



A Monthly e Magazine  
ISSN:2583-2212

Nov, 2023 3(11), 2842-2845

Popular Article

## Heat Stress and its Management in Dairy Cattle

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Heat stress is failure of heat dissipation of body when too much heat is produced. Summer season is the most detrimental for production in animals especially reared in tropical and sub-tropical area. Exotic dairy cows are more prone to environmental stress as they have more heat of metabolism. Moreover, they are high producer and high producer animals are more susceptible to heat stress. Heat Stress has harmful impact on production, reproduction, metabolism and immune status of animal. Semen quality of exotic cattle is also affected by heat stress. Similarly, fertility decreases during highly warm months due to heat stress. In managerial perspective, cooling systems (Fans and mist) along with shades and grazing at night are involved in environmental modification. Due to heat stress, intake of dry matter decreases but requirement of energy increases along with the bypass protein. So there is need of nutrition based management of animals in proper way. Heat stress in animals is associated the imbalance in heat production and dissipation in the body of the animals; more heat is produced or absorbed but less heat is dissipated from body. Dairy animals are warm-blooded animals and have ability to maintain their temperature on a specific degree. When more heat is produced or absorbed by the body but less is dispersed, animals suffer from heat stress. This condition harmfully affects the performance of animals. Animals reduce their production and reproduction performance.

The thermal comfort zone for Bos-Taurus and Bos indicus is 2-20°C and 10-27°C. Animals experience heat stress when the body temperature is above the optimum range defined for normal activity because the total heat produced is greater than the heat dissipation capability. To measure heat stress in animal bioclimatic index, temperature humidity index (THI) is commonly used. It has been proved by experiments that performance of animals decrease when temperature humidity



index (THI) reaches 68- 72.

**Table: The stress level and THI number**

THI	Stress Level	Effect and symptoms
<72	None	No effect and symptoms.
72 -79	Mild	Dairy cow will adjust by seeking shade. Respiration rate and dilation of the blood vessel increase. The effect on milk production will be minimal
80 – 89	Moderate	Both saliva production and respiration will increase. Feed intake will decrease and water consumption will increase. Milk production and reproduction will be decrease.
90 – 98	Severe	Cows will become very uncomfortable. Rapid respiration and excessive saliva production.
>98	Danger	Potential cow death can occur

### Effect of heat stress on feed intake

As the environmental temperature increases the temperature of the animal's body also increases due to which dry matter intake. Heat stress cause reduction in feed intake and a failure in nutrient availability due to which body weight decreases and ultimately the animals go into physiological negative energy balance escorted by a reduction in the cows.

### Effect on the quantity and quality of the milk

High yielding cows are more sensitive to heat stress as compared with dry cows. Dry matter intake is reduced when a cow becomes heat-stressed resulting in the lower availability of nutrients used for milk synthesis. In Addition, mild to severe heat stress can increase metabolic maintenance requirements by 7 to 25% (NRC, 2001) further decreasing the nutrients supply for production.

### Effect on female reproduction

During summer, season conception rate of cows is decreased ranging between 20 and 30%,



with marked seasonal patterns of estrus exposure. A warm environment harmfully affects the cow's ability to show estrus behavior, due to which both the intensity and duration of estrous expression are reduced. When dry matter intake reduces, the intensity and duration of estrous expression also reduce due to effects on the production of the hormones. In beef cattle, estrous behavior and frequency decrease during the summer as compared to winter months. When European breeds are moved to tropical areas, their estrous behavior observed shorter due to warm environment. In dairy cow, farm profitability depends on milk production and reproductive success, which is negatively affected by heat stress. Effects on cow's service period: Cow's service period is defined as the time-period between date of calving and date of conception of a cow. The service period is longer for cows which calve in summer as comparatively to those who calve in winter. In summer, it may be as long as for 150+ days but in winter calving cow, its length may be up to 120 days. Effects on conception rate in cows: Heat stress has adverse effects on cow's conception rate. If THI is more than 72 at the time of insemination, the chance of conception is reduced. It has been seen that if heat stress continues for 3-5 days before insemination and almost 5-7 days after insemination, conception rate is minimized in cows. Effects on pregnancy rate in cows: It is reported that pregnancy rate decreases when temperature and relative humidity goes up from 25<sup>o</sup> C and 50% respectively. Month of insemination has also significant effect on pregnancy rate. It is observed that pregnancy rate is decreased from 34.1% to 15.7% in tropical areas in May to July.

### **Heat stress management**

**Water:** Neat and clean water is important for milk production and thermal homeostasis. It is observed that heat stressed cows must remain well hydrated for optimum production. If water is abundant and clean, their consumption rate will increase. To keep animal cool water tank should be clear from feed debris and algae.

**Rumen health:** In summer season, normal micro flora of animals change due to heat stress and cause rumen acidosis. Fiber quality has a principal role in ration. During heat stress, it works like a buffer. Rumen pH can also be maintained by dietary HCO<sub>3</sub> and monensin. Propionate production increases by monensin that is a predominant gluconeogenic precursor in animals and thus improves the glucose status of heat-stressed cows.

**Shade:** To protect animals from solar radiations, shade is a basic protecting method. The tree and other plants are the most effective source of shade for animals to protect from sun radiations. Evaporation occurs in summer from leaves of plant, which create a cooling effect on animal's body. When we use metallic or concrete shade for the animal's protection from sun radiation, roof



isolation with suitable materials and painting with white colour reduces heat stress or solar radiation (Buffington et al., 1983). Direction of the shade is also very important. East-West direction of the shade reduces heat stress in summer in South Asia. Due to less solar radiations exposure with covered area of the shade, temperature of the shade is reduced and animals feel comfortable.

**Night grazing:** In day time, the breathing and body temperature of the animals are increased in summer season. Night grazing is also a tool to prevent the animals from heat stress. In the daytime, solar radiations falling on the body of the animals increase temperature of the animals. On night time there is no problem of such radiation and animals can allow pasturing.

**Cooling system:** To control heat stress in exotic breed cows, cooling systems are being used in Asian countries. The principle of cooling system is depends on evaporation, which make possible with the use of fans, mist and force ventilation. When we spray water on the body of the animals and ventilate air by fans, evaporation is produced through which temperature of the cow's body is decreased resulting in increased milk production and reproduction performance. If the external temperature is lower than that of the body temperature, only fans are beneficial. Zone cooling reduce the body temperature and respiration rate due to which feed intake and milk production are increased.

## Conclusion

Summer season is the most detrimental for production in animals especially reared in tropical and sub-tropical area. Exotic dairy cows are more prone to environmental stress as they have more heat of metabolism. In tropical region, production of the animals can be maintained through nutritional management during heat stress. These strategies include supplementation of monensin, propylene glycol, niacin, yeast, by pass fat as well as sodium bicarbonate.

