

Effect of Genetic and Non-Genetic Factors on Staple Length in Indigenous and Crossbred Sheep

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Abstract: A study was conducted to determine the effect of breed group, age, period of birth, season of shearing and sex on staple length. Wool samples were collected from Bannur (n = 68) and UAS-improved strain (n = 120) maintained at UAS Campus, Bangalore. Wool samples (n = 608) were also collected from Bannur (n = 69), Rambouillet x Deccani (n = 56), Corriedale x Bannur (n = 76), Corriedale x Deccani (n = 122) and Deccani (n = 97) before shearing at the left side region at Large Scale Sheep Breeding and Training Centre, Kudapura, Chellakere of Chiradurga district of Karnataka. The Least Squares Analysis of Variance technique was adapted to detect the significant sources of non-genetic variation. The overall least square mean of staple length was 3.97 ± 0.05 cm. The comparison of means among genetic groups revealed that the longest staple length was recorded in Corriedale x Deccani (4.87 ± 0.03 cm) followed by Deccani (4.72 ± 0.20 cm), UAS-improved strain (4.14 ± 0.04 cm), Rambouillet x Deccani (3.77 ± 0.10 cm), Bannur (3.17 ± 0.06 cm) and Corriedale x Bannur (2.87 ± 0.06 cm). Significant differences in staple length were noticed with respect to breed, age, period of birth, season of shearing and sex.

Key words: Staple length, genetic and non genetic factors, least square analysis, Deccani, Bannur, Corriedale, Rambouillet

INTRODUCTION

The wool production potential of native breeds of sheep is not sufficient to meet ever increasing demand of wool of the state as well as India. Several exotic breeds of sheep have been introduced in the region for crossbreeding of the local sheep for improving production and quality of wool.

The indigenous breeds of Karnataka viz., Deccani, Bannur are known for quality mutton production but are lacking in production of superior quality wool. Therefore, crossbreeding with superior exotic wool breeds of sheep like Corriedale and Rambouillet was taken up as breeding policy to improve wool traits as well as other economic traits.

Staple length is an important trait determining wool quality in sheep. This trait is affected, both by genetic and non-genetic factors with varying degree. Hence, an attempt was made to determine the effect of breed group, age, period of birth, season of shearing and sex on staple length.

MATERIALS AND METHODS

Wool samples were collected from Bannur (n = 68) and UAS-improved strain (n = 120) maintained at UAS

campus, Bangalore. Wool samples (n = 608) were also collected from Bannur (n = 69), Rambouillet x Deccani (n = 56), Corriedale x Bannur (n = 76), Corriedale x Deccani (n = 122) and Deccani (n = 97) before shearing at the left side region at Large Scale Sheep Breeding and Training Centre, Kudapura, Chellakere of Chiradurga district of Karnataka.

Samples were collected from one square inch area in left mid side region using curved scissors. The samples collected were packed in labeled plastic bags. Staple length of each animal was recorded immediately after shearing to the nearest fraction of 0.1 cm.

The staple length of unscoured wool samples was measured by placing staple unstretched on a black velvet board using forceps. The measurement was taken from the base of the staple of fibres to the tip where the majority of the fibres end. An average of 10 random staples represented the mean staple length. The Least Squares Analysis of Variance technique was adapted to detect the significant sources of non-genetic variation if any (Harvey, 1987). The following mathematical model was adapted:

$$Y_{ijklmn} = \mu + G_i + A_j + Y_k + S_l + X_m + e_{ijklmn}$$

Where:

- Y_{ijklmn} = The record of the nth individual belonging to ith genetic group
- jth = Age group
- kth = Period of birth, shorn at lth season belonging to mth sex
- μ = The population mean
- G_i = The fixed effect of ith genetic group (i = 1, 2, 3... 6)
- A_j = The fixed effect of jth age group (j = 1, 2, 3 ... 7)
- Y_k = The fixed effect of kth period of birth (k = 1, 2)
- S_l = The fixed effect of lth season of shearing (l = 1, 2)
- X_m = The fixed effect of mth sex group (m = 1, 2)
- e_{ijklmn} = The random error associated with Y_{ijklmn} and assumed to be identically, independently and normally distributed with mean zero and unit variance and interaction between various effects was assumed to be zero

The Least Square means of different groups within each of the factors were compared by computing the Least Significant Difference (LSD) (Snedecor and Cochran, 1968).

RESULTS AND DISCUSSION

The least square mean and standard error computed for staple length (cm) are shown in Table 1. The overall

Genetic and non-genetic factors	Number of samples	Mean	SE	Coefficient of variation
Overall	608	3.97	0.05	30.23
Genetic groups				
Bannur	137	3.17	0.06 ^a	22.40
R x D	56	3.77	0.10 ^b	20.42
C x B	76	2.87	0.06 ^a	18.81
C x D	122	4.87	0.03 ^d	7.39
Deccani	97	4.72	0.20 ^d	41.31
UAS	120	4.14	0.04 ^c	11.59
Age (years)				
½ to 1½	52	4.43	0.06 ^c	10.38
1½ to 2½	65	4.03	0.09 ^b	18.14
2½ to 3½	64	3.74	0.13 ^a	27.27
3½ to 4½	106	3.62	0.09 ^a	25.14
4½ to 5½	114	3.93	0.13 ^{ab}	36.39
5½ to 6½	83	4.17	0.16 ^{bc}	35.97
6½ to 7½	124	4.07	0.12 ^b	33.42
Period of birth				
1987-90	384	4.02	0.07 ^a	33.33
1991-94	224	3.88	0.06 ^b	23.20
Season of shearing				
Dec.-Jan.	292	4.14	0.07 ^a	28.02
July-Aug.	316	3.81	0.07 ^b	31.76
Sex				
Male	85	4.20	0.13 ^a	27.62
Female	523	3.93	0.05 ^b	30.53

R x D: Rambouillet x Deccani; C x B: Corriedale x Bannur; C x D: Corriedale x Daecani; UAS: UAS improved strain; Column-wise means with atleast one common superscript do not differ significantly

least square mean of staple length was 3.97±0.05 cm. The comparison of means among genetic groups revealed that the longest staple length was recorded in Corriedale x Deccani (4.87±0.03 cm) followed by Deccani (4.72±0.20 cm), UAS-improved strain (4.14±0.04 cm), Rambouillet x Deccani (3.77±0.10 cm), Bannur (3.17±0.06 cm) and Corriedale x Bannur (2.87±0.06 cm).

The staple length in Bannur and Corriedale x Bannur crossbreds did not differ significantly from each other. The mean values for staple length were similar in Deccani and Corriedale x Deccani which were significantly higher than the values recorded in Rambouillet x Deccani, UAS-improved strain, Bannur and Corriedale x Bannur crosses. UAS-improved strain had significantly longer staple length than Bannur and Rambouillet x Deccani crossbreds. The staple of Corriedale x Bannur (2.87±0.06 cm) was comparatively shorter than that of pure breed Bannur (3.17±0.06 cm). Differences in staple length due to genetic groups have been reported by Umrikar *et al.* (1992), Malik and Singh (2006) and Singh *et al.* (2008) in different native and crossbred sheep.

The staple length of young sheep ½ to 1½ years was significantly higher (4.43±0.06 cm) than that of other age groups. Sheep aged 3½ to 4½ years had the least staple length (3.62±0.09 cm) and was not significantly different from those of 2½ to 3½ and 4½ to 5½ years groups.

Sheep belonging to age group of half to 1½ and 5½ to 6½ years had longer staple length and the values did not differ significantly. The staple length of above age groups were significantly higher than age groups >1½ to 2½ and 6½ to 7½.

Significant difference (p<0.01) in staple length due to age was reported by Krishnappa (1979) in Corriedale x Deccani and by Garcia and Alvarez (1992) in German Mutton Merinos. The lambs born in Period I had significantly longer staple length (4.02±0.07 cm) than those born in Period II (3.88±0.06 cm). This significant difference was (p<0.01) probably due to environmental and physiological conditions provided by ewes.

The sheep shorn in the month of December and January had longer staple length (4.14±0.07 cm) than sheep shorn in the months of July and August (3.81±0.07 cm). The difference was statistically significant (p<0.01). This observation was supported by earlier reports of Chaudhary and Malik (1972) in Chokla and Kandril (1984) in Ossimi flock of sheep. This may be due to favourable winter climatic conditions.

CONCLUSION

The staple length was longer (4.20±0.05 cm) in rams than in ewes (3.93±0.05 cm). The difference was

significant ($p \leq 0.01$) which may be due to hormonal differences. This findings closely tallied with the results of Chopra (1972) in Nali. Contrary to this, Krishnamurthy *et al.* (1975) in Nilagiri and its crosses and Krishnappa (1979) in Corriedale x Deccani and Deccani reported that sex had no effect on staple length.

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