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Scientific Management of Livestock During Drought: Strategies for Nutritional Security, Animal Health and Sustainable Production

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1. Introduction:

Livestock production plays a significant role in rural livelihoods, nutritional security and agricultural sustainability in India. However, recurrent droughts and prolonged dry spells threaten livestock production systems by reducing fodder availability, limiting water resources and increasing the cost of animal feeding. The impacts are particularly severe in rain-fed regions where livestock depend heavily on seasonal pastures, crop residues and locally available feed resources.

Drought affects livestock through several interconnected pathways. Reduced forage production limits nutrient intake, while poor-quality crop residues may fail to meet the requirements of lactating, growing and pregnant animals. Simultaneously, elevated environmental temperatures can increase maintenance energy requirements, reduce



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voluntary feed intake and compromise reproductive efficiency. These combined stresses can lead to declining body condition, lower milk production and reduced farm profitability.

Accordingly, drought management should extend beyond emergency feeding and incorporate preventive planning, efficient utilisation of available resources and scientifically balanced livestock management (FAO, 1986; IPCC, 2022).

2. Nutritional Management During Fodder Scarcity

2.1 Strategic utilisation of available feed resources

Feed scarcity is among the most immediate consequences of drought. Reduced availability of green fodder often increases dependence on cereal straws, crop residues and purchased concentrates. Although these materials can contribute to the ration, their nutritional composition varies considerably.

Mature cereal residues generally contain high concentrations of structural carbohydrates and may have limited digestibility and low crude protein content. Feeding such materials as the sole dietary component can result in inadequate energy and protein intake, particularly in high-producing dairy animals.

A practical strategy is to formulate rations according to animal category, body weight, physiological stage, milk yield and available feed ingredients. Suitable protein and energy supplements may be incorporated to correct nutritional deficiencies. However, supplementation should be based on ration assessment rather than indiscriminate concentrate feeding. Chopping appropriate crop residues, reducing feed wastage and maintaining hygienic storage can further improve the utilisation of available feed resources (FAO, 1986).

2.2 Nutritional prioritisation of vulnerable animals

During severe feed shortages, feeding plans should account for differences in physiological requirements. Late-pregnant animals, high-yielding cows and buffaloes, growing calves and animals recovering from illness require particular attention.

Inadequate nutrition during late gestation can adversely affect maternal condition and subsequent lactation performance. Similarly, insufficient nutrient intake in young animals may compromise growth and delay their development.

Feed allocation should therefore be guided by nutritional requirements and animal welfare, while ensuring that no animal is subjected to prolonged or severe undernutrition. Where the available feed supply is insufficient, early consultation with a veterinarian or animal nutritionist is essential.

2.3 Fodder conservation and drought preparedness

Conservation of surplus fodder during periods of abundance is an important strategy for reducing seasonal feed shortages.

Silage is produced by preserving suitable green fodder through controlled fermentation under anaerobic conditions. **Hay** is prepared by drying forage to a moisture level suitable for safe storage. Both methods can provide reserve feed during drought, provided that harvesting, preparation and storage are properly managed.

Maize and sorghum are commonly used for silage production, although crop suitability depends on local agronomic and environmental conditions. Effective compaction and airtight sealing are essential for limiting undesirable microbial activity. Stored fodder should be inspected before feeding, and visibly mouldy, rotten or contaminated material should be discarded.

Community fodder banks, cooperative silage facilities and shared chopping equipment may improve access to fodder conservation technologies for smallholder farmers.

3. Water Management and Prevention of Dehydration

Water is essential for thermoregulation, digestion, nutrient transport, excretion and milk synthesis. During drought, inadequate water availability can reduce feed intake and compromise animal performance. Water requirements vary according to species, body weight, lactation stage, feed composition, physical activity and environmental temperature.

Lactating animals generally require substantial quantities of water because



milk production involves considerable water output. High ambient temperatures further increase the importance of adequate drinking-water access.

Recommended management measures include:

- Providing continuous access to clean drinking water wherever feasible.
- Cleaning water troughs regularly and protecting water sources from faecal and chemical contamination.
- Repairing leaking pipes and improving water-storage efficiency.
- Providing shade near feeding and watering areas.
- Monitoring animals for reduced intake, weakness and other signs that may indicate dehydration or illness.

Water conservation should focus on reducing wastage rather than restricting essential drinking water. Where water quality is uncertain, appropriate testing and treatment should be undertaken.

4. Management of Heat Stress During Drought

Drought frequently coincides with high environmental temperatures and, in some regions, high humidity. Heat stress occurs when an animal cannot dissipate sufficient body heat to maintain physiological balance.

Cattle and buffaloes respond to heat stress through physiological and behavioural changes, including increased respiratory rate, sweating where effective, altered feeding behaviour and reduced activity. Feed intake



and milk production may decline, while reproductive processes can also be adversely affected.

Renaudeau et al. (2012) reviewed the physiological and productive consequences of heat stress in livestock, highlighting the importance of environmental management and appropriate nutrition.

Practical heat-stress mitigation

Farmers can reduce heat exposure through the following measures:

1. **Shade:** Provide trees, roofs or appropriately designed shelters that reduce direct solar radiation.
2. **Ventilation:** Maintain sufficient airflow in animal housing.
3. **Water access:** Ensure adequate drinking water and maintain clean watering facilities.
4. **Feeding management:** Offer fresh feed during cooler periods when practical and minimise feed spoilage.
5. **Cooling:** Use suitable sprinkling or other cooling systems where water availability permits.
6. **Handling:** Avoid unnecessary transportation, restraint and strenuous activity during peak heat.

Heat-stress severity should be assessed using environmental conditions and animal responses rather than temperature alone. Persistent panting, marked weakness, abnormal behaviour or collapse requires prompt veterinary attention.

5. **Disease Prevention and Veterinary Care**

Nutritional inadequacy, dehydration and heat stress can complicate the management of livestock diseases. However, disease occurrence during drought is influenced by multiple factors, including pathogen exposure, animal condition, hygiene and management practices.

Preventive veterinary care should remain a priority even when resources are limited. Farmers should follow locally recommended vaccination schedules, maintain appropriate parasite-control programmes and monitor animals for changes in appetite, body condition, milk production and behaviour.

Feed and water sources should be protected against contamination, and suspected infectious cases should be assessed promptly by a veterinarian. Medication should be administered under appropriate professional guidance.

Particular attention is required when animals graze drought-stressed forage. Certain plants and crops can accumulate toxic compounds under specific environmental conditions. Unknown plants, chemically contaminated feed and suspicious forage should not be fed without assessment.

6. **Reproductive and Production Management**

Drought-associated nutritional stress may influence reproductive performance through changes in energy balance, body condition and metabolic function. In dairy cattle and buffaloes, inadequate nutrient intake can contribute to reduced reproductive activity, delayed conception and longer calving intervals.

Maintaining appropriate body condition and providing balanced nutrition are therefore important components of reproductive management. Farmers should maintain records of breeding dates, calving, milk production and reproductive examinations to identify emerging problems.

Milk-yield fluctuations should be interpreted in conjunction with feed intake, water availability, ambient temperature and health status. A reduction in milk yield may indicate nutritional inadequacy, heat stress, disease or a combination of these factors.

7. Developing a Farm-Level Drought Management Plan

An effective drought management plan should be developed before feed and water supplies become critically limited. The plan should include:

- Estimation of herd-level feed and water requirements.
- Assessment of existing fodder stocks and their expected duration.
- Conservation of suitable green fodder as hay or silage.
- Identification of reliable feed suppliers and alternative feed resources.
- Maintenance of animal health, vaccination and production records.
- Identification of veterinary services and locally available drought-support programmes.

Farmers should periodically assess body condition, milk yield and feed availability to identify emerging nutritional problems. Early intervention is generally more practical than attempting to restore animals after severe weight loss or prolonged undernutrition.

At the community level, coordinated fodder banks, shared machinery, local feed inventories and timely veterinary outreach can strengthen livestock resilience.

8. Conclusion

Drought imposes multiple stresses on livestock through reduced feed availability, water scarcity and increased thermal load. These challenges can negatively affect nutritional status, milk production, reproductive efficiency and animal welfare.

An integrated management approach based on balanced feeding, conservation of fodder, adequate drinking water, heat-stress mitigation and preventive veterinary care is essential for reducing drought-associated

losses. The effectiveness of these interventions depends on local climate, livestock species, production system and available resources.

Scientific drought preparedness should therefore be considered a continuous component of livestock management rather than an emergency response. Collaboration among farmers, veterinarians, animal nutritionists, agricultural institutions and government agencies can strengthen the resilience and sustainability of livestock production systems.

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