

Heat Stress in Dairy Cattle: A Growing Challenge for Dairy Farming

Ankita Bhosale¹, Snehal Misal², Prashant Rokade³

Introduction:

Climate change is creating new challenges for dairy farming. Rising temperatures, increasing humidity and extreme weather can seriously affect **animal health, milk production and reproduction**.

Heat stress occurs when cattle are unable to lose enough body heat to maintain their normal temperature. It can reduce feed intake, milk yield and fertility, increase health problems and ultimately cause economic losses for farmers. The problem is particularly important in hot and humid regions.

What Is Heat Stress?

Dairy cattle continuously produce heat through normal body functions, digestion and milk production. Under comfortable conditions, this heat is balanced by heat loss to the environment. This comfortable range is known as the **thermoneutral zone (TNZ)**.

When temperature and humidity rise beyond the animal's ability to dissipate heat, **heat stress develops**. The cow responds by increasing respiration, sweating, water intake

and changing her feeding and resting behaviour. Severe heat stress can result in hyperthermia.

The severity depends on several factors, including **temperature, humidity, solar radiation, wind, breed, age, milk production and housing conditions**. High-producing cows are particularly vulnerable because they generate more metabolic heat.

Recognizing Heat Stress

Early recognition allows farmers to take timely action. Common signs include:

- ☞ Rapid breathing or panting
- ☞ Increased water intake and sweating
- ☞ Reduced feed intake and rumination
- ☞ Increased standing and seeking shade
- ☞ Increased body temperature
- ☞ Reduced activity
- ☞ Declining milk production

High-yielding and recently calved cows may require particular attention during hot weather.

Why Temperature and Humidity Matter

Ankita Bhosale¹, Snehal Misal², Prashant Rokade³

¹ Division of Livestock Production Management, ICAR-National Dairy Research Institute, Karnal- 132001, Haryana, India.

² Division of Animal Genetics and Breeding, ICAR-National Dairy Research Institute, Karnal- 132001, Haryana, India.

³ Assistant Professor, Department of Veterinary Pathology, M.B. Veterinary College Dungarpur, RAJUVAS, Bikaner 314001, Rajasthan, India

Temperature alone does not determine heat stress. **High humidity reduces the effectiveness of cooling through evaporation**, making hot conditions more difficult for cattle to tolerate.

The **Temperature-Humidity Index (THI)** combines temperature and humidity to estimate the heat load experienced by cattle. As THI increases, heat stress becomes more severe. The source information considers values around **70 or below generally comfortable**, although the exact threshold can vary with breed, production level and acclimatization.

Therefore, monitoring both **temperature and humidity** can help farmers identify heat-risk periods and introduce cooling measures at the right time.

Impact of Heat Stress on Milk Production

Heat stress can cause a significant **decline in milk production**. High temperatures reduce feed intake, leaving less energy and nutrients available for milk synthesis.

Heat stress also alters metabolism, hormonal activity and mammary gland function. **High-producing cows are particularly vulnerable** because they generate more metabolic heat.

Milk composition, including **milk fat and protein**, may also be affected. Prolonged

heat stress can therefore cause considerable economic losses to dairy farmers.

Heat Stress and Reproductive Performance

High temperatures can reduce **reproductive efficiency** by affecting reproductive hormones, oestrus expression, ovarian function, oocytes and early embryos.

Important effects include:

- ☞ Weak or less noticeable heat signs
- ☞ Reduced conception rates
- ☞ Increased embryonic losses
- ☞ Altered ovarian activity
- ☞ Longer calving intervals

Effect on Bulls

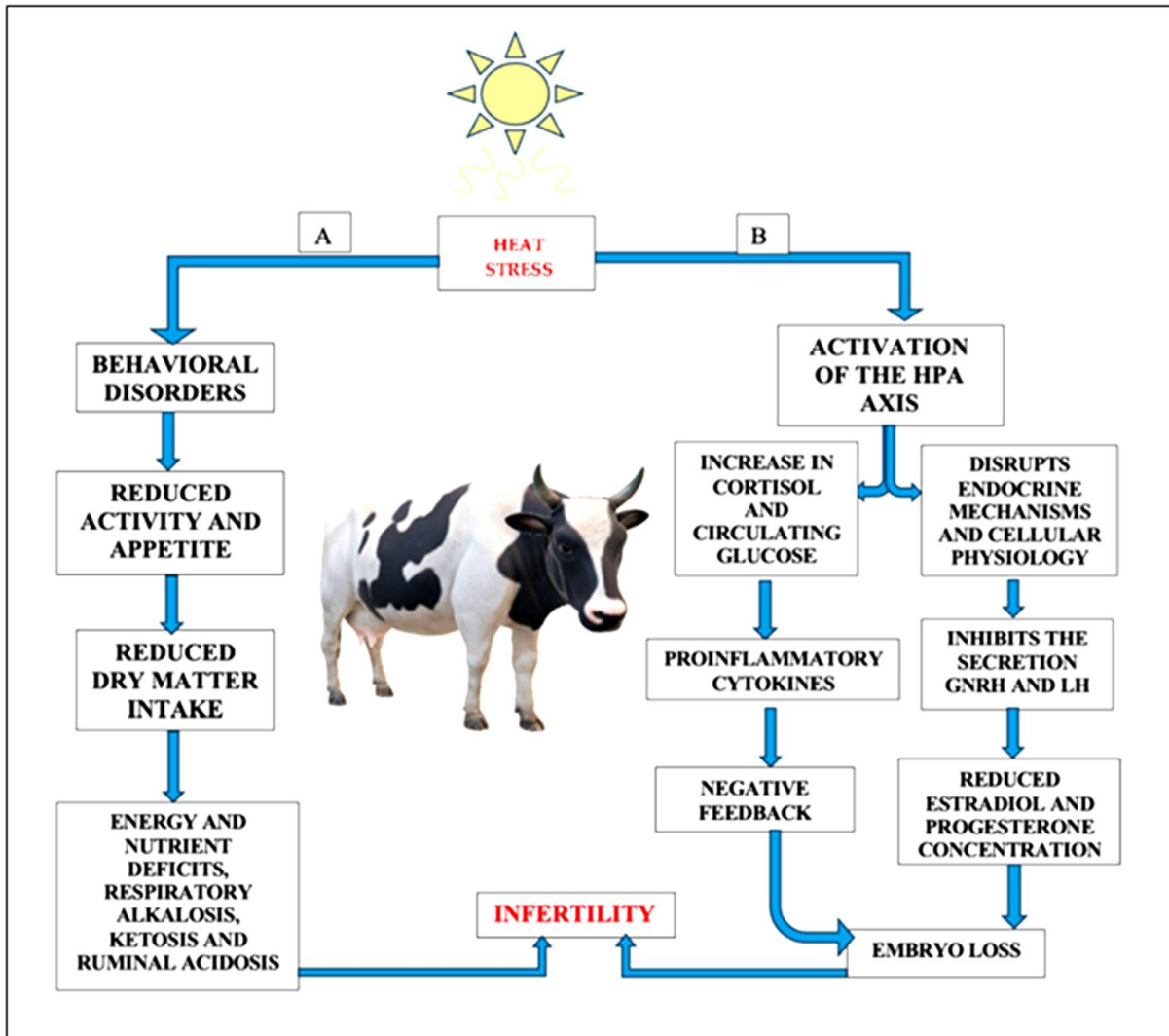
Heat stress can also reduce **sperm quality and male fertility**. Therefore, bulls and other breeding animals should also be protected from excessive heat.

Heat Stress and Animal Health

Heat stress affects **feed intake, metabolism, water balance and immunity**, making cattle more vulnerable to health problems.

It may also increase the risk of **retained placenta, postpartum disorders and metabolic problems such as ketosis**. Hot and humid conditions can additionally favour certain disease vectors and parasites.

Thus, heat-stress management is an important part of overall herd health management.



Impact of Heat Stress on Dairy Cow Health and Productivity

Water: The First Line of Defence

Adequate **clean drinking water** is essential during hot weather because cattle increase water intake to support cooling.

Farmers should ensure:

- ☞ Clean water is available throughout the day.
- ☞ Drinking points are easily accessible.
- ☞ Troughs are cleaned regularly.
- ☞ Enough space is available for several animals to drink.

☞ Water is available near feeding and resting areas.

High-yielding cows require particular attention because of their greater water demand.

Shade and Ventilation

Shade reduces the heat load from direct sunlight, while good ventilation helps remove heat from the animal's body.

Practical measures include:

- ☞ Trees or suitable shade structures

- ☞ Good natural ventilation
- ☞ Fans where appropriate
- ☞ Sprinklers or showers combined with adequate airflow

Cooling systems work best when animals have sufficient space and continuous air movement.

Feeding Management During Hot Weather

Heat stress reduces feed intake, making **nutritional management** especially important.

Farmers should:

- ☞ Provide good-quality, highly digestible feed.
- ☞ Maintain adequate energy, protein and fibre.
- ☞ Offer feed during cooler hours, particularly morning and evening.
- ☞ Maintain proper rumen function.
- ☞ Use suitable dietary fat sources when required.

Buffers, yeast products and other feed additives may be useful in specific feeding programmes, but their use should depend on the complete ration and nutritional requirements of the animals.

Role of Minerals and Vitamins

Heat stress can disturb **water and electrolyte balance** and increase the need for certain nutrients.

- ☞ Maintain adequate **potassium and sodium** in the ration.

- ☞ Vitamins such as **E and C**, along with niacin, may provide supportive benefits.

- ☞ Supplements should complement—not replace—**shade, water, ventilation, cooling and balanced nutrition**.

Breeding for Heat-Tolerant Cattle

Management provides immediate relief, while **genetic improvement offers a long-term solution**.

Cattle breeds differ in their ability to tolerate heat, with locally adapted and tropical cattle generally showing better heat tolerance.

Since heat tolerance has a **genetic component**, animals that maintain production and fertility during heat stress can be considered for breeding programmes.

The **slick-hair trait**, characterized by a short and smooth hair coat, is one example associated with improved heat regulation.

Role of Genomics in Heat-Tolerance Breeding

Genomic selection can help identify young bulls and heifers with desirable genetic potential for heat tolerance.

Future breeding programmes can combine heat tolerance with:

- ☞ Milk production
- ☞ Fertility
- ☞ Disease resistance
- ☞ Adaptability to local conditions

The goal should be to develop cattle that are both **productive and resilient**, rather than selecting for heat tolerance alone.

An Integrated Approach to Heat-Stress Management

Effective heat-stress management requires a combination of short- and long-term measures.

1. Environmental Management

Provide **shade, clean water, good ventilation, fans and suitable cooling systems**.

2. Nutritional Management

Provide **high-quality feed, adequate energy, protein, fibre, minerals and electrolytes**, with feeding during cooler hours.

3. Genetic Improvement

Select animals that maintain **body-temperature regulation, milk production and fertility** under heat stress.

Preparing Dairy Farms for a Changing Climate

Climate change makes heat-stress management increasingly important for the future of dairy farming. Farmers cannot control the outside temperature, but they can control many of the factors that determine how animals respond to it.

Providing shade, water and ventilation can offer immediate protection. Appropriate cooling systems can further reduce heat load during severe conditions. Good nutritional

management helps maintain nutrient intake and rumen health, while long-term breeding programmes can gradually improve the natural heat tolerance of dairy cattle.

The key is to take action **before heat stress becomes severe**.

A farm that monitors temperature and humidity, observes cattle behaviour, maintains adequate water availability and introduces cooling measures at the right time is better prepared to protect both animal welfare and productivity.

Conclusion

Heat stress is more than a seasonal problem. It can influence **feed intake, milk production, reproduction, animal health and farm profitability**. As environmental temperatures continue to rise, its importance in dairy production is likely to increase.

Fortunately, farmers have several practical tools available. Adequate shade, clean water, proper ventilation, cooling systems and appropriate feeding can provide immediate protection. In the longer term, selecting animals with better natural heat tolerance and using genomic technologies may help develop dairy populations that are better adapted to hot environments.

The future of dairy farming will not depend only on producing more milk. It will also depend on maintaining **healthy, productive and resilient animals that can**

perform under changing climatic conditions.

Managing heat stress today is an investment in the productivity, health and sustainability of dairy farming tomorrow.

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