



**VETERINARY
TODAY**
INTERNATIONAL
ISSN 2583-8288

Summer Management of Buffaloes: Strategies to Mitigate Heat Stress and Sustain Productivity

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doi.org/10.5281/VeterinaryToday.22170217

Abstract

Buffaloes are highly susceptible to heat stress owing to their dark skin pigmentation, sparse hair coat, and relatively lower density of functional sweat glands compared with cattle. Exposure to elevated ambient temperatures and humidity during summer adversely affects feed intake, growth performance, milk yield, reproductive efficiency, immune competence and overall welfare. Heat stress induces physiological and behavioral alterations aimed at maintaining thermal homeostasis, often at the expense of productive functions. Therefore, implementation of appropriate summer management strategies is essential for sustaining animal health and farm profitability. This article reviews practical and economically feasible approaches for mitigating heat stress in buffaloes, including environmental modifications, cooling interventions, nutritional management, water provision, health care and innovative low-cost technologies suitable for smallholder production systems.

Keywords: Buffalo, Heat stress, Summer management, Thermal comfort, Welfare

Introduction

Buffaloes contribute significantly to milk production in many tropical and subtropical countries. However, their thermoregulatory capacity is limited under conditions of high environmental temperature. The Temperature-Humidity Index (THI) is commonly used to assess heat stress in livestock, and buffaloes exhibit pronounced physiological responses when THI exceeds the comfort threshold. During summer, animals experience increased respiratory rate, elevated rectal temperature, reduced dry matter intake, altered endocrine function, and compromised reproductive performance. Effective summer management is therefore critical to minimize production losses and maintain animal welfare.

Environmental Management

Provision of Adequate Shade

Protection from direct solar radiation is a primary requirement for reducing heat load. Housing structures should be designed to maximize ventilation and minimize heat accumulation. High-roof sheds, open-sided

housing, and appropriate orientation of buildings facilitate natural airflow.

Planting shade trees around animal housing provides a sustainable and environmentally friendly means of reducing ambient temperature. Tree species such as neem, subabul, and shisham can provide effective shade while contributing to environmental sustainability.

Roof Modification Strategies

Application of white reflective coatings or lime-based whitewash on shed roofs reduces solar heat absorption. Additionally, installation of shade nets and use of locally available thatching materials can further improve thermal comfort within animal shelters.

Water and Cooling Management

Continuous Access to Drinking Water

Water intake increases substantially during periods of heat stress. Buffaloes should have unrestricted access to clean, fresh, and cool drinking water throughout the day. Water troughs should be strategically located and



cleaned regularly to prevent microbial contamination.

Wallowing and Hydro-Cooling

Wallowing represents a natural thermoregulatory behavior in buffaloes. Immersion in water facilitates conductive and evaporative heat loss, thereby reducing body temperature and physiological stress. Where wallowing facilities are unavailable, sprinkler systems, misters, or periodic showering can serve as effective alternatives.

Low-Cost Cooling Innovations

Several affordable cooling technologies can be adopted by smallholder farmers:

- ✚ Wet gunny-bag curtains positioned around sheds to enhance evaporative cooling.
- ✚ Roof sprinkling systems using perforated PVC pipes.
- ✚ Earthen water storage containers that naturally maintain lower water temperatures.
- ✚ Vegetative roofing systems utilizing climbing plants to reduce solar heat gain.

These interventions require minimal investment and can substantially improve the thermal environment.

Nutritional Management

Feeding Schedule Optimization

Heat stress reduces voluntary feed intake, resulting in negative energy balance and decreased productivity. Feeding should therefore be scheduled during cooler periods of the day, preferably early morning and late evening.

Diet Quality and Nutrient Density

Provision of high-quality, digestible fodder and balanced concentrate mixtures is essential during summer. Inclusion of nutrient-dense feed ingredients helps compensate for reduced feed consumption. Green fodders with higher moisture content can also contribute to maintaining hydration status.

Mineral and Electrolyte Supplementation

Heat stress increases mineral losses and may disrupt electrolyte balance. Supplementation with mineral mixtures, common salt and electrolytes helps maintain

osmotic balance, supports metabolic functions, and improves resilience to thermal stress.

Health Management

Elevated temperature and humidity create favorable conditions for the proliferation of pathogens, flies, and ectoparasites. Maintaining proper hygiene, efficient manure disposal, and adequate drainage are critical preventive measures. Routine vaccination and deworming programs should be implemented according to regional veterinary recommendations.

Animals should be monitored regularly for clinical indicators of heat stress, including:

- ✚ Increased respiratory rate
- ✚ Excessive salivation
- ✚ Elevated rectal temperature
- ✚ Reduced feed intake
- ✚ Decline in milk production
- ✚ Lethargy and reduced activity

Early detection facilitates timely intervention and reduces production losses.

Reproductive Management

Heat stress negatively affects reproductive performance by disrupting endocrine function and reducing expression of estrus. Conception rates often decline during summer due to impaired follicular development and embryonic survival. Provision of adequate cooling, balanced nutrition, and strategic breeding management can help mitigate these effects and improve reproductive efficiency.

Calf Management

Buffalo calves possess limited thermoregulatory capacity and are particularly vulnerable to dehydration and thermal stress. Calf housing should provide adequate shade, ventilation, and access to clean drinking water. Proper sanitation and regular health monitoring are essential to ensure optimal growth and development during summer months.

Future Perspectives

Climate change is expected to increase the frequency and intensity of heat waves, posing additional challenges to buffalo production systems. Adoption of climate-resilient housing designs, precision cooling technologies, heat-tolerant breeding strategies, and sustainable resource management practices will become increasingly important for



maintaining productivity under changing environmental conditions.

Conclusion

Heat stress represents a major constraint to buffalo productivity and welfare during summer. A combination of environmental modification, effective cooling systems, strategic nutritional management, adequate water provision, and preventive health care can substantially reduce thermal stress and its associated economic losses. Low-cost technologies such as shade enhancement, evaporative cooling through wet gunny bags, roof sprinkling, and tree-based shelter systems offer practical solutions for resource-limited farmers. Adoption of these integrated management strategies is essential for sustaining buffalo health, productivity, and profitability under hot climatic conditions.