VENTILATION AND AIR CONDITIONING OF DAIRY COW SHADE

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Abstract— Milk production of cows reduces due to the change in environmental conditions. In the summer as the temperature of surrounding is more than the comfort conditions of cow, hence in the summer season decrease the milk production, health and re-productivity etc. In summer, from March to June the increase temperature and reduce humidity due to heat stress developed in the cow body. Genetic progress in milk production is closely related to increase feed intake. This case is taken for the study in this project for providing the comfort conditions for cow and increase the milk production. This study is concentrated to keep the temperature and humidity within the comfort limit by providing effective cooling by using mist evaporative cooling. By providing cooling cow increase milk production, improve health of cows. Hence increase the profit of the plant

Keywords— Heat, Stress, Temperature, Humidity, Sweating, Moisture, comfort

Introduction

Cow comfort has tended to concentrate on genetic improvements to Increase milk production and on the thermal environment is a major factor negatively effect. Dairy ability of the modern cow as her capacity to produce Milk has increased. Decreased in milk fat and protein is the most important milk composition changes under heat stress condition. Lowering the environmental temperature by modifying the Structure of the shade where the cows are kept by introducing cooling facilities. Heat loses from animals by sprinkling them with water using sprinkler. Thermo neutral zone is defined as the zone of minimal heat production at rectal temperature. Out of this zone, some disturbances will be observed. (Fig. 1) illustrate this concept.Air moisture increases the rate of evaporation heat loss from dairy from a dairy cows under high temperature conditions, therefore dairy cow performance falls markedly in hot and humid summers.[1]

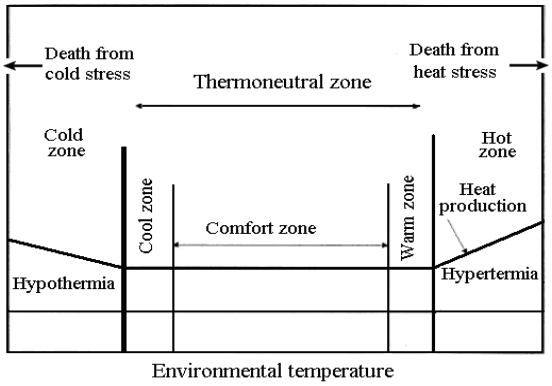


Fig.1 Schematic figure of thermo neutral zone and comfort zone (Adapted from Curtis, 1981) [1]

II. CLIMATE

In Solapur region condition as (pune metrological dept.) summer month march to June i.e. 4 month

Month	Max. Temp.(° C)	Relative humidity (%)	Mean wind speed(kmph)
March	37.7	23	4
April	40.1	23	4.6
May	40.2	27	5.2
June	39.9	49	6.2

The dairy cows raised in such a climate are, on average, more greatly affected by heat stress than cows raised in cooler climates. However, because of the low relative humidity (RH), evaporative cooling is very effective
For example, at 104°F and 15% RH, an evaporative cooling system operating at 75% evaporation efficiency will reduce the temperature by almost 25 °F Due to its effectiveness, evaporative cooling often also makes sense economically. An economic analysis showed that implementing high-pressure misters mounted on fans can reduce the overall cost.

III. EFFECT OF HEAT STRESS DAIRY COW

Heat stress effect on dairy cow in several ways and finally cause to decrease animal milk production and performance. Some of most important results of heat stress in dairy cows include: [5]

1. Increased respiration rate
2. An increase in heart rate and increased sweating.
3. Decreased dry matter intake and feed intake.
4. Decreased milk production and milk quality.
5. Change in body hormones level and reproductive performance.

IV. BASIC STUCTURE AND LAYOUT

In dry lots, 45 to 50 square feet of shade should be provided per cow. Dry-lot shades are typically oriented North-South to maximize the distance their shadow moves during the day so that, as the animals move with the shade, the manure and urine they produce will be spread over a wider area and the abandoned ground can dry. The recommended height for dry-lot shades is 11 feet. One advantage these structures have over basic dry-lot shades is that the cows do not have to leave the shade to access the feed line.

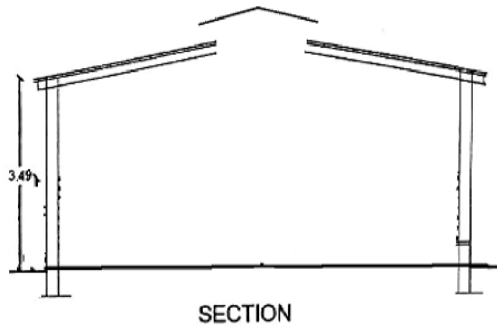


Fig. 2 Basic layout of the shade

V. THERMAL HUMIDITY INDEX

The index was then adapted for evaluating dairy cows production under specific profile environmental explosion. Milk production in dairy cows decrease with increase THI

THI= DBT+0.36PT+41.2

Where THI= Temperature and relative humidity index
DBT = dry bulb temperature (^{0}C)
DPT= due point temperature (^{0}C)

The normal value were consider <74, alert values where those from 75 to 78, danger values are those from 79 to 83 and emergency value were the ones >84

Ex1) outdoor THI

DBT= 36^{o}C DPT =18^{o}C then

THI=36+.36*18+41.2

=83.68

Ex 2) indoor THI

DBT= 25^{o}C DPT =17^{o}C then

THI=25+.36*18+41.2

=71.68

The normal value were consider <74,

IN DOOR CONDTION

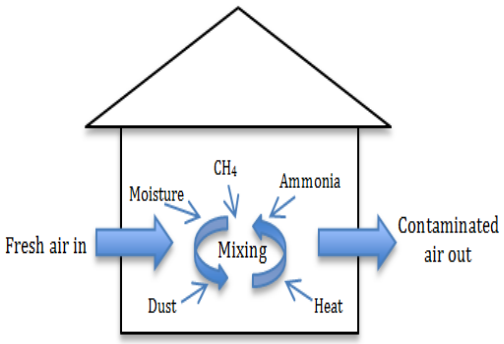
Temperature (^{0} C)	Relative humidity (%)
26(^{0}C)	50%
27(^{0}C)	50%

Evaporation
Latent mode of heat transfer in heat absorbed during change in liquid to vapor

Evaporative cooling
The reduction of dry-bulb temperature by the evaporation of moisture into the air. The heat required for the evaporation is supplied by the sensible heat loss of the air.

Mechanical ventilation
Air movement through a building caused by electrically powered fans.

V. METHOD OF PREVENTION OF HEAT STRESS



1. Increasing heat loss from animals by sprinkling them with water, using fans and so on.
2. Lowering the environmental temperature by modifying the structure of the shade where the cow are kept, or by introducing cooling facilities.
3. Increasing the efficiency of feed energy utilization, and reducing the heat increment of animals by feeding strategies.
4. Increase the air velocity of the shade

Shade, fans, mist and fan systems, and night grazing, are presented as effective methods of modifying the environments of dairy cow for prevention of heart stress in hot climate. Fans can increase the air movement and air movement increases the rate of heat loss from a cow's body surface, as long as the air temperature is lower than the cow's skin temperature. In climates with a low relative humidity, fog or mist systems (fine spray) usage provides evaporative cooling. These systems cool the air around the dairy cows.

VI. EVAPORATIVE COOLERS

Mounting fans and misters below a structure's eave is especially compatible with dry-lot shades (see figure 3). Some systems, such as Flip Fan (Schaefer Ventilation Equipment Corp., Sauk Rapids, MN) are also shade tracking. Shade-tracking systems offer the advantage of supplying cooling to the shaded area as it moves throughout the day. Besides providing the cows more comfort, this feature spreads manure and urine over a greater area and eliminates the need for a curtain to block afternoon sun. In addition, the Flip Fan can be adjusted to blow mist into the loafing area, where cows often rest at night. Recommended spacing varies by specific product. As an example, the recommended number of fans per truss, depending on its length, is shown for the FlipFan system

Fig 3. Flip Fan system cooling cows under a dry-lot shade

Increasing summer milk yield and fertility and reducing seasonality in milk supply to the dairy industry are among the main goals of dairy sectors in hot regions. In the last three decades, intensive cooling.

System and summer management practices were developed and largely introduced to the dairy Farm in these countries, among them, Israel. Extension services of the Israeli ministry of agriculture and the Israel Cattle Breeders Association cooperated to develop a computerized index based on the Israeli "Herd book" data, to evaluate the effectiveness of cooling cows in the summer.

This article presents how the summer: winter ratio index can be used as a tool to evaluate farm's Capabilities to combat summer heat stress and reduce summers negative impact of cows Performance

VII. ADVANTAGES

1. Increases milk production and re-productivity cow
2. Decreases heat stress
3. Increases fat to protein ratio and longevity
4. Reduce the labor cost
5. Increases the farm profit

VIII. CONCLUSION

Hot weather reduces milk production in cow with high genetic merit for milk production. In summer season by providing cooling system in the shade to increases the milk production, improving health of cow, longevity, re productivity etc. Climates and increase the cows performance and consequently increase the profitability. Use of management methods and nutritional ways for prevention the heat stress effects; reduce the heat stress effects in comfort condition.

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