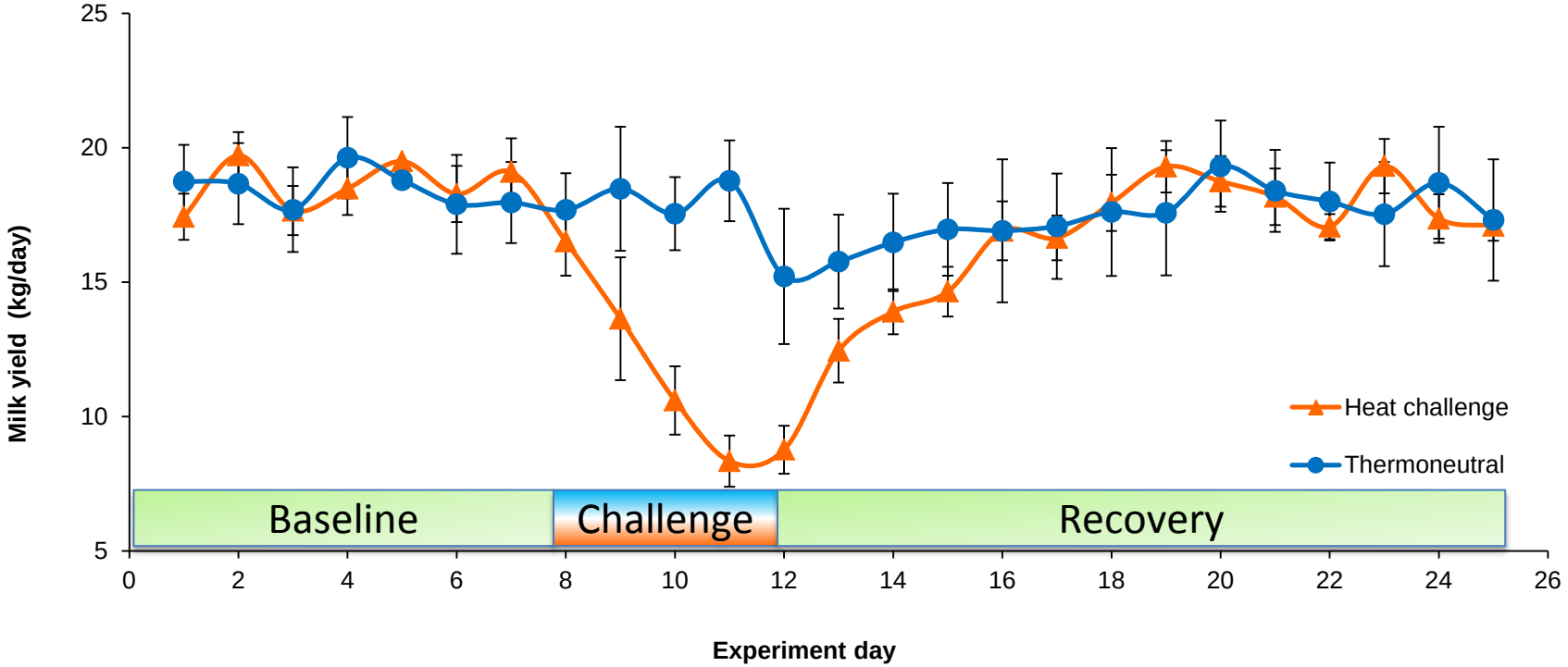
Measurements

	Baseline - Ambient 7 days	Challenge - Chambers 4 days	Recovery - Ambient 14 days
Milk yield & composition	Daily	Daily	Daily
Feed intake	Daily	Daily	Daily
Rectal temperature	AM & PM x 2 days	2 x day	AM & PM x 4 days
Skin surface temperature	AM & PM x 2 days	2 x day	AM & PM x 4 days
Vaginal temperature	every 30 mins	every 15 mins	every 30 mins
Respiration rate	AM & PM x 2 days	3 x day	AM & PM x 4 days
Blood sample	1 x	1 x	1 x
Water intake	-	Daily	-
Urine and faeces output	-	Daily	-

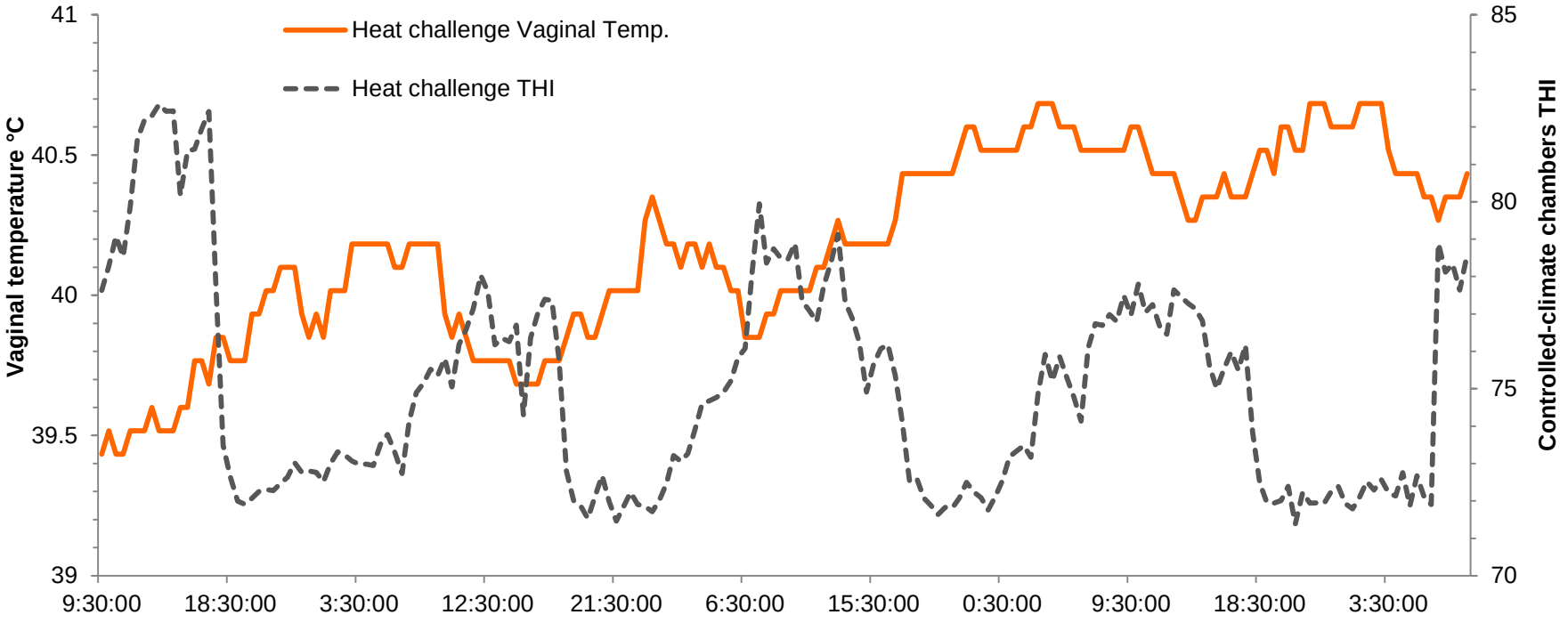
Feed intake decline



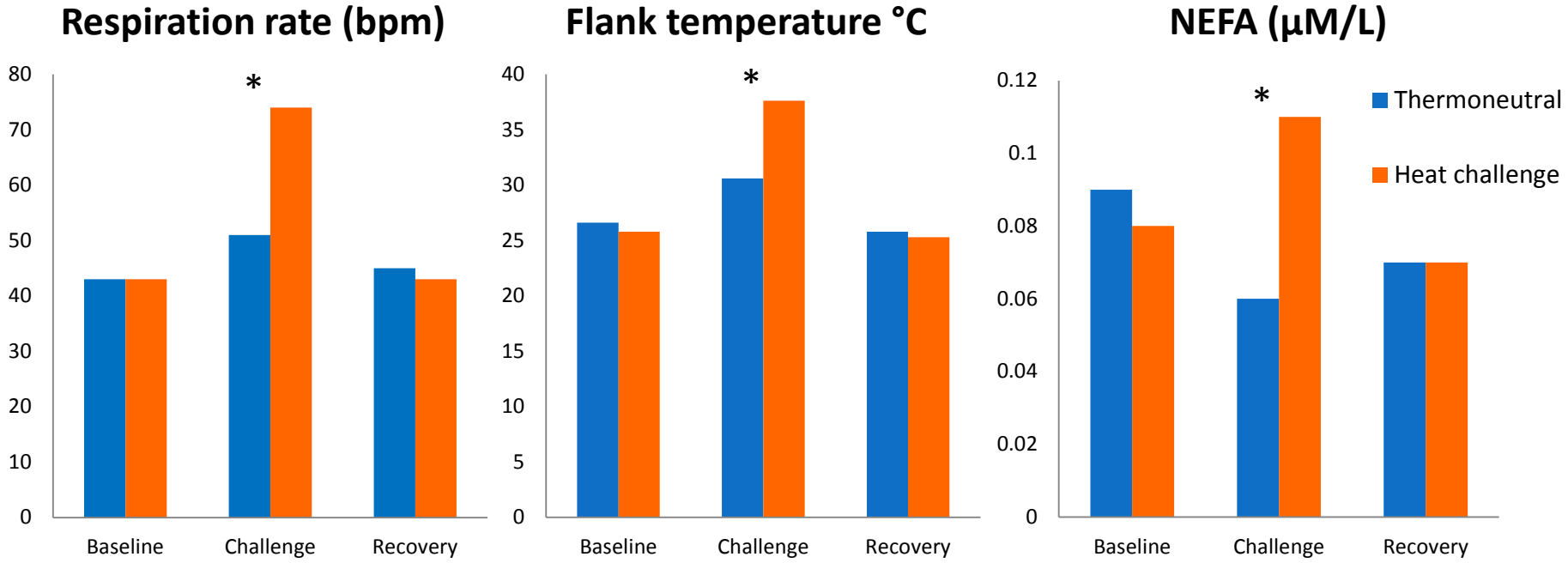
Milk yield decline



Accumulation of body heat



Heat stress adaptations



*P < 0.05

Conclusions

- The heat challenge successfully induced the characteristic physical adaptations of heat stress

- Short-term heat stress adversely affected production and induced physiological stress responses in lactating dairy cows acclimated to a temperate environment

- There was a period of metabolic recovery following the heat challenge as there was a delay in return to normal feed intake and milk yield

SCIENTIFIC REPORTS

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Genomic Selection Improves Heat Tolerance in Dairy Cattle

J. B. Garner[1], M. L. Douglas[1], S. R. O Williams[1], W. J. Wales[1], L. C. Marett[1], T. T. T. Nguyen[2], C. M. Reich[2] & B. J. Hayes[2,3]

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Dairy products are a key source of valuable proteins and fats for many millions of people worldwide. Dairy cattle are highly susceptible to heat-stress induced decline in milk production, and as the frequency and duration of heat-stress events increases, the long term security of nutrition from dairy products is threatened. Identification of dairy cattle more tolerant of heat stress conditions would be an important progression towards breeding better adapted dairy herds to future climates. Breeding for heat tolerance could be accelerated with genomic selection, using genome wide DNA markers that predict tolerance to heat stress. Here we demonstrate the value of genomic predictions for heat tolerance in cohorts of Holstein cows predicted to be heat tolerant and heat susceptible