

STRESS IN THE DAIRY HERD

what impacts and what solutions?



Stress is a natural phenomenon allowing animals to **adapt to an unusual situation disrupting their organism's balance**. This stress increases energy expenditures of the animal in order to restore its equilibrium, which can lead to reduced performance and aggravated health risks. When the animal fails to adapt, the consequences can be dramatic, even leading to mortality. Stress results in **increased heart and respiration rates**. An animal that is regularly stressed, especially because of competition with other animals, may end up isolated from the herd. Stress can also be objectified by different measures: behavioral observations, measurements of biological or biochemical parameters...

Stress : solutions to be adapted according to the origin of the stress

The sources of stress are multiple and can be classified into 4 categories:

- **Relationships between animals:** nervousness, introduction of new conspecifics, etc.
- **Diseases : mastitis, lameness**, etc.
- **Environmental conditions:** overcrowding and competition in watering and feeding areas, heat waves, cold and wet weather, etc.
- **Breeding management:** handling, transport, weaning, milking (e.g. switch to automatic milking systems), etc.

A distinction is made between **acute stress**, the consequences of which are directly noticeable,

and **chronic stress** (e.g. overcrowding), which has an indirect negative impact on longevity and resistance to disease.

The overall management of stress involves zootechnical and sanitary **prevention** of diseases, compliance with **recommendations regarding housing** and **controlled interventions** (adapted restraint, calm environment, etc.).

As the origins of stress are multiple, we will focus on 2 examples of chronic stress: heat stress which dairy cows are increasingly confronted with and stress induced by overcrowding.

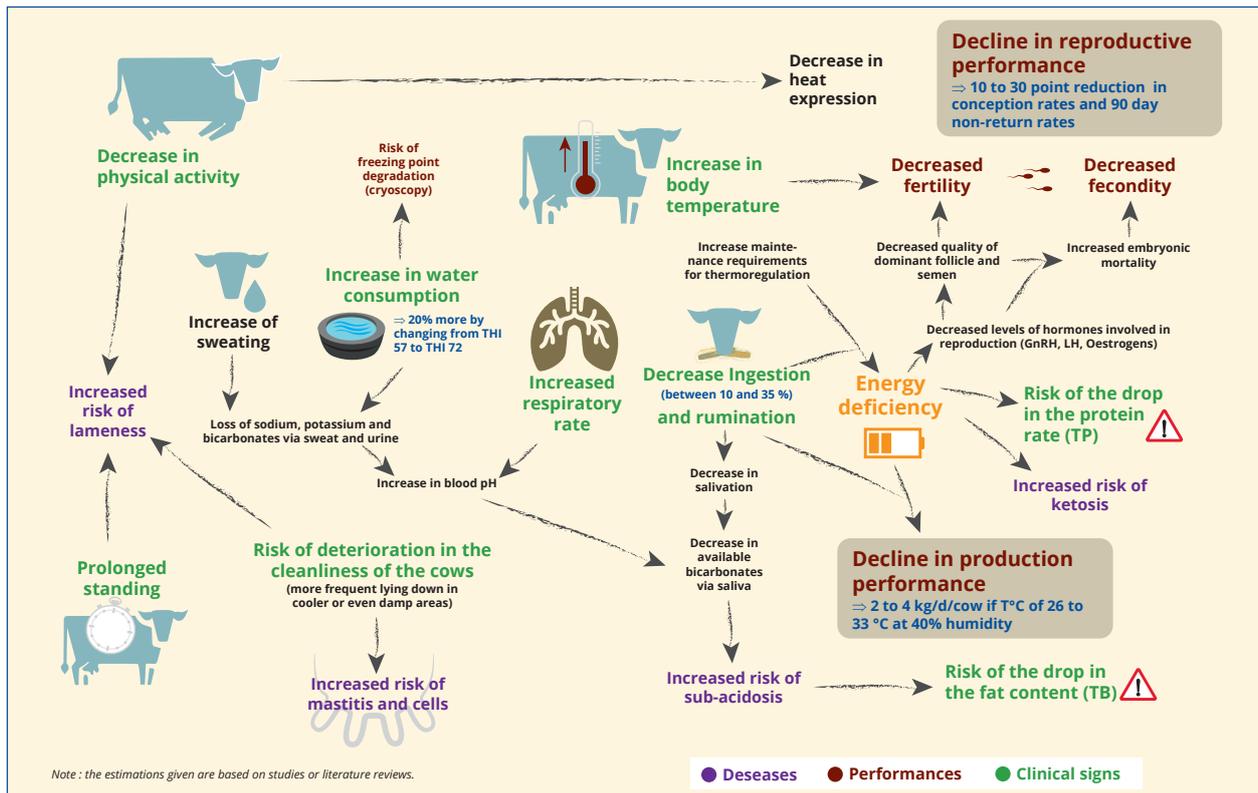
Heat stress: impacts, detection, prevention and control measures

Multiple short and medium term impacts for the animal and the farm

Heat stress affects animal welfare, performance and health. The attached diagram summarises these main effects. The impact of heat stress is particularly high in **lactating cows, especially in high-producing cows (> 9,000 kg of milk), in the middle of lactation**. Heat stress has a major impact on animal welfare : **increased competition** for shade, watering and feeding areas, increased **risk of injury** and accidents, fatigue...

Heat stress therefore not only has a lasting nega-

tive effect on the metabolism and health risk for the cow, but also on her offspring. **Indeed, the heat stress suffered by cows, particularly at the end of gestation, has a negative impact on the survival and production capacity of the calves born from these pregnancies:** lower birth weight, potentially poorer immunity due to a maternal colostrum less rich in antibodies, lower milk production during their first lactation. Dry cows exposed to heat stress also have lower milk production in the following lactation.



Source: IDELE 2022



Clear clinical signs and biomarkers studied in milk

Heat stress is highlighted by **panting score** (open mouth...), prolonged standing, increased density of animals in watering areas, shade or draughts... Cows are very sensitive because of their **limited capacity to evacuate**

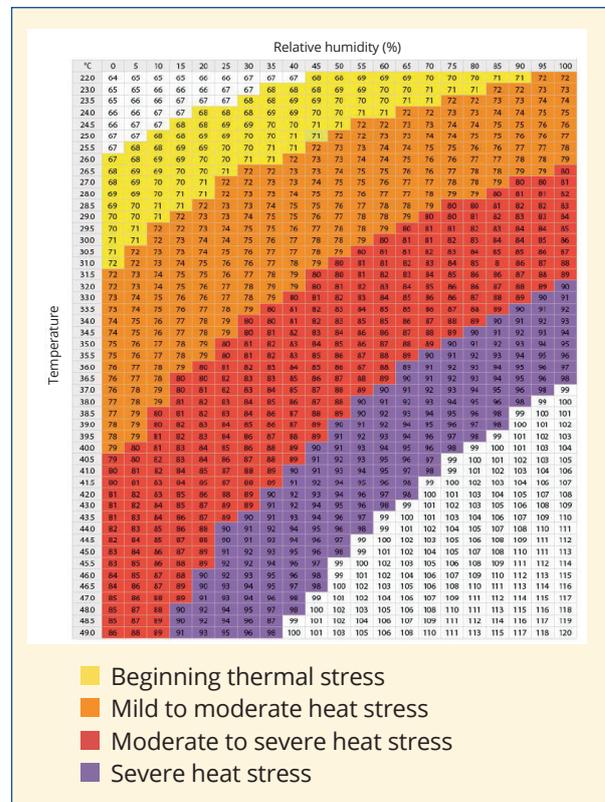
heat by transpiration and rumen fermentations increasing body temperature by 1 to 2°C.

Heat stress also impacts the fine composition of milk : modification of the fatty acid profile and the ratio between the various caseins. The HAPPYMOO project therefore looked for biomarkers in milk that would make it easier to detect stress in the animal. It was based in particular on MIR (medium infrared spectrometry) analyses. The results of this programme are available on the Happymoo website (link at the end of this document).

The THI : a warning tool

Heat stress occurs when temperature and humidity conditions are too high. To better identify these periods of risk, the THI (Temperature Humidity Index) is generally used to assess the thermal discomfort of cows. It takes into account not only the temperature but also the level of relative humidity in the air, which accentuates the

effect of heat. Heat stress is generally triggered when the THI reaches 68 (e.g. 23°C with 40% humidity).



Source: Impacts of heat stress on dairy cows, Literature review - CNIEL - August 2021

Various means of control and prevention in the event of high THI

The attached table summarises various measures to combat and/or prevent heat stress. The most

important points of vigilance are highlighted, in particular the housing, watering and mineral supply to compensate for electrolyte and water losses due to high heat.

	Main recommendations
Housing	<ul style="list-style-type: none"> • Increase the air intake area • Limit the surface area of transluents if cows are kept indoors in summer • Mechanical ventilation possible: fan, fogger (beware of the health risk associated with high humidity) • Improve the quality of the bedding if cows are kept indoors • Avoid overcrowding (1 cubicle per cow, minimum of 7 m² per cow in a straw area)
Watering	<ul style="list-style-type: none"> • At least 10 cm of drinking trough per cow (and/or 1 water point per 10-15 cows) • Flow rate of drinkers > 15 L/min • Daily cleaning of drinking troughs • Water quality analysed at least once a year
Feeding	<ul style="list-style-type: none"> • Ensuring rapid silo advancement to limit the risk of fermentation • Increase mineral intake (bicarbonates and prevention of sub-acidosis, sodium, potassium, etc.) and adjust vitamin intake ; aim for a minimum dietary cation-anion balance (DCAB) of 300 to 350 meq per kg DM ingested in lactation (i.e. 150 to 300 g of sodium bicarbonate per cow per day) • Live yeast contributes to a better balance of rumen flora and can limit the drop in pH • Reduce the cellulose content to a sufficient level and incorporate fibre into the ration (pay attention to the length of the cut to reduce sorting but maintain rumination) • Densify the energy content of the ration but use non-acidogenic energy sources (fat, or even protected starch with very slow degradation, etc.)
Livestock management	<ul style="list-style-type: none"> • Anticipate periods of heat stress with detection tools (mobile applications that automatically measure THI with alert criteria etc.) • Move animals out at night and into a well-ventilated building during the day • Provide shaded pastures for summer if day grazing • Multiplying ration distributions and/or distributing the majority of the ration in the evening for night-time consumption • Remove refusals even more systematically • Maintain good hygiene in bedding and traffic areas to reduce the risk of lameness and mastitis • Reinforce milking hygiene in case of increased udder contamination • Strengthen individual cellular monitoring to detect early clinical or sub-clinical mastitis • Strengthen lameness monitoring

These recommendations are not exhaustive and should be adapted in consultation with the veterinarian and the livestock advisor.

Overcrowding and stress

Like heat stress, overcrowding is another source of stress and discomfort for animals, which negatively impacts their well-being, health and performance.

Impacts at all levels

The stress induced by overcrowding leads to an increase in agonistic behaviors: competition due to lack of space at the trough, at the watering hole or for lying down increases **aggressiveness** between animals, which increases the risk of **injuries** (crushed teats, trauma, skin lesions...). **Over-**

crowding hinders the freedom of movement and exercise of the animals, also increasing the risk of **lameness**. The normal behaviors of the species can be impacted (expression of heat...). The lack of space in the sleeping areas also reduces the resting time. **The fatigue generated by prolonged standing can weaken the body's defenses and thus increase the health risk.** If the maintenance measures of the lying areas are not reinforced, the state of cleanliness of the animals can deteriorate (potential increase of cell concentrations, foot lesions...). All of these ele-

ments contribute to a **decrease in the animal's well-being**. As the animals prefer resting to feeding, the level of ingestion can also decrease, with a potential **negative impact on milk** production and even live weight of the animal. The impact of stress is greater in dominated animals.

Warning signs and biomarkers under study

Competition for bedding, watering and feeding areas is a stress warning sign that can be easily observed when there is overcrowding. A **decrease in production** can also be observed. To go further, **the HAPPYMOO project studied and compared the evolution of different potential biomarkers of chronic stress under different experimental conditions of overcrowding**. In particular, the variations of some blood parameters (glycemia, fructosamine, body defense cells such as leukocytes, eosinophils, neutrophils...) or of molecules in milk (citrates...) were studied. All the detailed results of this program are available on the Happymoo website (link at the end of this document).

Control measures

The respect of loading densities, the accessibility to the trough and the watering place are essential for the well-being of the animal and the optimiza-

tion of the performance of the animals. The zoo-technical recommendations are as follows:

- **7 to 8 m²/cow, 1 cubicle per cow,**
- **twice-daily maintenance of the sleeping and circulation areas,**
- **1 trough space per cow,**
- **at least 10 cm of drinking trough per cow (and/or 1 water point per 10-15 cows).**

These recommendations are also valid for dry cows.

If the overcrowding cannot be corrected immediately, enhanced housing and milking hygiene measures are essential. These precautions will help to limit the health risks but will not reduce the impact on animal welfare and performance.

More generally, when expanding a herd, it is important to think ahead to prevent any risk of overcrowding and the deleterious consequences that can result from it.

The sources of stress in dairy farming are therefore multiple and the management of this stress will require the adaptation of measures according to the origin of the stress and its consequences on the organism.

The HappyMoo project: monitoring tools for happy cows

This document was produced in the framework of the Interreg NWE Happymoo project, financed by the European Union and co-funded by the Walloon Region in Belgium. The aim of this project was to identify molecules whose monitoring in particular by mean infrared spectroscopy in milk would help to detect health problems in livestock.



Find all the results of the HappyMoo program on the website

<https://www.nweurope.eu/projects/project-search/happymoo/>

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