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# Regulating heat stress of dairy animal

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***Abstract—*** *The effects of high ambient temperatures on production animals, once thought to be limited to tropical areas, has extended into northern latitudes in response to the increasing global temperature. Compounded by the increasing number of dairy animals and the intensification of production, heat stress has become one of the most important challenges facing the dairy industry today. The objectives of this review were to present an overview of the effects of heat stress on dairy cattle welfare and highlight important research gaps in the literature. We will also briefly discuss current heat abatement strategies, as well as the sustainability of future heat stress management. Heat stress has negative effects on the health and biological functioning of dairy cows through depressed milk production and reduced reproductive performance. Heat stress can also compromise the affective state of dairy cows by inducing feelings of hunger and thirst, and we have highlighted the need for research efforts to examine the potential relationship between heat stress, frustration, aggression, and pain. Little work has examined how heat stress affects an animal's natural coping behaviors, as well as how the animal's evolutionary adaptations for thermoregulation are managed in modern dairy systems. More research is needed to identify improved comprehensive cow-side measurements that can indicate real-time responses to elevated ambient temperatures and that could be incorporated into heat abatement management decisions.*

***Keywords—*** *Fogger, Thermostate, Water pump, Pipe, Tempcontroller.*

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## I. INTRODUCTION

Heat stress is a major problem faced by dairy animals during summer months which leads to decreased milk production and lower rates of fertility. This article explains about heat stress, it's causes, it's impact and solutions. Heat Stress and it's symptoms Hot temperature and high humidity causes stress on dairy cattle. The ideal temperature for dairy cattle is around 20degree Celsius to 27 degrees Celsius inside the dairy shed and the humidity should be around 60%. Though this might look normal for north Indian dairy farmers, in south India it gets really hot and humid in summer. The symptoms of heat stress are reduced feed intake and decrease in milk yield. The effect of heat stress is more visible in high yielding animals. Heat stress can cause losses in production of 20 percent or more and reduce conception rates by 10 to 20 percent. Causes for Heat Stress Heat stress occurs when any combination of environmental conditions causes the effective temperature of the environment to be higher than the animal's thermos neutral (comfort) zone. Four environmental factors influence effective temperature Since cattle sweat very little, the main ways they cool themselves are through breathing, radiating heat from their bodies, and reducing feed/forage intake. As intake declines, energy needed for performance also declines, whether for milk production in cows or weight gain in growing cattle. The body can only work properly at a certain temperature. The animal body maintains itself at a constant temperature, within a small range, in order for the systems to work properly. This normal body temperature is different in different types of animals. There are a number of ways by which animals control the temperature of the body:

The rectal temperature reference range for an adult cow is 37.8-39.2°Celsius [100.0-102.5°Fahrenheit], and a little higher for a calf at 38.6-39.4°Celsius [101.5-103.5°Fahrenheit]. However, bear in mind that a small proportion of 'normal' animals will have a rectal temperature outside of these ranges. In addition, you are likely to get an artificially low reading unless the thermometer is placed directly against the rectal wall.

Improved description of the effects of environmental conditions on milk yield, DMI, and body temperature are needed to better predict the effects of seasonal heat stress. An understanding of the interaction of various environmental factors with lactational performance is necessary so that management techniques and cooling practices can be developed to meet the needs of the high producing cow subject to the effects of hot, humid conditions. The objectives of this study were to determine the influence of environmental conditions on milk temperature, DMI, and milk yield and to determine the combined effects of environmental stressors (including ambient temperature, RH, and the effects of previous days of exposure) on performance of lactating dairy cows exposed to hot, humid weather conditions.

## II. LITERATURE REVIEW

Allen, J. D., L. W. Hall, R. J. Collier, and J. F. Smith. 2015. Effect of core body temperature, time of day, and climate conditions on behavioral patterns of lactating dairy cows experiencing mild to moderate heat stress. J. Dairy Sci. 98:118–127.

Cattle show several responses to heat load, including spending more time standing. Little is known about what benefit this may provide for the animals. Data from 3 separate cooling management trials were analyzed to investigate the relationship between behavioral patterns in lactating dairy cows experiencing mild to moderate heat stress and their body temperature. Cows (n=157) were each fitted with a leg data logger that measured position and an intravaginal data logger that measures core body temperature (CBT). Ambient conditions were also collected. All data were standardized to 5-min intervals, and information was divided into several categories: when standing and lying bouts were initiated and the continuance of each bout (7,963 lying and 6,276 standing bouts). In one location, cows were continuously subjected to heat-stress levels according to temperature-humidity index (THI) range (THI≥72). The THI range for the other 2 locations was below and above a heat-stress threshold of 72 THI. Overall and regardless of period of day, cows stood up at greater CBT compared with continuing to stand or switching to a lying position. In contrast, cows lay down at lower CBT compared with continuing to lie or switching to a standing position, and lying bouts lasted longer when cows had lower CBT. Standing bouts also lasted longer when cattle had greater CBT, and they were less likely to lie down (less than 50% of lying bouts initiated) when their body temperature was over 38.8°C. Also, cow standing behavior was affected once THI reached 68. Increasing CBT decreased lying duration and increased standing duration. A CBT of 38.93°C marked a 50% likelihood a cow would be standing. This is the first physiological evidence that standing may help cool cows and provides insight into a communally observed behavioral response to heat.

## III. WORKING

- When a temperature sensor measures the environmental humidity and temperature and sends this output to the Arduino module. If the temperature is higher than the set-point or threshold value set by the user then Arduino activates the relay module. And this relay module turns on the high-pressure pump and it turns on Fogger These Foggers installed below the roof of the shed/ animal house. Small water droplets the look like fog/mist are produced from Fogger/Misters. These small water droplets evaporate before they reach the surface of the shed. By this, the temperature of the shed and animal house starts decreasing. The shed's temperature reaches the lower set-point of temperature. This sensor captures the temperature and again sends it to the microcontroller module. This time relay turns off the pressure pump. And these pressure pumps turn off the Fogger/Mister. This Fogger system Pipeline is usually made of 16 mm drip pipe. The thickness of this pipe is 1.2 mm. The Fogger/ Misters are fixed on these pipelines. The distance between each Fogger/Mister should be 10 to 13 ft.

## IV. CALCULATION

*A.* Motor specification :
- **Capacity range 60-90 feet**
- **Power = 0.5hp**
- **Pressure = 2.5 Bar**
- **Rpm = 2900**
- **Phase = single phase**

*B.* Pipe specification :
- **Dia = 16mm**
- **Length = 80 feet**

*C.* Fogger specification :
- **QTY = 6**
- **Water spray = 15 liter per hour**

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- **Water pump=400 liter per hr.**
- **Foggers =90 liter per hr.**
- **Each fogger = 0.250 liter per min.**
- **Each fogger = 15 liter per hr.**

**15/60=0.250 liter per min.**
**90/60= 15 liter per hr.**

## V. CONCLUSION

If optimum production is to be achieved in Vidni, dairy cows must be provided with relief from heat and humidity. Several methods are available for doing this. On -off fogger automatically. This system can use for a small dairy farm as well as a big dairy farm. This system can replace the manual process of cooling livestock sheds or it may reduce water wastage. This system is useful in those areas where the temperature is very high in summer. This system can reduce the diseases that occur from high heat or heat stress. This system also maintains the milk yields and hot days of summer. Farmers can maintain the quality and quantity of milk using this system. This system is easy to use and reliable.

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