

Genetic trends for performance traits of Malpura sheep

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Received: 11 October 2009; Accepted: 20 May 2010

Key words: Environmental trend, Genetic trend, Malpura Sheep, Phenotypic trend

Malpura sheep is one of the heaviest sheep breeds of India, known for its adaptability to the harsh environment and potential for high meat production. The evaluation of genetic trend gives an indication of breed direction as well as the rate of genetic improvement since the application of the breeding programme (Bosso *et al.* 2007). Estimation of genetic trends over time is problematic because of the difficulty in conducting experiments in uniform conditions over a period of several generations, so that changes in performance of a selected population may reflect, in part, both environmental and genetic changes (Shaat *et al.* 2004). Theoretically it is possible to simultaneously maintain a control population to remove the influence of environmental change but this could prove expensive especially over a long period of time. Genetic trends for lamb performance traits in Malpura sheep have not been examined. The objectives of this study were to estimate genetic trend for different performance traits in Malpura sheep.

Data and management: The data for this study represents a total of 1882 Malpura lambs, progeny of 106 sires. Data available for the analysis were collected from the breeding flock of Malpura sheep maintained at the CSWRI, Avikanagar. The 6 different economic traits used for the analysis were birth weight (BWT), weaning weight (3WT), 6 month weight (6WT), 9 month weight (9WT), 12 month weight (12WT) and first greasy fleece yield (GFY). Data were collected over the years 1998 to 2007. The flock was a closed type where 250 breeding females were maintained during each year. 10 to 15 sires were used per year for breeding. Active selection was practiced for males. Top ranking males were selected on the basis of index involving 6WT and GFY for breeding. All the animals in this flock were kept under semi-intensive management system. Animals were treated in same way in both the seasons with respect to management and concentrate supplementation.

Statistical analysis: The phenotypic, genetic and environmental trends were estimated by the methods

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developed by Smith (1962). The phenotypic trend was estimated as the regression of population performance on time. To eliminate the effect of year to year fluctuations in the environment, each record was expressed as deviation from the contemporaries. These records were then used to obtain the genetic trends which were computed as twice the pooled intrasire regression of the performance of the sire progeny on time ($-2b(P-S)T$). The environmental trend was computed as the difference between the phenotypic and the genetic trends, i.e. $(b_{PT}-2(b_{PT}-b_{ST}))$. Standard errors were estimated for all the trends by using square roots of the variance of the genetic gain.

Least squares means along with their standard errors for various traits taken under study for BWT, 3WT, 6WT, 9WT, 12WT and GFY were 3.00 ± 0.01 , 13.53 ± 0.07 , 20.54 ± 0.09 , 23.68 ± 0.11 , 27.19 ± 0.12 and 0.590 ± 0.005 kg, respectively (Table 1). Results agree with earlier estimates by Mishra *et al.* (2009). Variance for the traits was increasing with the increase in age of the animals. Lowest variance was found for birth weight (0.29), whereas highest variance was found for 9WT (21.69). Very low variance was also observed for the GFY. Range for most of the traits was extensive. This reflects the scope for selection of lambs towards higher range of economic traits.

There was overall improvement in all the traits over the years, however, the improvement in these traits is not consistent (Fig. 1). There were major fluctuations in the performance of lambs for these traits. Since year 1998, there

Table 1. Descriptive statistics for performance traits of Malpura sheep

Trait	Mean $\pm$ SE (kg)	Range (kg)	Variance
BWT	3.00 $\pm$ 0.01 (1882)	0.80–4.80	0.29
3WT	13.53 $\pm$ 0.07 (1735)	4.00–22.80	10.11
6WT	20.54 $\pm$ 0.09 (1622)	7.80–36.00	17.68
9WT	23.68 $\pm$ 0.11 (1357)	9.50–42.00	21.69
12WT	27.19 $\pm$ 0.12 (1165)	15.30–42.60	19.72
GFY	0.590 $\pm$ 0.005 (1737)	0.08–2.04	0.044

Numbers in parentheses are the number of observations.

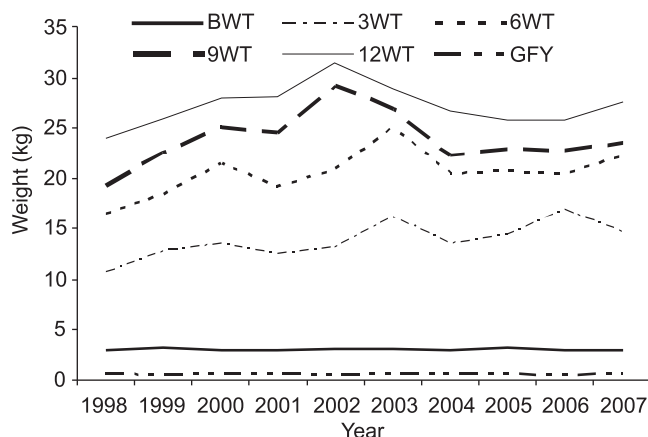


Fig. 1. Year-wise performance for different economic traits of Malpura sheep.

has been consistent linear upward progress in majority of the traits. This trend continued up to year 2002 for 12WT and 9WT and 2003 for 6WT and 3WT. After attaining the peak in performances during these years, decline was observed up to year 2004 in the production traits of Malpura sheep. This decline was also not constant and it took upward turn in the year 2005 till end. However, in all the production traits there was overall increase in the magnitude, irrespective of the ups and downs in between. Significant year differences can be attributed to the variation in rainfall and temperature during the course of study.

Genetic trends: The estimates of annual rates of genetic progress for all the growth traits were positive. For birth weight the genetic gain was nonsignificant over the period of study, and there was very low genetic improvement in birth weight. However, the genetic trend was significant for all the body weight traits from weaning (3WT) to 12 month weight. It is evident that selection of Malpura rams for body weight gain was effective in the flock and in right direction. Annual rates of genetic progress for 3WT, 6WT, 9WT and 12WT were 0.58, 0.61, 0.95 and 0.46 kg, respectively (Table 2). These estimates provide a very good picture of the selection programme for Malpura sheep as far as body weight traits are concerned. The genetic trend was non-significant for the GFY (0.007 kg). There is a need for reviewing the ongoing breeding programmes for the Malpura

sheep. Few long-term experiments involving selection for growth rate alone have been carried out in sheep. An estimate of 0.620 kg annually for genetic trend of 90 days lamb weight was reported by Lax *et al.* (1979). Shrestha *et al.* (1996) estimated genetic trends for Canadian sheep in birth weight and at 91 days of age as 0.013 and 0.023 kg/year in Suffolk and 0.007 and 0.025 kg/year in Finnsheep, respectively. Estimates of genetic change per year for 6WT were positive for Ossimi and Rahmani sheep by Shaat *et al.* (2004). Mokhtari and Rashidi (2010) also reported positive and significant genetic trends in Kermani Sheep for Birth weight ($P < 0.05$), 3WT, 6WT, 9WT and 12WT ($P < 0.01$) and were .002, 0.125, 0.091, 0.081 and 0.156 kg per year, respectively. These results are in agreement with estimates obtained in this study. On the other hand, a negative estimate of annual rate of genetic response (-0.136 kg) in the Indian Avivastra sheep for 180-day weight was reported by Singh and Dhillon (1991).

Phenotypic trends: The estimates of phenotypic trends were positive for all the traits. It was nonsignificant for BWT and GFY, indicating no phenotypic gain in these traits over the period of study. Phenotypic trend was low for 9WT and 12WT too, however, it was significant and high for weaning weight and 6 month weight. Singh and Dhillon (1991) reported a decline in phenotypic trend for GFY and 6WT in Avivastra sheep.

Environmental trends: The estimates of all the environmental trends for Malpura sheep were negative. There was significant and high environmental trend (negative in direction) for weight traits from weaning to 12WT. This indicates that in spite of favourable selection programmes and selecting elite rams in each generation, the desired results were not obtained in the breeding programmes. Year to year fluctuation of the rainfall, temperature, and availability of the feed and fodder resources and above all different managerial practices during the course of study contributed heavily for the negative environmental trends in the performance traits of the Malpura sheep.

All the efforts towards improving the Malpura sheep as a good quality mutton type sheep did not bring the desired results due to negative impact of the environment on the production potential of the animals. The negative trend of the environment must be restricted immediately so as to have good results of selection for favourable traits. Though it is not possible to control climatic variable but through consistent good management practices over the year animals can be insulated from negative impact of environment leading to enhanced performance of the flock and consistent trend in production traits.

ACKNOWLEDGEMENTS

Authors acknowledge the contribution of Shri Ashok Kumar Prasad (T-4) and Shri M L Jangid (T-6) for data management. Support provided by the Director, CSWRI for

Table 2. Genetic, phenotypic and environmental trends for performance traits of Malpura sheep

Trait	Genetic trend	Phenotypic trend	Environmental trend
Birth weight	0.06 ± 0.007	0.00 ± 0.004	-0.07 ± 0.0008
3 M weight	0.58 ± 0.046	0.31 ± 0.026	-0.27 ± 0.053
6 M weight	0.61 ± 0.07	0.37 ± 0.037	-0.24 ± 0.08
9 M weight	0.95 ± 0.11	0.07 ± 0.04	-0.88 ± 0.12
12 M weight	0.46 ± 0.11	0.03 ± 0.04	-0.42 ± 0.12
GFY	0.007 ± 0.003	-0.001 ± 0.001	-0.008 ± 0.004

execution of the project is deeply acknowledged.

SUMMARY

Genetic trends for lamb's economic traits (body weight traits and first greasy fleece yield) were studied on a total of 1882 Malpura lambs being progeny of 106 sires obtained over 10 year period (1998–2007). The estimates were obtained as twice the pooled intra-sire regression of the sire progeny performance on time, each record expressed as a deviation from the contemporary averages. Genetic trends were positive for all the traits. Highly significant trend was observed for weight at weaning (3 month) to 12 month weight. Genetic trends for birth weight, weight at 3, 6, 9, 12 month and for first greasy fleece yield were 0.06, 0.58, 0.61, 0.95, 0.46 and 0.08 respectively. Environmental trends were negative for all the traits under study, thus limiting the phenotypic expression for production traits in Malpura lambs. Selection was effective for bringing out desired genetic improvement in the flock, however, there is urgent need to insulate the flock against environmental fluctuations.

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