



Performance of wool type angora rabbits under temperate conditions of Kashmir (J&K), India

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Abstract: An attempt has been made to determine the production and quality performance of wool type Angora rabbits and screen out the best suitable breed under temperate conditions of Kashmir. A total of 202 records of French Angora and German Angora rabbit breeds maintained for 3 years (2009-2011) were evaluated to estimate the performance of quality and production traits in relation to genetic and non-genetic factors. For French Angora rabbits, the overall body weight gain (adult weight), annual wool yield (AWY), staple length (SL), medullation percentage (MP) and fiber diameter (FD) were found to be 2.506 ± 0.0432 kg, 303.575 ± 0.316 gms, 5.161 ± 0.0183 cms, 2.228 ± 0.0217 % and 12.289 ± 0.0178 μ , respectively. In case of German Angora rabbits, the values of 2.506 ± 0.033 kg, 605.96 ± 0.474 gms, 6.219 ± 0.0279 cms, 2.513 ± 0.0348 % and 12.347 ± 0.0265 μ were observed for the respective traits. The breed was found to reveal significant effect ($P < 0.01$) on birth weight, weaning weight, annual weight, annual wool yield, staple length and medullation percentage and non-significant effect on fiber diameter. The sex was found to exhibit non-significant effect on all the traits under study. Based on present study, it can be concluded that German Angora breed of rabbit is most suitable for angora wool production and quality under temperate climatic conditions of Kashmir region.

Keywords: Angora rabbits, Kashmir, Production performance, Temperate climate, Wool quality

INTRODUCTION

Angora rabbit wool is softer, silky and is eight times warmer than Angora sheep wool (Pokharna *et al.*, 2004). Rabbit fur is widely used throughout the world. Angora wool is the third largest animal fibre produced, after sheep wool and mohair, with annual world production of about 8500 tons. Presently, China dominates the International Angora wool market and contributes about 90 % to the total world production of Angora wool (Schlink and Liu, 2013). India is marginal producer of Angora wool with estimated annual production of about 30-40 tons. Angora wool production is the most important economic trait among Angora rabbits and appears to be affected by a number of genetic as well as non-genetic factors (Thebault *et al.*, 1992; Katoch *et al.*, 1999; Allain *et al.*, 2004). Heritability estimates as genetic parameters for different wool traits in Angora rabbit are reported to be low to moderate (Allain *et al.*, 2004). Further, wool traits could be improved by direct and indirect selection methods in Angora rabbits (Allain *et al.*, 2004; Rafat *et al.*, 2007). Initial wool clips have been found to be important in early selection due to their high genetic correlation with latter clips (Rafat *et al.*,

2009). Significant genetic correlation has been reported between wool yield and corresponding body weight in Angora rabbits (Garcia and Magofke, 2010; Singh *et al.*, 2006). Likewise, correlated responses for body weight after selection for fleece yield in Angora rabbits have been observed experimentally (Qinyu, 2012). Present investigation was carried out to evaluate the performance of wool type Angora Rabbits under temperate conditions of Kashmir (J&K), India.

MATERIALS AND METHODS

The data has been recorded over a period of three years (2009 to 2011) from the different breeds of rabbits maintained at Government Angora Rabbit Farm, Wusan- Pattan, District Baramulla, J&K, India. The traits studied were body weight gain, annual wool yield, staple length, medullation percentage and fiber diameter. Temperature (maximum and minimum) and relative humidity were also recorded on monthly basis during the entire period of study (Table 1). Mean, standard errors and coefficient of variations (CV) were computed statistically. The effects of genetic and non-genetic factors such as breed and sex on the growth parameters were analyzed by least square analysis using the technique developed by Harvey (1990).

Table 1. Average temperature and humidity for the period of 2009-2011.

| Month | Temperature | | Relative Humidity % |
|-----------|-------------|------------|---------------------|
| | Maximum °C | Minimum °C | |
| January | 7.0 | -2.0 | 82 |
| February | 8.2 | -0.7 | 79 |
| March | 14.1 | 3.4 | 70 |
| April | 20.5 | 7.9 | 64 |
| May | 24.5 | 10.8 | 61 |
| June | 29.6 | 14.9 | 56 |
| July | 30.1 | 18.1 | 66 |
| August | 29.6 | 17.5 | 70 |
| September | 27.4 | 12.1 | 67 |
| October | 22.4 | 5.8 | 69 |
| November | 15.1 | 0.9 | 77 |
| December | 8.2 | -1.5 | 84 |
| Average | 19.7 | 7.3 | 70.4 |

The following model was adapted in the present investigation with assumptions that the different components being fitted into the model were linear, independent and additive.

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

Where, Y_{ijk} = k^{th} record of individual of i^{th} ram of j^{th} sex

μ = Overall mean
 S_i = Random effect of i^{th} ram
 S_j = Fixed effect of j^{th} sex
 e_{ijk} = Error associated with each observation and assumed to be normally and independently distributed with mean zero and variance $(0, \sigma_e^2)$

R_i = Random effect of i^{th} ram

S_j = Fixed effect of j^{th} sex

e_{ijk} = Error associated with each observation and assumed to be normally and independently distributed with mean zero and variance $(0, \sigma_e^2)$

RESULTS AND DISCUSSION

Growth performance: The least square means for birth weight (BT), weaning weight (WT) and annual weight gain (AwT) along with their standard errors are presented in Table 2. The average birth weight, weaning weight and adult weight were found to be 0.387 ± 0.00698 kg (127), 0.964 ± 0.00798 kg (127) and 2.506 ± 0.0333 kg (127), respectively for French Angora,

whereas the value of respective traits were found to be 0.39 ± 0.00893 kg (75), 0.961 ± 0.0102 kg (75), and 2.519 ± 0.0432 kg (75) for German Angora. Sivakumar et al. (2013) observed 0.5 kg birth weight and lower estimate of 0.6-0.7 kg weaning weight in Soviet Chinchilla breeds of rabbit. Lower estimate of 0.6-0.7 kg weaning weight and 1.8-1.9 kg adult weight were observed by Ghosh et al. (2008) in New Zealand White and Soviet Chinchilla breeds. On contrary, lower estimates of birth weight ranged from 0.3-0.4 kg and higher estimate of weaning weight from 2.1-2.2 were observed by Olonofeso et al. (2012) in three breeds of rabbit. The lower estimate of adult weight ranging from 2.2-2.5 kg were observed by Khalil et al. (2013) in Baladi Red and New Zealand White breeds of rabbit. Similar results of weaning weight from 0.7-1.3 kg were observed by Adelodun (2015) in four breeds of rabbit.

Breed was found to reveal significant effect ($P < 0.01$) on birth weight, weaning weight and annual weight, but effect of sex was found to be non-significant on these traits. Similar findings of significant effect of breed on live litter body weight of Rabbit in Minna, Niger State, Nigeria were observed by Egena et al. (2012). Significant effect of genotype and non-significant effect of sex on individual kit weight in rabbit breeds and thier crosses were reported by Chineke (2005). On contrary, breed having non-significant effect on individual weaning weight on local rabbits of subtropical climate were reported by Ghosh et al. (2008).

Wool production performance: The least square means for annual wool yield (AWY), staple length (SL), medullation percentage (MP) and fiber diameter (FD) along with their standard errors are presented in Table 3. The average for annual wool yield (AWY), staple length (SL), medullation percentage (MP) and fiber diameter (FD) were found to be 303.575 ± 0.316 gm (127), 5.161 ± 0.0183 cm(127), 2.228 ± 0.0217 percent (127) and 12.289 ± 0.0178 μ(127), respective-

Table 2. Least square means ± SEM for growth parameters of wool type rabbit breeds (Sex- Wise Comparison).

| Traits | French Angora | | | German Angora | | |
|----------|---------------|---------------|----------------|---------------|---------------|----------------|
| | Male (72) | Female (55) | Overall (127) | Male (37) | Female (38) | Overall (75) |
| BT (Kg) | 0.382 ± 0.009 | 0.393 ± 0.010 | 0.390 ± 0.0089 | 0.398 ± 0.012 | 0.383 ± 0.013 | 0.387 ± 0.0069 |
| WT (Kg) | 0.962 ± 0.011 | 0.966 ± 0.012 | 0.961 ± 0.0102 | 0.972 ± 0.016 | 0.951 ± 0.013 | 0.964 ± 0.0079 |
| AwT (Kg) | 2.517 ± 0.044 | 2.493 ± 0.051 | 2.519 ± 0.0432 | 2.497 ± 0.062 | 2.539 ± 0.061 | 2.506 ± 0.033 |

Table 3. Least squares means ± SEM for production traits of wool type rabbit breeds (Sex- Wise Comparison).

| Traits | French Angora | | | German Angora | | |
|------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| | Male (72) | Female (55) | Overall | Male (37) | Female (38) | Overall |
| Annual wool yield (gm) | 303.583 ± 0.412 | 303.564 ± 0.494 | 303.574 ± 0.453 | 605.838 ± 0.686 | 606.079 ± 0.663 | 605.958 ± 0.675 |
| Staple length (cm) | 7.103 ± 1.111 | 6.024 ± 0.852 | 6.564 ± 0.9815 | 6.192 ± 0.038 | 6.245 ± 0.041 | 6.218 ± 0.395 |
| Medullation (%) | 2.221 ± 0.029 | 2.238 ± 0.033 | 2.229 ± 0.031 | 3.162 ± 0.692 | 3.871 ± 0.936 | 3.516 ± 0.814 |
| Fibre diameter (μ) | 12.288 ± 0.024 | 12.291 ± 0.027 | 12.289 ± 0.025 | 12.341 ± 0.039 | 12.353 ± 0.036 | 12.347 ± 0.037 |

ly for French Angora. The value of respective traits were observed to be 605.96 ± 0.474 gm (75), 6.219 ± 0.0279 cm (75), 2.513 ± 0.0348 percent (75) and 12.347 ± 0.0265 μ (75) for German Angora. Similar findings with the values of 335.7 ± 26.2 gm AWY in British Angora, 656.4 ± 161.0 gm AWY in Chinese Angora and higher estimate of 949.6 ± 101.1 gm AWY in German Angora were observed by Neupane *et al.* (2010). Higher estimates of 775.75 ± 20.45 gm AWY in German Angora were observed by Singh *et al.* (2006). No literature was found to estimate fiber diameter, staple length and medullation percentage in German and French Angora Rabbits. Breed was found to reveal significant effect on annual wool yield, staple length and medullation percentage, but has non-significant effect on fiber diameter. The effect of sex was found to be non-significant on annual wool yield, staple length, medullation percentage and fiber diameter. Similar results of significant effect of breed on wool production of different lines and strains of Angora rabbit were reported by Neupane *et al.* (2010). On the contrary, significant effect of sex on wool yield in Angora rabbit was reported by Sood *et al.* (2007).

Conclusion

The most common rabbit breeds in India as well in temperate Kashmir for Angora wool production are French Angora and German Angora and their production performance under different climatic conditions has to be ascertained by screen out the best suiting breed for the region for production and quality of angora wool. The German Angora breed of rabbits found to be best suited under temperate climate conditions of Kashmir valley of J&K. The overall body weight gain in adult rabbits was 2.506 ± 0.033 kg and the annual wool yield was 605.96 ± 0.474 gms with staple length of 6.219 ± 0.0279 cms, medullation percentage of 2.513 ± 0.0348 % and fiber diameter 12.347 ± 0.0265 μ which is better than French Angora breed of rabbits. Based on present study it can be concluded that German Angora breed will be suitable for profitable wool production, and the findings will also help in further technology development and its transfer to the end users (farmers) in the region for successful rearing and maximizing income.

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