

Betaine as a dietary additive to mitigate heat stress

Feeding Cool Cows – Fact Sheet 3

KEY POINTS

Feeding cows during hot weather can be complex as the digestion and fermentation of feed generates heat within the cow.

Simple changes, such as supplementing the diet with an additive such as betaine, can reduce some of the negative impacts of hot weather.

Supplementing a cow's diet with betaine can result in lower body temperature that helps to maintain feed intake, and support milk yield during hot periods.

- Assisting animals to recover from periods of heat stress.
- Assisting in essential amino acid cycles within the cow (such as methionine) that may help to optimise reproduction outcomes.

Previous work in Australia by University of Melbourne scientists with grazing dairy cows showed dietary betaine provided a significant milk yield increase of 6 per cent in summer (February/March) over cows not receiving betaine. (Dunshea et al 2019).

Feeding Betaine?

Betaine is generally fed as part of the concentrate mix on farms, in a similar manner to other supplements. No specialist feeding infrastructure is required to add betaine to a lactating cow diet.

Introduction

As the frequency of heatwaves in Australia increase, extra management strategies are required to deal with heat stress in dairy cows. Environmental interventions such as providing shade, sprinklers, fans and adjusting milking times all help to mitigate the effects of heat stress.

During a heat event up to 50 per cent of the reduction in milk yield is attributed to reduced dry matter intake, therefore any strategy that helps to reduce the decline in Dry Matter Intake (DMI) will help sustain milk production.

The DairyFeedbase Feeding Cool Cows project investigated the use of betaine as an option to reduce the negative impact that a heat event has on DMI.

Betaine

Betaine (trimethylglycine) is a naturally occurring extract from sugar beet that is often used by the ruminant feed industry in Australia. Addition of betaine to the diet of animals can increase their resilience to heat exposure through several mechanisms including:

- Assisting to maintain cellular fluid balance and therefore reducing the base heat production and maintenance requirements of cows.

Figure 1 Dry matter intake per cow

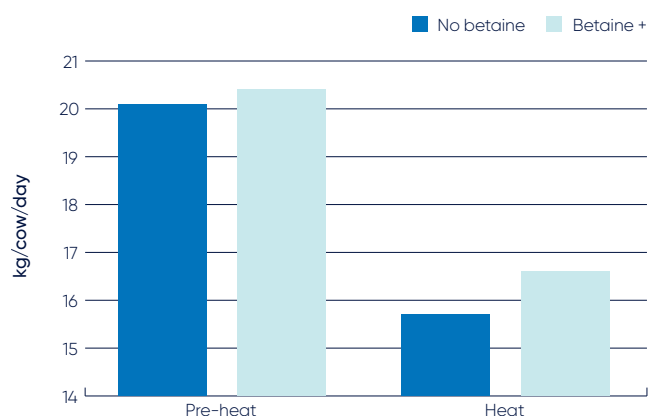
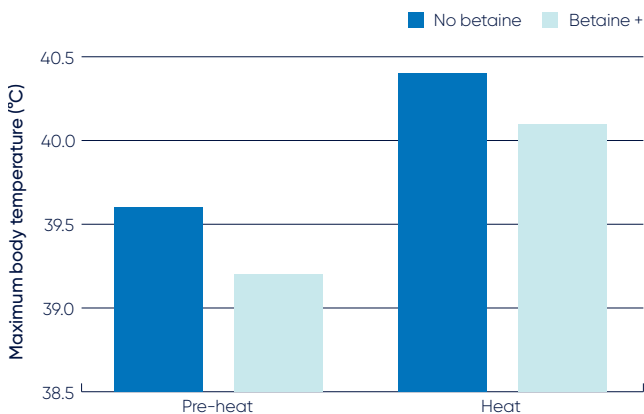


Figure 2 Maximum body temperature per cow



In work conducted by the Feeding Cool Cows project, cows fed betaine had consistently lower body temperature than cows not fed betaine, both before and during the period of heat stress. Dry matter intake decreased for all cows during the heat challenge, but the decrease was smaller for cows fed betaine, as demonstrated in Figures 1 and 2.

As betaine works on modifying the cow's metabolism, this assisted in ensuring a quicker recovery from that period of heat stress. This meant that cows that received betaine also tended to produce more milk solids overall than their un-supplemented counterparts.

Because metabolic adaptation to betaine can take several weeks it is best if betaine is incorporated into the diet several weeks prior to the onset of high temperatures (approximately 4 weeks). This period of adaptation may lead to a smaller reduction in milk production, in cows experiencing periods of heat stress over the warmer months.

Economics

Betaine is a low-cost dietary supplement that can help cows to better manage heat stress. Betaine is most often fed in a powder form, and there are no changes to farm infrastructure required to incorporate this into the cow's diet. Under the DairyFeedbase Feeding Cool Cows project, farm systems economists assessed a range of scenarios to determine the net benefit of feeding betaine to dairy cows during summer periods. Adding betaine to the diet of lactating cows, at the manufacturer's recommended rate, proved to be economical under most scenarios tested.

A future climate example for the Northern Victoria region between September to March was considered. The period examined spanned a total of 212 days, including 91 days of heat stress conditions where the average daily temperature and humidity index (THI) was above 75.

In this scenario, feeding betaine resulted in approximately \$30 net benefit per cow over the hot weather period when compared with feeding a control diet containing

no betaine. Almost all of the net benefit of feeding betaine was derived on the heat stress days where loss of milk yield due to heat stress was minimised.

The \$30 net benefit was derived from an extra 9 kg milk solids produced by cows fed betaine over the hot weather period, compared to those fed the control diet, minus the extra cost of the betaine supplement. For this scenario the cost of both diets was calculated on a dry matter basis. A conservative five-year average milk price and feed price was used in the analysis, noting that results will vary between individual farms and locations with different weather profiles.

In addition to minimising loss of milk production due to heat stress, the lower body temperature of cows fed betaine may result in less metabolic stress and lower rates of embryonic losses during the summer months. While not taken into account in these analyses, these factors may also have a positive impact on overall farm profit.

Conclusion

If using betaine within your 'summer' diet consider:

- Early implementation into the diet to allow cows time to adapt and to make the most of the positive impact betaine can have to minimise production losses during hot weather.
- Remember that betaine works on the cow's metabolism and can help the cow maintain dry matter intake and recover quicker from heat stress.
- Based on a future climate example for Northern Victoria, feeding betaine from September to March showed the potential to provide a net benefit of \$30 per cow.
- When looking at ways to manage heat stress in your herd, be sure to remember that nutrition is just one component of a heat stress management plan. Physical cooling options such as shade, sprinklers and adjusted milking times remain an important tool to manage heat stress for any milking herd.

Further reading

'Dietary Fat and Betaine Supplements Offered to Lactating Cows Affect Dry Matter Intake, Milk Production and Body Temperature Responses to an Acute Heat Challenge'. 2021 by Williams et al.

'Economic Threshold Analysis of Supplementing Dairy Cow Diets with Betaine and Fat during a Heat Challenge: A Pre – and Post-Experimental Comparison'. 2022 by Lewis et al.

'Betaine Improves Milk Yield in Grazing Dairy Cows Supplemented with Concentrates at High Temperatures'. 2019 by Dunshea et al.

For more information on the Feeding Cool Cows project and other ways to manage heat stress visit [Cool Cows | Dairy Australia](#).