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Addressing field constraints in sheep farming: Pathways to sustainability and economic growth

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Abstract

Sheep farming in economically poor districts is primarily managed by marginal farmers using traditional methods, limiting profitability and productivity. A study was conducted to analyze key constraints and propose effective technological interventions to enhance sheep farming practices. Major challenges identified include low awareness among farmers, inadequate access to veterinary facilities, reliance on unimproved breeding stock, unavailability of quality inputs, and restricted access to credit. Other barriers include labor constraints, particularly the dependence on elderly, women, and children for animal care, the absence of organized marketing systems, and the lack of scientific feeding practices, leading to poor nutrition and growth performance of sheep.

To address these challenges, suggested interventions include comprehensive training programs to educate farmers on modern techniques, genetic improvement through the introduction of superior rams, strategic nutritional supplementation, advanced feeding techniques to enhance growth rates, ethnoveterinary practices to improve animal health, and the provision of farming inputs at subsidized rates. Additionally, strengthening veterinary services, promoting access to financial resources, and establishing structured marketing networks are essential to creating a sustainable and profitable sheep farming sector. The adoption of these modern technologies and scientific approaches can significantly improve the economic status of sheep farmers, ensuring long-term growth, increased productivity, and better livelihoods for the farming community.

Keywords: Sheep farming, technological interventions, sustainable agriculture, farmer wellness

Introduction

Sheep production in India is predominantly managed by poor and marginal farmers, who rely on extensive grazing systems for rearing their livestock [11]. As per the 20th Livestock Census conducted in 2019, India had a total sheep population of 74.26 million. Tamil Nadu ranks fourth in the country with a sheep population of approximately 4.5 million. Within the state, Krishnagiri district accounts for 2,29,150 sheep distributed across various blocks [9]. Despite the presence of 7,853 hectares of pasture and grazing land in Krishnagiri, the growth rate of the sheep population is significantly constrained [3]. We monitor livestock rearing across the entire district and conduct various awareness programs as part of Tamil Nadu Veterinary and Animal Sciences University. Our initiatives focus on improving farmers' knowledge of sustainable livestock farming practices, disease management, nutrition, and market linkages.

During our field visits, we engage with marginal sheep farmers to discuss the challenges they face in sheep rearing. Most farmers express concerns about the lack of profitability due to rising feed costs, inadequate veterinary support, limited market access, and fluctuating wool and meat prices. Additionally, the impact of climate change, including unpredictable weather patterns and water scarcity, has further worsened their situation [20].

As a result, younger generations are reluctant to continue in this sector and prefer migrating to urban areas in search of stable income opportunities. Consequently, the number of sheep farmers is steadily declining, which poses a threat to traditional livestock-based livelihoods and rural economies. Farmers expect government agencies or non-governmental organizations to intervene in this sector. What are the key challenges they face, and what alternative solutions could help improve the sheep farming community?

To address these challenges, this study aims to analyze the constraints in sheep rearing under extensive farming systems in the Krishnagiri Block of Tamil Nadu. Conducted

as part of the NABARD-sponsored FSPF project in Chennai, the study focuses on evaluating and promoting innovative approaches for sustainable sheep farming. The findings are expected to provide valuable insights into improving livestock management, ultimately enhancing the economic prospects of marginal farmers engaged in sheep rearing.

Methodology

The study included sheep rearers possessing a minimum of 20 animals. A benchmark survey was conducted to assess the level of awareness and adoption of modern technologies in sheep farming. The survey aimed to understand existing management practices, nutritional strategies, breeding patterns, and health interventions among farmers in the region.

The benchmark survey and questionnaire mentioned below were developed to identify field constraints in sheep farming in rural areas.

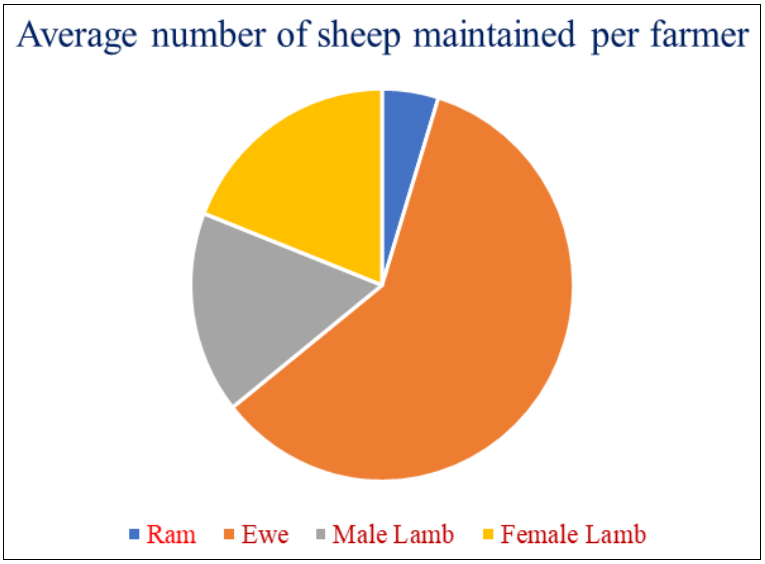
1.	Name and Address with mobile number, if any,	
2.	Number of sheep maintained	Rams- Ewes - Ram lambs- Ewe lambs -
3.	Breed	
4.	Land Holding	Wet land----------Acre. Dry land ---------Acre.
5.	Housing of sheep	Housed in shed - Yes No Folded in Patti - Yes No
6.	Night Folding done in Agricultural land If yes	Yes No How many months in a year ------– Income per month Rs.-------–
7.	Regular Feeding	Only Grazing Grazing + Grass Grazing + Grass + Conc. supplement
8.	Duration of Grazing available in Year (Months)	
9.	Where the Animals are Grazed	1. Harvested Agricultural land 2. Village grazing land 3. Lake bed
10.	Problems in Grazing (Rank)	Only few months
		Poor avail.in summer
		Lack of man power
		Too many animals grazing
		Pasture not improved
		No shade
		To walk for long
		No water facility
11.	Any supplement Given after Grazing	Yes No
	If yes	Name Qty 1. 2.
12.	Do you cultivate and feed green grass? If yes, Qty. given per day	Yes No -------Kg
13.	Mating season (specify month)	
14.	Any supplement before mating	Yes No
	If yes	Name Qty Duration 1. 2.
15.	No. of Breeding Rams in flock	
16.	No. of Breedable Ewes in Flock	
17.	Age at sexual maturity in female	
18.	Body weight at the time of first mating	
19.	Tupping %	
20.	Percentage of twins in flock	
21.	Qty. milk consumed by lambs	
22.	Are your Rams used for Breeding born in your flock itself	Yes No
	If No	How long you use the same Ram for Breeding ? ---------years
23.	Where from you buy your Rams ?	1.Shandy 2. Other Farmer flock
24.	Are you grazing both your Rams and Ewes together	Yes No
25.	Do you feed supplement in last 1.5 month of Pregnancy	Yes No
	If yes	Name Qty 1. 2.

26.	Approximate birth weight of Lambs	----------Kg Not Known
27.	Percentage of pre weaning lamb mortality	
28.	Do you feed supplement to lactating Ewes	Yes No
	If yes	Name Qty Duration 1. 2.
29.	% of survival of lambs at weaning (3 months)	
30.	App. Weight of lambs at weaning	----------Kg
31.	Body weight of Growers (Ram lambs) at (If body weight is not available, one or two animals in the category be weighed and recorded)	6 months age-------Kg 9 months age-------Kg
32.	Body weight of Growers Ewe growers (If body weight is not available, one or two animals in the category be weighed and recorded)	6 months age-------Kg 9 months age--------Kg 12 months age------Kg
33.	Do you know about Azolla and its feeding	Yes No
34.	Are you willing to produce and feed Azolla	Yes No
35.	Age / wt. of animals sold	-------
36.	No. of animals sold/ year	
37.	Place of selling animals	1.Shandy 2. Farm itself
38.	Have you visited any Government/ private sheep farm in the last 5 years	Yes No
39.	Are you vaccinate your animals regularly	Yes No
40.	Are you deworming your animals regularly	Yes No
41.	Have you under gone any training	Yes No
42.	Approximate annual income	Rs.--------

Key Findings and Discussion

1. Average Number of Sheep Maintained

We conducted a benchmark survey of nearly 200 sheep farmers in and around Krishnagiri district, Tamil Nadu. Most of them were small and marginal farmers, typically keeping only 20-40 animals, with very few exceeding 50. Some farmers combined their flocks for grazing to optimize resources and reduce individual workload. In a typical flock of around 40 animals, the majority were ewe, with only one or two rams. Farmers primarily raised male lambs for meat, selling them once they reached market size (Graph 1). In contrast, female lambs were either retained for breeding to sustain their own flocks or sold to other sheep farmers and new sheep farming entrepreneurs. This survey highlights the traditional sheep farming practices in the region, emphasizing small-scale operations, community cooperation, and a clear distinction in the rearing and selling patterns of male and female lambs.



2. Lack of Awareness in Breed Selection Among Sheep Farmers

The most commonly raised sheep breeds in the Krishnagiri district are Mecheri, Ramanathapuram White, and Trichy Black, along with some mixed-genotype breeds. Our survey revealed that most farmers lack awareness about the importance of breed selection. But very few of farmers maintain the tract suitable breeds like Mecheri breed. They are generally unaware that the choice of breed can significantly impact factors such as adaptability, meat quality, and disease resistance. This knowledge gap suggests the need for awareness programs to help farmers make informed decisions for better productivity and profitability [6].

3. Landholding Capacity of Farmers

As per our observations and data collection, more than 90% of the farmers were landless. Only a very small percentage owned land, and even then, the land was extremely dry and less suitable for agriculture. This indicates a heavy reliance on common grazing lands and shared resources for sustaining their sheep farming activities.

4. Sheep Housing Practices in Rural Areas

Rural sheep farmers do not have proper housing structures for maintaining their sheep. Instead, they keep their sheep in "*Patti*," a traditional open or semi-open enclosure made from locally available materials. While this practice exposes the animals to environmental challenges, it is widely followed due to economic constraints and traditional sheep-rearing methods. Additionally, some sheep rearers graze their animals in harvested agricultural fields. During these periods, they migrate from one place to another, following the harvest cycles. Rather than returning to their homes each day, they prefer to stay in the harvested fields, where they fold the sheep in a "Patti" within the field itself.

Farmers mention two key benefits of this practice:

- **Reduced animal movement:** By staying near the grazing area, they avoid the long journey back to their homes, minimizing stress on the animals.
- **Additional income and soil enrichment:** Agricultural landowners often pay a small amount to the farmers for keeping their sheep in the fields overnight. The dung and urine left by the animals act as natural manure, enriching the soil and benefiting the next crop cycle.

This traditional approach highlights the close relationship between sheep farming and local agricultural practices, where both farmers and landowners mutually benefit.

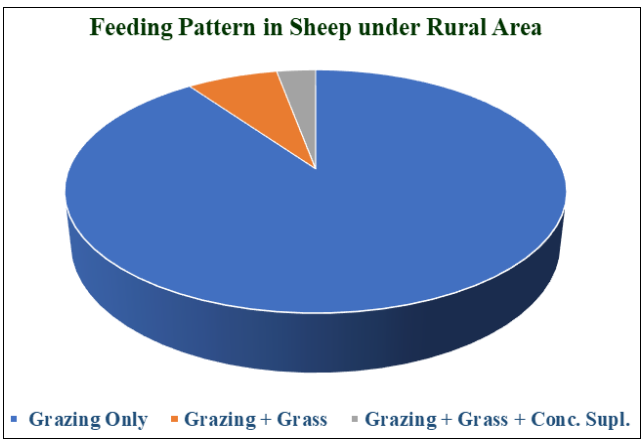
5. Feeding Patterns of Sheep in Rural Areas

Our benchmark data revealed that almost 90% of sheep farmers primarily rely on natural grazing as the main source of nutrition for their flocks. The animals are typically taken to common grazing lands, harvested agricultural fields, and roadside pastures for feeding. Some farmers also supplement grazing with tree fodder to enhance nutrition. Our survey further indicates that supplementary feeding, such as crop residues and kitchen waste, is practiced without any scientific understanding. Farmers mentioned that they provide these feed materials mainly to fill the animals' stomachs, without considering their nutritional value. However, during lean seasons or severe drought conditions, when grazing resources are scarce or green fodder is unavailable, farmers rely more on locally available fodder, crop residues, and kitchen waste to sustain their sheep [7].

As part of our survey, we collected data on the types of crop residues commonly used by farmers for feeding their sheep. The findings revealed that farmers primarily rely on various cereal by-products, such as rice straw, rice husk, maize, sorghum, and pearl millet. In addition, legume husks, including *karamani* (cowpea) husk and *thuvarai paruppu* (pigeon pea) husk, are widely used. Farmers also utilize pulses and oilseed residues, such as *kollu pottu* (horse gram residue) and soya, along with agricultural stalks like cotton stalks. Apart from dry residues, some farmers incorporate green fodder alternatives, including hedge lucerne, lucerne, cowpea, and cluster beans, to supplement their sheep's diet. However, these crop residues are often used without any scientific formulation or processing, primarily to fill the animals' stomachs rather than to provide balanced nutrition.

Concentrate feeding is extremely rare among marginal farmers due to financial constraints, limiting their ability to provide high-nutrient diets for improved sheep growth and productivity. This data highlights the need for awareness and training on balanced feeding practices to improve sheep health and productivity in rural areas.

Preliminary studies identified inadequate nutritional management during critical reproductive periods—particularly before conception and during pregnancy—as a major constraint in sheep farming. Poor feeding practices during these stages resulted in reduced reproductive efficiency, lower birth weights, and increased mortality rates among lambs [8].



To address this issue, we implemented farmer-friendly interventions focused on improving feeding strategies during critical periods. Specifically, we emphasized the importance of adequate nutrition:

Nutritional Support During Critical Periods

- Training programs were conducted to educate farmers on the significance of proper ewe nutrition before and during pregnancy.
- Farmers were provided with guidance on maintaining a healthy and productive flock to ensure profitable and sustainable sheep farming.

Flushing with Concentrate Feed

- To improve reproductive performance, a targeted feeding strategy known as flushing was introduced.
- Ewes were supplemented with 150 grams of concentrate feed per day for three to four weeks prior to the breeding season to enhance ovulation rates and improve conception rates.

6. Inbreeding in Sheep and Its Consequences on Sheep Farming

Our preliminary survey revealed a major issue in sheep breeding practices: most farmers maintain the same ram for their flock for more than three to four years. Many farmers believe that their ram is superior and responsible for producing strong offspring. However, over time, this practice results in unintentional inbreeding, as the ram eventually mates with its own daughters. Since these offspring are born from ewes that were also mated with the same ram, the cycle of inbreeding continues, leading to serious reproductive and health issues in future generations.

One interesting observation from our study was that breeding rams were significantly larger than their female counterparts. This size difference can create additional challenges in sheep breeding, including difficulties in mating and potential birthing complications.

Inbreeding, the mating of closely related animals within the same flock, is a common practice in traditional sheep farming due to limited breeding stock and a lack of awareness about genetic diversity [19]. While it may seem convenient for small and marginal farmers, prolonged

inbreeding can lead to serious negative consequences that affect both the productivity and sustainability of sheep farming. One of the major consequences of inbreeding is reduced genetic diversity, which results in weaker immunity and increased susceptibility to diseases. Inbred sheep often suffer from poor growth rates, reduced fertility, and higher mortality rates among lambs. Additionally, physical deformities and genetic disorders become more prevalent, leading to unfit animals that cannot perform well under field conditions. Over time, inbreeding can also reduce the overall adaptability of sheep to harsh environmental conditions, making them less resilient to climate changes and nutritional stress. The economic impact of inbreeding is significant. Farmers experience lower meat yield, reduced reproductive efficiency, and increased veterinary costs due to frequent health issues. This directly affects their profitability and long-term sustainability. To mitigate these effects, it is essential to introduce new breeding stock, promote crossbreeding, and educate farmers on proper genetic management [18]. Raising awareness about the dangers of prolonged ram use and encouraging rotation or replacement of breeding males at appropriate intervals can significantly improve flock productivity and genetic diversity. Implementing scientific breeding practices will enhance overall flock health, ensuring better growth rates, disease resistance, and economic returns for rural sheep farmers [12].

7. Other salient findings in our studies

Our preliminary finding also highlights a critical gap in sheep farming management. The absence of systematic record-keeping for essential parameters such as birth weight, maturity weight, morbidity, mortality, medical history, and vaccination schedules significantly hampers effective decision-making. Without accurate data, farmers face challenges in monitoring animal health, implementing genetic selection strategies, and controlling disease outbreaks [10]. This lack of documentation ultimately leads to inefficiencies, increased risks, and reduced productivity, thereby impacting the long-term sustainability and profitability of sheep farming.

In addition to the above challenges, most sheep farmers have not undergone any training or workshops on recent advancements in sheep farming and management, which are regularly organized by Veterinary University Training and Research Centres (VUTRCs) or Krishi Vigyan Kendras (KVKs). Furthermore, a significant number of farmers are unaware of the existence of these facilities in each district of Tamil Nadu. Additionally, many farmers have never visited any organized or government-run farms in and around their district. This lack of awareness and access to training opportunities further limits their ability to adopt modern practices, improve productivity, and enhance the overall sustainability of sheep farming.

Constraints in Sheep Farming from Our Studies

Our study revealed several key challenges faced by sheep farmers that significantly impact productivity and profitability. The major constraints observed include:

- **Inbreeding:** A common issue due to farmers maintaining the same ram for multiple years, leading to genetic weaknesses, poor reproductive performance, and increased health problems in offspring.
- **Poor nutrition during critical periods:** Many farmers rely solely on natural grazing without providing balanced supplementary feed, leading to malnutrition, especially during pregnancy, lactation, and growth phases.
- **Low birth weight and weaning weight of lambs:** Nutritional deficiencies and poor breeding management result in weak lambs at birth, affecting their survival rates and overall growth potential.
- **High lamb mortality:** Due to inadequate nutrition, disease susceptibility, and lack of proper healthcare, lamb mortality remains a significant concern among rural sheep farmers.
- **Reduced feed efficiency in male lambs grown for meat production:** Poor feeding strategies lead to slow growth rates and lower meat yields, affecting the economic returns for farmers raising sheep for meat purposes.
- **Poor marketing ability among sheep keepers:** Many farmers struggle with selling their sheep at competitive prices due to a lack of market access, price fluctuations, and limited bargaining power.

Addressing Constraints and the Way Forward for Sustainable and Profitable Sheep Farming in Rural Areas

To overcome the challenges identified in sheep farming and enhance sustainability and profitability, several strategic interventions can be implemented:

1. Genetic Improvement and Breed Development [18]

- **Introduction of improved male germplasm:** Introducing genetically superior breedable rams can significantly reduce inbreeding within flocks, leading to better reproductive performance, disease resistance, and higher flock productivity.
- **Selective breeding and crossbreeding programs:** Establishing scientific breeding centers to promote superior indigenous and crossbred sheep varieties for enhanced growth rate, adaptability, and meat yield.
- **Artificial Insemination (AI) and Embryo Transfer Technology (ETT):** Encouraging AI and ETT techniques to improve genetic diversity and productivity in sheep flocks.

2. Improved Nutrition and Feeding Management [2, 4, 5]

- **Provision of balanced feed during critical periods:** Ensuring proper nutrition during key reproductive phases such as flushing, advanced pregnancy, and lactation in ewes can help reduce low birth weight issues and improve weaning weight, leading to stronger, healthier lambs.
- **Azolla feeding as a supplement:** Incorporating Azolla into the sheep feeding system, particularly during the summer months when green fodder is scarce, can provide a high-protein, cost-effective alternative to improve nutrition and productivity.
- **Feeding through the oesophageal groove in pre-weaning lambs:** Implementing this practice will reduce early-stage lamb mortality, ensuring better survival

rates and improved growth during the early weeks of life.

- **Groundnut oil cake for weaned lambs:** Providing groundnut oil cake as a supplementary feed for weaned lambs will enhance early body weight gain, improving growth efficiency and reducing the time needed to reach market weight.
- **Silage and hay production:** Training farmers on fodder conservation techniques like silage and hay-making to ensure year-round fodder availability.
- **Hydroponic green fodder cultivation:** Promoting hydroponic technology for green fodder production, especially in water-scarce regions.
- **Mineral mixture supplementation:** Providing region-specific mineral mixtures to prevent nutrient deficiencies, enhancing overall productivity and reproductive efficiency.

3. Advanced Healthcare and Disease Control [1, 16]

- **Regular vaccination and deworming:** Strengthening disease surveillance, vaccination programs to control PPR, FMD, Enterotoxemia, and Sheep Pox.
- **Mobile Veterinary Units (MVUs):** Deploying MVUs in remote villages to provide on-the-spot veterinary care and emergency treatment.
- **Workshops on ethnoveterinary first aid practices:** Conducting training sessions on ethnoveterinary medicine will help farmers manage common sheep ailments using locally available herbs and traditional remedies, reducing dependency on costly veterinary treatments.

4. Infrastructure Development and Housing [7]

- **Improved housing structures:** Promoting semi-intensive and intensive housing systems to reduce predation, weather-related stress, and disease transmission.
- **Community grazing lands and fodder banks:** Establishing fodder banks and community grazing lands to ensure sustainable forage availability.

5. Financial and Policy Support [15]

- **Subsidized credit and insurance schemes:** Providing low-interest loans, microfinance options, and livestock insurance to protect farmers from economic losses due to disease outbreaks and mortality.
- **Sheep Farmer Producer Organizations (FPOs):** Encouraging the formation of FPOs and cooperatives to improve bargaining power, bulk input procurement, and better market linkages.
- **Government incentives and schemes:** Strengthening existing government initiatives like the National Livestock Mission and state-funded programs for sheep farmers.

6. Market Development and Value Addition [13, 14]

- **Better market access and direct marketing:** Establishing organized sheep markets, online livestock trading platforms, and direct farmer-consumer sales to improve price realization.
- **Meat processing and value-added products:** Encouraging meat processing, branding, and marketing of value-added products like mutton jerky, kebabs, and ready-to-eat meat.
- **Wool industry development:** Promoting indigenous wool-based industries and linking farmers to handicraft, carpet, and textile markets to utilize sheep wool effectively.
- Additionally, improving access to finance and market development through self-help groups and cooperative societies can facilitate better financial support for farmers.

7. Climate-Resilient and Sustainable Practices [17]

- **Drought-resilient sheep farming:** Introducing climate-resilient sheep breeds and water-efficient fodder crops to cope with changing weather patterns.
- **Agroforestry and silvopastoral systems:** Integrating sheep farming with tree-based systems for sustainable grazing and improved soil fertility.
- **Waste management and biogas production:** Utilizing sheep manure for biogas production and organic farming, reducing environmental impact.

8. Digital Innovations

Mobile apps and digital advisory services

Leveraging mobile-based advisory services to provide real-time information on sheep health, nutrition, and market prices.

9. Farmer Training and Awareness

Training and Workshops on Sheep Farming

Organizing regular training programs on improved sheep farming practices, market access strategies, and scientific feeding techniques will empower farmers with the knowledge and skills needed to enhance profitability and sustainability in sheep farming.

By implementing these strategic measures, India can significantly enhance sheep farming productivity, profitability, and sustainability. Strengthening genetic resources, nutrition management, disease control, infrastructure, financial access, marketing opportunities, climate resilience, and farmer education will lead to a thriving sheep farming sector. This, in turn, will improve rural livelihoods, food security, and the overall livestock economy, ensuring long-term benefits for farmers and the nation.

Conclusion

Sheep farming in rural India, particularly in Krishnagiri district, is dominated by small-scale farmers who rely on traditional practices with limited access to scientific breeding, nutrition, and healthcare. Our study highlights key challenges such as inbreeding, poor nutrition during critical reproductive periods, inadequate housing, and limited market access. These factors contribute to low productivity, high lamb mortality, and reduced profitability.

To address these issues, strategic interventions are necessary. Introducing superior breedable rams can reduce inbreeding and enhance flock productivity. Balanced nutrition, including supplementary feeding with Azolla and groundnut oil cake, can improve lamb survival and growth rates. Training farmers in scientific feeding, disease

management, and improved marketing strategies will further strengthen the sector. Additionally, better housing infrastructure, financial support, and organized market access can help farmers achieve greater sustainability and profitability.

By adopting these measures, sheep farming in India can become more productive, economically viable, and resilient, ultimately improving rural livelihoods and strengthening the livestock sector.

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References

1. Acharya RM. Sheep and Goat Breeds of India. FAO Animal Production and Health Paper No. 30, Food and Agriculture Organization of the United Nations; 1982.
2. Bhatt PN, Karim SA, Suresh KP. Nutritional management of sheep for optimal productivity: A review. Indian J Anim Sci. 2019;89(3):247-256.
3. Devi P, Gupta R. Socioeconomic status of sheep farmers in southern India: A field-based study. Int J Livest Res. 2019;9(6):115-130.
4. Dhangar SB, Pandey S, Kumar S. Impact of strategic feeding on growth performance in sheep farming. Small Rumin Res. 2021;199:106375.
5. FAO. Fodder production and feeding strategies for small ruminants in developing countries. Food and Agriculture Organization of the United Nations; 2022.
6. FAO. Sustainable sheep production: Challenges and solutions in developing countries. Food and Agriculture Organization of the United Nations; 2021.
7. ICAR-CIRG. Advances in small ruminant production and management. Central Institute for Research on Goats (CIRG), Indian Council of Agricultural Research, Mathura, India; 2019.
8. ICAR-NIANP. Feeding strategies for sheep under semi-arid conditions. Indian Council of Agricultural Research – National Institute of Animal Nutrition and Physiology, Bengaluru; 2020.
9. Indian Livestock Census. Livestock population trends and productivity in India. Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India; 2019.
10. Kumar S, Sharma R. Disease prevention and control strategies in small ruminants. J Vet Sci Technol. 2017;8(5):255-267.
11. NABARD. Financing sheep farming in India: Opportunities and challenges. National Bank for Agriculture and Rural Development Report; 2023.
12. National Livestock Mission (NLM). Guidelines for Sheep and Goat Development. Department of Animal Husbandry and Dairying, Government of India; 2023.
13. Patil NA, Rao AR. Role of farmer cooperatives in enhancing sheep farming profitability. Indian J Anim Husbandry. 2022;59(4):321-336.
14. Rajendran R, Prasad CS. Market access and value addition in sheep farming: A case study from Tamil Nadu. Indian J Agric Mark. 2018;32(2):45-58.
15. Singh SP, Mehta BS. Economic analysis of sheep farming in arid and semi-arid regions of India. Agric Econ Res Rev. 2019;32(1):65-78.
16. Sinha NK, Kumar R. Role of ethnoveterinary medicine in sheep health management. Vet World. 2020;13(4):789-795.
17. Subramaniam MD, Ramesh T. Climate-resilient strategies for sustainable sheep farming in India. J Anim Vet Sci. 2021;12(3):112-125.
18. Suresh KP, Giridhar K, Kumar S. Genetic improvement strategies in sheep production. Indian J Anim Genet Breed. 2018;40(2):135-143.
19. Venkataramanan R, Balachandran C. Inbreeding and its effects on growth performance in Indian sheep breeds. Trop Anim Health Prod. 2017;49(5):1037-1045.
20. World Bank. Livestock sector development in India: Opportunities and challenges. World Bank Reports on Indian Agriculture; 2022.