Indian Journal of Animal Sciences **80** (4): 350–353, April 2010

Growth rate and wool production of Marwari lambs under arid region of Rajasthan

H K NARULA[1], AJAY KUMAR[2], M AYUB[3] and VIMAL MEHROTRA[4]

Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner, Rajasthan 334 006 India

Received: 23 April 2009;Accepted: 20 November 2009

ABSTRACT

Marwari breed, an important carpet wool producing sheep breed of India, is well adapted to harsh and erratic climatic conditions of hot arid region, and has capacity to cover large area during migration. The present study was conducted to evaluate growth and wool production of Marwari lambs in an organized farm under hot arid climate of Rajasthan. The data on 981 lambs born during 2004–07 were utilized for assessing production potential of Marwari sheep maintained at the Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner. The overall least squares means for birth, 3, 6, 9 and 12 months weight of lambs were 2.93±0.01, 15.88±0.09, 22.59±0.12, 28.22±0.11 and 30.44± 0.12 kg, respectively. The effects of sex, type of birth and year of lambing were highly significant on all the body weights. The improvement in the body weights at all stages was observed during the period under study. The overall least squares means for first and second six monthly greasy fleece weights were 596.93±5.48 and 675.43±7.46 g, respectively. The greasy fleece yield was significantly affected by year, type of birth and sex of lamb. The overall least squares means of fibre diameter, hetro fibres, hairy fibres, medullation, staple length and crimps were 33.56±0.26 μ, 36.00±0.70%, 17.66±0.43%, 53.66±0.85%, 5.15±0.05 cm and 0.66±0.01 per cm, respectively. It was concluded that there was an improvement in growth and wool production in the Marwari sheep due to selection programme being applied in the Network Project on sheep.

Key words: Average daily gain, Growth, Marwari sheep, Sheep, Wool yield, Wool quality

Marwari, an important carpet wool producing sheep breed having medium and coarse carpet wool, is widely distributed in Jodhpur, Jalore, Nagaur, Pali and Barmer districts of Rajasthan. This breed is well adapted to harsh and erratic climatic conditions of hot arid regions and has capacity to cover large areas during migration. Early expressed growth traits are very important economic traits and could be used for genetic improvement of traits. Better growth is essential for appropriate reproduction, production and survivability in sheep. Better growth rate and wool yield has direct relevance to sheep farmers because heavier lambs with high growth rate and high wool yield will lead to more economic returns to sheep farmers. Besides genetic merit, these traits are largely determined by non-genetic factors. Before planning and implementing a sheep breeding plan through selective breeding, it is necessary to evaluate factors affecting body weights and greasy fleece yields. Therefore, in the present study an attempt was made to evaluate the growth, wool yield, wool quality and factors affecting these traits in Marwari sheep at an organized farm under arid conditions of Rajasthan.

Present address: [1] Senior Scientist, (E mail hknarula @yahoo.co.in), [2] Scientist.

[3,4] Technical Officers, Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner.

MATERIALS AND METHODS

The data collected on 972 Marwari lambs born during 2004 to 2007 at the Central Sheep and Wool Research Institute, Arid Region Campus, Bikaner,Rajasthan, under the project entitled “Improvement of Marwari sheep for carpet wool production through selection (Network Project on Sheep Improvement)” were utilized for the present study. The climate of Bikaner is hot arid with normal rainfall of 200–240 mm. The lambs were maintained in groups under semi-intensive system of management with 8 h grazing per day. The lambs were allowed to suckle their dams up to 3 months of age. The suckling lambs were also fed concentrate mixture up to weaning and allowed to graze separately from their dams. The lambs were supplemented with 250– 300 g concentrate ration after weaning during various growth stages. These were offered green as well as dry fodder during lean period. The data were recorded for sex of lamb, date of lambing, dams’ weight at lambing and live body weights at birth, 3, 6, 9 and 12 months of age along with greasy fleece weights in first and second 6 monthly clips. Average daily weight gains of individual lamb during 0–3, 3-6 and 6–12

months were calculated. The animals were washed properly 48 h before shearing to remove dirt and dust from wool and for smoothening shearing of animals. All the animals were shorn twice a year, i.e. spring and autumn and shearing was carried out using scissors in March and August, respectively. The wool samples (588) were collected from the mid side region of the body of animals and analyzed for various fibre quality traits, viz. fibre diameter, hetro fibre, hairy fire, medullation, staple length and crimps. The breeding rams were selected on the basis of an index incorporating 6 months live body weight and first six monthly greasy fleece yields. The ewes were mated at random to the selected males. The data on growth traits and greasy fleece yields were classified according to year of lambing, sex of lambs and type of birth. The statistical analysis was carried out (Harvey 1990) to assess the impact of sex of lamb and year of lambing on body weights and average daily weight gains by taking year of lambing, sex of lamb and type of birth as fixed effect.

RESULTS AND DISCUSSION

Growth performance: The overall least squares means for live body weights at birth, 3, 6, 9 and 12 months of age are given in Table 1. The birth weight ranged between 2.98 and 3.07 kg. The 6 and 12 months body weights ranged between 20.58 to 24.84 and 28.20 to 33.08 kg, respectively. All the body weights were influenced significantly (P<0.01) by year of lambing. The year differences could be due to varying availability of feeds/fodders, physical environment and other management factors prevailing in different years. Though, efforts were made to ensure uniform feeding and management of the flock over the years, there were many such factors which were beyond the control of farm managers. To list a few such factors are wind velocity, rainfall, sunshine hours, minimum and maximum temperatures, types of grasses predominant across different months of year, growth of pasture, incidence of certain diseases etc. In addition to this, continuous selection and culling process also created differences in performance. On account of genetic/other factors such as selection of rams for breeding, culling of old and inferior stock and flock strength across different months of year and age composition of flock at different intervals due to overlapping generations, there could be variations in growth and other performance traits. The weight gain/day from birth to 3 months, 3 to 6 months, 6 to 12 months was observed to be 143, 75.14 and 40.77 g, respectively. Comparatively, lower body weights at birth, 3, 6, 9 and 12 months were reported by Nehra and Singh (2006). The significant influence of year of birth on all the body weights at different stages was reported by Narula *et al.* (2007) and Dass *et al.* (2008). The average daily gains during 0–3, 3-6 and 6–12 months ranged from 128.67 to 156.13 g, 66.94 to 89.90 gm and 28.71 to 50.67 g, respectively. The growth performance showed an increasing trend with slight fluctuations. The 6 and 12 months body weights improved from 21.07 kg 24.84 kg and 28.2 kg to 30.63 kg, respectively.

Sex of lambs had significant effect on all the body weights at different ages and various average daily gains (Table 2). Males were significantly heavier than females at all the stages of growth and it may be due to differences in physiology of two sexes. The findings are in agreement with those reported by Nehra and Singh (2006), Narula *et al.* (2007), Dass *et al.* (2008) and Narula *et al.* (2009).The birth, weaning, 6, 9 and 12 months weights in males were 4.18, 12.44, 19.10, 17.53 and 20.02%, respectively, higher than females. Besides the effects of sex hormones and other physiological factors, differences in body weights of male and female lambs/ hoggets could be due to differential culling rates as more number of males was culled after the hogget stage while

Table1. Least squares means for live body weights (kg) at different ages in Marwari sheep

Trait/Effect	Birth wt	3 M wt	6 M wt	9 M wt	12 M wt
Overall mean	2.93±0.01 (981)	15.88±0.09 (972)	22.59±0.12 (946)	28.22±0.11 (743)	30.44±0.12 (643)
Sex	**	**	**	**	**
Male	2.99±0.02 (511)	16.81±0.11 (504)	24.56±0.15 (486)	30.50±0.14 (375)	33.21±0.17 (298)
Female	2.87±0.02 (470)	14.95±0.11 (468)	20.62±0.15 (460)	25.95±0.15 (368)	27.67±0.16 (345)
Year	**	**	**	**	**
2004	2.98±0.03 (271)	15.38±0.15 (271)	21.07±0.20 (269)	26.43±0.18 (222)	28.20±0.21 (192)
2005	2.75±0.04 (102)	17.18±0.23 (99)	23.87±0.29 (97)	31.74±0.31 (77)	33.08±0.33 (77)
2006	2.92±0.02 (307)	14.36±0.13 (303)	20.58±0.16 (295)	25.70±0.18 (217)	29.83±0.20 (214)
2007	3.07±0.02 (301)	16.61±0.13 (299)	24.84±0.18 (285)	29.02±0.18 (227)	30.63±0.23 (160)
Type of birth	**	**	**	**	**
Single	3.28±0.02 (765)	17.05±0.09 (761)	23.68±0.11 (740)	28.53±0.12 (591)	30.73±0.13 (509)
Twin	2.59±0.023(216)	14.71±0.16 (211)	21.51±0.21 (206)	27.05±0.23 (152)	29.27±0.26 (134)
Regression coefficient of DWts at lambing average	**0.041±.003 32.24±3.97	**0.281±0.020 32.25±3.96			

DWt,Dams' weight at lambing, ** significant (P<0.01),figures in parentheses are number of observations.

Table 2. Least squares means for average daily gains (g) in different periods

Particulars	ADG 1 (0–3 M)		ADG 2 (3-6 M)		ADG 3 (6–12 M)	
	Number	Mean	Number	Mean	Number	Mean
Overall mean	972	143.41±1.01	940	75.14±1.04	637	40.77±0.64
Sex		**		**		**
Male	504	153.06±1.26	484	86.36±1.30	293	44.01±0.83
Female	468	133.68±1.27	456	63.93±1.31	344	37.53±0.77
Year		**		**		**
2004	271	130.82±2.06	263	64.06±1.73	186	35.80±1.06
2005	99	156.13±2.44	97	79.68±2.51	77	48.52±1.44
2006	303	128.67±1.39	295	66.94±1.43	214	50.67±0.85
2007	299	150.29±1.46	285	89.90±1.51	160	28.71±1.03
Type of birth		**		NS		**
Single	761	152.14±2.06	735	74.17±0.97	503	38.63±0.58
Twin	211	134.69±1.73	205	76.12±1.79	134	42.91±1.12

females were retained to replenish the fertility of stock through replacement of older ewes with younger and genetically superior ones. Selection intensity in males is much higher than females. Type of birth had significant effect (P<0.01) on all the body weights. Single born animals were heavier than twin born animals at all the stages of growth. The single born animals were heavier by 26.66, 15.90, 10 and 4.98% at birth, 3, 6 and 12 months, respectively. The differences in the body weights were higher at initial stage than later stages.

Regression of dam's weight at lambing was found highly significant on birth and 3 months weight. The results indicated that if dam is heavier at lambing then its lamb will also be heavier at birth and subsequent ages. The higher birth weight of heavier lambs may be due to body conditions of dam during pregnancy and lactation, which in turn resulted into healthy and heavier lambs. Sharma *et al.* (2003), Narula *et al.* (2007) and Dass *et al.* (2008) also found similar trend of regression of dams weight at lambing on birth and weaning weights of lambs.

Wool yield: The overall least squares means for first greasy fleece yield and second 6 monthly greasy fleece yields were 596.93 and 675.43 g, respectively (Table 3). In contrast to body weights, the female lambs produced more fleece than males. This may be due to higher primary and secondary follicles in females and also because of higher staple length and crimps in females. The lower values of clips yields were reported by Dass *et al.* (2008) in Marwari sheep. The influence of year and type of birth was significant (P<0.01) on first and second 6 monthly greasy fleece yield (GFY). The significant influence of year and sex was also reported by Dass and Singh (2002) and Dass *et al.* (2008). As far as type of birth is concerned, the single born lambs produced more clip yield than twin born lambs which was upto 4.7%. The wool yield of both clips improved over the years with slight fluctuations. The first clip and second six monthly greasy fleece yield improved by 20.17 and 18.14%, respectively, in 2007 (as compared to 2004). Still, there is scope of improvement in greasy fleece yield by introducing more genetic variability and introducing new sire lines in the flock.

Table 3. Least squares for different wool (g)

Particulars	First clip		Second clip	
	Number	Mean	Number	Mean
Overall mean	951	596.93±5.48	590	675.43±7.46
Sex		**		**
Male	493	597.47±6.98	241	635.59±10.58
Female	458	596.39±7.32	349	715.27±8.90
Year		**		**
2004	271	521.89±9.24	184	569.85±12.20
2005	96	622.68±13.3	76	699.87±16.53
2006	295	615.96±7.93	172	758.77±10.83
2007	289	627.19±8.15	158	673.25±11.69
Type of birth		**		**
Single	744	603.50±5.16	472	690.94±6.79
Twin	207	590.36±9.51	118	659.92±13.17

First clip, first six monthly greasy fleece yield;second clip, second six monthly greasy fleece yield.

Wool quality: The overall least squares means for fibre diameter, hetro fibres, hairy fibres, medullation, staple length and crimp were 33.56±0.26 μ, 36.00±0.70%, 17.66±0.43%, 53.66±0.85%, 5.15±0.05 cm and 0.66±0.01 per cm, respectively (Table 4). Comparatively lower fibre diameter and medullation% were reported by Dass *et al.* (2008) in Marwari breed. All the wool quality traits were significantly affected by year of lambing except medullation%. The significant effect of year on these traits was also reported by Dass and Singh (2002) and Dass *et al.* (2008). The staple length varied between 4.92 and 5.42 cm and this fulfills the requirement of carpet industry for making good quality carpets. The difference in wool quality parameters in different years may be due to availability of varying levels of feeds

Table 4. Least squares means for wool quality attributes of Marwari sheep

Effect/trait	Fibre diameter (μ)	Hetro fibre(%)	Hairy fibre(%)	Medullation (%)	Staple length (cm)	Crimp(/cm)
Overall Mean	33.56±0.26 (588)	36.00±0.70 (588)	17.66±0.43 (588)	53.66±0.85 (588)	5.15±0.05 (558)	0.66±0.01 (558)
Sex	**	NS	NS	*	**	**
Male	34.67±0.28 (385)	37.29±0.77 (385)	18.24±0.48 (385)	55.54±0.94 (385)	4.85±0.05 (385)	0.59±0.02 (385)
Female	32.44±0.43 (203)	34.70±1.16 (203)	17.08±0.72 (203)	51.79±1.40 (203)	5.46±0.08 (203)	0.73±0.03 (203)
Year	**	**	**	NS	**	*
2004	34.56±.49 (141)	37.56±1.30(141)	18.31±.79 (141)	55.87±1.64 (141)	5.19±.07 (141)	0.39±.02 (141)
2005	34.86±0.46 (121)	31.24±1.25(121)	22.89±0.77 (121)	54.14±1.52 (121)	5.42±0.08 (121)	0.62±0.03(121)
2006	31.80±0.37 (183)	37.79±1.01(183)	14.72±0.62 (183)	52.52±1.22 (183)	5.12±0.07 (183)	0.72±0.02(183)
2007	34.01±0.44 (143)	38.95±1.19(143)	15.37±0.74 (143)	54.33±1.44 (143)	4.92±0.09 (143)	0.65±0.03(143)

and fodders in terms of quality and quantity during different years. The influence of sex was significant on fibre diameter, medullation%, staple length and crimp per cm. The males were coarser in wool quality as compared to females as indicated by higher fibre diameter. The wool quality parameters indicated suitability of fibres produced by Marwari sheep for use in carpet industry. The percentage of hairy fibres should be between 10 and 15% for quality and life of carpets. So, there is need to further reduce medullation percentage and hairy fibres to establish this breed as best carpet wool breed of arid region.

It is concluded from the present study that despite high temperature, poor humidity and low rainfall resulting in reduction of vegetation in pasture land and causing physiological stress to the animals this breed performs well. At present Marwari breed is superior to majority of the indigenous carpet wool producing breeds in body weights and wool quantity. The quality of wool is also suitable for medium quality carpets. Hence it can be used for genetic improvement programmes in the farmers flocks located in the breeding tract of Marwari sheep.

ACKNOWLEDGEMENTS

Thanks are due to the Director of CSWRI and Head, ARC Bikaner, for providing necessary facilities and cooperation during the course of this study.

REFERENCES

Dass G and Singh V K. 2002. Improvement of Marwari sheep in hot arid climate. *Indian Journal of Animal Sciences* **72**: 253–56.

Dass G, Sharma P R and Mehrotra V. 2008. Production performance of Marwari lambs under hot arid region of Rajasthan. *Indian Journal of Animal Sciences* **78**: 117–20.

Harvey W R. 1990. Mixed Model Least Squares' and Maximum Likelihood Computer Programme PC–2 version. Ohio State University, USA.

Narula H K, Dass G, Sharma, P R, and Mehrotra, V. 2007. Impact of selection on growth and reproductive performance of Marwari sheep in arid region of Rajasthan. Abstracts. *National Symposium on Recent trends in technological interventions for rural prosperity in small holder livestock production systems*.College of Veterinary Science, Tirupati from 20–22 June, 2007, pp 49.

Narula H K, Dass G, Sharma P R and Mehrotra, V. 2009.Growth performance and survivability of Marwari lambs in an organized farm. *National Symposium on Livestock Biodiversity Conservation and Utilization: Lessons from Past and Future Perspectives*.NBAGR, Karnal from 12–13, February, 2009, pp 167.

Nehra K S and Singh V K. 2006. Genetic evaluation of Marwari sheep in arid zone: Growth. *Indian Journal of Small Ruminants* **12**: 91–94.

Sharma M K, Sharma N K, Singh V K and Beniwal B K. 2003. Genetic evaluation of Nali and Marwari sheep in arid zone of Rajasthan. *Indian Journal of Small ruminants* **9**: 65–68.