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Sheep Wool Improvement: Smart Breeding and Scientific Management for Better Returns

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Sheep rearing provides an important source of income to rural households through wool, meat and manure. However, the economic value of sheep farming depends not only on flock size but also on the quality and quantity of wool produced. Breed characteristics, genetic potential, nutrition, animal health and fleece management all influence wool production. Farmers can improve their returns by selecting suitable breeds, using superior breeding rams, maintaining production records, providing balanced nutrition and following proper shearing and wool-storage practices. This article presents practical approaches to improving wool production and fleece quality under Indian farming conditions. It also discusses important Indian sheep breeds and improved strains, including Bharat Merino, Avikalin, Kashmir Merino, Hissardale and Avivastra. Emphasis is given to scientific breeding, local adaptability and better wool marketing so that farmers can obtain improved returns from sheep rearing.

Keywords: Sheep, Wool production, Fleece quality, Sheep breeding, Fibre diameter, Genetic improvement, Wool management.

Introduction

Sheep rearing has long been an important component of livestock farming in India, particularly in arid, semi-arid and hilly regions. It provides livelihood opportunities to rural families through wool, meat and manure. Sheep are also suitable for areas where crop production is limited because they can utilise grazing resources such as grasses, crop residues and shrubs. However, the quantity and quality of wool obtained from a flock vary considerably according to breed, genetic potential, feeding, health and management practices. According to the 20th Livestock Census (2019), the country's sheep population was approximately 74.26 million. Telangana had the largest population, followed by Andhra Pradesh, Karnataka and Rajasthan (DAHD, 2019). Many sheep in southern India are primarily reared for meat, whereas Rajasthan and the Himalayan regions make major contributions to wool production. According to *Basic Animal Husbandry Statistics 2025*, India's estimated wool production during 2024–25 was approximately 34.57 million kg. Rajasthan contributed around 16.54 million kg, accounting for nearly 47.85% of national production, followed by Jammu and Kashmir with approximately 7.91 million kg (DAHD, 2025).

Table 1. State-wise wool production during 2024–25

State/UT	Wool production (million kg)	National share (%)
Rajasthan	16.54	47.85
Jammu and Kashmir	7.91	22.88
Gujarat	2.15	6.22

State/UT	Wool production (million kg)	National share (%)
Maharashtra	1.64	4.75
Himachal Pradesh	1.49	4.29
Haryana	0.68	1.97
Karnataka	0.65	1.87
Punjab	0.56	1.62
Uttar Pradesh	0.84	2.42
India	**34.57**	**100.00**

Note: Wool production figures are for 2024–25. Values are rounded. Source: DAHD (2019, 2025).

Rajasthan is India's leading wool-producing state, with nearly half of the country's total production. Indigenous breeds such as Chokla, Magra, Nali and Marwari are important in its arid and semi-arid regions. Similarly, Gaddi, Bhakarwal, Poonchi and Kashmir Merino are important sheep populations in Jammu and Kashmir and neighbouring Himalayan regions. These regional differences highlight the importance of selecting suitable breeds and adopting management practices according to local climatic conditions and wool requirements. The following practical measures can help farmers improve wool production and obtain better returns from sheep farming.

Select the Right Breed for Your Region

Breed selection is the first step towards improving wool production. A breed suitable for a cold region may not perform equally well under hot and dry conditions. Therefore, farmers should prefer locally adapted breeds rather than selecting animals only on the basis of body size or appearance. Some important Indian sheep breeds and their major utilities are presented below.

Table 2. Important Indian sheep breeds and their wool utility

Breed	Main region	Major utility
Chokla	Rajasthan	Carpet wool
Magra	Rajasthan	Carpet wool
Nali	Rajasthan	Carpet wool
Marwari	Rajasthan	Meat and carpet wool
Gaddi	Himalayan region	Carpet wool
Bhakarwal	Jammu and Kashmir	Carpet wool
Kashmir Merino	Jammu and Kashmir	Fine apparel wool
Nilgiri	Tamil Nadu	Fine apparel wool
Bharat Merino	Developed in India	Fine wool

Before purchasing sheep, farmers should consult local veterinary officers, animal husbandry departments or recognised sheep breeding farms. Animals already adapted to local grazing conditions, temperature and disease challenges are generally a safer choice.

Choose Good Breeding Rams

A breeding ram plays an important role in improving the genetic quality of the next generation because it contributes approximately half of the genetic material to its offspring. Therefore, special attention should be given to ram selection. A suitable breeding ram should possess:

- A healthy body with strong legs and sound feet.
- Good fleece coverage and uniform wool distribution.
- Higher fleece weight compared with animals of similar age and breed.
- Healthy skin without visible infections or parasites.
- Good reproductive health and body condition.

Avoid using the same ram continuously for mating with its daughters or other close relatives. Replace or rotate breeding rams at appropriate intervals to reduce inbreeding and maintain flock performance.

Maintain Records of Wool Production

Regular performance recording helps farmers identify superior animals and remove poor performers from the breeding flock. Without proper records, selection is often based only on physical appearance, which may lead to incorrect breeding decisions. Farmers should maintain records of:

- Animal identification number.
- Age and body weight.
- Date of shearing.
- Lambing and reproductive performance.
- Visible defects or abnormalities in the fleece.

Two important terms should be understood while recording wool production.

- **Greasy fleece weight:** It refers to the total weight of wool obtained after shearing, including natural grease, dust and other impurities.
- **Clean fleece weight:** It refers to the weight of wool remaining after removing grease, dirt and other impurities through cleaning.

Improve Wool Quality, Not Just Wool Quantity

The economic value of wool depends on several physical characteristics, including fibre diameter, staple length, crimp, medullation and cleanliness. Fine wool is generally preferred for apparel, whereas coarser wool is commonly used in carpets and other products. Important wool quality traits include:

- **Fibre diameter:** It refers to the thickness of an individual wool fibre and is measured in micrometres (µm). A smaller fibre diameter generally indicates finer wool. Fine fibres are preferred for clothing, while coarser fibres are suitable for carpets.
- **Staple length:** It refers to the length of a group or lock of wool fibres. Appropriate staple length improves wool processing and yarn production.
- **Crimp:** It refers to the natural waves or bends present along the wool fibre. Crimp is an important characteristic used in assessing wool quality.
- **Medullation:** It refers to the presence of a central hollow or partially hollow region within the fibre. A high proportion of medullated fibres can affect the softness and processing quality of wool.

These characteristics are influenced by both genetic and environmental factors.

Provide Balanced Nutrition Throughout the Year

Nutrition plays an important role in wool growth and fleece development. Wool fibres are mainly composed of keratin, a protein. Therefore, adequate protein, energy, minerals and clean drinking water are essential for maintaining normal wool growth. Farmers should follow these practices:

- Provide sufficient green fodder and good-quality dry roughage.
- Supplement the diet with suitable concentrate feed when grazing is inadequate.
- Give additional nutritional support to pregnant and lactating ewes and growing lambs.
- Avoid sudden changes in the feeding schedule.

Maintain Animal Health and Fleece Hygiene

Healthy skin is essential for healthy wool production. Skin infections, external parasites and wounds can damage the fleece and reduce its market value. Therefore, regular health care should be an important part of sheep management. Farmers should:

- Follow vaccination schedules recommended by the local veterinary department.
- Carry out deworming according to veterinary advice.
- Examine animals regularly for ticks, lice, mites and skin infections.
- Keep sheep sheds clean, dry and well ventilated.
- Separate animals showing signs of contagious skin diseases.
- Avoid overcrowding and prolonged exposure to wet and dirty conditions.

Follow Proper Shearing Practices

Shearing is the process of removing the wool fleece from sheep. It should be performed carefully to obtain a clean and usable fleece without causing injury to the animal. Important points during shearing include:

- Use clean and sharp shearing equipment.
- Keep the shearing area clean and dry.
- Avoid cutting the animal's skin.
- Remove the fleece as uniformly as possible.
- Keep the fleece of each animal separate when individual records are required.
- Avoid shearing during extremely cold or unsuitable weather without providing adequate protection.

After shearing, animals should be protected from sudden temperature changes, rain and cold winds. Avoid mixing wool from diseased animals with the main fleece collection. Clean equipment between animals when necessary, particularly when skin infections are suspected.

Sort, Grade and Store Wool Properly

The value of wool depends not only on the animal's genetic potential but also on how the fleece is handled after shearing. Wool contaminated with dirt, dung, vegetable matter and other unwanted materials may receive a lower market price. Different body regions may produce wool of different lengths and quality. Farmers should follow these steps:

- Remove dung locks, heavily soiled wool and unwanted materials.
- Separate wool according to fineness, length and colour wherever possible.
- Keep clean and dirty wool separately.
- Store wool in clean, dry and well-ventilated places.
- Protect stored wool from moisture, insects and rodents.

Use Scientific Breeding Strategies for Long-Term Improvement

Improving wool production is a gradual process that requires the selection of superior animals over several generations. Two important approaches are selection within indigenous breeds and crossbreeding.

A. Selection within Indigenous Breeds

Selection involves identifying animals with better performance and using them as parents for the next generation. This approach helps improve existing breeds while retaining their local adaptability. For example, Chokla, Magra and Marwari sheep are important in arid regions and can be selected for desirable fleece and growth traits. In semi-arid areas, breeds such as Malpura and Sonadi may be selected according to the local production objective.

B. Crossbreeding with Fine-Wool Breeds

Crossbreeding involves mating animals of different breeds to combine desirable characteristics. Merino and Rambouillet are well-known fine-wool breeds that have been used in sheep improvement programmes. Animals with a high proportion of exotic inheritance may produce good-quality wool under suitable farm conditions but can face difficulties under heat stress, inadequate nutrition and disease pressure. Some important Indian strains developed through breeding programmes include:

- **Bharat Merino:** Developed using indigenous sheep and fine-wool breeds such as Merino and Rambouillet. It is known for fine wool and has shown better performance under sub-temperate conditions. Reported annual greasy fleece yield at a sub-temperate research location was about 2.61 kg, with a staple length of 8.11 cm and fibre diameter of 19.4 µm. Under semi-arid conditions, the corresponding fleece yield was approximately 2.05 kg, demonstrating the influence of environment on performance.
- **Avikalin:** Developed through Rambouillet × Malpura breeding. It is a dual-purpose strain suitable for carpet wool and meat production and has been studied for adaptation to arid and semi-arid conditions. Reported annual greasy fleece yield is approximately 1.6–2.5 kg, with fibre diameter around 30–35 µm.

- **Kashmir Merino:** Developed using Merino types and native sheep of the northern temperate region. It is important for fine apparel wool. Reported annual greasy fleece yield is approximately 2.8 kg, with fibre diameter around 20 µm.
- **Hissardale:** Developed by crossing Australian Merino rams with Bikaneri sheep. Reported annual greasy fleece yield is approximately 2.8 kg, with staple length of 15.6 cm and fibre diameter of 20.4 µm.
- **Avivastra:** Developed through Rambouillet and Chokla-based breeding programmes for wool improvement. Its development also highlights the importance of evaluating crossbred animals under actual field conditions.

Learn from Organised Sheep Improvement Programmes

Organised breeding programmes in India have demonstrated that planned selection can improve the performance of indigenous sheep. The Network Project on Sheep Improvement has focused on improving important breeds under their respective production environments. These programmes involve performance recording, selection of superior breeding rams and distribution of improved breeding animals. For example, long-term selection work in Malpura sheep at ICAR–Central Sheep and Wool Research Institute (CSWRI), Avikanagar, has contributed to improvement in growth-related traits. Selection work in Chokla sheep has also reported improvements in body weight and fleece yield. Farmers can benefit by maintaining contact with nearby Krishi Vigyan Kendras (KVKs), veterinary universities, sheep breeding farms and animal husbandry departments.

Improve Profitability Through Better Wool Management

Higher wool production does not automatically guarantee higher income. Farmers should consider wool quality, local market demand, shearing expenses, feed costs and the prices offered by buyers. A practical approach to improving returns is to combine scientific breeding with proper nutrition, animal healthcare, timely shearing and appropriate wool storage. Farmers should also explore collective marketing through cooperatives and farmer groups.

Conclusion

Improving wool production requires a combination of scientific breeding and good farm management. Farmers should select breeds suited to their region, use superior breeding rams, maintain production records and provide balanced nutrition. Proper healthcare, timely shearing, wool grading and dry storage are equally important for maintaining fleece quality. Scientific sheep improvement programmes in India have demonstrated the potential to improve wool yield and quality through planned selection and suitable crossbreeding. However, the success of any breeding strategy depends on local climate, feed availability and the ability of animals to survive and reproduce under field conditions.

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