



Management of Heat and Feeding Biochemistry Stress in Dairy Animals

Kailash Chandra¹ and Neelam Purohit^{2*}

¹M Sc Bichemistry, H.N.B. Garhwal University, Shrinagar Garhwal, Uttarakhand, India

²M V Sc LPM, National Dairy Research Institute, Karnal, Haryana, India

*Corresponding Author: Neelam Purohit, M V Sc LPM, National Dairy Research Institute, Karnal, Haryana, India.

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Heat stress

- Heat stress occurs when the body temperature of the animals increases and they cannot dissipate body heat properly to maintain homeostasis, which is due to elevated ambient temperature above thermoneutral zone (4 to 21 along with high humidity and less air movement).
- Comfort zone – suitable temperature (10-18 ° C), relative humidity (55-65%), wind velocity (5-8 km/h), normal sunshine.
- TEMPERATURE HUMIDITY INDEX (THI)- THI combines atmospheric temperature as well as relative humidity in a single value and used widely because it gives the combined effects the environmental conditions. It is also called discomfort index.
- Combined effect of environment and relative humidity (THI = $0.72(C_{db} + C_{wb}) + 40.6 C_{db}$ = dry bulb temp C wb = wet bulb temp

Cause of heat stress

- Change in metabolism
- Protein deposition decreases
- Protein utilization increases to utilization of energy.

Cows have two main control strategies to maintain their thermal balance

- Increasing heat desiccation.
- Limitation in heat production.

Symptoms of heat stress

- Feed intake /Dry matter intake going decreases
- Milk yield going to decreases
- Loss of weight and reproduction potential low
- Somatic cell count may increases so increased risk of mastitis.
- Animals try to find shade (shelter seeking behavior)

- Try to remain in standing position for more exposure of body parts to environment
- Where water resources animal may herding that place
- Laboured breathing
- Excessive salivation
- Restlessness and uncomfortable
- Reduced birth weight of calves

Particularly in buffaloes

- Redness of hides on brisket, under the belly and between the legs of buffalo
- Tongue protrusion
- Fast Panting
- Very hot to touch and rectal temperature go rises than normal one.
- Embryonic mortality and fall in AI success rate
- Fertility Low
- Reduced feed intake,
- Decreased action
- Shelter seeking
- Increases respiratory rate, peripheral blood flow and sweating, pulse rate

Management of heat stress in dairy animals

Measurement to overcome heat stress

Cooling by reducing ambient temperature

- Misters
- High pressure foggers
- Evaporative cooling pads and fans

Enhancing the cow's natural mechanism of heat loss

Shades

- Natural shades
- Artificial shades – permanent shade structure and portable shade
- Cooling ponds
- Sprayers in parlor exit lanes
- Sprinkler and fan cooling systems (direct evaporative cooling)
- Night grazing
- Feeding high energy diet
- Feeding bypass protein

Mister

- Mister under shades in the loafing area should be used in conjugation with fans, at 8 to 9 feet above grade and oriented down at about 30 degrees, so that the water is blown onto the cows.
- Objective of mister - put water over the body of the cow, not to cool air, where its evaporation provides cooling.
- Water intake reduced after using misters.
- Over the cow bunk line mister should be used and water volume must be low enough to prevent slick conditions at the bunks, bunk line misters required at night.
- Free stall cows should be provided with bunk line misters with fans.
- However be sure that there is a roof peak opening and that the sides of building can be opened to provide a free flow of air through the covered area.

Fans

- The use of fans, particularly in the area of where poor ventilation.
- In Proper distance use of fans for cooling.

Sprinkling

- Cow body fully water after sprinkling and for evaporation using of fan and water cools the cow and encourages more feed intake and milk production.
- Next to feed bunk sprinkler and fan should be placed so that the feeding area is the coolest place in the farm, helping to increase more feed intake.

Cooled water

- It should be available fresh and toxin free.
- Drinking water 3-4 times in a day is needed in summer months.

- Showering /splashing of water on the body thrice a day causes more comfortable environment.
- As temperatures rise, cows will drink more because of a lot of water requirements for metabolic function of body.
- In hot weather, water intakes can increase by 15 - 20%, so it is essential that yards, buildings, grazing areas and dispersal areas are well supplied by water troughs.
- If cows have access to outside yards or grazing, it is very important that the water is close to shade and a source of feed.
- If animal go for grazing we should ensure that availability of water necessity there.

Wallowing

Wallowing is a learned behavior observed in buffaloes, where they immerse themselves in mud or water as a way to regulate their body temperature. This practice serves as a cost-effective and effortless means of coping with heat during the summer months. Buffaloes have distinctive physical characteristics that make them less adept at regulating their internal body heat, which can lead to increased body heat accumulation. This, in turn, negatively impacts their food consumption, overall productivity, and reproductive capabilities. One contributing factor is their dense, dark skin, which readily absorbs the abundant solar radiation prevalent in their habitat. Additionally, their sparse hair coat provides insufficient insulation against the rigors of high temperatures. Furthermore, the buffalo's skin contains fewer sweat glands (approximately one-sixth the number) than those found in Zebu cattle. These sweat glands are located deep within the skin, limiting the buffalo's ability to dissipate heat through evaporative means.

Shade

- Providing shade for dairy cows in dry lots has positive effects on their performance. They eat more, produce more milk, and have fewer difficulties with getting pregnant.
- Natural Shade from Trees:
- Trees are great for shade. They block the sun's heat and the moisture from their leaves cools the air. This doesn't mess up the air flow. Artificial Shade:
- Portable Shades:
- These should be placed east to west and each cow needs about 40-45 square feet of shade. The shade should be around 12-13 feet high.

Permanent shade structure

- If the shade structure is 40 feet wide or less, it should be at least 12 feet tall at the edge. If it's wider, it needs to be 16 feet tall.

- Keep at least 50 feet of space between this shade structure and other buildings.
- The roof should be slanted like a triangle with a slope of 4:12 and a continuous opening at the top.
- Painting the roof white and adding insulation under it helps reflect the sun's heat and keeps the cows cooler.

Night grazing

it is important, because it causes

- Temperature regulation (comfortable temperature during night)
- Forage quality: Some of the plant mainly bloom during night which is beneficial to buffalo.
- Activeness: Due to cooler temperature during night buffalo feel more relaxed and stress free, eat more comparatively day time.

Feeding high-energy diets

- We should offer low-fiber diet and high carbohydrate diets which is fermentable, lower dietary heat increment compared to high fiber diets.
- Although during summer metabolic energy increases heat stress so feed intake lower accordingly. so that, it is important to increase the energy content of the diet of dairy buffaloes, in order to maintain their energy intake under hot conditions.
- In summer we have to offer fatty acid diet or fatty acids salts to improving energy supply.
- We should have to offer such kind of feed who increases the production and lower body temperature, pulse rate and respiration.
- Rations should not exceed 4.5% of the overall dry matter as fat.
- This supplemental fat can come from whole seeds such as cottonseeds or soybeans, tallow, rumen inert sources, or combinations.
- Inert sources of energy: cotton seed cake, soybeans cake ,tallow (supplemental feed)
- Feed additive yeast (10g/animal/day), niacin (6g/animal/day), zinc(40mg/kgDMI), chromium (1.5mg/kg DMI).
- Supply. 9% calcium and 35% magnesium in the ration when fats are fed.
- Rations should be contained 36-40 %CP.
- Potassium ion should be increased to at least 1.5% of DM, sodium ion to .45%, chlorine 0.25 to 0.35 %,salt 3-4 ounce.
- supplementing 100,000 international units (IU) of vitamin A per day, 50,000 IU of vitamin D, and 500 IU of vitamin E.

Feeding by-Pass Protein

- Dietary protein degradability is also critical under heat stress conditions.

- It is well known that excessive protein intake increases heat production and decreases reproductive performance.
- However, the protein requirement of buffalo increases and dry matter intake decreases in a hot environment, consequently, the protein supplied to lactating buffaloes during summer is not always sufficient.
- By using fish meal, which is a by-pass protein, the milk yield and protein content of buffalo milk increases but the ruminal ammonia production decreases.