Reducing the impact of hot weather

Findings from the "Sustainable dairy farm systems for profit" project

M5 Project Information Series - Studies on Mutdapilly Research Station and subtropical dairy farms 2001 to 2005

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Information updated May 2006

Overview

HEAT stress in dairy cattle can have an immediate impact on milk production and composition, which can persist for several days – or for the whole lactation if stress is severe.

A 200-cow herd in southeast Queensland could be losing $18,500 annually in milk income, due to hot and humid conditions. That could be reduced to a $1,200 loss with improved cow management during hot weather – including plenty of shade and water in paddocks, at feed areas, and with sprinklers.

This estimate is for a 200-cow herd in southeast Queensland, earning 32 cents a litre for summer milk, and with cows yielding more than 20 litres a day at the beginning of summer.

Try out the calculation for your own farm on www.dairyinfo.biz. Go to Information Databases, then to Heatload Maps of Australia. Click on Economic Analysis for a Given Farming Type, and enter your details for an estimate of losses due to heat and humidity on your farm.

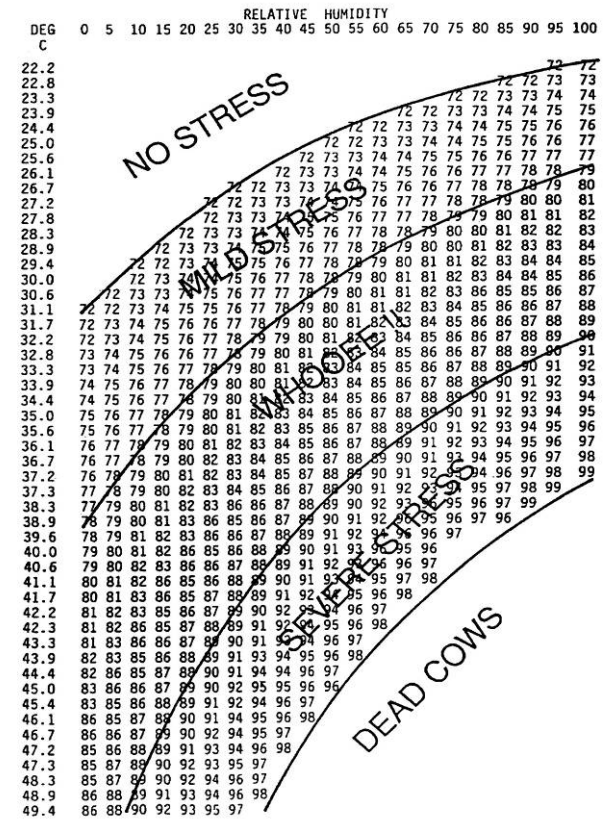
The impact of hot, humid conditions on production may be further compounded by its impact on fertility – with widespread poor conception and pregnancy rates recorded in the region during the summer months.

Several studies, including the Mutdapilly farmlets aspect of the *Sustainable dairy farm systems for profit* project, have quantified the impact of the region's hotter months on milk production and composition and on fertility, and offer some recommendations for minimising these losses.

Industry background

HEAT load on dairy cattle is estimated with a Temperature Humidity Index (THI), which combines the impact of both relative humidity and air temperature. As relative humidity increases at any temperature, cow comfort declines, and it becomes progressively more difficult for the cow to cool itself by evaporation. The impact of the combined effects of temperature and humidity on cows is summarised in *Figure 1*.

FIGURE 1. THE impact of the combined effects of temperature and humidity on cows.



Source: Dr Frank Wiersama (1990) Dept of Ag Eng, The University of Arizona, Tuscon, Arizona.

When THI is in the 70s, cows are under mild heat stress. If this escalates into the 80s, then cows will

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be suffering some heat stress problems. THIs in the 90s are severe, and can result in death.

Cows can experience THIs in the 80s at a temperature as low as 27ºC, if humidity is extreme. Conversely, temperatures can go into the mid 40s, and stress levels need not be severe if humidity is very low.

Impact on production

Milk production and composition are affected when THI reaches 78 to 80. A sudden and major increase in heat and humidity can cause a further crash in milk protein % when it is already seasonally low. Milk protein can fall by 0.2 to 0.4% units in mild to extreme heat stress, as a result of reduced feed intake and physiological effects on the cow.

A high THI has a two-fold impact on nutrition – a direct effect on dry matter intake, plus an indirect effect on forage quality. Higher THIs increase plant growth rate which increases the fibre content of plants - which in turn lowers forage quality and reduces dry matter intake.

Cow factors that reduce feed intake during periods of heat stress include panting – which reduces cud chewing, slows feed break-down and reduces the amount of water and buffers from saliva for healthy rumen function. Standing in the shade to keep cool restricts cows' grazing time and intake. Any form of stress, including heat stress, can slow down rumen contractions, which in turn slows down digestion.

Impact on fertility

Continuously hot humid weather can also have a severe impact on conception rate, particularly in high-producing cows – with 4 to 6 inseminations frequently needed for conception during summer months. Conception rate drops dramatically when THI reaches 72.

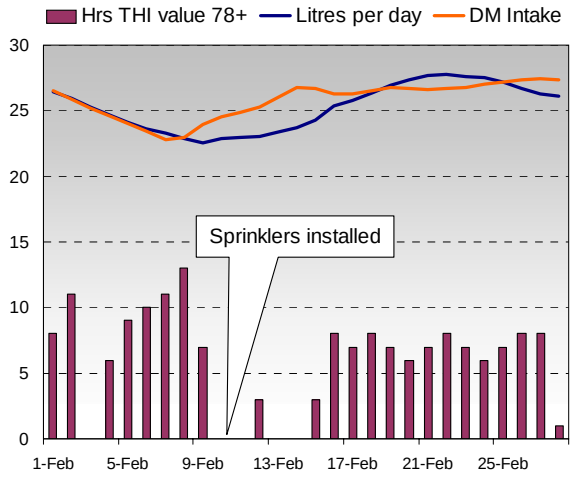
Lessons from the M5 project

Mutdapilly M5 farmlet herds

Installation of sprinklers at the feedlot

IN February 2005, the Mutdapilly research station M5 feedlot farmlet herd had sprinklers installed, which turned on when air temperature reached 26ºC. Traditionally on the research station, feed intake and milk production have fallen dramatically in January, February and March heat waves. In the summer of 2005 when feedlot sprinklers were installed, both feed intake and milk production increased, *Figure 2*.

FIGURE 2. MUTDAPILLY M5 farmlet herd milk production and dry matter intake for February 2005, compared with the number of hours a day with THI above 78, when milk production is known to decline significantly. Cow-cooling sprinklers were installed during February 2005. In the second half of the month, the THI remained above 78 for more than 5 hours a day – but milk production and feed intake continued to improve.



The sprinklers - the same as those used in previous heat stress trials at the station 10 years ago – are half-circle garden types, spaced at 1.5 metre intervals and at 1.8 metres height, above the neck rail where cows feed *Photo 1* and *Photo 2*.

PHOTO 1. HALF-CIRCLE garden sprinklers have been installed at 1.5 metre intervals over the cows on their feeding alley.

Water is drawn from a holding tank with a 0.75 KW pump. A pressure-relief valve limits sprinkler pressure to around 60 kPa, with sprinklers delivering about 2 litres a minute. Set on a timer, the sprinklers come on for 3 minutes and

off for 10 minutes whenever the temperature is more than 26ºC.

Water for the sprinklers was drawn from a large concrete tank of weir/creek water, at a temperature of around 23-27ºC. Most of the cooling effect comes from the latent heat of evaporation as the cows dry, rather than the water temperature.

Time was spent ensuring that the sprinklers only wet the cows on the concrete feeding alley – not the gravel loafing pad or the feed.

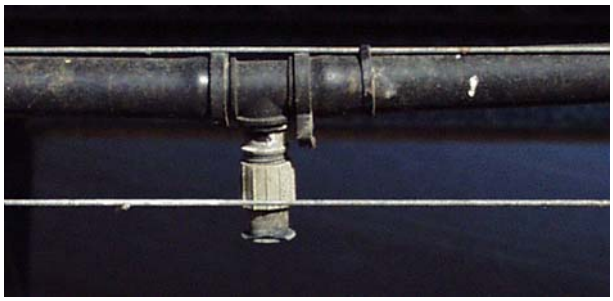


PHOTO 2. SET at 1.8 metres high, above the neck feeding-rail, these sprinklers have been cooling the Mutdapilly farmlet feedlot cows during summer – improving milk production and feed intake.

PHOTO 3. SPRINKLERS in operation in the M5 feedlot. Cows tended to stand with heads away from sprinklers, but would not move from under sprinklers in hot weather.

Installing the sprinklers created and highlighted other management issues.

- A well-drained concrete feed pad is essential if sprinklers are used. The Mutdapilly feed pad has generally coped well.
- Cows get filthy if the pad is not scraped every day when sprinklers are in use.
- Mastitis was no worse after sprinklers were installed.

Impact of heat and humidity on farmlet herd fertility

THERE was an obvious seasonal effect on the farmlet herds' 6-week in-calf rate, the prime indicator of reproduction success, (*Figure 3*). Summer mating seasons had a much lower 6-week ICR (46%) than winter mating seasons (69%) – which were always above industry averages found by the InCalf project.

With reasonable submission rates in all seasons, the seasonal differences in 6-week ICR are a reflection of conception rates.

FIGURE 3. AVERAGE 6-week in-calf rate and 1st service conception rate for the farmlet herds in summer and winter.

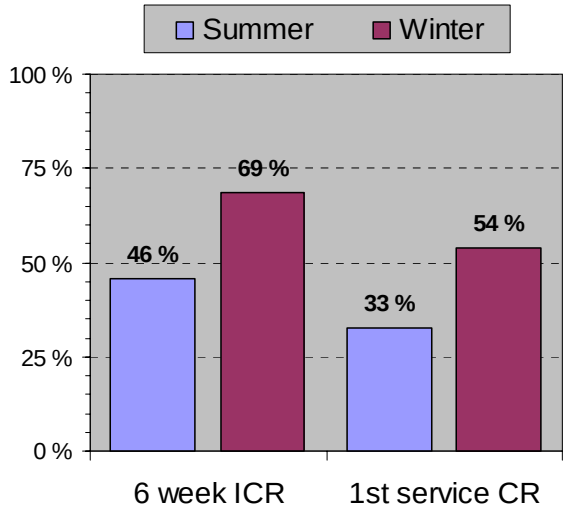


Figure 3 shows that first-service conception rates were also different in each season.

Summer mating seasons had a much lower first-service CR (33%) than winter mating seasons (54%). Winter conception rates were generally near or above average - indicating that the inseminators were capable of good results.

Other studies

A DETAILED fertility study on the Atherton Tableland recently found that conception rate drops dramatically when daily THI reaches 72.

The study found that heat load at any stage from at least 4 weeks before service to 2 weeks after service affects the chance of conception. Weather conditions in the week following service had the most depressing effect on conception, followed by weather the week before.

The study also found the effects of heat stress to be cumulative – moderate heat load for a long period impacted on conception rate, more than higher heat load for a short period around the time of service.

Recommendations

Maximise cow comfort and minimise production losses during hotter months.

- Provide access to shade throughout the day. Shade can reduce radiant heat load from the environment by up to 50%.
- Provide cool, clean water and enough trough space in all paddocks and at the dairy. Cows may drink 50% of their daily water intake straight after milking, so sufficient cool, clean water is needed at the dairy exit as well as in entry laneways and yards. Milking cows have the capacity to drink up to 100 litres a day during hot weather. A 200-cow herd may therefore require up to 5,000 litres of cool clean water after each milking in summer. Many farms are not set up to deliver this quantity over the 1-2 hours that cows are exiting the dairy.
- Cooling cows at the dairy with shade, sprinklers or fans – before and after milking – will improve their comfort and enhance their capacity to eat.
- Queensland trials showed that 30 minutes of wetting cows with sprinklers can produce an extra litre of milk; 60 minutes produced an extra 1.5 litres in hot weather. The sprinklers should deliver large drops to wet cows to the skin.
- Let the cows wander home and stand under sprinklers. Lower body temperatures will encourage higher feed and pasture intake during and after milking.
- With cows doing up to 70% of their grazing at night during hot weather, provide quality, well-fertilised night paddocks. With limited grazing time, lush, leafy pastures will produce the best results.
- Fibre digestion creates a higher metabolic heat load, so increase the proportion of concentrates to minimise this effect. Hot cows will eat little pasture, but will tolerate an increased ration of readily-digestible concentrate and hay/silage in shaded areas.
- Walking to feed increases cow heat load, so reduce their walking distance during the hotter times of day. In hot conditions, try to bring feed to the cows, rather than cows to feed.

Change summer mating practices

- Because of the number of inseminations needed before successful conception, it may be worth considering not mating during the hot months by changing to a more seasonal or batch-calving system.
- If you decide to continue to mate during the hottest months, you might consider using lower-priced semen, or running a bull for summer services.
- There are pros and cons to using a bull during hot times. The advantages of using bulls include - reduced requirement for heat detection; time saved by not doing AI; reduced semen costs. Possible disadvantages include – potentially no better results than AI; disease risks; likely lower genetic value than AI semen; safety risks; and the cost of buying (or raising) and maintaining a bull, including extra facilities.

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The *Sustainable dairy farm systems for profit* project at Mutdapilly Research Station and on associated commercial farms investigated the potential impact of intensification of five subtropical dairy farming systems on business productivity, on the social well being of farming families and on the farm environment.