

# The importance of planning ahead to detect early signs of heat stress

With global warming, heat stress is a common and growing concern in ruminant production and experts are now fully aware that it is not limited to two summer months or tropical regions. Cattle naturally change their behaviour to help alleviate the stress which can disrupt digestion, increase inflammation and reduce dairy cow performance and health.

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Long before milk production is affected, heat stress can be detected and recognised by changes in animal behaviour. Detecting the signs of heat stress as early as possible is essential to preserving its full production and health potential by adjusting the herd management. Here are some tips.

## Watch the weather

The temperature-humidity index (THI) is a common indicator of heat stress risk (Table 1). That is because temperature is important but also the air relative humidity level, which exacerbates the effect of heat.

The THI in the barn could be higher than the THI based on meteorological data. On the other hand, the solar radiation could increase the actual heat stress in grazing animals. By placing a thermo-hygrometer – or new generation of

sensors that continuously monitor THI within the barn – close to the animals, producers can monitor and anticipate heat stress risks.

The negative impact of heat stress is linked to the THI level and to the duration of exposure, both in terms of the number of hours/day and the number of consecutive days of stress. For dairy cows, the common threshold admitted by the scientific community was 68. However, practical field studies showed that heat stress can impact the cow from a THI of 62.

Impact of heat stress on dairy production will depend on the geographic location. When cows are under continuous heat stress conditions, they can adapt thanks to alleviation strategy, therefore it is important to follow other indicators to detect the impact of heat stress.

## Animal observation is key to detect early signs of heat stress

The first signs of moderate heat stress include:

- Shallow breathing.
- Increased respiration rate.
- Reduced feed intake and erratic feeding behaviour.
- Reduced lying time: to increase heat dispersion, the animal will spend less time lying quietly (and ruminating). Research has shown a



significant drop in lying time under the heat stress threshold.

- Decreased rumination activity: there is a correlation between rumination time and rumen function, hence the lowered production performance. In dairy cows, it has been shown that for each 10-point increase in the THI, daily rumination could be reduced by one hour and dairy production by 2.7kg/day.

We estimated that a good target is to have 50-60% of dairy cows lying in their stalls ruminating at the same time. Under heat stress conditions, rumination is suboptimal in 50% of farms.

- Higher somatic cell count in milk.
- Potential locomotion issues. Longer term signs include impact on animal fertility and longevity.

## Look out for signs of reduced rumen function

The following signs can indicate poor rumen function: decreased lying and rumination time, loss of saliva through panting, a reduction in meal frequency and a larger meal size, also known as 'slug feeding'.

The experts at Lallemand can also help producers measure rumen function on their operation by assessing signs such as:

- **Manure colour and consistency:** These are effective ways to assess rumen function. The presence of undigested grain or cotton seeds, for example, are signs of sub-optimal rumen function, where precious (and expensive) nutrients are not being fully digested by the animal.
- **Locomotion:**

Lameness can be a sign of poor rumen function and SARA. Heat stress can exacerbate poor rumen fermentation and function and negatively affect animal behaviour resulting in even worse locomotion scores and higher incidence of lameness.

We have observed 11% less cows with a good locomotion score during heat stress.



## What happens inside the rumen?

The observed changes in feeding behaviour and rumination will impact rumen pH and microflora activity. During heat stress, there is a shift in microbial populations with a reduction of fibrolytic flora. The risk of subacute rumen acidosis (SARA) is increased, which can lead to lameness, liquid faeces, lower milk production and more.

## Consequences on animal performance and health

The reduced rumen function and lower feed intake leads to a reduced energy supply, which impacts dairy performance. Milk yield and milk components are reduced. Milk loss is linked to both heat stress levels and duration of exposure.

According to Hammami et al., 2013, in Northern Europe cows are losing -0.164kg of milk per hour with THI of 62 and start to observe a depression in milk quality.

Bourraoui et al., 2002 found higher losses in milk, fat and protein yields in Mediterranean regions (-0.41; -0.681 and -0.562kg) respectively, per units above 68.

It has also been shown that heat stressed animals experience increased oxidative stress combined with a lower antioxidant status.

This could also have a negative effect on animal health, immune defences, and reproductive performance (for example somatic cell count, fertility and longevity).

## Importance of prevention

It is crucial to detect the first signs of heat stress as early as possible, by monitoring both the environment and the animals. During a risky time, it is important to prepare the animals and support proper rumen function and rumen pH to help maintain the performance level.

Nutritional strategies to preserve dairy performance should focus on supporting nutrient utilisation by optimising diet digestion, while preserving rumen function. In this context, the rumen specific yeast *S. cerevisiae* CNCM I-1077 – demonstrated to improve both nutrient digestion and rumen efficiency – has already been shown to effectively alleviate the toll of heat stress on dairy production and improve rumination behaviour.

The live yeast acts as a rumen modifier. It works by improving the overall rumen environment and function through the control of rumen pH. *S. cerevisiae* CNCM I-1077 also helps improve animal performance through enhanced fibre degradation.

A study by the University of Florida in 2021 further demonstrates the live yeast benefits on rumen fermentation profiles and feeding behaviour during heat stress, two parameters which are intimately linked. This is translated into better feed efficiency and preserved milk production:

- Feed efficiency is improved by 7.6% (+130g energy-corrected milk/Kg DMI) in the supplemented animals as compared to control.
- Energy-corrected milk is improved by 2kg cow/day as compared to control.

| Temperature |      | Relative humidity (%) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |
|-------------|------|-----------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|
| °F          | °C   | 10                    | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85  | 90  | 95  | 100 |
| 60          | 15.6 | 59                    | 59 | 59 | 59 | 59 | 59 | 59 | 59 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60  | 60  | 60  | 60  |
| 61          | 16.1 | 60                    | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 61 | 61 | 61 | 61 | 61  | 61  | 61  | 61  |
| 62          | 16.7 | 60                    | 60 | 60 | 60 | 60 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 62 | 62  | 62  | 62  | 62  |
| 63          | 17.2 | 61                    | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 63  | 63  | 63  | 63  |
| 64          | 17.8 | 61                    | 61 | 61 | 62 | 62 | 62 | 62 | 62 | 62 | 63 | 63 | 63 | 63 | 63 | 63 | 64  | 64  | 64  | 64  |
| 65          | 18.3 | 62                    | 62 | 62 | 62 | 62 | 62 | 63 | 63 | 63 | 63 | 63 | 64 | 64 | 64 | 64 | 64  | 65  | 65  | 65  |
| 66          | 18.9 | 62                    | 62 | 62 | 63 | 63 | 63 | 63 | 64 | 64 | 64 | 64 | 64 | 65 | 65 | 65 | 65  | 66  | 66  | 66  |
| 67          | 19.4 | 63                    | 63 | 63 | 63 | 64 | 64 | 64 | 64 | 65 | 65 | 65 | 65 | 66 | 66 | 66 | 66  | 67  | 67  | 67  |
| 68          | 20   | 63                    | 63 | 64 | 64 | 64 | 64 | 65 | 65 | 65 | 66 | 66 | 66 | 66 | 67 | 67 | 67  | 67  | 68  | 68  |
| 69          | 20.6 | 64                    | 64 | 64 | 64 | 65 | 65 | 65 | 66 | 66 | 66 | 67 | 67 | 67 | 67 | 68 | 68  | 68  | 69  | 69  |
| 70          | 21.1 | 64                    | 65 | 65 | 65 | 65 | 66 | 66 | 66 | 67 | 67 | 67 | 68 | 68 | 68 | 69 | 69  | 69  | 70  | 70  |
| 71          | 21.7 | 65                    | 65 | 65 | 66 | 66 | 66 | 67 | 67 | 67 | 68 | 68 | 68 | 69 | 69 | 70 | 70  | 70  | 71  | 71  |
| 72          | 22.2 | 65                    | 65 | 66 | 66 | 67 | 67 | 67 | 68 | 68 | 69 | 69 | 69 | 70 | 70 | 70 | 71  | 71  | 72  | 72  |
| 73          | 22.8 | 66                    | 66 | 66 | 67 | 67 | 68 | 68 | 68 | 69 | 69 | 70 | 70 | 71 | 71 | 71 | 72  | 72  | 73  | 73  |
| 74          | 23.3 | 66                    | 67 | 67 | 67 | 68 | 68 | 69 | 69 | 70 | 70 | 70 | 71 | 71 | 72 | 72 | 73  | 73  | 74  | 74  |
| 75          | 23.9 | 67                    | 67 | 68 | 68 | 68 | 69 | 69 | 70 | 70 | 71 | 71 | 72 | 73 | 73 | 74 | 74  | 75  | 75  | 75  |
| 76          | 24.4 | 67                    | 68 | 68 | 69 | 69 | 70 | 70 | 71 | 71 | 72 | 72 | 73 | 73 | 74 | 74 | 75  | 75  | 76  | 76  |
| 77          | 25   | 68                    | 68 | 69 | 69 | 70 | 70 | 71 | 71 | 72 | 72 | 73 | 73 | 74 | 74 | 75 | 75  | 76  | 76  | 77  |
| 78          | 25.6 | 68                    | 69 | 69 | 70 | 70 | 71 | 71 | 72 | 73 | 73 | 74 | 74 | 75 | 75 | 76 | 76  | 77  | 77  | 78  |
| 79          | 26.1 | 69                    | 69 | 70 | 70 | 71 | 71 | 72 | 73 | 73 | 74 | 74 | 75 | 76 | 76 | 77 | 77  | 78  | 78  | 79  |
| 80          | 26.7 | 69                    | 70 | 70 | 71 | 72 | 72 | 73 | 73 | 74 | 75 | 75 | 76 | 76 | 77 | 78 | 78  | 79  | 79  | 80  |
| 81          | 27.2 | 70                    | 70 | 71 | 72 | 72 | 73 | 73 | 74 | 75 | 75 | 76 | 77 | 77 | 78 | 78 | 79  | 80  | 80  | 81  |
| 82          | 27.8 | 70                    | 71 | 71 | 72 | 73 | 73 | 74 | 74 | 75 | 76 | 77 | 77 | 78 | 79 | 79 | 80  | 81  | 81  | 82  |
| 83          | 28.3 | 71                    | 71 | 72 | 73 | 73 | 74 | 75 | 75 | 76 | 77 | 78 | 78 | 79 | 80 | 80 | 81  | 82  | 82  | 83  |
| 84          | 28.9 | 71                    | 72 | 73 | 73 | 74 | 75 | 75 | 76 | 77 | 78 | 78 | 79 | 80 | 80 | 81 | 82  | 83  | 83  | 84  |
| 85          | 29.4 | 72                    | 72 | 73 | 74 | 75 | 75 | 76 | 77 | 78 | 78 | 79 | 80 | 81 | 81 | 82 | 83  | 84  | 84  | 85  |
| 86          | 30   | 72                    | 73 | 74 | 74 | 75 | 76 | 77 | 78 | 78 | 79 | 80 | 81 | 81 | 82 | 83 | 84  | 84  | 85  | 86  |
| 87          | 30.6 | 73                    | 73 | 74 | 75 | 76 | 77 | 77 | 78 | 79 | 80 | 81 | 81 | 82 | 83 | 84 | 85  | 85  | 86  | 87  |
| 88          | 31.1 | 73                    | 74 | 75 | 76 | 76 | 77 | 78 | 79 | 80 | 81 | 81 | 82 | 83 | 84 | 85 | 86  | 86  | 87  | 88  |
| 89          | 31.7 | 74                    | 75 | 75 | 76 | 77 | 78 | 79 | 80 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 86  | 87  | 88  | 89  |
| 90          | 32.2 | 74                    | 75 | 76 | 77 | 78 | 79 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 86 | 87  | 88  | 89  | 90  |
| 91          | 32.8 | 75                    | 76 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 86 | 87 | 88  | 89  | 90  | 91  |
| 92          | 33.3 | 75                    | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 85 | 86 | 87 | 88 | 89  | 90  | 91  | 92  |
| 93          | 33.9 | 76                    | 77 | 78 | 79 | 80 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90  | 91  | 92  | 93  |
| 94          | 34.4 | 76                    | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91  | 92  | 93  | 94  |
| 95          | 35   | 77                    | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92  | 93  | 94  | 95  |
| 96          | 35.6 | 77                    | 78 | 79 | 80 | 81 | 82 | 83 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93  | 94  | 95  | 96  |
| 97          | 36.1 | 78                    | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 91 | 92 | 93 | 94  | 95  | 96  | 97  |
| 98          | 36.7 | 78                    | 79 | 80 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 93 | 94 | 95  | 96  | 97  | 98  |
| 99          | 37.2 | 79                    | 80 | 81 | 82 | 83 | 84 | 85 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 96  | 97  | 98  | 99  |
| 100         | 37.8 | 79                    | 80 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 90 | 91 | 92 | 93 | 94 | 95 | 97  | 98  | 99  | 100 |
| 101         | 38.3 | 80                    | 81 | 82 | 83 | 84 | 86 | 87 | 88 | 89 | 90 | 92 | 93 | 94 | 95 | 96 | 97  | 99  | 100 | 101 |
| 102         | 38.9 | 80                    | 81 | 83 | 84 | 85 | 86 | 87 | 89 | 90 | 91 | 92 | 94 | 95 | 96 | 97 | 98  | 100 | 101 | 102 |
| 103         | 39.4 | 81                    | 82 | 83 | 84 | 86 | 87 | 88 | 89 | 91 | 92 | 93 | 94 | 96 | 97 | 98 | 99  | 101 | 102 | 103 |
| 104         | 40   | 81                    | 82 | 84 | 85 | 86 | 88 | 89 | 90 | 91 | 93 | 94 | 95 | 96 | 98 | 99 | 100 | 101 | 103 | 104 |

**Table 1. The Temperature-Humidity Index (THI) calculated based on NRC 1971.**

## Antioxidant supplementation is key

During a period of heat stress, the animal faces a decrease in antioxidant status. For example, the level of superoxide dismutase enzyme (SOD) can decrease and the pro-oxidant and stress indicator, such as Malondialdehyde (MDA) can more than double.

In a dairy cow this can be translated into a risk of higher somatic cell counts: from 200,000 in winter to 250,000 during hot times.

This is why ensuring an adequate level of antioxidant solution is important.

Nutritionists can choose and combine different sources of antioxidants, either primary or secondary antioxidants.

Providing primary antioxidants such as selenium yeast (such as Alkosel) or a natural source of superoxide dismutase (such as Melofeed) is shown to increase the antioxidant status of animals with positive consequences on milk quality. ■

References are available from the author on request