



## RESEARCH PAPER

## OPEN ACCESS

## Crossbreeding of Rambouillet and native sheep for mutton and wool production in Pakistan

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### Abstract

Pakistan has about 28 sheep breeds with a total population of 30.9 million heads found in the country. Sheep are kept primarily for mutton production but wool and skin are secondary products. Wool, which is produced in the country, is of coarse type and it is used for carpet and carpet by-products. To upgrade the local sheep in Swat valley, Rambouillet sheep were imported from USA. Out of which, Pure Rambouillet rams were distributed among the sheep farmers in Swat valley. As a result of crossbreeding, about 90% of the sheep population became crossbred. To see the impact of crossbreeding under field conditions, the basic performance data of production traits were collected and analyzed statistically. The mature body weight of sheep were increased significantly ( $p < 0.01$ ) from  $26.32 \pm 0.62$  kg to  $31.52 \pm 0.27$  kg. The fertility rate difference between the two groups was not significant (80% Vs 85%). The lamb survival rate was significantly higher 93% in crossbreed whereas it was 84% in local sheep. Wool production and quality was significantly improved about 116%. The significant ( $p < 0.01$ ) difference was observed in wool production which increased from 0.8 kg to 1.8 kg per annum in local vs. crossbred. The quality of wool was improved from  $30.32\mu$  to  $23.10\mu$  in local and crossbred sheep, respectively.

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## Introduction

Pakistan has about 28 breeds of sheep with a total population of 30.9 million heads. (Economic Survey, 2018-2019). Mostly sheep in Pakistan are primarily raised for mutton production and wool is a secondary byproduct. The export earnings from added value wool products is a key contributing factor in the foreign exchange earnings. As The indigenous wool produced is of poor quality with regards to wool yield and fiber fineness, the reason being low production potential of the local sheep breeds. In a review study (Getachew *et al.*, 2016) examined whether or not sheep crossbreeding is a feasible option to improve indigenous sheep breeds in developing countries using Ethiopian case as example. Performance evaluation results from the on-station and on-farm (mainly based on Awassi pilot crossbreeding villages) found that crossbreds often outperformed their local contemporaries. Thus comparisons of pure local sheep and crossbreds among those breeds produced in some areas indicated a good outcome of this type of crossbreeding. However, the performance of crossbred sheep varied by location and depended on management and exotic inheritance levels. Regardless of location, farmers participating in crossbreeding often showed keen interest in crossbreeding, mainly due to the fast growth, larger body size of crossbreds resulting in higher market prices as compared to their local sheep breeds.

Based on these facts and in order to improve the production traits of indigenous sheep with regards to mutton and wool, the Rambouillet sheep were imported in Pakistan from USA to upgrade the local sheep for mutton, wool production and its quality. Therefore, It was planned to assess the performance of Rambouillet, crossbreds and Khutta (local) sheep which was morphologically characterized under the field conditions of Swat valley of Pakistan.

## Materials and methods

### *Area of Study*

For the improvement of body weight for enhancing mutton and quantity and quality of wool, Rambouillet

genes were introduced in Swat valley in order to evolve a semi-fine wool breed for the hilly areas of Swat valley. For which, the flock owners of different areas of Swat were interviewed for flock detail as per modified individual flock detail proforma.

### *Collection of Information*

Information about flock size, husbandry practices, ram use from 60 flocks in Swat were collected. Amongst the 60 flock owners interviewed, 45 were keeping 'Nimchai' sheep (Rambouillet and local sheep cross) only, 8 had both the 'Nimchai' and 'Khutta' (indigenous type) and remaining 7 had 'Khutta' sheep only. Flock size in 'Nimchai' flocks was large (120-350 sheep/flock). All flocks represented six different areas of Swat. The flocks in Swat returned from their summer pastures in November-December and then registration and data collection on these flocks started in January. The second round of data collection was undertaken in the end of April when lambing in the flocks was just complete. The investigation team visited twice the experimental flocks in the period between first and second recording and vaccinated for Enterotoxaemia (ET) (initial and booster dose) and also recorded lambing, mortality etc. in all these flocks. A plan was designed to compare growth, fertility, wool yield and quality, and survivability of Rambouillet crossbreds and the local sheep in the existing environmental circumstances.

### *Wool Sample Collection*

Mid side wool samples were collected after taking the data of total fleece weight of each sheep. The wool samples were analyzed for clean fleece yield, fiber diameter and staple length.

### *Statistical Analysis*

All the data collected were computerized and analyzed with analysis of variance technique using the Statistical Analysis System (SAS). Significant differences were separated using the least significant method (Steel and Torrie, 1980).

## Results and discussion

### *Body weight of Khutta and Rambouillet-crossbred Sheep*

The Rambouillet crossbreds were heavier in weight at all stages of life than local sheep (Table 1). The body weight of local sheep <1 year of age was significantly lower than other groups but variation in body weight of other age groups was non-significant. The increase from 1 year stage to hogget age was 35.0%. The body weight did increase during later stage but at a diminishing rate. The increase from hogget weight to adult stage at 2 years to 4 years of age did not differ significantly but differences were significant for body weight at 1 year age and hogget body weight.

**Table 1.** Mean  $\pm$  Standard Errors in body weight among the local and Rambouillet-crossbred sheep at various stages of life in Swat area.

Age of Sheep	Local Sheep	Rambouillet-Crossbred
	Mean $\pm$ SE (kg)	Mean $\pm$ SE (kg)
0	19.50 $\pm$ 0.25 <sup>d</sup>	23.59 $\pm$ 0.21 <sup>a</sup>
1	26.32 $\pm$ 0.62 <sup>b</sup>	31.52 $\pm$ 0.27 <sup>a</sup>
2	28.38 $\pm$ 0.75 <sup>b</sup>	34.08 $\pm$ 0.06 <sup>a</sup>
3	29.43 $\pm$ 0.52 <sup>b</sup>	35.45 $\pm$ 0.23 <sup>a</sup>
4	30.22 $\pm$ 0.41 <sup>b</sup>	36.12 $\pm$ 0.20 <sup>a</sup>

0. Below one year of age

1. 1 year to <2 years of age

2. 2 years to < 3 years of age

3. 3 year to <4 years of age

4. 4 years of age

Means with different superscripts differ significantly (P<0.01)

The results show clearly that crossbreeding has resulted in improvement of body weight at all ages in Rambouillet crossbred sheep. So this study shows a definite advantage of reaping the benefits of crossbreeding in terms of more lamb weights at all stages of their life.

#### Fertility of Ewes

Table 2 shows fertility in the local Khutta and Rambouillet-crossbred ewes recorded in Swat outreach area. The fertility in local sheep averaged 80% while fertility was 85% in Rambouillet crossbred ewes. The overall fertility rate was 82.5% in the ewes of Swat outreach area.

There were no significant difference between the two groups. This was due to that both groups were kept under same plan of nutrition.

**Table 2.** Analysis of variance of fertility in local and Rambouillet crossbred sheep in Swat area.

Types of Sheep	No. of Ewes			Mean Fertility (%)
	Total	Pregnant	Lambled	
Local	337	180	90	80.0
Rambouillet Crossbred	1295	596	500	85.0
Overall	1632	776	590	82.3

The study has clearly shown that the overall fertility rate has not been affected significantly by crossbreeding. The underlying factor seems to be low heritability of the reproductive traits.

#### Survival Rate of Lambs

The mortality rate in local and Rambouillet-crossbred lambs was 15.6% and 6.6%, respectively (Table 3). This indicated that survival rate was higher (93.4%) in Rambouillet breed than the local sheep (84.4%). The overall survival rate of lambs was 92.2% over the two genetic groups combined.

**Table 3.** Survival rate in the local and Rambouillet crossbred lambs in Swat area\*.

Types of Sheep	No. of Ewes Lambled	No. of Lambs Died	Mortality Rate (%)	Survival Rate (%)
Local	90	14	15.6	84.4
Rambouillet-Crossbred	561	37	6.6	93.4
Overall	651	51	7.8	92.2

\* This information is based on data collected during January recording.

As Rambouillet sheep breed was imported from USA and it was brought from a temperate environment and crossed with native sheep of Swat area which is also a cold region of Pakistan and the present study has shown that there was an increase in survival rate which is an indication of adaptability of Rambouillet crossbred to environment condition of Swat valley.

#### Wool Quantity and Quality

The results on the total wool yield and important wool parameters are given in table 4. Rambouillet sheep has the highest wool yield (3.8kg) as compared to the local (0.80kg). The major improvement in total wool yield

was observed in Rambouillet crossbred which was 1.8kg as compared to Khutta (0.80kg), it was significantly higher. Similar results were reported (Khan *et al.* 2015). The other parameters like clean fleece yield, fiber diameter and staple length were improved as a result of genetics heterogeneity. Similar findings were observed (Khan *et al.*, 1996 and 2015).

**Table 4.** Some important wool characters in local, Rambouillet-Cross and Pure Rambouillet.

Breed	No.	Wool Yield (kg)	Clean Fleece Yield (%)	Fiber Diameter ( $\mu$ )	Staple Length (cm)
Rambouillet	300	3.80	67.8	20.78 $\pm$ 4.13	5.6 $\pm$ 2.4
Rambouillet-Cross	122	1.80	86.2	23.10 $\pm$ 6.32	3.2 $\pm$ 1.3
Khutta (Local)	220	0.80	85.66	30.32 $\pm$ 10.27	4.13 $\pm$ 2.0

The present study has shown that as the Rambouillet sheep is one of the good wool producing breed so it outperformed the local sheep in the colder environment of Swat region of Pakistan too. However, the crossbreeding also resulted in improvement of wool in the hybrids of Rambouillet with native sheep than the pure native sheep.

### Conclusion

Body weight in sheep improved by 23.0% in Swat area with the introduction of Rambouillet genes through ram distribution. Lamb survival rate was higher (93.4%) in Rambouillet-crossbred than Khutta sheep (84.4%). The significant difference was observed in wool production, which increased from 0.8kg to 1.8kg (about 116%) on the same time, the wool quality was improved from 30.32  $\mu$  to 23.10 $\mu$ .

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