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STATUS OF NEWLY DEVELOPED WOOL STRAINS OF SHEEP IN INDIA - A REVIEW

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ABSTRACT

Sheep development programmes for bringing about genetic improvement in the quality and quantity of carpet wool through selection within the Indian breeds, and for fine wool through crossbreeding with exotic breeds *viz.*, Rambouillet and/or Merino have been undertaken during the last four decades. As a result of these efforts, a number of improved strains of sheep like Avivastra, Avikalin, Bharat Marino, Deccani Merino, Gaddi synthetic, Hissardale, Kashmir Merino, Nilgiri, Nilgiri synthetic and Patanwadi synthetic strains of sheep have been evolved from the crossbred foundation stocks. The performance of these synthetic strains of sheep has been presented.

The sheep population in India is about 61.80 million (Livestock census, 2003) ranking fourth in the world and about 4.57% of the world population. In spite of this vast reservoir of genetic resources of sheep, the country produces only about 50.7 million kg of wool, which comes to about 1.80 per cent of the world wool production. One of the major reasons for the poor productivity of Indian sheep is the poor genetic potential for wool production. Crossbreeding with reputed breeds like Merino and Rambouillet has been used world over to augment wool productivity and quality. Lowland and Down breeds of sheep in Great Britain have been evolved by crossbreeding the native breeds with South Down as one of the improver breeds. The Corriedale was developed in New Zealand by crossing Lincoln rams with Merino ewes and selecting the best halfbreds for further multiplication of the flock (Lotsy, 1925). The Canadian Corriedale was developed by interbreeding and selection among the foundation stock formed by crossing Lincoln x Rambouillet crossbred ewes with Corriedale rams (Nicholas, 1927). Similar attempts for developing Corriedale were also made in Russia (Dobrogorskiev, 1937), Australia (Peacock, 1938) and France (Portal and Quittet, 1951). The Columbia breed of sheep was developed in the United States of America by crossing Lincoln rams with Rambouillet ewes (Spencer and Stochr, 1941) followed by selection and interbreeding among the halfbreds. The reciprocal crosses between Rambouillet rams and Lincoln ewes were also produced and interbred to evolve Panama breed of sheep. The English Leicester x Merino crossbreds was used in the development of Corriedale breed of sheep (Rae, 1952). Some other breeds of sheep developed in USA from crossbred foundation stock by using selection and interbreeding are: the Romeldale, developed by using halfbreds produced by crossing Romney rams with Rambouillet ewes; the Thribble cross, evolved by using the crosses between Cotswold rams and Spanish Merino ewes; the Debouillet, by crossing the Delaine Merino with Rambouillet (Pastoral Review, 1950); the Montadale, by crossing Columbia rams with Cheviot ewes (Mattongly, 1945).

Keeping in view the success of crossbreeding for improving productivity of sheep, efforts have also been made in India from time to time to bring about genetic improvement in the productivity of indigenous sheep. The earliest effort in this direction was made in 1800, when the East India Company imported Cape Merino and South Down sheep for crossbreeding with the native breeds. Since

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then, a number of large-scale sheep development programmes have been undertaken in various parts of the country (Acharya, 1974). The progress of these programmes has been reviewed from time to time and steps taken for improving the productivity of sheep to meet the requirements of the country for apparel and carpet quality wool.

The National Commission on Agriculture (1976) of the Government of India emphasized the need for bringing about improvement in the productivity of Indian breeds of sheep for fine wool and recommended the crossing of the native breeds with Rambouillet and/or Merino breeds of sheep. Sheep development programmes for bringing about genetic improvement in the quality and quantity of carpet wool through selection within the Indian breeds, and for fine wool through crossbreeding with exotic breeds have, therefore, been undertaken from time to time for achieving these objectives. As a result of these efforts, a number of improved strains of sheep like Avivastra (Acharya *et al.*, 1975), Avikalin (Mani Mohan, 1977), Bharat Marino (Dixit et al., 2001), Deccani Merino (Mirajkar and Patil, 1970), Gaddi synthetic (Anonymous, 1998), Hissardale (Kalra, 1967), Kashmir Merino (Khan and Singh, 1974), Nilgiri (Dharamrajan *et al.*, 1972), Nilgiri synthetic (AICRP, 1993) and Patanwadi synthetic (Patnayak and Bohra, 1993) breeds of sheep have been evolved from the crossbred foundation stocks. The performance of these synthetic breeds of sheep has been presented in Table-1 and reviewed in the following paragraphs:

Development and Performance of newly evolved strains of sheep in India

Avikalin: The Avikalin, a superior carpet- wool breed of sheep has been evolved at Central Sheep and Wool Research Institute, Avikanagar (Rajasthan) in 1975 by pooling the Rambouillet x Malpura and Rambouillet x Jaisalmeri halfbreds to constitute the foundation population (Acharya *et al.*, 1975). This was followed by interbreeding and selection to stabilize the performance of this genotype developed for superior carpet wool. During the period 1975 to 1978, the newly constituted group was known as "excellent carpet wool strain". In 1979, it was renamed as Avikalin (**Avi**: sheep; **Kalin**: carpet)

The six monthly greasy fleece weight, staple length, fibre diameter and medullation percentage varied between 0.86 and 1.55 kg, 2.99 and 4.09 cm, 20.50 and 25.04 microns, and 22.10 and 36.09 %, respectively (Table 1). The performance reports indicated that the average fibre diameter was lesser than the required for an ideal carpet wool breed (usually around 30 microns). There was, therefore, a need for making necessary amendments in the breeding programme to achieve the required targets.

Avivastra: The Avivastra strain of sheep has also been evolved at the Central Sheep and Wool Research Institute, Avikanagar (Rajasthan) by pooling the Rambouillet x Chokla halfbreds and 5/8ths and Rambouillet x Malpura halfbreds into one genetic group, followed by interbreeding and selection to develop a new genotype for apparel wool. The new genotype constituted by pooling various crossbred groups in 1975 was named "Avikouillet-F", which was subsequently renamed as Avivastra (**Avi**: sheep and **Vastra**: clothes/apparel).

The average six monthly greasy fleece weight, staple length, fibre diameter and medullation percentage varied between 0.88 and 1.74 kg, 3.19 and 3.72 cm, 19.60 and 21.77 microns, and 7.62 and 17.79%, respectively (Table 1). A perusal of the performance of Avivastra sheep showed that while this strain fulfilled the required standard of fibre diameter for apparel wool, the medullation percentage was higher and the staple length shorter than the required

Table 1. Means (±SE) for fleece characteristics of some newly developed synthetic strains of sheep in India

Synthetic breed	6-monthly greasy fleece weight (kg)	Staple length (cm)	Fibre diameter (Microns)	Medullation percentage	References
Avikalin	0.94±0.05	2.99±0.10	23.24	36.60	Mani Mohan (1977b)
Avikalin	1.55±0.03	3.27±0.09	20.50±0.80	22.10±0.95	Kishore et al (1983)
Avikalin	0.86±0.00	4.09±0.06	25.04±0.20	36.09±0.01	Singh (1998)
Avivastra	1.79±0.11	3.19±0.17	19.60±0.29	7.62±0.56	Kishore et al (1982c)
Avivastra	0.88±0.02	3.72±0.06	21.77±0.16	17.79±0.01	Singh and Dhillon (1992c)
Bharat Merino	0.87±0.01	3.32±0.07	18.89±0.15	4.39±0.49	Dixit (2000)
Deccani Merino	1.50**	5.75±0.29	22.10	1.60	Mirajkar and Patil (1970)
Gaddi synthetic	1.80±0.03	-	-	-	CSWRI (1998)
Hissardale	1.92**	-	-	-	Nanda (1947)
Hissardale	2.27±2.72**	6.15±0.15*	24.45	0.55	Kalara (1967)
Hissardale	1.46	5.52±0.19	21.53±0.32	-	Mirajkar and Patil (1970)
Kashmir Merino	2.80±0.08**	5.60±0.07	20.40±0.14	-	Khan and Singh (1974)
Kashmir Merino	2.45±0.04**	4.77±0.05	20.94±0.09	-	Shiekh (1984)
Nilgiri	0.80	-	-	-	Singh (1967)
Nilgiri	0.90±1.40	7.01±0.22	21.57±0.54	18.00±4.73	Mirajkar and Patil (1970)
Nilgiri	-	-	26.50	17.72	Dharamrajan *et al.* (1972)
Nilgiri	0.20	8.70	27.40	8.40	Krishnamurthy *et al.* (1975)
Nilgiri	0.62±0.03	-	27.34±0.08	11.31	Acharya (1982)
Nilgiri synthetic	2.39**	7.12	21.9	3.0	AICRP (1993)
Patanwadisynthetic	1.50±0.01	-	-	-	AICRP (1993)
Patanwadisynthetic	-	4.6 - 5.2	19.3 - 23.2	9.0 - 20.8	Patnayak and Bohra (1993)

* Average fibre length, ** Annual greasy fleece weight.

standards for meeting the requirements of the worsted spinning system.

Bharat Merino: The Bharat Merino has also been evolved at the Central sheep and Wool Research Institute, Avikanagar (Rajasthan) from a foundation population created by pooling 3/4th crossbreds of Rambouillet and Russian Merino with Chokla, Jaisalmeri, Malpura and Nali breeds of Indian sheep into one gene pool in 1982. Since then, multiple trait selection followed by inbreeding has been used for genetic improvement of this closed flock, which has undergone more than ten generations of selection so far.

The average six monthly greasy fleece weight, staple length, fibre diameter and medullation percentage of this breed were 0.87 kg, 3.32 cm, 18.89 microns, and 4.39%, respectively (Table 1). The short staples of wool (<5cm) and high medullation percentage (>1%) warrant a critical review of the ongoing breeding programme so that Bharat Merino may become an ideal fine wool sheep. This had shown improved staple length (9.40) and annual clips (2.70 kg) under the sub-temperate conditions of Kodaikanal, Tamilnadu (Anonymous, 1998). Therefore, a change in its environment from hot-arid to sub-temperate may improve its fleece characteristics.

Deccani Merino: The Deccani Merino is a medium fine wool strain, evolved at Sheep breeding Farm, Poona. The averages greasy fleece weight, staple length, fibre diameter and medullation percentage were 1.50 kg, 5.75 cm, 22.10 microns and 1.60%, respectively (Table 1). The performance shows that this strain also has the characteristics of a fine wool breed.

Gaddi Synthetic: Gaddi synthetic sheep has been evolved at North Temperate Regional Station (CSWRI, Avikanagar), Garsa, Kullu (Himachal Pradesh) by pooling 5/8th and 3/4th crossbreds of Rambouillet with Gaddi in 1998 followed by inter-se mating and selection.

The average annual greasy fleece weight of this breed was 1.80 kg.

Hissardale: The Hissardale strain of sheep was developed at Government Livestock Farm, Hisar (Haryana) by selection and interbreeding among the crossbred foundation stock produced by mating Bikaneri ewes with Australian Merino rams. Strain has got 75% Merino inheritance. A small flock of this sheep is being maintained at Government Livestock Farm, Hissar and appears to be well adapted to the extreme hot, dry and cold climate of North Indian plains. Over the years, there has been deterioration in the performance of this breed, probably due to inbreeding and no selection due to small population size. The National Commission on Agriculture (1976), therefore, recommended the out crossing of this flock with some other fine wool breed like Rambouillet or Merino followed by selection for increasing greasy fleece yield and improving fleece quality.

The annual greasy fleece weight, staple length and fibre diameter ranges between 1.92 and 2.72 kg, 5.52 and 6.15 cm. and 21.53 and 24.45 microns respectively. A perusal of the information on this sheep (Table 1) revealed that the Hissardale fulfilled the requirements of apparel type wool.

Kashmir Merino: The Kashmir Merino strain of sheep has been evolved at the Government Sheep Breeding and Research Farm, Reasi (Jammu) by using the foundation population produced by mating ewes of Kashmir Valley, Gaddi, Bhakarwal, and Poonchi (predominantly migratory sheep) found in Kashmir Valley with rams of exotic breeds like Delaine Merino, Rambouillet and Soviet Merino breeds. The level of exotic inheritance in the crossbred sheep used as the foundation population for evolving the Kashmir Merino varied from very low to almost 100 per cent. Most of the animals had 50 to 75 per cent of exotic inheritance for fine wool (Acharya, 1982). *Inter-se* mating and rigorous selection has been followed for improving the fleece characteristics and body weights of Kashmir Merino. Because of the involvement of a number of native and exotic breeds, the Kashmir Merino sheep are highly variable in their morphological and production performance characteristics. The annual greasy fleece weight, staple length and fibre diameter ranged between 2.45 and 2.80 kg, 4.77 and 5.60 cm, and 20.40 and 20.94 microns, respectively (Table 1). The limited information on the performance of Kashmir Merino sheep showed that, like Hissardale, the animals of this breed also produced on an average, heavier fleeces of the quality required for the manufacture of good quality apparel. Unlike Hissardale, a large population of Kashmir Merino sheep is available in the Kashmir Valley and can be used for further improving their productivity and of the native sheep of the valley.

Nilgiri: The Nilgiri strain of sheep is believed to have been evolved as a result of interbreeding among crosses of the Coimbatore, a hairy breed of sheep in the Coimbatore district in Tamil Nadu, with Cape Merino, Tasmanian Merino, South Down and Cheviot rams. The breed has been reported to be well adapted to the environmental conditions in the Nilgiri hills. The six-monthly greasy fleece weight, staple length and fibre diameter and medullation percentage varied from 0.20 to 0.90 kg, 7.01 to 8.70 cm, 21.57 to 27.40 microns, and 8.00 to 11.31 % respectively (Table 1). A perusal of the performance of the Nilgiri sheep revealed that the animals of this strain produced lesser greasy fleece and had greater proportion of medullated fibres as compared to the Hissardale and Kashmir Merino breeds of sheep, indicating poor yield and quality of fleece of this breed. In order to bring further improvement in this strain, crossbreeding of Nilgiri with Rambouillet and Soviet Merino was undertaken under the All India Coordinated

Research Project on Sheep Breeding (AICRP, 1993) for fine wool of the Indian Council of Agricultural Research.

Nilgiri Synthetic: The Nilgiri synthetic strain was developed under AICRP on sheep breeding for fine wool at Sadynallah, Ooty (Tamilnadu). The 3/4th crossbred animals of Rambouillet/Russian Merino and Niligiri crosses were selected and inter-se mated. The average annual greasy fleece weight, staple length, fibre diameter and medullation percentage were 2.39 kg, 7.12 cm, 21.9 microns, and 3.0 %, respectively (Table 1). This breed has the characteristics of a fine wool breed.

Patanwadi Synthetic: Patanwadi Synthetic sheep strain was evolved by crossing Patanwadi with Rambouillet at Gujrat Agricultural University, Dantiwada under the All India Coordinated Research Project (AICRP, 1993) on sheep breeding for fine wool. Halfbreds and 5/8th crosses were pooled to form the foundation stock, from which this strain was developed by stabilizing the exotic inheritance at about 50% level through inter-se-mating. The average annual greasy fleece weight, staple length, fibre diameter and medullation percentage of this breed were 1.50 kg, 4.60 to 5.20 cm, 19.30 to 23.20 microns, and 9.0 to 20.8 %, respectively (Table 1). The short staple length and higher medullation percentage are a serious limitation for its use in the worsted sector.

A perusal of the performance of these newly evolved strains presented in Table 1 reveals that these evolved genotypes through crossbreeding with superior breeds are distinctly superior in wool yield and quality characteristics as compared to the native Indian breeds, but nowhere nearer to the internationally recognized breeds of fine wool sheep. Low production of these synthetic strains compared to exotic breeds may be due to small sized population resulting in ineffective use of selection, poor management and less favorable environment conditions in the country. There is, therefore, need for systematic approach in the sheep breeding programmes for bringing about effective genetic improvement in the fleece characteristics of these newly evolved strains. Efforts may be made to improve the population size as well as management conditions and synthetic strains suited to Indian conditions may be propagated further so as to have an impact on national production system of wool.

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