

HEAT STRESS IN DAIRY CATTLE NUTRITION

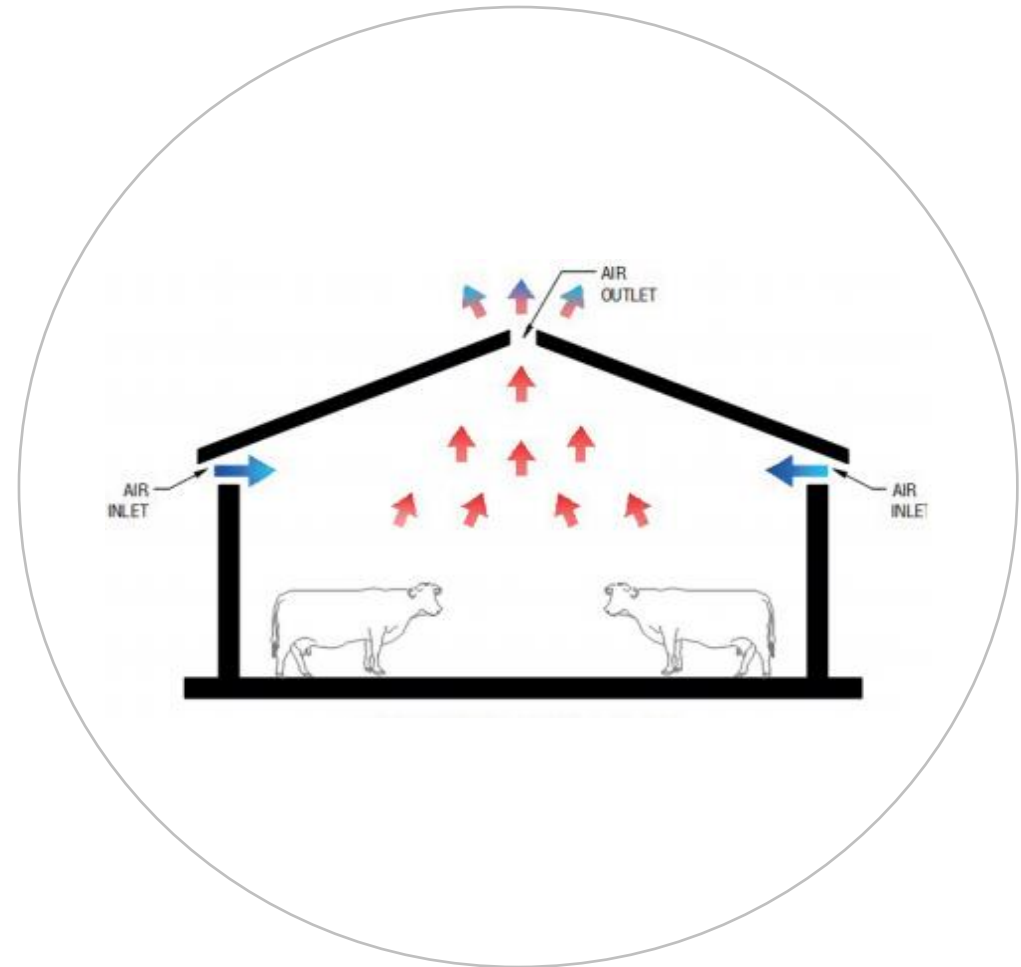
(Level 1)

Topic	Training & information Content
3.1	Estimating feeding value of fodder & feed on dairy farms
3.2	Sampling feeds & forages/analysis interpretation
3.3	Estimating Dry Matter intake for various breeds/age categories of dairy cattle in the tropics
3.4	Reviewing feed intake, rumen fill, Body Condition Scoring (BCS)
3.5	Life weight estimation of cows
3.6	Rumen fermentation
3.7	Mineral & vitamin requirement, guidelines
3.8	Manure scoring and evaluation
3.9	Guidelines for ration calculations for various breeds, heifers, lactation stage (Rumen8)
3.10	Use of Rumen8 software for ration calculation
3.11	Optimization of ration with Rumen8
3.12	Feeding management guidelines
3.13	Feeding management of dry cows/close-up
3.14	Feeding systems
3.15	Metabolic disorders
3.16	Scoring locomotion and hoof condition
3.17	Mycotoxin in dairy cattle nutrition
3.18	Heat stress in dairy cattle nutrition
3.19	Monitoring feeding management, using KPIs (based on Rumen8)



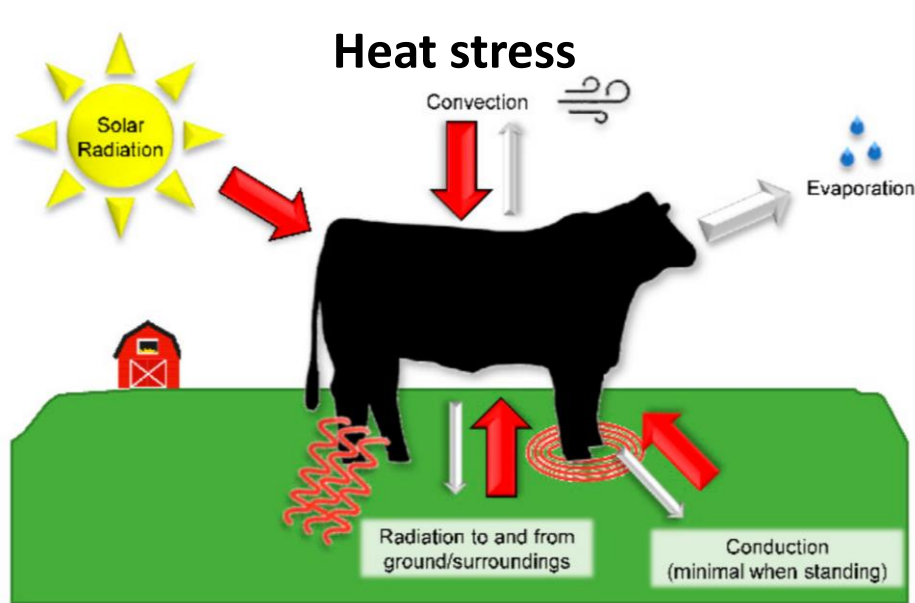
1. You will learn about (learning objectives):

- Heat stress in dairy cows.
- How heat stress affects nutrition in dairy cows.
- Causes of heat stress and how to prevent them.



2. Introduction

- Heat stress negatively impacts performance parameters in dairy cattle thus significant financial burden.
- Heat stress occurs when cows generate and absorb more heat than they can easily get rid off.



Source: https://www.mdpi.com/animals/animals-11-03539/article_deploy/html/images/animals-11-03539-g001.png



3. Factors that influence heat stress

- i. Environmental and management factors
 - The weather and climatic conditions.
 - Cow barn design; ventilation and space.
 - Transportation of the cows.
- ii. Cows factors
 - Milk production and stage of lactation.
 - Health.
- iii. Feed.
 - Fibrous feeds with low digestibility produce more heat while being digested.



Milk production and stage of lactation



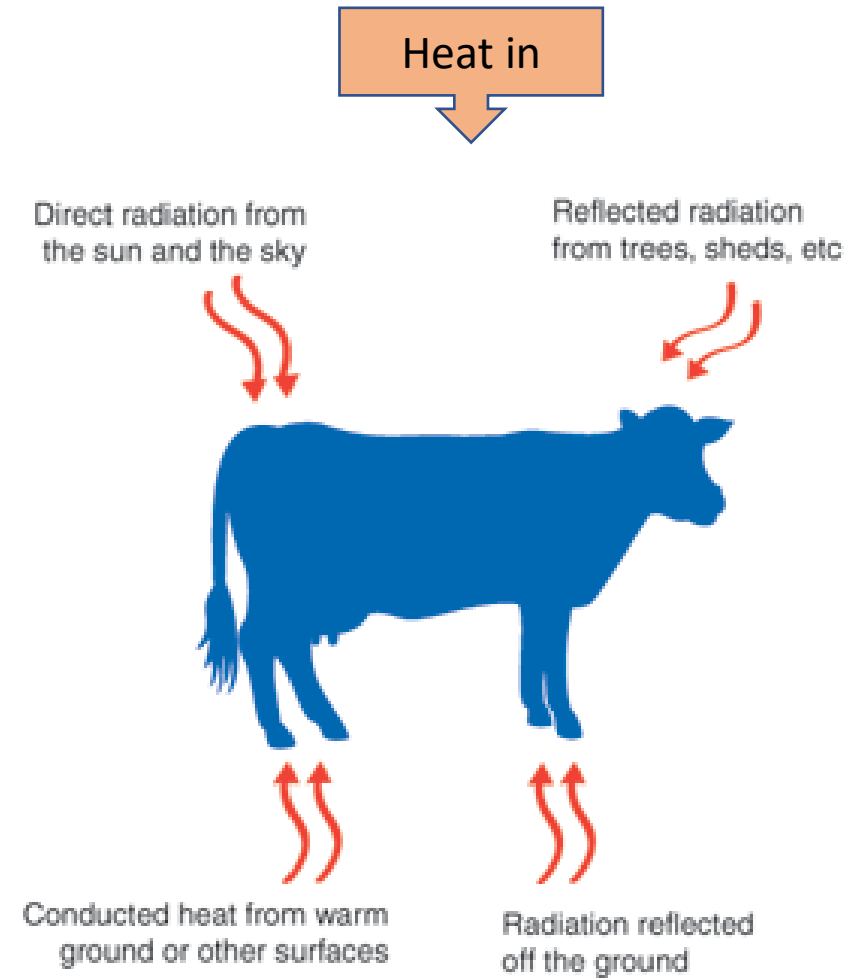
Fibrous feeds have low digestibility therefore more heat compared to less fibrous feed.

4. Environmental factors

- Cows absorb heat;
 - when out in the sun,
 - in cow barns with minimum ventilation,
 - from the ground or other surfaces.
- Temperature and humidity determine when a cow starts feeling heat stressed.



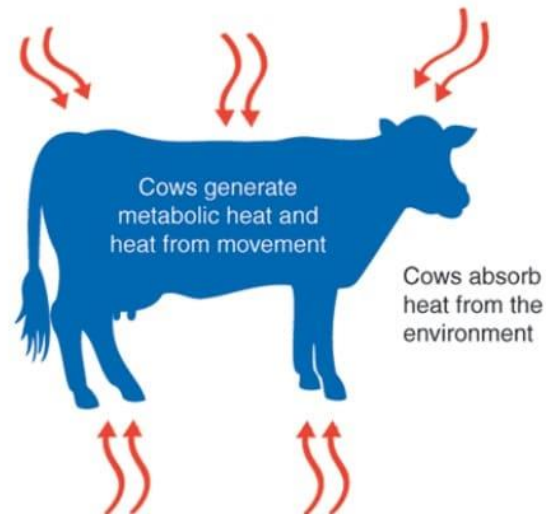
Cows get heat when out in the sun



How cows get heat from the sun and surrounding.

4.1 Environmental factors: Transporting cows

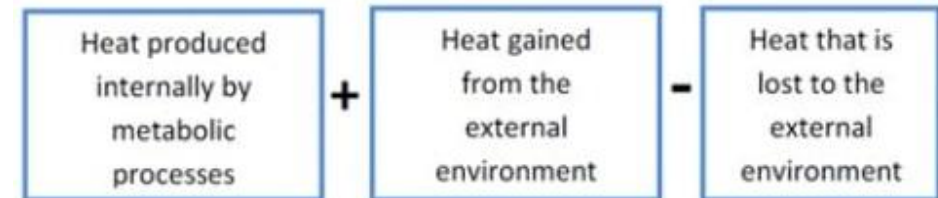
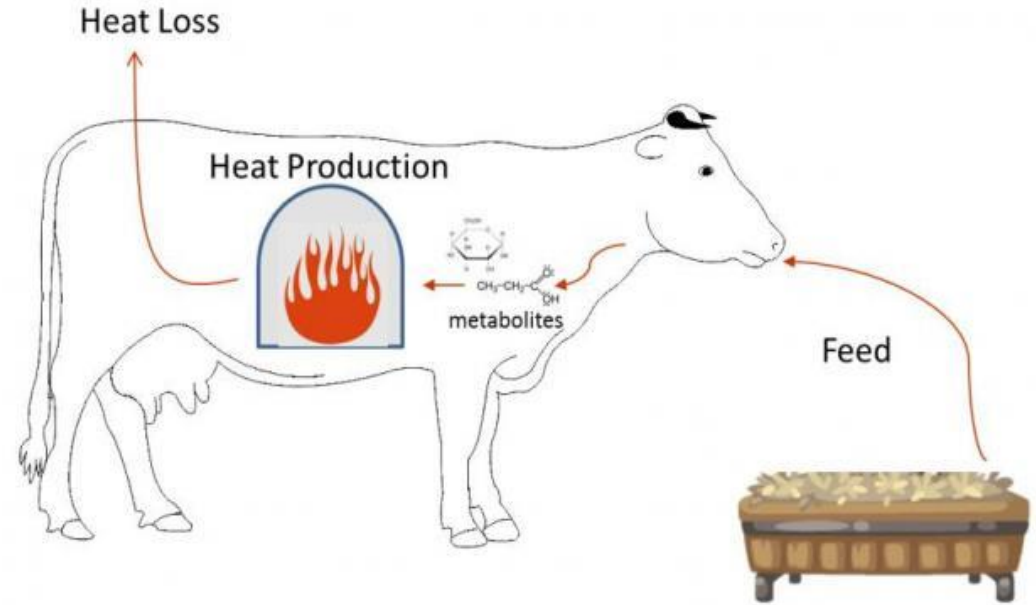
- Transport can create or worsen existing heat loads.
- Truck design can influence the environmental impact on animals.



Track design can influence temperature gain by cows.

5. Cow factors: Heat produced from within the cow

- The cow burns fuel in the form of metabolites (e.g. VFA) produced from feedstuff.
- Some of the heat released is lost to the environment.
- When heat stress occurs, it means the cow cannot lose all the heat of metabolism.

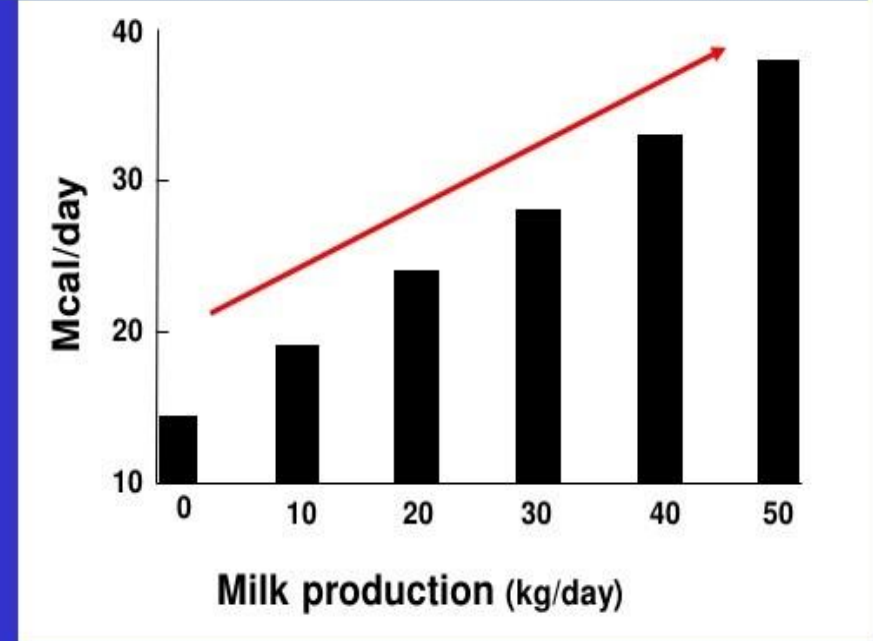


5.1 Cow factors: Stage of lactation

- In high milk producing cows, the heat production is higher and the effect of a high environment temperature is more pronounced.
- Dry cows can experience heat stress from high fiber content in the ration with low digestibility.

Heat production is related to milk level

1 Mcal (Megacalories) = 4.184 Megajoules



6. Early signs of heat stress

- i. Restless, spend increased time standing.
- ii. Slight, excessive drooling or foaming.
- iii. Elevated breathing.
- iv. Panting/open mouth breathing with tongue out.
Breathing is labored/respiration rate increase.
- v. Head dropped down.
- vi. Individual animals may isolate from the herd.
- vii. Crowding around water sources.
- viii. Increased water intake.



Drooling/foaming



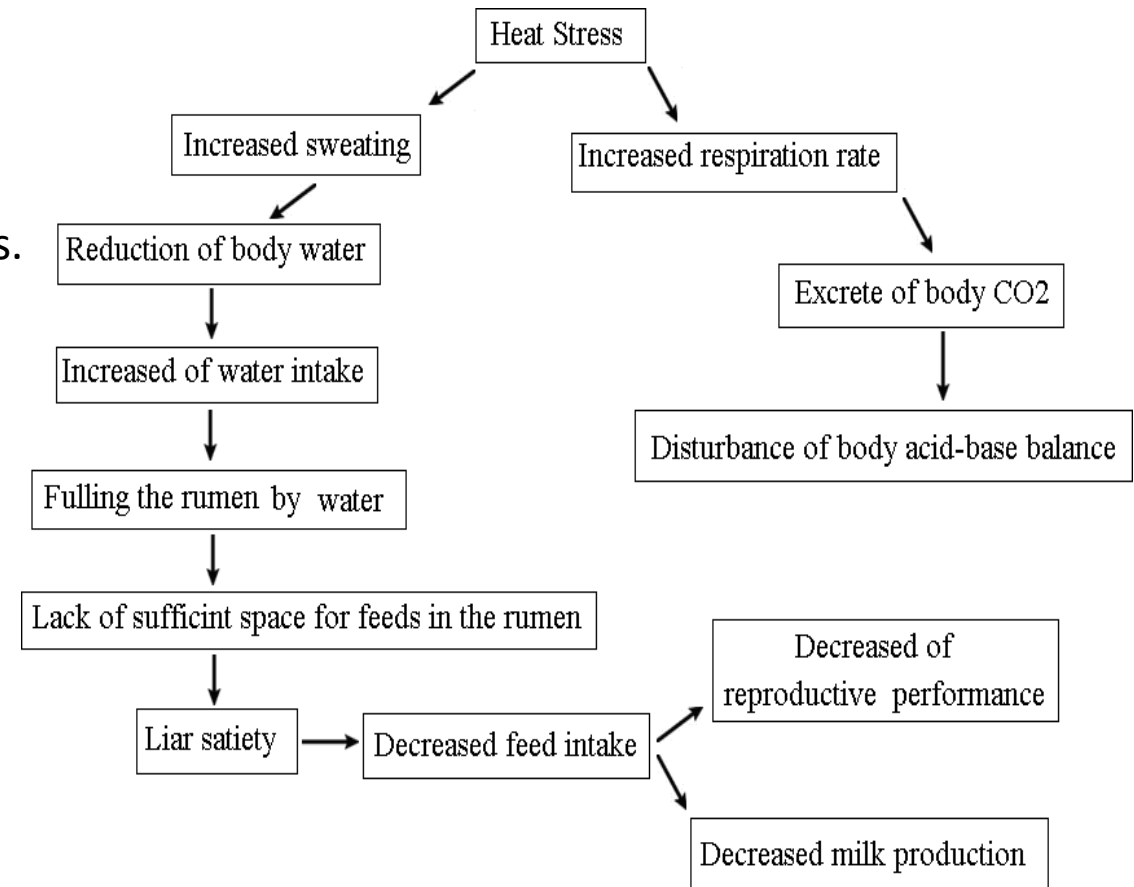
Increased water intake

7. Effects of heat stress in dairy cows

- Decreased milk production and milk quality.
- Change in body hormone levels.
- Poor reproductive performance.
- Lower calves birth weight.
- Increase the maintenance energy requirements.
- Metabolic disorders.

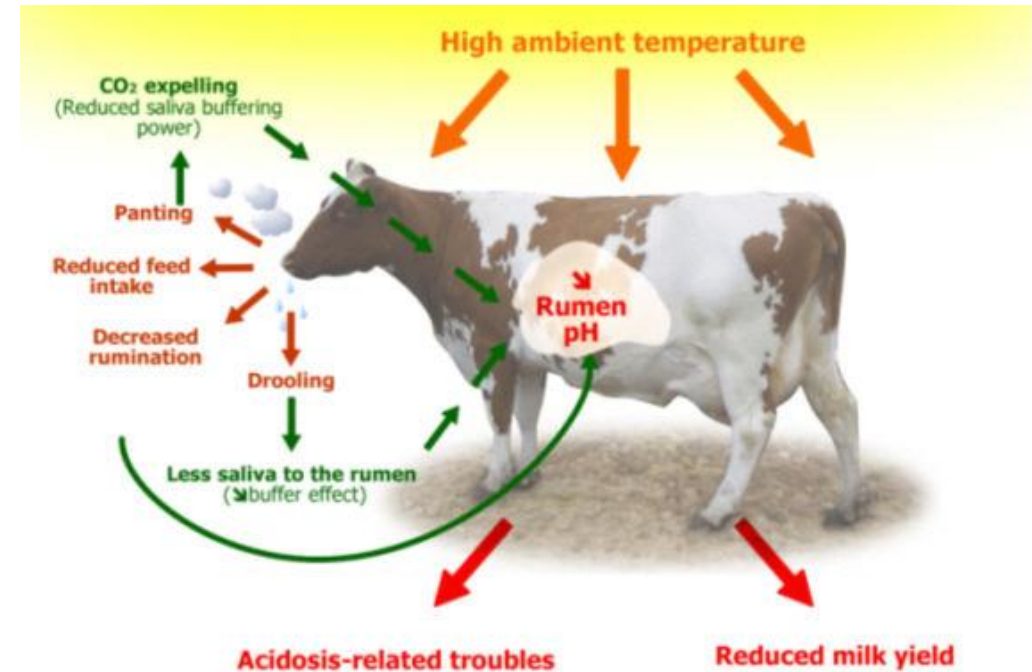


Decreased milk production



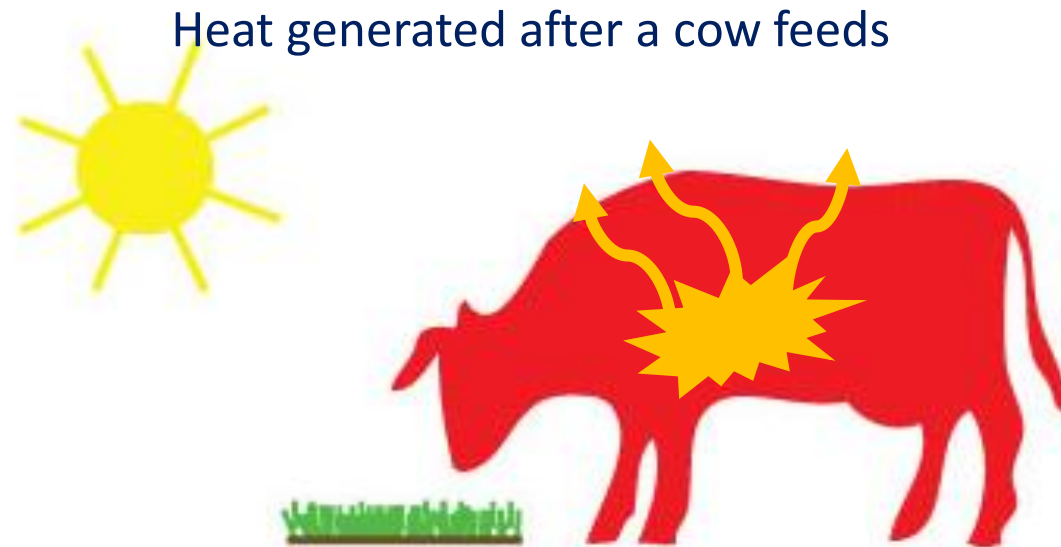
7.1 Effects of heat stress in dairy cows Cont'd...

- Increased heart beat rate and sweating.
- Decreased blood flow to internal organs.
- Changes in digestion of food.
- Decreased dry matter and feed intake.
- Possible deaths.



8. Heat stress affecting dry matter intake (DMI)

- During cooler days or part of the day, cows feed intake is not affected by heat stress.
- Heat stress affect feed intake when the cow cannot lose the excess heat easily and naturally.
- Eating behavior is negatively affected; cattle prefer to eat during cooler times of the morning and late evening.



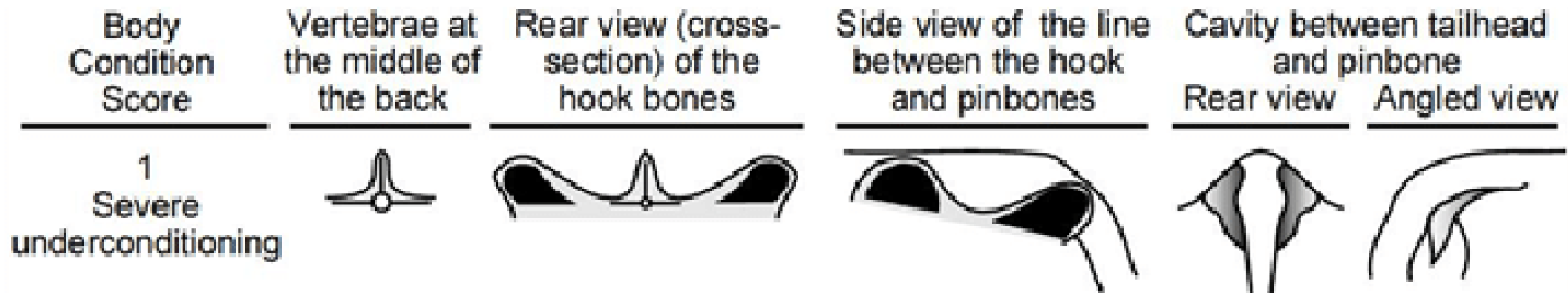
Cows get a lot of their energy by breaking down the fibre in the plants they eat. Breaking down fibre generates heat, so a cow's body temperature will naturally rise slightly after eating. Normally, this is okay, but a rise in body temperature can be dangerous if the cow is already in a hot climate.



Cows reduce feed intake in control of heat stress

9. Effects of reduced/depressed DMI

- This lowers rumen pH (more acidic) causing rumen acidosis.
- Lowers chewing of cud and gut motility.
- Reduces milk fat.
- Drop in milk production.
- Water and electrolyte loss.
- Body condition of the cow drops.



10. DMI management during heat stress

- Feed more frequently during cooler periods of the day.
- Feed a TMR to avoid selective eating and to maximize DMI.
- Provide a cool area for forage feeding.
- Manage the silage bunkers to avoid heating and molding of the silage face surface.
- Use quality forage to maintain required fiber level.



Manage silage bunkers.

10.1 DMI management during heat stress Cont'd...

- Increase minerals to make up for losses in sweat.
- Maintain forage and water quality and availability.
- Add fat to the ration.
- Possibly have fans and or sprinklers over feeding areas when cows are kept indoors.



Increase minerals.



Quality water.

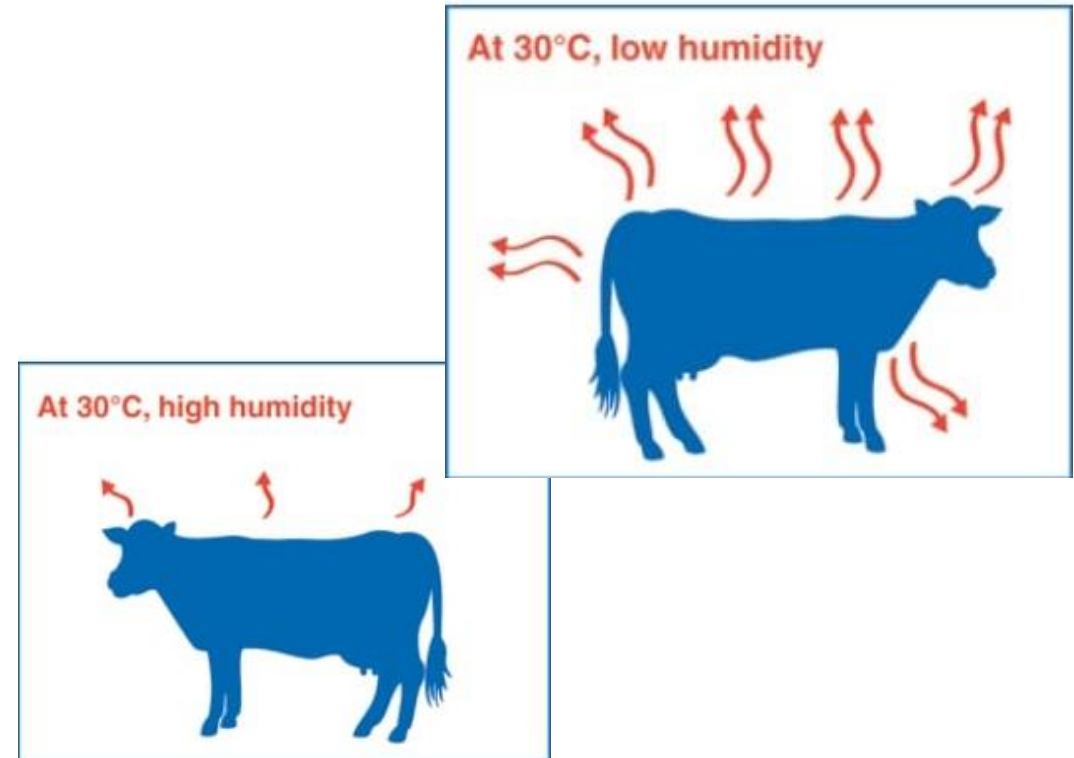
11. How cows lose heat

- Physical contact with surrounding objects.
- When a cow wades into a pool, she is cooled by conduction.



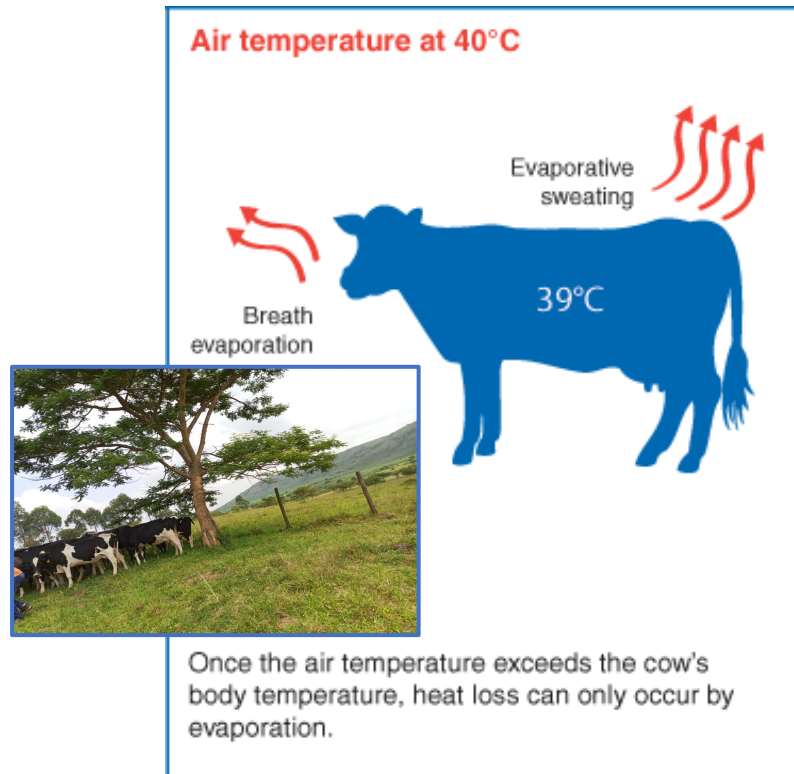
Cows wade into a pool of water to lose heat.

- Humidity - Air moisture can influence evaporative heat loss from dairy cows through both skin and respiratory tract.



11.1 How cows lose heat Cont'd...


- Evaporative cooling - when sweat or moisture is evaporated from the skin or respiratory tract.



- Panting - Heat stress leads to high loss of saliva (from drooling and open-mouthed breathing) in hot weather.
- Increased sweating.
- Increased water intake, among others..

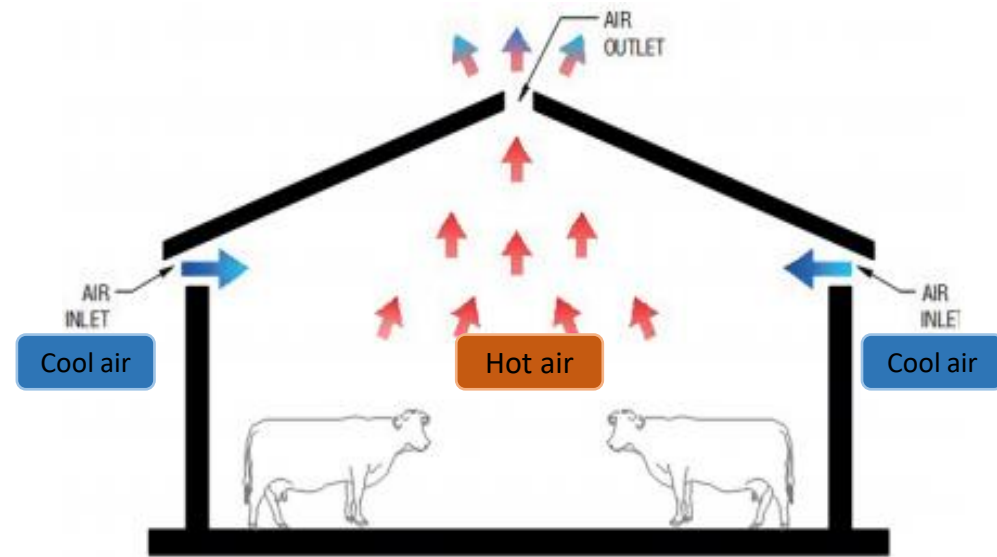


Heat Loss:
Sweating
Panting
Radiation
Conduction
Convection



12. Preventing heat stress

- Shades for cows grazing.
- Sprinkling them with water, using fans.
- For cow barns, provide adequate ventilation and enough space.
- Breeding of cows (cross breeds) for improved heat tolerance is a long term option.



13. Take home messages/Summary

- i. Heat stress acclimation process causes several physiological, endocrinal and biochemical changes in cattle.
- ii. Heat stress greatly affect feed intake in cows, leading to reduced performance.
- iii. Breeding of dairy cows for improved heat tolerance is a long term process.
- iv. Recommended cow comfort and barn structure can contribute to solving heat stress.

