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Original Research Article

Non-Genetic Factors Influencing the Wool Traits of Rambouillet Sheep in Jammu

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A B S T R A C T

The data for the present investigation were analyzed from records (1998-2002) of Rambouillet sheep maintained at The Government Sheep Breeding and Research Farm, Reasi, Jammu. The averages were 1.42±0.01 kg, 5.23±0.03 cm and 21.30±0.02 µ for greasy fleece weight (GFW), staple length (SL) and fiber diameter (FD) respectively. The highest CV (%) was observed for GFW (44.33 %) whereas the lowest CV (%) was observed for FD (4.68 %). The least-squares means were 1.44±0.02 kg, 5.26±0.03 cm and 21.30±0.02 µ for GFW, SL and FD respectively. The effect of year had significant effect for all the traits under present study. The effect of sex was significant ($P<0.01$) for GFW whereas non-significant effect on SL and FD for wool traits. Negative phenotypic correlation of GFW, SL with FD indicates that improvement in one trait will automatically affect the other trait. Whereas, selection for improvement in GFW will automatically improve the SL. These estimates revealed that there is scope for genetic improvement of these traits through appropriate selection methods and index.

Keywords

Fibre diameter, Greasy fleece weight, staple length, Rambouillet

Introduction

Sheep plays an important role in the livelihood of a poor, landless or small or marginal farmers engaged in sheep rearing especially in the arid/semi-arid and mountainous areas where crop and/or dairy farming are not economical. Sheep are very good economic converter of grass into wool, milk and meat. In fact, there is no substitute for sheep as a class of livestock for utilizing wastelands, stubbles of cultivated corps, tree topping, farm wastes or weeds from the field (Sahana, 2001). Sheep utilize very sparse and low set vegetation for feed due to its extremely close grazing nature due to bifid upper lip and therefore never compete with goat or bigger animals (Banerjee, 1989). Rambouillet is a well-known breed due to its excellent maternal ability. It is the largest fine wool breed adaptable to wide variety of arid range conditions, has a well-developed flocking instinct and is long lived. Rambouillet is intensively used for crossbreeding programme in Jammu and Kashmir for improving the productivity of native sheep.

Production traits are the main criterion for selection of animals. Greasy fleece weight

(GFW) is very important for evaluating the quantity of clean wool. Staple length (SL) is important because the SL of the fiber indicates quality and fineness of wool. Fiber diameter (FD) is important physical attribute of wool fiber and is responsible for fineness of the wool. There are many non-genetic factors, which influence the phenotypic expression of the production of sheep. Therefore, the present study was undertaken with the object to investigate the effect of non-genetic factors on wool production traits in Rambouillet sheep.

Materials and Methods

The data were obtained from the records of 2393 Rambouillet sheep comprises of 1252 rams and 1141 ewes maintained at The Government Sheep Breeding and Research Farm, Reasi, is located 80 kms on north-east of Jammu and lies between 330 05" N latitude and 740 5" E longitude. The farm followed semi-migratory production system. In middle of April the sheep were shifted to alpine pastures, viz. Zaban situated at an altitude of 6000- 8000 meters above sea level and allowed to graze there upto end of September. At alpine pastures sheep were kept open and allowed to grazing during day time for twelve hours without any supplementary feeding. During winter (middle of December to end of February) the sheep were housed in concrete sheds with baton floors, provided with hay racks and feeding channels. From middle of March to mid-April and October to mid-December the flocks are grazed at subalpine pastures. The wool production data consisting of GFW, SL and FD for present study were collected from 1998 to 2002. The data were suitably classified to study the major effect of non-genetic factors like years and sex. The mean, standard errors and coefficient of variations (CV %) of production traits were computed statistically (Snedecor and Cochran, 1994). The effects of non-genetic factors such as years and sex on various normalized wool traits were analyzed by least squares analysis using Statistical Package for Animal Breeding (SPAB2) programme developed by Sethi, 2006. The following model was used for present investigation with assumptions that the different components being fitted into the model were linear, independent and additive.

$$Y_{ijk} = \mu + P_i + S_j + e_{ijk}$$

Where, Y_{ijk} = k^{th} observation under j^{th} sex and i^{th} year, μ= Overall population mean, P_i = effect of i^{th} year, S_j = effect of j^{th} sex, e_{ijk} = Random error associated with each observation and assume to be normally and independently distributed with mean zero and variance (0, σ2e)

The statistical significance of various fixed effects (genotype and sex; years and sex) in the least squares model was determined by 'F' test. For significant effects, the differences between pairs of levels of effects were tested by Duncan's multiple range test (DMRT) as modified by Kramer 1957. The phenotypic correlations among wool traits were calculated by using statistical software SPSS version 14.0.

Results and Discussion

The production traits considered in present study were GFW, SL and FD along with standard errors (S.E), standard deviations (SD) and coefficient of variation (CV %) are presented in Table 1. The results showed that the mean for GFW, SL and FD was found to be 1.49±0.009 kg, 5.52±0.02 cm, and 21.25±0.01 µ with CV 42.69%, 24.92% and 4.53%, respectively. Coefficient of variations among traits under study were low to medium indicating that the traits had low to medium variability with the highest CV (%) for GFW. This showed that GFW had maximum variability hence there is scope for its improvement. The least squares means were 1.44±0.02 kg, 5.26±0.03 cm and 21.30±0.02 µ for GFW, SL and FD respectively (Table 2 and Fig. 1). The highest GFW of 1.98±0.03 kg was found in the year 2002. Year of lambing showed a highly significant ($P<0.01$) source of variation in this study. The variability in GFW, SL and FD due to years may be due to variations in physical environmental conditions, feeding, forage availability prevailing in different years for grazing resources and selection of rams. Mir *et al.,* (2000) reported significant a effect of year of birth on GFW in Corriedale sheep. Tomar *et al.,* (2000) reported a significant effect of year of birth and season of birth on GFW in Bharat Merino sheep. Lambs born in spring season had slightly lower GFW which did not differ significantly from those born in winter season.

The performances of females were better than the males for all the traits although it was significant ($P<0.01$) for GFW only. The differences in GFW in female and male lambs may be due to differences in their endocrine profile. Mishra *et al.,* (2009) reported a non-significant effect of sex on GFY in Garole-Malpura crossbred sheep. Chopra *et al.,* (2010) also reported a significant effect of year of birth and non-significant effect of sex of lamb on FD and SL in Bharat Merino sheep which is similar to present findings.

The results from the present study showed that the average mean from 1998-2002 for GFW was found to be 1.42±0.01 kg which was very close to the overall mean of GFW of; 1.60±0.12 kg reported by Kaira *et al.,* 1982; 1.49±0.00 kg reported by Khan, 2012 in Rambouillet. Lower estimates ranged from 0.80±0.05 kg to 1.35 kg were reported by Chatterjee & Kapoor, 1971; Mohan and Acharya, 1982; Singh *et al.,* 1987; Jain *et al.,* 2000 in Rambouillet sheep and Singh *et al.,* 2008 in three exotic (Corriedale, Poll Dorset and South Down) and one crossbred (Local X Corriedale) sheep. Higher estimates of 2.07±0.08 kg and 2.21±0.02 kg were reported by Mahajan *et al.,* 1975 and Pandey *et al.,* 2000 respectively in Rambouillet sheep. The coefficient of variation of GFW was the highest (44.33%) among all the traits under study indicating that the trait had variability.

The results from the present study showed that the average mean from 1998-2002 for SL was found to be 5.23±0.03 cm which were very close to the average staple length of 5.35 cm reported by Chatterjee and Kapoor, 1971; 5.20±0.23 cm reported by Singh *et al.,* 2008 in three exotic (Corriedale, Poll Dorset and South Down) and one crossbred (Local X Corriedale) sheep and 5.52±0.02 cm reported by Khan, 2012; in Rambouillet. Lower estimates ranging from 3.25±0.01cm to 3.41±0.69 cm were reported by Kaira *et al.,* 1982; Mohan and Acharya, 1982; and Mehta, 1986 in Rambouillet sheep. Higher estimate of 8.00±0.10 cm was reported by Ganai and Pandey, 1993 in ½ Rambouillet and ½ Australian Merino sheep. The coefficient of variation of SL was the medium (25.78%) among all the traits under study indicating that the trait had medium variability.

The results from the present study showed that the average mean from1998-2002 for FD was found to be 21.30±0.02µ in Rambouillet sheep which were very close to the average fiber diameter of 20.90±0.10µ reported by Ganai and Pandey, 1993 in ½ Rambouillet and ½ Australian Merino and 21.25±0.01 µ reported by Khan, 2012 in Rambouillet sheep.

Fig.1 Least squares mean for wool traits in Rambouillet sheep from 1998-2002

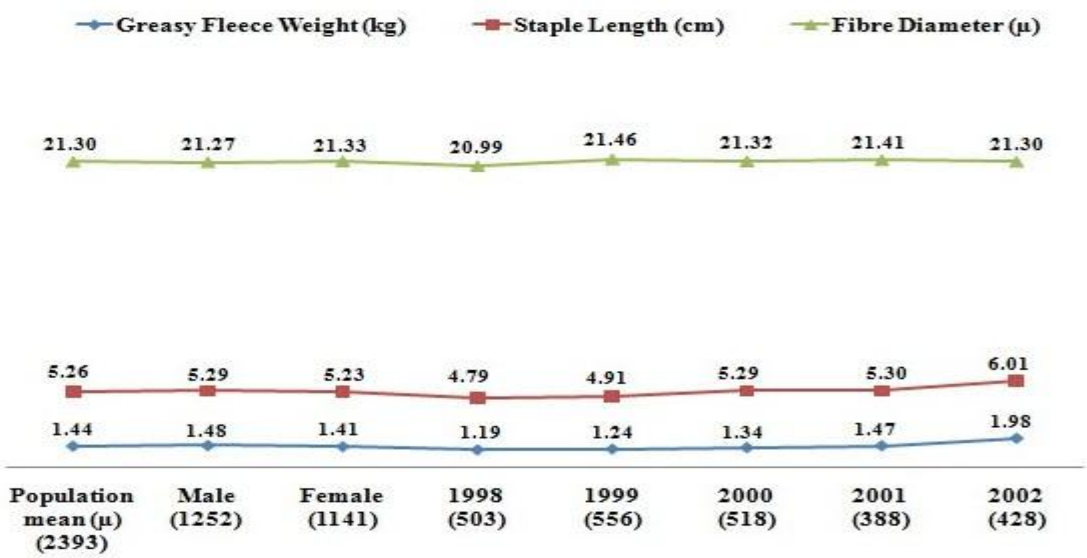

Table.1 Average estimates along with standard errors of wool traits in Rambouillet sheep from 1998-2002

Traits	Number of observations	Mean	Standard Error	Standard Deviation	CV (%)
GFW (gm)	2393	1.42	0.01	0.63	44.33
SL (cm)	2393	5.23	0.03	1.35	25.78
FD (micron)	2393	21.3	0.02	1.00	4.68

Table.2 Least squares means for various non-genetic factors influencing wool traits in Rambouillet sheep from 1998-2002

Particulars	Number of observations	Traits		
		Greasy Fleece Weight (kg)	Staple Length (cm)	Fibre Diameter (µ)
Sex		**	NS	NS
Mean (µ)	**2393**	**1.44±0.01**	**5.26±0.03**	**21.30±0.02**
Male	1252	$1.48{\pm}0.02^{b}$	5.29±0.04	21.27±0.03
Female	1141	$1.41{\pm}0.02^{a}$	5.23±0.04	21.33±0.03
Year		**	**	*
1998	503	$1.19{\pm}0.03^{a}$	$4.79{\pm}0.06^{a}$	$20.99{\pm}0.04^{a}$
1999	556	$1.24{\pm}0.02^{a}$	$4.91{\pm}0.05^{a}$	$21.46{\pm}0.04^{c}$
2000	518	$1.34{\pm}0.02^{b}$	$5.29{\pm}0.06^{b}$	$21.32{\pm}0.04^{b}$
2001	388	$1.47{\pm}0.03^{c}$	$5.30{\pm}0.07^{b}$	$21.41{\pm}0.05^{bc}$
2002	428	$1.98{\pm}0.03^{d}$	$6.01{\pm}0.06^{c}$	$21.30{\pm}0.05^{b}$

** (P<0.01), * (P<0.05), non-significant (NS) and values bearing same superscripts in a column under different subheading did not differ significantly.

Table.3 Phenotypic correlation between the wool traits in Rambouillet sheep

Traits	Greasy Fleece Weight (kg)	Staple Length (cm)	Fibre Diameter (μ)
Greasy Fleece Weight (kg)	1.00		
Staple Length (cm)	0.15	1.00	
Fibre Diameter (μ)	-0.02	-0.05	1.00

Lower estimates ranged from 13.34μ to 16.71μ were reported by Chatterjee and Kapoor, 1971; Krishnan and Charyulu, 1975; Mohan and Acharya, 1982; Mehta, 1986; and Singh *et al.*, 1987 in Rambouillet sheep. Higher estimates were reported by Umrikar, 1992 in exotic sheep and 26.20±0.82 μ reported by Singh *et al.*, 2008 in three exotic (Corriedale, Poll Dorset and South Down) and one crossbred (Local X Corriedale) sheep. The coefficient of variation of FD was the low (4.68%) among all the traits under study indicating that the trait had medium variability.

The least square analysis of variance showed significant effect of year on GFW, SL and FD (P<0.05). The effect of sex on GFW was found to be highly significant (P<0.01) and this effect was non-significant for SL and FD in Rambouillet sheep. The overall least squares means of GFW, SL and FD were found to be 1.44±0.02 kg, 5.26±0.03 cm and 21.30±0.02 μ respectively in Rambouillet sheep.

Male had higher SL (5.29±0.04 cm) than female SL (5.23±0.04 cm). The effect of sex was significant (P<0.01) on GFW. Similar findings were reported by Malik *et al.*, 1980 in Rambouillet crosses; Walkley *et al.*, 1987 in Australian Merino; Taneja *et al.*, 1992 in Magra; Sinha and Singh, 1996 in Muzaffarnagri; Pandey *et al.*, 2000 and Khan, 2012 in Rambouillet sheep. On contrary non-significant (P<0.01) effect of sex on GFW was reported Krishnamurthy *et al.*, 1975 in Merino, Nilgiri & their crosses.

The highest GFW of 1.98±0.03 kg, SL of 6.01±0.06 was found in the lambs born in year 2002 and the superior FD of 20.99±0.04 μ was found in the lambs born in year 1998**.** The effect of year of birth was highly significant (P<0.01) on GFW. Similar findings were reported by Malik *et al.*, 1980 in Rambouillet crosses; Singh *et al.*, 1987 in Corriedale, Nali and Chokla; Kulkarni and Deshpande, 1990 in Merino and Deccani half bred; Sinha and Singh, 1996 in Muzaffarnagri; Pandey *et al.*, 2000 in Rambouillet; Gamez *et al.*, 2008 in Local Coriollo sheep; Mishra *et al.*, 2009 in Malpura sheep and Khan, 2012 in Rambouillet sheep. On contrary non-significant effect of year of birth on GFW was reported by Kumar and Tomar, 1982 in Corriedale sheep and Ganai and Pandey, 1993 in Rambouillet & its crosses with Australian Merino.

The effect of sex was non-significant on SL. Similar findings were reported by Acharya, 1985 and Khan, 2012 in Rambouillet. On contrary significant effect of sex on SL was reported by Vesely *et al.*, 1970 in Rambouillet and Malik *et al.*, 1990 in Corriedale and Russian Merino. The effect of year of birth was highly significant (P<0.01) on SL. Similar findings were reported by Gregory and Ponzoni, 1981 in Australian Merino; Malik *et al.*, 1990 in Nali and its crosses with Corriedale and Russian Merino; Wang *et al.*, 1994 in Xinjiang and its crosses and Khan, 2012 in Rambouillet sheep. On contrary non-significant effect of year of birth on SL was reported by Kulkarni and Deshpande, 1990 in Merino and Deccani half bred.

The effect of sex was non-significant on FD. Similar findings were reported by Khan, 2012 in Rambouillet sheep. On contrary significant effect of sex on FD was reported by Vesely *et al.,* 1970 in Rambouillet and Malik *et al.,* 1990 in Nali and its crosses with Corriedale and Russian Merino. The effect of year of birth was significant ($P<0.05$) on FD. Similar findings were reported by Gajbhiye and Johar, 1985 in Magra sheep; Malik *et al.,* 1990 in Nali and its crosses with Corriedale and Russian Merino; Snyman *et al.,* 1995 in Afrino and Khan, 2012 in Rambouillet sheep. On contrary non-significant effect of year of birth on FD was reported by Kulkarni and Deshpande, 1990 in Merino and Deccani half bred. The significant differences between years may be due to difference in the availability of inputs in terms of feed and fodder, which directly affects the health, climatic conditions prevailing in different years of the farm and also due to difference in the managemental practices prevailing in different years.

The phenotypic correlation of GFW was found to have low positive phenotypic correlation with SL of 0.15 and low negative with FD (-0.02). SL was found to have low negative phenotypic correlation with FD (-0.05) as presented in Table 3. Similar findings were reported by Mehta (1986) between GFW and SL in Rambouillet; Matebesi *et al.,* 2009 in Tygerhoek Merino flock between GFW and SL and Merino breeds of sheep and Khan (2012) reported low and positive phenotypic correlation of GFW with SL whereas low negative phenotypic correlation was found with FD and negative phenotypic correlations among SL and FD in Rambouillet cross sheep. On the other hand, the positive phenotypic correlation between SL and FD was reported by Matebesi *et al.,* 2009 in Tygerhoek Merino flock; whereas Safari *et al.,* 2007 in Merino sheep and Matebesi *et al.,* 2009 in Tygerhoek Merino reported positive phenotypic correlation between GFW and FD.

Coefficient of variation (CV %) among all traits (except GFW) under study was low to medium indicating that the traits had low to medium variability. The highest CV% for GFW showed maximum variability hence there is scope for its improvement. The year was found to have significant ($P<0.01$) effect on wool traits. The highly significant differences between years may be due to difference in the availability of inputs in terms of feed and fodder, which directly affects the health, climatic conditions prevailing in different years in the farm and also due to difference in the managemental practices prevailing in different years. Overall, sex was found to have highly significant ($P<0.01$) effect on GFW and non-significant effect on SL and FD. The significant difference in between the sex may be due to reflection of physiological difference in the growth of both the sexes. Highly significant ($P<0.01$) phenotypic correlation of GFW, SL with FD indicates that improvement in one trait will automatically affect the other trait. Whereas, selection for improvement in GFW will automatically improve the SL.

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