Non-Genetic Factors Effecting Reproduction Traits in Rambouillet Sheep

N.N. Khan1*, N. Assad2, Nishant Kumar3, D. Chakraborty3, Aadil Ayaz4, Aarif Ali5, Mashooq Ahmad Dar5 and Suheel Yousuf Wani1

1Division of Animal Genetics and Breeding, Faculty of Veterinary Sciences and Animal Husbandry Sher-e-Kashmir University of Agriculture Sciences and Technology Shuhama, Alustang Kashmir 190006, India
2Animal Husbandry Department, J&K, India
3Division of Animal Genetics and Breeding SKUAST Jammu, India
4Department of Zoology and Biotechnology, Hemwati Nandan Bahuguna Garhwal University Uttrakhand India, 246174
5Department of Biochemistry University of Kashmir, Jammu and Kashmir, India

A B S T R A C T

A total of 4186 records of Rambouillet sheep maintained at Government Sheep Breeding and Research Farm, Reasi, Jammu, India for 10 years (1998-2007) were analyzed to estimate the reproduction traits in relation to non-genetic factors viz., season of lambing and year of lambing on Age at first fertile service, Age at first lambing, litter size at birth and interlambing period. The overall mean for Age at first fertile service (AFFS), Age at first lambing (AFL), litter size at birth (LS) and interlambing period (ILP) were 727.17±2.03 days, 877.04±2.01 days, 1.05±0.00, and 368.34±0.22 days with corresponding coefficient of variations 12.40%, 10.21% 2.15% and 2.67%, respectively. In present study, year and season had non-significant effect on AFFS, AFL, LS and ILP.

Keywords
Non-genetic factors, Reproduction, Rambouillet Sheep

Accepted: 29 June 2017
Available Online: 10 August 2017

Introduction

Rambouillet is well known breed due to its excellence in 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. The breed, although originally developed in France as a wool breed, after importation in the mid 1800s (Dickson et al., 1933), was developed into a dual-purpose breed in the U.S. (Hultz et al., 1931). The breed is also well known for its meat. Rambouillet is intensively used for cross breeding programme in India for improving the productivity of native sheep. Reproductive characteristics have been recognized as main factors affecting profitability of sheep breeding systems (Matos et al., 1997). Therefore, improvement in ewe productivity is a key target in sheep breeding and could be attained to some extent by increasing the number of lambs weaned and weight of lambs weaned per ewe within a specific year (Duguma et al., 2002). The
major part of the income in any sheep production system is supplied through lamb production (Ekiz et al., 2005). Profitable wool and mutton production and faster genetic progress of sheep flock are mainly dependent on higher degree of reproductive efficiency of breedable ewes. The economics of sheep farming is based not only the characters of wool and mutton production alone but also on ewes efficient reproduction performance. Failure to maintain sufficiently higher degree of reproductive efficiency is the major economic loss to the sheep husbandry.

Materials and Methods

The data were obtained from the records of 4186 Rambouillet sheep maintained at Government Sheep Breeding and Research Farm, Reasi, Jammu, India. The data were spread over a period of ten years i.e. from 1998 to 2007. The reproduction traits studied were age at first fertile service, age at first lambing, litter size at birth and interlambing period. The mean, standard errors and coefficient of variations (CV) were computed statistically. The effects of non-genetic factors such as years and seasons on these reproduction traits were analyzed by least squares analysis using the technique developed by Harvey (1990). The following model was used for present investigation with assumptions that the different components being fitted into the model were linear, independent and additive.

\[ Y_{ijklm} = \mu + R_i + Y_j + S_k + e_{ijkl} \]

Where,
- \( Y_{ijklm} \) = \(^{m}\) record of individual of \(^{i}\) Ram lambed in \(^{j}\) year, \(^{k}\) season and 
- \( \mu \) = Overall population mean 
- \( R_i \) = Random effect of \(^{i}\) ram 
- \( Y_j \) = Fixed effect of \(^{j}\) year of lambing 
- \( S_k \) = Fixed effect of \(^{k}\) season of lambing 
- \( e_{ijkl} \) = Error associated with each observation and assume to be normally and independently distributed with mean zero and variance \( (0, \sigma^2_e) \)

The least square means of significant effects were compared using Duncan's multiple range test (DMRT) as modified by Kramer (1957).

Results and Discussion

The average estimates of reproduction traits viz. AFFS, AFL, LS, and ILP along with standard errors (S.E), standard deviations (SD) and coefficient of variation (CV%) are presented in table 1. The least square means for AFFS, AFL, LS, and ILP along with their standard errors are presented in table 2 and ANOVA in table 3. The overall mean of age at first fertile service in present investigation was estimated as 727.17±2.03 days and falls within the range of 707.00±42.0 days reported by Arora et al., (1978) in Malpura and Chokla breed of sheep. Lower estimates ranged from 583.02±1.05 days to 639.1± 15.94 days were reported by Bohra (1993), Khan et al., (2002), and Babar and Javed (2009) in Rambouillet breed of sheep. Higher estimate of 819.68±70.52 days was reported by Jain et al., (2001) in Rambouillet breed of sheep. The coefficient of variation of AFFS was low (12.40) indicating that the trait had low variability. The overall mean of age at first lambing in present investigation was estimated as 877.04±2.01 days. It is in close agreement with the findings (967.3± 25.5 days) of Bohra (1993) in Rambouillet breed of sheep. Lower estimate of 735.67±1.13 days was reported by Khan et al., (2002) in Rambouillet breed of sheep. Higher estimates of 819.68±70.52 days was reported by Jain et al., (2001) in Rambouillet breed of sheep. The coefficient of variation of AFL was low (10.21) indicating that the trait had low variability. The overall mean of litter size
in present investigation was estimated as 1.05±0.00 which were very close to the average litter size reported by Ferda et al., (2009) in Fat tailed sheep. Higher estimates were reported by Shaoqi Rao (1997) in Suffolk, Targhee and Polypay breeds of sheep. The overall mean of inter lambing period in present investigation was estimated as 368.34± 0.22 days which were very close to the average inter lambing period of 370.70±1.09 days reported by Jain et al., (2001) in Rambouillet breed of sheep. Lower estimates were reported by Gonzalez et al., (1986) in Merino, Lehnerr (1990) in Swiss White Alpine breed of sheep. Higher estimates were reported by Khan et al., (2002) in Rambouillet, and Babar and Javed (2009) in Rambouillet breed of sheep. The coefficient of variation of ILP was low (2.67) indicating that the trait had low variability.

The effect of year of birth was non-significant on age at first fertile service. No literature was available as concerned regarding the non-significant effect of year on age at first fertile service. However significant effect of year on age at first fertile service was reported by Narayanswamy et al., (1976) in Mandya sheep, Kabuga and Akowuah (1991) in Djallonke and Sahel sheep, Jain et al., (2000) in Rambouillet, and Khan et al., (2002) in Rambouillet and Kaghani sheep.

The effect of season of birth was non-significant on age at first fertile service. Similar findings were reported by Babar and Javed (2009) in Rambouillet. On contrary significant effect of season of birth on age at first fertile service was reported by Sinha (1996) in Muzaffarnagri and their crosses with Dorset and Suffolk, Jain et al., (2000) in Rambouillet, and Khan et al., (2002) in Rambouillet and Kaghani sheep. The effect of year of birth was non-significant on age at first lambing. Similar findings were reported by Kaul (1979) in Muzaffarnagri, Tamu (1980) in Rambouillet, and Babar and Javed (2009) in Rambouillet. On contrary significant effect of season of birth on age at first lambing was reported by Malik et al., (1978) in Rambouillet with chokla, Malpura and Jaisalmeri, and Narayanswamy (1978) in Bannur sheep, and Gabina et al., (1990) in Lacha ewes. The effect of season of birth was non-significant on age at first lambing.

Table.1 Average estimates along with standard errors of reproduction traits

| TRAITS   | Number of observations | Mean ± SE | Standard deviation | CV (%) |
|----------|------------------------|-----------|--------------------|--------|
| AFFS(days) | 1976                  | 727.17±2.03 | 90.21              | 12.40  |
| AFL(days) | 1976                  | 877.04±2.01 | 89.62              | 10.21  |
| LS       | 4186                  | 1.05±0.00  | 0.22               | 21.51  |
| ILP(days) | 1976                  | 368.34±0.22 | 9.84               | 2.67   |
Table 2: Analysis of variance for reproduction traits in Rambouillet sheep

| Sources of variation          | AFFS  | AFL    | LS     | ILP   |
|------------------------------|-------|--------|--------|-------|
|                              | MSS   |        |        |       |
| Season of lambing            | 2740.82 | 4097.04 | 0.0018 | 23.27 |
|                              | (1)   | (1)    | (1)    | (1)   |
| Year of lambing              | 6919.11 | 7374.98 | 0.22** | 46.78 |
|                              | (9)   | (9)    | (9)    | (9)   |
| Sex                          | -     | -      | 0.03   | -     |
|                              |       |        | (1)    |       |
| Residual/Error               | 8148.16 | 4097.04 | 0.05   | 97.27 |

Figures in parenthesis indicate degree of freedom  
** indicate significant at 1% level
Table 3: Least squares mean for various non-genetic factors influencing reproduction traits in Rambouillet sheep

| Particulars       | AFSS mean±SE(x) | AFL mean±SE(x) | LS mean±SE(x) | ILP mean±SE(x) |
|-------------------|-----------------|----------------|---------------|----------------|
| Overall mean      | 724.02±4.96 (1976) | 873.40±4.92 (1976) | 1.05±0.00 (4186) | 368.48±0.54 (1976) |

| Year    | AFSS mean±SE(x) | AFL mean±SE(x) | LS mean±SE(x) | ILP mean±SE(x) |
|---------|-----------------|----------------|---------------|----------------|
| 1998    | 723.44±7.56 (208) | 871.73±7.51 (208) | 1.07±0.01abc (503) | 368.99±0.82 (208) |
| 1999    | 730.80±6.65 (269) | 880.69±6.60 (269) | 1.06±0.01bcd (556) | 368.93±0.72 (269) |
| 2000    | 726.59±7.24 (260) | 875.09±7.19 (260) | 1.09±0.01abc (518) | 368.51±0.79 (260) |
| 2001    | 714.37±8.01 (196) | 862.65±7.96 (196) | 1.02±0.01 (388) | 369.15±0.87 (196) |
| 2002    | 722.04±7.61 (211) | 871.80±7.56 (211) | 1.04±0.01abc (428) | 368.04±0.83 (211) |
| 2003    | 719.91±11.63 (73) | 870.31±11.54 (73) | 1.02±0.01 (232) | 367.47±1.27 (73) |
| 2004    | 719.84±7.68 (217) | 869.54±7.63 (217) | 1.05±0.01abc (405) | 368.08±0.83 (217) |
| 2005    | 734.87±7.63 (212) | 884.16±7.57 (212) | 1.03±0.01 (418) | 369.06±0.83 (212) |
| 2006    | 723.39±7.69 (190) | 873.84±7.64 (190) | 1.05±0.01abc (411) | 368.52±0.84 (190) |
| 2007    | 724.96±9.04 (140) | 874.15±8.98 (140) | 1.03±0.01abc (327) | 368.08±0.98 (140) |

| Season          | AFSS mean±SE(x) | AFL mean±SE(x) | LS mean±SE(x) | ILP mean±SE(x) |
|-----------------|-----------------|----------------|---------------|----------------|
| winter (Dec-Feb)| 726.84±2.20 (1883) | 876.84±2.18 (1883) | 1.05±0.00 (3984) | 368.22±0.24 (1883) |
| spring (March-May)| 721.20±9.57 (93) | 869.95±9.50 (93) | 1.05±0.01 (202) | 368.74±1.04 (93) |

| Sex          | AFSS mean±SE(x) | AFL mean±SE(x) | LS mean±SE(x) | ILP mean±SE(x) |
|--------------|-----------------|----------------|---------------|----------------|
| Male         | -               | -              | 1.04±0.00 (2213) | -              |
| Female       | -               | -              | 1.05±0.00 (1973) | -              |

Figures in parenthesis indicate number of observations
Means with same superscript do not differ significantly
However significant effect of season on litter size was reported by Molina et al., (1991) in Manchega sheep, Shelton et al., (1991) in Rambouillet and Ferda et al., (2009) in Fat tailed sheep. The effect of sex was non-significant on litter size. No literature was available as concerned regarding the non-significant effect of sex on litter size. However significant effect of sex on litter size was reported by Trejo et al., (1990) in Chalma sheep, Molina et al., (1991) in Manchega sheep and Shelton et al., (1991) in Rambouillet. The effect of year of birth was non-significant on inter lambing period. Similar findings were reported by Sinha (1996) in Muzaffarnagri and its crosses with Dorset and Suffolk. On contrary significant effect of year of birth on inter lambing period was reported by Narayanswamy (1978) in Bannur sheep, Iniquez et al., (1991) in Sumatran sheep, Kabuga and Akowuah (1991) in Djalonke and Sahel sheep, Khan et al., (2002) in Rambouillet and Kaghani sheep, and Babar and Javed (2009) in Rambouillet.

The effect of season of birth was non-significant on inter lambing period. Similar findings were reported by Sinha (1981) in Muzaffarnagri and their crosses with Dorset and Suffolk. On contrary significant effect of season of birth on inter lambing period was reported by Trejo et al., (1990) in Chalma sheep, Iniquez et al., (1991) in Sumatran sheep, and Khan et al., (2002) in Rambouillet and Kaghani sheep.

**Acknowledgements**

Authors are thankful to the in-charge and staff of Government Sheep Breeding and Research Farm, Reasi, Jammu for providing facilities and help for the present study.

**References**

Arora, C.L., Acharya, R.M., Kishore Kamal, Rawat, P.S., Uppal, P.K., Sharma, M.M., Gaur, D. and Mehta, B.S. 1978. Evaluation of performance of the new strains of sheep evolved at C.S.W.R.I and development of suitable selection criteria for their further improvement. Annual Report, Central Sheep on Wool Research Institute, Avidanagar, 7-12.

Babar, M.E. and Javed, K. 2009. Non genetic factors effecting reproduction and growth traits of fine wool breeds. *J Agri. Sci.*, 34(3): 225-231.

Bohra, S.D.J. 1993. A note on wool production characteristics of fine wool breeds. *Livestock Advisor.*, 8(11): 27-28.

Dickson, W.F. and Lush, J.L. 1933. Inbreeding and the genetic history of the Rambouillet sheep. *American J. Heredity*, 24: 19–33.

Duguma, G., Schoeman, S.J., Cloete, S.W.P. and Jordaan, G.F. 2002. Genetic and environmental parameters for productivity in Merinos. *South Africa J. Ani. Sci.*, 32: 154-159.

Ekiz, B., Ozcan, M., Yilmaz, A. and Ceyhan, A. 2005. Estimates of phenotypic and genetic parameters for ewe productivity traits of Turkish Merino sheep. *Turkey J. Vet. Ani. Sci.*, 29: 557–564.

Ferda Koycegiz, Ebru Emsen, Carlos Alcibiades Gimenez Diaz and Muzeyyen Kutluca. 2009. Effects of Lambing Season, Lamb Breed and Ewe Parity on Production Traits of Fat Tailed Sheep and Their Lambs. *J. Ani. Vet. Adv.*, 8(1): 195-198.

Gabina, D.E., Urarte, Z.J., Arran, F., Arrese, and Sierra, I. 1990. Factors affecting variations in fertility of Lacha ewes. *Ani. Breed Abstract*, 59(3): 1799.

Gonzalez, L., Espejo, J.M., Diaz, A., Serranogarrido, and Avarez Martinez, J. 1986. Increasing lambing frequency by means of techniques for controlling the oestrus cycle in Merino and Merino × Romanov ewes. *Ani. Breed Abstract*, 55(8): 503.

Harvey, W.R. 1990. User guide for LSMLMW and MIXMDL package mixed model least squares and maximum likelihood computer programme. PC–2 version Mimeograph Columb, Ohio, USA

Hultz, F.S. and Hill, J.A. 1931. Range Sheep and Wool in the Seventeen Western States, Wiley New York.
Iniquez, L., Sanchez, U. and Ginting, S. 1991. Productivity of Sumatran sheep in a system integrated with rubber plantation. *Ani. Breed Abstract*, 61(11): 7574.

Jain R.S., Qureshi, M.I. and Joshi, S. 2000. Genetic studies on greasy fleece yield in Rambouillet sheep in the arid region of Rajasthan. *Indian Vet. J.*, 77: 317-320.

Jain R.S., Qureshi, M.I., Khan, F.H. and Tripathi, G.S. 2001. Factors effecting first fertile service in Rambouillet sheep. *Indian Vet. J.*, 78: 547-548.

Kabuga, J.D. and Akowuah, F. 1991. Reproductive performance of Djallonke × Sahel Crossbred ewes in Ghana. *Small Ruminant Res.*, 5(3): 245-254.

Kaul, S.K. 1979. Genetics of reproductive traits and their relationships with blood groups and body weight in Muzaffarnagri, Ph.D. Thesis, Agra University Agra.

Khan, M.A, Parvez, M., Rashid, S. and Faisal, M. 2002. Genetic and non genetic factors effecting reproductive performance of Rambouillet sheep. *Sarhad J. Agri.*, 22(4): 125-3138.

Kramer, C.R. 1957. Extension of multiple range tests to group correlated means. *Biometrics*, 13: 13-18.

Lehnherr, R. 1990. Population genetic analysis of reproductive traits in 4 Swiss breeds of sheep. *Ani. Breed Abstract*, 58(10): 6677.

Malik, R.C., Singh, R.N. and Mehta, B.S. 1978. Effect of season of birth on growth and subsequent reproduction in crossbred sheep. *Indian Vet. J.*, 55: 707-712.

Matos, C.A., Thomas, D.L., Gianola, D., Tempelman, R.J. and Young, L.D. 1997. Genetic analysis of discrete traits in sheep using linear and nonlinear models: I. Estimation of genetic parameters. *J. Ani. Sci.*, 75: 76–87.

Mokhtari M.S., Rashidi, A. and Esmailizadeh, A.K. 2010. Estimates of Phenotypic and Genetic Parameters for Reproductive Traits in Kermani Sheep. *Small Ruminant Res.*, 88(1).

Molina, A.L., Gallego, J.I., Perez, and Bernabeu, R. 1991. Growth of Manchega lambs in relation to body condition of dam season of birth, type of birth and sex. *Animal Breed Abstract*, 60(4): 2147.

Narayanswamy, M., Balaine, D.S. and Balbir Singh 1976. A note on studies of age at first lambing and lambing interval in Bannur (Mandya) sheep. *Indian J. Ani. Sci.*, 46(11): 4749.

Shaoqi Rao. 1997. Genetic Analysis of sheep discrete reproductive traits using simulation and field data. Ph.D Thesis of Virginia Polytechnic Institute and State University.

Shelton, M., Willingha, T., Thompson, P. and Roserts, E.M. 1991. Influence of docking and castration on growth and carcass traits of fat-tail Karakul, Rambouillet and crossbred lambs. *Small Ruminant Res.*, 4(3): 235-243.

Sinha, N.K. and Singh, S.K. 1996. Genetic and phenotypic parameters of body weights and wool yield in Muzzafarnagri sheep. National seminar on sheep and goat production and utilization, CSWRI Avikanagar Rajasthan. *Abstracts of Contributory Papers*, 2.

Tamu, D. 1980. Studies on reproductive performance of Russian Merino and Rambouillet ewes under semi-arid conditions of Rajasthan. Term Paper in Sheep Husbandry and Wool technology CSWRI, Avikanagar.

Trejo, G.A., Perez, P.Y., Gonzales, D.F. and Frey, S.E. 1990. Some production and reproductive parameters in Pellibuey ewes in a commercial flock at Chalma Mexico State. *Ani. Breed Abstract*, 59(1): 335.

How to cite this article:

Khan, N.N., N. Assad, Nishant Kumar, D. Chakraborty, Aadir Ayaz, Aarif Ali, Mashooq Ahmad Dar and Suheel Yousuf Wani. 2017. Non-Genetic Factors Effecting Reproduction Traits in Rambouillet Sheep. *Int.J.Curr.Microbiol.App.Sci.* 6(8): 3698-3704.

doi: [https://doi.org/10.20546/ijcmas.2017.608.446](https://doi.org/10.20546/ijcmas.2017.608.446)