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Climate-Smart Strategies for Sustainable Dairying

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Abstract

The dairy sector plays a pivotal role in global food and nutritional security, yet it is increasingly vulnerable to the adverse impacts of climate change. Rising temperatures, extreme weather events and resource constraints threaten animal health, milk productivity and the livelihood of millions of farmers. Climate-smart dairying (CSD) offers an integrated approach to mitigate these challenges by enhancing resilience, reducing greenhouse gas emissions and promoting resource efficiency. This article outlines sustainable strategies for dairying, focusing on improved housing, resilient feeding systems, and efficient water use, breeding for adaptability, manure management, renewable energy adoption and farmer capacity building. Adoption of these measures will ensure sustainable milk production, environmental protection, and socio-economic security of dairy farmers.

Keywords: Climate-smart dairying, heat stress, sustainable livestock, fodder management, renewable energy, animal welfare

Introduction

Dairying contributes significantly to rural livelihoods, nutritional security and national economies worldwide. However, climate change poses unprecedented challenges, including heat stress, reduced feed availability, water scarcity and disease outbreaks (IPCC, 2021). The livestock sector contributes about 14.5% of global greenhouse gas (GHG) emissions (FAO, 2019), primarily from enteric fermentation and manure management. India, the world's largest milk producer, faces additional challenges due to its large population of smallholder dairy farmers (NDDB, 2020). Therefore, adopting climate-smart strategies is imperative for ensuring sustainability, profitability and resilience in dairy production systems.

Climate-Smart Strategies for Sustainable Dairying

Improved Animal Housing and Microclimate Management

- Construction of ventilated sheds with reflective roofs, green shade nets and tree plantations.
- Use of cooling devices like fans, sprinklers and foggers to alleviate heat stress.

Efficient Feeding and Nutrition

- Cultivation of climate-resilient fodder species (Sorghum, Bajra, Napier grass).
- Conservation methods such as silage and hay making.
- Balanced feeding using total mixed rations (TMR), bypass nutrients and mineral-vitamin supplementation.
- Feed additives like yeast, probiotics and organic trace minerals to improve feed efficiency and reduce methane emissions.

Water Resource Management

- Rainwater harvesting and farm ponds to ensure year-round availability.
- Reuse of wastewater from dairy operations.
- Micro-irrigation systems for efficient fodder cultivation.

Breeding for Climate Resilience

- Genetic selection of indigenous and crossbred cattle with heat and disease tolerance.
- Advanced reproductive technologies such as artificial insemination and embryo transfer.
- Conservation of native breeds adapted to local climates.

Manure and Waste Management

- Biogas plants for clean energy and methane reduction.
- Composting and slurry application as organic fertilizers to improve soil health.
- Reducing dependency on chemical fertilizers through nutrient recycling.

Renewable Energy Integration

- Solar-powered water pumps, chaff cutters, and milk chilling units.
- Solar heaters for water and milk processing.
- Community-level renewable energy systems to reduce carbon footprints.

Animal Health and Welfare

- Comprehensive vaccination and deworming programs.
- Nutritional supplementation during stress periods.
- Clean water and hygienic housing to minimize disease risks.

Farmer Awareness and Capacity Building

- Training programs on climate-smart practices, fodder conservation, and sustainable resource use.
- Cooperative models for collective action and resource sharing.
- Use of ICT tools and mobile applications for weather alerts, disease surveillance, and market linkages.

Conclusion

Climate-smart strategies in dairying are vital for sustainable milk production, livelihood security, and environmental protection. Integrated approaches combining resilient housing, efficient nutrition, water and energy management, genetic improvement, and waste recycling can significantly enhance dairy sustainability. Policy interventions, research innovations, and farmer-centric extension services will accelerate the adoption of climate-smart dairying, making the sector resilient against future climate uncertainties.

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