

# Wool Fibre of Local and Crossbred Sheep: Production, Processing Technique and Performance

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## Abstract

*Local sheep in Indonesia are mainly raised to produce meat. In fact some of local sheep also actually produce strong (harsh) wool that have not been utilized as some farmers do shearing the sheep for sanitation purposes. Studies on wool production and technology of local sheep in Indonesia have not been reported. This field research was aimed to study (i) wool production and the fineness of local sheep and crossbred sheep wool, (ii) simple wool processing technique and (iii) Processing performance of both type of wool. The data of wool production were collected in Bogor by using 12 adult female sheep for each of local and crossbred sheep. The results showed that wool production of local sheep was lower than crossbred sheep ( $605.55 \pm 22.98$  g/head/year and  $2911.75 \pm 108.82$  g/head/year, respectively). Wool fibres of local sheep were much coarser than crossbred ( $35.06 \pm 6.14$   $\mu$  and  $22.94 \pm 0.88$   $\mu$ , respectively). This study also found that simple wool processing technique was able to be used for local sheep wool. This process steps included (i) sorting 1 (ii) washing (iii) drying (iv) sorting 2 (v) combing (vi) yarning, (vii) whitening, (viii) designing (ix) coloring and (x) weaving. It was found that processing performance of crossbred sheep wool was likely better than local sheep wool. It was concluded that both wool types produced by local and crossbred sheep were able to be processed to make different quality of yarn with simple processing technique. It is recommended that the technique can be applied to develop wool processing small industry to increase value added of sheep farming business as well as source of income for the community.*

*Keywords: fiber diameter, local sheep, processing, wool production*

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## Introduction

Local sheep in Indonesia are mainly raised to produce meat and some additional and economic product such as sheep skin/hide. Some of local sheep, however, also actually produce strong (harsh) wool that have not been utilized, as some farm-

ers shear the sheep for sanitation purposes. This type of sheep are local crossbred sheep that have been in Indonesia for decades and well adapted in certain areas. The crossbred sheep were originated from the importation of subtropical sheep from Netherlands and other sheep producer countries, some decades ago. Studies on wool production and technology of either local or its crossbred sheep in Indonesia have not been many reported. Parakkasi *et al* (1994) reported that wool growth and fibre diameter of Priangan sheep were 0,30 g/cm<sup>2</sup>/day and 51,47 µm, respectively, while Syamyono *et al* (2002) found that the wool production of Priangan sheep was 391,5 ± 90,2 g/head/year, and sheep fibre diameter (FD) were 30,13±13,11 µm for their wool and 130,44±20,58 µm for kemp (rough wool). On the contrary, wool growth of subtropical dual type sheep were much higher as reported by Lupton *et al.* (2004) that Dorset produced wool of 2,3-4,1 kg/head/year. Similarly the FD of the sheep was also much finer than Priangan sheep (FD of Dorset was around 31,5±6,45 µm, Finsheep 27,5±6,08µm, Romanov 27,7±17,46 µm, Texel 34,1±7.32 µm, and Montadale 29,3±5,98 µm) (Lupton *et al.*, 2004).

This field research was then aimed to (i) study wool production and fibre diameter of local sheep and crossbred sheep in both sex (ii) identify wool processing technique and (iii) to study processing performance by using loss percentage of wool staple during wool processing in both local and crossbred sheep at different sex.

## Materials and Methods

### *Materials*

- Local thin tailed sheep: 5 heads of each male and female adult sheep (2 years old) were used from Sekati sheep farmer group, Ciomas Bogor.
- Crossbred sheep: 5 heads of each male and female adult crossbred sheep (Merino x Dorset) were used from a sheep fattening commercial farm, Gunung Putri, Bogor.
- Equipments: wool shearing scissors, scale, micrometer, small scissor, holed ruler, carder, yarn maker, plastic bags, detergent and disinfectant.

### *Methods*

- Wool production: sheep were shorn throughout the body by using manual shearing scissor special for sheep wool/hairs. The greasy wool was then weighed. The date of last shearing was recorded according to secondary data from the farmer group (for thin tailed local sheep) or enterprise (for crossbred sheep).
- The fineness of wool was determined by measuring fiber diameter (FD). Wool sample was taken by clipping the wool staple at 5 different areas (1 cm<sup>2</sup> each) by putting the staple clip at a hole area of a ruler. FD of one sample was the average of 4 wool fiber having the mosr coarser (2 fibers) and the most finest (2 fibers). By using a micrometer the fiber was measured at the base of fibre with a normal

pressure.

- Identification of wool processing technique: Direct observation was conducted to record the technique applied in a wool processing used in wool handicraft group in Indramayu. Timing, materials and procedures of the technique were identified.
- Processing Performance/Processing loss of wool staple. Samples were weighed at each step of wool processing by using a scale. Percentage of wool loss is defined as percentage wool loss of total wool before being processed in each step.
- Statistical Analysis: data between local and crossbred sheep were compared with descriptive analysis, as they were collected from different locations and different management system. T-test was used to compare the differences between sheep sex on the processing performances.

## Results and Discussion

### *Wool Production and Fiber Diameter*

Sheep are characterized to have woolly typed hairs, some breed of sheep produce good wool, others are just harsh wool. Results of this study show that in local sheep there were no significant differences between sex on wool production ( $589.3 \pm 85.43$  and  $621.8 \pm 105.94$ , respectively in male and female sheep). FD was also similar between male and female sheep ( $39.4 \pm 1.87$  and  $30.72 \pm 4.98$ , respectively) ( $p > 0.05$ ) (Table 1). Wool production in crossbred sheep was around 4-5 much higher than wool production in local sheep, although statistically these data cannot compared as the wool were from different locations. However for local sheep, they are given a good standard of sheep farming system in the village. Wool growth starts at the base of wool follicle from a root of follicle called dermal papilla where nutrients input is supplied to the follicle through the blood vessels to dermal papilla.

Similarly, wool of crossbred sheep were finer than local sheep wool (Table 1). According to wool standard, the crossbred FD in this study can be categorized as medium wool type and the local sheep wool was as strong/coarse wool. Genetically sheep have wool type, meat type as well as dual purpose (Cottle, 1994). Crossbred

Table 1. Wool production and fiber diameter of local and crossbred sheep in both sexes

Sheep breed	Sex	Wool production (Greasy weight) (g)	FD ( $\mu$ m)
Local sheep	Male	$589.3 \pm 85.43$	$39.40 \pm 1.87$
	Female	$621.8 \pm 105.94$	$30.72 \pm 4.98$
Crossbred Sheep	Male	$2,834.8 \pm 360.99$	$22.32 \pm 1.47$
	Female	$2,988.7 \pm 453.56$	$23.56 \pm 2.04$

sheep used in this study were between Merino (wool producers) and Dorset (meat type), it is therefore the wool was identified as medium type, unlike most Merinos have fine wool.

### Wool processing technique

This study shows that the wool processing technique was quite simple. There were 10 steps identified in the processing, including (i) sorting 1 (ii) washing (with detergent and disinfectant) (iii) drying (iv) sorting 2 (v) combing (vi) yarning, (vii) whitening/bleaching, (viii) designing (ix) coloring and (x) weaving. More simple steps were shown in Figure 1.

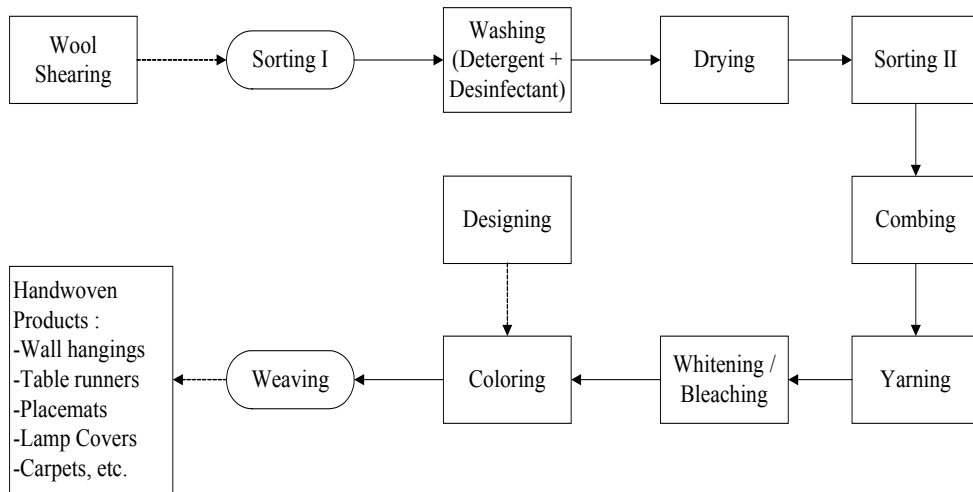


Figure 1. Diagram of steps in wool processing technique

In first step, sorting was applied by cleaning and throw away any dirt/strange materials stuck on the wool, such as dry feces, soils, dry grass etc. Washing process was started by soaking the wool in water for 24 hours to partition sticky wool fibres. Then soaking and cleaning with detergent for 2-3 hours (100 g detergent/10 liters of water) was applied to the greasy wool. The next step was soaking for one hour and cleaning with disinfectant (10 cc detergent/10 liter of water). Drying procedure was proceeded by putting the wool under sun until dried for 2-3 days depending on the climate condition. The dried wool were then sorted again by separating the wool fibres by hands and hand carders. The next process was combing the wool fibers by using drum carder several times. The combing wool staples were then process to become wool yarn by yarning the wool using non-machine yarning tool. Yarning needs experience to practice to be a skillful yarning technician. To clean any left wool grease produced by sebaceous glands in order to make cleaner and more white, whitening the yarn was then applied by boiling the wool for 2 minutes in solution of

2 liters of water, 10 cc of peroxide acids (H<sub>2</sub>O<sub>2</sub>) and 2 tea spoons of detergent, then rinsing with clean water and dried under indirect sunshine. Coloring the wool yarn was applied by boiling the wool yarn in a solution of 10 liters of water, 0.3 liters of vinegar concentrate for 1 hour, rinsing and then drying. Type of color depends on the design of the woven handicrafts. The last step was weaving the yarn by using non-machine weaver. This technique needed a special skills involving patience, accuracy and arts.

### Processing Performance

Wool staples from both breed were processed according to the technique identified in this study. The loss of wool during processing is important to study the efficiency of wool process that will determine the profit of its business. The results show that there were no significance differences of processing loss between sheep sex at any processing steps in both sheep breeds ( $p>0.05$ ) (Table 2). However, when comparing sheep breed, local sheep wool was likely to have more loss in all processing steps. For local sheep wool, the average loss percentage in sorting 1, washing/drying, sorting 2, carding and yarning were 5.8; 45.7; 12.1; 16.1; 12.8 %, respectively, whereas for crossbred the average lost in the steps were 1.52; 31.2; 4.12; 13.1; 6.6 %, respectively at the wool processing steps. This findings may indicate that processing performance of crossbred sheep wool was better than local sheep wool.

Wool fibres can be processed during especially carding, yarning and weaving when the wool staples need to be strong. Keratin protein in wool follicles make the strength, in addition the waviness of wool making flexibility during the process to avoid breakage of fibres. Finer wool would have better wool processing performances (Leeder, 1984). Wool processing performance such as the loss during processing depends on breed, sheep nutrition and climate conditions (Hynd, 1989).

Table 2. Processing loss of wool in local sheep and crossbred sheep in both sex

Sheep Breed	Sex	Processing Loss (%)				
		Sorting 1	Washing + Drying	Sorting 2	Carding	Yarning
Local sheep	Male	3.74 ± 1.45	38.52 ± 8.63	12.52 ± 8.55	16.58 ± 4.74	17.44 ± 8.08
	Female	7.76 ± 6.00	52.84 ± 9.62	11.6 ± 4.74	15.58 ± 4.67	9.36 ± 1.67
Crossbred Sheep	Male	1.18 ± 1.52	27.40 ± 4.25	5.14 ± 1.41	13.90 ± 6.55	5.30 ± 4.20
	Female	1.86 ± 2.47	34.98 ± 6.18	3.10 ± 1.84	12.30 ± 7.61	7.94 ± 2.53

### Conclusions

Wool production of local sheep was likely less than in crossbred sheep. Fiber diameter of crossbred sheep was clearly finer than in local sheep wool. Wool

processing technique was quite simple and reliable to process local and crossbred sheep wool. This process steps were (i) sorting 1 (ii) washing (iii) drying (iv) sorting 2 (v) combing (vi) yarning, (vii) whitening, (viii) designing (ix) coloring and (x) weaving. Wool in local sheep was able to process, however processing performance of crossbred sheep wool was likely better than local sheep wool. It is recommended that the technique can be applied to develop wool processing small industry to increase value added of sheep farming business as well as source of income for the community.

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