LIFETIME LAMB PRODUCTION OF NILAGIRI EWES

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ABSTRACT

The reproductive rate and lifetime productivity of ewes of Nilagiri sheep was assessed as a trait of ewe and expressed in terms of number of lambs produced (TLB), number of lambs weaned (TLW) and total weight weaned (TWW). Data from 2146 lambing records of Nilagiri ewes born during the period from 1978 to 2001 were analyzed. The mean number of lambs born per ewe during their lifetime varied from 3.69 ± 0.14 to 5.08 ± 0.36 for the different periods with an overall mean of 4.59 ± 0.12. The differences in total lambs born between the periods is significant (P<0.01). For the trait of TLW, the means for different periods varied form 2.65 ± 015 to 4.60 ± 015 and the overall mean was 3.42 ± 0.12. Higher weaning percentage were recorded in earlier years than in recent years of the study period and the differences in weaning percentage between periods was significant (P<0.01). The total weight weaned (TWW) ranged from 26.77 ± 1.50 to 45.95 ± 3.67 kg. The overall mean for this trait was 32.86 ± 1.19 kg. The heritability estimate for the reproductive traits were 0.377 ± 0.201(TLB), 0.505 ± 0.215 (TLW) and 0.537 ± 0.218 (TWW).

Key words: Nilagiri sheep, Lifetime ewe productivity traits, number of lambs produced, number of lambs weaned, total weight weaned.

INTRODUCTION

The term reproduction rate in sheep, described previously as the number of ewes lambed per ewe joined (fertility) and /or number of lambs born per ewe lambed (prolificacy) is presently being reported as a composite character after factorizing several components of reproduction in to it. Ewe productivity, which also encompasses the reproduction rate, is measured by a composite character 'total weight weaned per ewe' (TWW). Number of lambs born (Ewe prolificacy) accounted for approximately 37 percent of the genetic improvement in total weight weaned (Ercanbrack and Knight, 1998). The weighted mean genetic correlation between total weight weaned and number of lambs born (TLB) was 0.60 and between total weight weaned and number of lambs weaned (TLW) was 0.80 (Snowder and Fogarty, 2009). Selection for such a trait is expected to bring more benefit to ewe productivity than selection for a single component trait of reproduction (Vanimisetti et al., 2007; Snowder and Fogarty, 2009).

The Nilagiri sheep is one among a few fertile sheep in India with good fecundity characteristics (Saravanan, et al., 2020), was earlier reported in terms of net reproduction rate and age specific replacement rate (Mohan *et al*., 1986). Hence the present study was carried out to assess the reproductive rate of Nilagiri sheep in terms of lifetime lamb produced and total weight weaned per ewe and their heritability.

MATERIALS AND METHODS

The data from 2146 lambing records of Nilagiri ewe lambs born at Sheep Breeding Research Station, Sandynallah were used for this study. Among the 1278 ewe lambs born, 1169 had been weaned and 766 had reached the joining age of 18 months. As there was continuous removal of ewes from the flock after joining, due to culling and death, those ewes whose culling age or survival age was five years or more than five years were alone included for the analysis of lifetime productivity. All these ewes had almost completed their lifetime when the analysis was taken up.

The recording of fertility and prolificacy data were similar to the one reported by Afolayan *et al*. (2008). In the fertility analysis ewes that lambed were recorded as 1 and ewes that failed to lamb were noted as 0. In the prolificacy analysis ewes that had not lambed were not included in the analysis. The lamb survival, expressed as number of lambs weaned per lamb born, was recorded as 1 if the lamb had survived for 90 days and its weight had been recorded. The weaning weight was taken as a trait of the ewe with recording of weaning weight of individual lambs.

Independent analysis was carried out with two sets of data. The first set of data came from 16 birth years of lambs from 1981 to 1996. The years were

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grouped in to four periods (Period 1 to 4) of four years each. For this analysis 407 ewes with multiple lambing records were available. In the preliminary analysis (Harvey, 1990) the effect of sex on weaning weight was found to be significant (P<0.01). Hence the weaning weight of the individual lambs was corrected for sex effect. The periods were taken as fixed effects. The weight weaned by a ewe in each of her lambings was reckoned as the total weight weaned (TWW) using the sex corrected data. The number of lambs produced by a ewe in her lifetime (TLB) and number of lambs weaned by a ewe were also arrived by summing over all the lambings of a ewe.

The heritability of the traits TLB, TLW and TWW were analyzed by mixed model least squares programme (Harvey, 1990) for the first set of data. Form this data set. Sires with less than four different ewe records were dropped. 286 sire records were available for this analysis.

The second set of data pertains to the years from 1979 to 2001. This data was utilized to study the effect of the year of birth, birth type of ewes and the culling/survival age of ewes on the total number of lambs born per ewe (TLB) and total weight weaned per ewe (TLW). The year, birth type and survival age were considered as fixed effects in the analysis. The age of ewe at first lambing was included as a covariate. The number of ewes available during the years 1979 to 1988 was very small due to diversion of Nilagiri ewes for a crossbreeding programme that ran concurrently during these years. A total of 502 ewes with multiple lambing records were available for this analysis.

RESULTS AND DISCUSSION

The least squares mean and their standard errors for data set-1 were furnished in table-1. The least squares mean and their standard errors for data set- 2 were given in table-2.

In data set 1, the mean number of lambs born per ewe during their lifetime varied from 3.69 ± 0.14 to 5.12 ± 0.22 for the different periods with an overall mean of 4.59 ± 0.12. The Nilagiri ewes are fertile sheep with an annual twinning rate of 10 -12 per cent. There is a possibility of a major gene influencing the fertility rate in this breed (Saravanan *et al.*, 2020). Nilagiri sheep is adapted to a temperate climate and are under a strong influence of photoperiodism. The breeding season is regulated and during the non-breeding season the males are separated from the females. The ewe lambs are first put to breeding at 18 months of age. Under these conditions, a lifetime production level of 4 to 5 lambs is considered optimum. The TLB was higher than Malpura ewes (3.26 ± 0.13) and is similar (5.47 ± 0.44) to the TLB in Garole Malpura cross ewes (Mishra *et al.*, 2009). The differences in total lambs born between the periods is significant (P<0.01). The effect of year on litter size were reported by (Taye et al., 2011) in tropical Ethiopian breed. For the trait of TLW, the means for different periods varied form 2.65 ± 015 to 4.60 ± 015 and the overall mean was 3.42 ± 0.12. Higher weaning percentage were recorded in earlier years than in recent years of the study period and the differences in weaning percentage between periods was significant (P<0.01).

The total weight weaned (TWW) ranged from 26.77 ± 1.50 to 45.95 ± 3.67 kg. The overall mean for this trait was 32.86 ± 1.19 kg. The differences in total weight weaned between the periods were highly significant (P<0.01). Nilagiri ewes are medium sized with adult body weight ranging from 28 to 35 kg. The ewes lambing during the spring season has to traverse through a period of fodder inadequacy during the summer months. Hence, they always wean lambs of lower body weight. Anilkumar *et. al.* (2011) reported a mean weaning weight of 9.02 ± 0.31 kg for Nilagiri lambs.

In the analysis of data set 2, the overall least squares mean was 3.42 ± 0.12 (numbers) for TLW and was 32.86 ± 1.19 (kg) for TWW. The TLW was slightly higher than Malpura ewes (3.13 ± 0.13) and is less than (5.47 ± 0.44) the TLW in Garole Malpura cross ewes (Mishra *et al.*, 2009). The ewe productivity in terms of number of lambs born in their lifetime varied from 4.17 ± 0.54 to 6.11 ± 0.55 and the total weight weaned per ewe, varied widely between the years with estimates of 25.82 ± 3.30 kg for the ewe birth year 1992 to 53.03 ± 5.35 kg for the ewes born during the year 1988. Taking in to consideration that the ewes were expected to produce one lamb per year and the first lamb drop is at two years, the number of lambs born per ewe corresponds with the survival age (survival age minus two), in the respective group of ewes. The differences between years in number of lambs born were not significant. But the differences in total weight weaned between the ewes of different birth years were significant (P<0.01).

The birth type of ewes had significantly (P<0.01) affected the lifetime productivity of lambs by the ewes. The ewes born as single had produced a mean number of 4.68 ± 0.12 lambs and those born as twin, had produced a mean number of 5.58 ± 0.19 lambs. The results are in concurrence with the report of Gonzalez *et.al*. (1986), observed a higher lambing rate of 7.5 per cent in twin born ewes than single born ewes in Corriedale sheep. Basuthakur *et al.* (1973) and Pettigrew *et al.* (2019) reported that ewes born as singles produced less lamb in their lifetime than ewes born as twin in Columbia, Targhee and Romney ewes. However, Loureiro *et al.*, (2016) found no difference in pregnancy rate, number and weight of lambs weaned, for ewes born as either singles or twins. Twin born ewes weaned more

weight than ewes born as singles even though the differences were not significant (P>0.05).

As the culling or survival age of ewes increased from 5 to 9 years, 0.5 to 1.1 lambs were added per year of survival with the mean lamb productivity of 3.51 ± 0.20, 4.45 ± 0.16, 4.91 ± 0.15, 6.01 ± 0.17 and 6.76 ± 0.39 respectively for the ewes of age 5, 6, 7, 8 and 9 years. The differences in the number of lambs produced between the age groups were significant (P<0.01). However, Pettigrew et al. (2019) observed no effect (P>0.05) of dam age group on lifetime total progeny weaning weight. Akta *et al*., (2015) observed in Anatolian Merino ewes that average number of lambs weaned per ewe joined increased with the age of the ewes, even up to 8-9 years. Retaining high performing ewes longer in the breeding flocks were suggested as a measure to improve reproduction rate in Merino ewes (Lee *et al*., 2009). Aliyari *et al*. (2012) also reported positive relationship between longevity and lifetime production efficiency.

The heritability estimates for all the three reproductive traits analyzed were very high (Table-3) with large standard errors in comparison to the reported heritability estimates. Vanimisetti *et al*. (2007) reported heritability estimates of 0.12, 0.09 and 0.12 for number of lambs born, number of lambs weaned and total litter weigh weaned. Low heritability estimate (0.13) for litter size has also been reported by Casellas *et al*. (2007). The flock under study has been under a long-term selection scheme for body weight at six months of age of the lambs. The flock is responding to selection as reflected by an increase in the average breeding value of the flock over the years. The present data reflects optimum performance for the traits analyzed. Selection for the composite trait of weight weaned should add additional response to the weaning weight.

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Table-1 : Least squares means ± SE for ewe productivity traits in Nilagiri sheep (data set -1)

Trait	Number of ewes	TLB (Number)	TLW (Number)	TWW (kg)
μ	407	4.59 ± 0.12	3.42 ± 0.12	32.86 ± 1.19
Effect*		(P<0.01)**	(P<0.01)**	(P<0.01)**
Period 1	25	5.08 ± 0.36	4.60 ± 0.38	45.95 ± 3.67
Period 2	68	5.12 ± 0.22	3.24 ± 0.23	31.22 ± 2.23
Period 3	150	4.47 ± 0.15	2.65 ± 0.15	26.77 ± 1.50
Period 4	164	3.69 ± 0.14	3.20 ± 0.15	27.50 ± 1.43

** - significant

Table-2 : Least squares means ± SE for ewe productivity traits in Nilagiri sheep (data set -2)

Effects	Number of ewes	TLB (Number)	TWW (kg)
μ	502	5.13 ± 0.13	37.48 ± 1.27
Year of birth**		(P>0.05) ^{NS}	(P<0.01) **
Birth type*		(P<0.01) **	(P>0.05) ^{NS}
Single	413	4.68 ± 0.12	36.74 ± 1.14
Twin	89	5.58 ± 0.19	38.76 ± 1.82
Survival age*		(P<0.01) **	(P<0.01) **
5	66	3.51 ± 0.20	26.50 ± 1.93
6	150	4.45 ± 0.16	31.83 ± 1.54
7	162	4.91 ± 0.15	35.65 ± 1.48
8	109	6.01 ± 0.17	44.02 ± 1.61
9 and above	15	6.76 ± 0.39	50.74 ± 3.80

*S- significant *NS – Non-significant ** - Means for years not presented.

Table 3. : Heritability of ewe productivity traits

Trait	Heritability estimates
TLB	0.377 ± 0.201
TLW	0.505 ± 0.215
TWW	0.537 ± 0.218