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Research Article

EVALUATION OF F_1 AND F_2 CROSSES OF NALI WITH CORRIEDALE AND RUSSIAN MERINO SHEEP FOR GROWTH AND WOOL TRAITS

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ABSTRACT

The data recorded on Nali purebreds F_1 (MN, CN) and F_2 (MNMN, CNCN) genetic groups produced by mating sires of Corriedale and Russian Merino with Nali ewes maintained at Animal Breeding farm of University and were analyzed for body weight, daily gain during growing period and wool traits. Least squares means were estimated after correcting the data for the significant environmental effects like year, season, sex and weight at lambing using a linear fixed model. Among the crossbreds, per cent improvement was found to be more in MN crossbreds for all growth and wool traits except birth weight over Nali than the CN crossbreds except for grease fleece weight. Similar trend of improvement was observed for F_2 of MN and CN crossbreds. No decline in the performance of F_2 over F_1 generation was observed for all the traits.

Key words: Crossbred, synthetic population, heterosis, gene action

Crossbreeding of indigenous breeds with exotic breeds have been used as one of the tool for genetic improvement in the economic traits. Crossbreeding allows to make use of heterosis for both maternal and offspring components of performance. In crossing different breeds, heterosis effects can appear. In secondary crossbred generations such as backcrosses and F_2 generations and crosses with more than two breeds, epistatic effects may be of further importance.

Nitter (1978) reviewed the critical experiments to evaluate the possible importance of recombination effect in sheep. He further, observed a tendency of F_2 versus F_1 comparison to give higher estimates of heterosis for most maternal traits and the compared to F_1 versus parental mean. This study describes the comparison of F_1 and F_2 crosses of two exotic breeds of sheep (Merino, Corriedale) with the native Nali simultaneously for production and wool traits.

MATERIALS AND METHODS

The data on growth and wool production traits were collected from 1980 to 1996 on the native Nali, F_1 crossbreds of Corriedale and Merino rams with Nali ewes (MN, CN) and compared to their inter-se mating (F_2 – MNMN, CNCN) maintained at Animal Breeding farm of University. The growth and wool quality traits under similar management and environmental conditions were evaluated for the genetic groups produced under study. The native purebred and crossbred rams retained for breeding were selected on the basis of six months body weight with due emphasis on fleece quality. The data on birth weight, weaning weight, six month and yearling weight, average daily weight gain from birth to weaning and from weaning to six months age, grease fleece weight at first clip, staple length, average fibre diameter and medulation percentage were recorded on individual animals of each genetic group. The least squares means and standard errors of the various genetic groups were obtained for all the traits using the following linear model as per Harvey (1966).

$$Y_{ijklm} = \square + G_i + S_j + P_k + T_l + b\,(X_{ijklm} - \overline{X}) + e_{ijklm}$$

Where

Y_{ijklm} is the observation on the mth lamb of kth genetic group, j^{th} sex born in i^{th} season of lth year

$\square$ is population mean

G_i is the effect of ith season of lambing (i = 1, 2)

S_j is the effect of jth sex (j =1, 2)

P_k is the effect of kth genetic group (k= 1, 5)

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T_l is the effect of lth year (l = 1, 2 - - 17)
X_{ijklm} is the weight of dam at lambing
b is the partial regression of the trait(s) on weight of the dam at lambing,
e_{ijklm} is the random error peculiar to m^{th} observation belonging to i^{th} season of lambing, j^{th} sex, k^{th} genetic group, l^{th} year assumed to be NID (0, σ^2).

Linear contrast for various combinations of genetic groups for all the traits was also computed as described by Snedecor and Cochran (1968). Per cent improvement in growth and wool traits of F_1 and F_2 genetic groups in comparison to Nali purebreds was calculated.

RESULTS AND DISCUSSION

Least squares means of growth and wool traits and linear contrasts of Nali versus F_1 and F_2 of two breeds of sheep have been presented in Table 1.

Growth traits: Mean birth weight of Nali purebred group was significantly lower than F_1 and F_2 groups except for MN group. Birth weight of MNMN group (F_2) was significantly higher than its F_1 group. Significant linear contrast was observed for all F_1 and F_2 groups over Nali purebreds for this trait. However, there were existed of non-significant differences for weaning weight among all the groups except CNCN which had lowest weaning weight. Six month body weight of F_2 group was significantly lower than their respective F_1 groups. However, these F_2 groups did not differ significantly from their respective F_1 groups for yearling weight. The MNMN group had significantly higher yearling weight than all the groups except MN group. Average daily gain from birth to weaning age was statistically similar for F_1 and F_2 group. Average daily gain from weaning to six months was significantly lower for F_2 groups over their F_1 groups. Linear contrasts were observed to be non-significant for all F_1 and F_2 groups over Nali purebred for all traits except birth weight, average fibre diameter and medulation percentage. Non-significant differences between respective F_1 and F_2 groups indicating no decline in heterosis indicated the importance of additive gene action in general for all traits barring birth weight, average fibre diameter and medulation percentage. Among the crossbreds, per cent improvement (Table 2) was found to be more in MN crossbreds for all growth traits except birth weight than CN crossbreds. Similar trend was observed for the F_2 of MN and CN groups.

Wool traits: Grease fleece weight was found to be statistically similar for all the genetic groups

Table 1
Least squares means of growth and wool traits and linear contrasts of Nali versus F_1's and F_2's of two breeds of sheep

Traits	Genetic group					Linear contrasts			
						F_1 crosses		F_2 crosses	
	N	MN	CN	MN MN	CN CN	MN	CN	MN MN	CN CN
Birth weight (kg)	2.84^{c}+0.02 (554)	3.09^{bc}+0.03 (399)	3.13^{ab}+0.04 (312)	3.21^{a}+0.06 (77)	3.10^{b}+0.09 (39)	-0.25**+0.04	-0.29**+0.04	-0.37**+0.07	-0.26**+0.09
Weaning weight (kg)	10.03^{a}+0.11 (471)	10.27^{a}+0.17 (290)	9.93^{a}+0.17 (258)	10.21^{a}+0.29 (66)	9.76^{b}+0.39 (34)	-0.24-0.20	0.10+0.20	-0.18-0.31	0.27+0.40
Six month weight (kg)	14.43^{b}+0.16 (396)	14.92^{a}+0.25 (244)	14.24^{ab}+0.27 (194)	14.44^{c}+0.41 (61)	13.65^{d}+0.58 (27)	-0.149+0.30	0.19+0.31	-0.01+0.44	0.78+0.61
Yearling weight (kg)	19.45^{b}+0.40 (194)	20.59^{ab}+0.59 (87)	19.35^{b}+0.64 (82)	21.22^{a}+0.89 (28)	18.68^{c}+1.25 (13)	-1.14+0.72	0.10+0.76	-1.77+0.98	0.77+1.31
Av. daily gain from birth to weaning (g)	79.09^{a}+1.18 (471)	79.20^{a}+1.84 (290)	74.86^{b}+1.90 (258)	77.21^{a}+3.15 (66)	74.03^{b}+4.22 (34)	-0.11+2.99	4.23+2.24	1.88+3.36	479+4.38
Av. daily gain from weaning to 6 months (g)	45.27^{b}+1.26 (396)	50.17^{a}+2.01 (244)	44.38^{b}+2.09 (194)	45.04^{b}+3.21 (61)	35.64^{c}+4.57 (27)	-4.90*+2.36	0.89+2.44	0.23+3.45	9.63+4.74
Grease fleece weight (kg)	0.77^{a}+0.15 (404)	0.78^{a}+0.02 (289)	0.78^{a}+0.02 (200)	0.73^{ab}+0.04 (60)	0.69^{b}+0.45 (29)	-0.01+0.03	-0.02+0.03	0.03+0.04	0.09+0.05
Staple length (cm)	6.50^{a}+0.11 (245)	5.26^{c}+0.16 (178)	6.67^{a}+0.15 (143)	5.90^{b}+0.37 (14)	5.91^{b}+0.38 (14)	1.09**+0.19	-0.32+0.19	0.45+0.39	0.44+0.39
Av. fibre diameter (μ)	29.60^{a}+0.43 (242)	23.26^{c}+0.60 (173)	25.72^{b}+0.62 (124)	25.94^{b}+1.39 (14)	25.93^{b}+1.42 (14)	6.34**+0.74	3.88**+0.75	3.66**+1.46	3.67**+1.49
Medulation percentage	50.70^{a}+1.20 (242)	18.57^{c}+1.66 (173)	31.26^{b}+1.70 (124)	20.78^{c}+3.84 (14)	28.15^{b}+3.91 (14)	32.13**+2.06	19.44**+2.08	29.92**+4.02	22.55**+4.09

Figures within parentheses are the number of observations
Means bearing different superscripts in a row differ significantly (P<0.05)

Table 2
Per cent improvement in F_1 and F_2 generations involving two breeds over Nali purebred

Traits	F_1 crosses		F_2 crosses	
	MN	CN	MNMN	CNCN
Birth weight	8.80	10.21	13.03	9.15
Weaning weight	2.39	-0.99	1.79	-2.69
Six month weight	3.39	-1.39	0.07	-5.40
Yearling weight	5,86	-0.51	9.10	-3.96
Av.daily gain*	0.14	-5.35	-2.3	-6.39
Av. daily gain**	10.82	-1.96	-0.51	21.27
Grease fleece weight	1.30	2.21	-4.43	-11.47
Staple length	-17.17	5.04	-7.80	-6.93
Av. fibre diameter	-21.41	-13.11	-12.36	-12.39
Medulation percentage	-63.02	-38.34	-59.01	-44.48

* Average daily gain from birth to weaning
** Average daily gain from weaning to six months

except for CNCN group and had similar performance to that of MNMN group. Highest staple length was observed for CN crossbreds followed by Nali purebreds. The F_2 groups did not differ from each other for staple length while CNCN group (F_2) had significantly less staple length over CN (F_1). Comparison between crossbred groups and Nali (linear contrast) were found non-significant for grease fleece weight and staple length. Significantly higher fibre diameter was recorded for Nali purebreds than all other crossbred group which is obvious as this breed is a carpet type breed. The fibre diameter of wool of MN crossbreds was significantly lower than the CN crossbreds. This is because, Merino being a superior fine wool breed as compared to Corriedale. The F_2 group (MNMN) showed superiority over its F_1 group (MN) indicating the importance of additive gene action for this trait.

Highest medulation percentage was also recorded for Nali purebreds than all the crossbred groups. There were existed non-significant difference between F_1 and F_2 groups of respective breeds involved in crossing. Contrast estimates indicated that Nali breed has significantly higher fibre diameter and medulation percentage than all the crossbred groups.

For the wool traits, the MN crossbred had more per cent improvement (Table 2) over Nali than the CN crossbreds except for grease fleece weight. Similar trends of improvement in wool traits was observed for the F_2 of MN and CN crossbreds.

From the present results, it may be inferred that subsequent crossing of F_1 of two breed did not show significant decline in growth and wool traits. Nitter (1978) reported that crossbred lambs have on an average a five per cent higher weaning weight than purebred lambs. The weaning weight of crossbred ewes was about 6-7 per cent higher in comparison to the purebred ewes. Vesely and Peters (1979) reported that for the pre-weaning live weight gain, the three-way crosses retained between 30 and 50 per cent of the heterosis present in F_1 crosses.

In the present study, decline in the performance of F_2 over F_1 of Nali and Corriedale breeds have been observed for growth traits. However, no decline in performance of F_2 over F_1 involving Nali and Russian Merino breeds has been observed for growth and wool traits which strongly point out towards the formation of a synthetic population.

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