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Research article

Comparative Production Performance of Fullblood, F1, and F2 Dorper Rams at Barokah Farm, Kediri

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Abstract

Barokah Farm, Kediri, is a commercial sheep breeding farm that has recently implemented a breeding program involving fullblood Dorper sheep to improve the genetic potential and production performance of its flock. This study aimed to compare the production performance of fullblood Dorper rams with that of F1 and F2 Dorper × Texel crossbred rams. A total of 30 male sheep, consisting of 10 fullblood Dorper, 10 F1, and 10 F2 sheep aged approximately 12 months with an average initial body weight of 63.4 ± 3.8 kg, were observed for 29 days. Production performance was evaluated based on body measurements, feed intake, average daily gain (ADG), and feed conversion ratio (FCR). The results showed that fullblood Dorper rams exhibited superior body size, with an average chest girth of 100 cm, body length of 87 cm, and height at withers of 73 cm, followed by F2 and F1 sheep. Average daily feed intake was highest in fullblood Dorper sheep (1,493 g/head/day), followed by F2 sheep (1,425 g/head/day) and F1 sheep (1,271 g/head/day). Similarly, the highest ADG was recorded in fullblood Dorper sheep (316 g/head/day), followed by F2 (240 g/head/day) and F1 sheep (198 g/head/day). Feed utilization efficiency was also greatest in fullblood Dorper sheep, with the lowest FCR (4.72), compared with F2 (5.90) and F1 sheep (6.42). Overall, fullblood Dorper sheep consistently outperformed both F1 and F2 crossbred sheep in all production parameters evaluated. These findings indicate that crossbreeding fullblood Dorper with Texel sheep has not yet produced offspring with production performance comparable to or exceeding that of fullblood Dorper sheep under the management conditions of Barokah Farm..

Keywords : Dorper sheep, Crossbreeding, Production performance, Average daily gain, Feed conversion ratio.

INTRODUCTION

Indonesia has experienced consistent economic growth and increased per capita income, accompanied by greater public awareness of the nutritional importance of animal protein (Hikmawaty et al., 2019). Consequently, demand for mutton has risen, particularly in restaurants, hotels, and households for traditional dishes, aqiqah, and Eid al-Adha. This trend highlights the necessity to enhance sheep productivity through genetic improvement and improved production management (Batchelor et al., 2019).

Dorper sheep originate from South Africa and were developed by crossing Dorset Horn rams with Blackhead Persian ewes. This breed is recognized for rapid growth, adaptability, efficient feed utilization, and high-quality carcasses (Cloete et al., 2000; Figueiredo et al., 2019). Mature Dorper sheep exhibit accelerated growth and are regarded as among the most productive meat sheep in both extensive and intensive production systems (Snowder and Duckett, 2003). Texel sheep,

originating from Texel Island in the Netherlands, are internationally recognized for their pronounced musculature, high yield of lean meat, and favorable carcass characteristics (Wolf et al., 1980; Safari et al., 2005). Due to these attributes, Dorper and Texel sheep are frequently used as parent breeds in crossbreeding programs to enhance meat production.

The introduction of Dorper and Texel sheep to Indonesia has created new opportunities for advancing the national sheep industry. Dorper sheep demonstrate strong adaptability to tropical climates, while Texel sheep contribute improved body conformation and musculature. Research indicates that Dorper crossbreeds exhibit superior growth rates, feed efficiency, and carcass quality compared to local breeds, positioning them as promising candidates for commercial meat production in tropical regions (Lakew et al., 2014; Athifa et al., 2022). However, the production performance of subsequent generations, particularly F1 and F2 Dorper × Texel crossbreeds in Indonesia, remains insufficiently investigated.

Growth performance in sheep is influenced by the interaction between genetic and environmental factors. Genetic potential determines growth rate, mature body size, feed utilization efficiency, and carcass composition, whereas environmental factors such as feed quality, nutrient intake, health status, housing conditions, ambient temperature, and overall management determine the extent to which this genetic potential can be expressed (Safari et al., 2005; Schreurs & Kenyon, 2017). Poor nutrition, illness, heat, or poor management can reduce growth and limit even the best animals' productivity (Schreurs & Kenyon, 2017). However, comparative information regarding the production performance of Fullblood, F1, and F2 Dorper sheep under Indonesian production systems remains limited. Therefore, this study aimed to compare the production performance of Fullblood, F1, and F2 Dorper rams raised at Barokah Farm in Kediri by evaluating morphometric traits, feed intake, average daily gain (ADG), and feed conversion ratio (FCR). The findings are expected to provide scientific evidence to support breeding strategies for improving meat sheep productivity in Indonesia.

MATERIALS AND METHODS

Study Site

The study was conducted at Barokah Farm, located in Ngadimulyo Village, Ngadiluwih District, Kediri Regency, East Java Province, Indonesia.

Animal and Experimental Design

This study employed a comparative observational design to evaluate the production performance of three genetic groups of Dorper sheep. A total of 30 healthy male sheep, consisting of 10 Fullblood Dorper, 10 F1 Dorper, and 10 F2 Dorper sheep, approximately 12 months of age, were used in this study. The animals had an average initial body weight of 63.4 ± 3.8 kg and were maintained under identical housing, feeding, and management conditions throughout the experimental period. The equipment used in this study included a digital hanging scale (crane scale) for weighing animals and feed, a measuring tape for chest girth and body length measurements, a measuring stick for height at withers, weighing ropes, and stationery for recording observations.

All experimental sheep received the same complete mixed diet consisting of fresh elephant grass (Pennisetum purpureum) and concentrate throughout the 29-day experimental period. Feed was offered twice daily, and clean drinking water was available ad libitum. Representative feed samples were analyzed at the Feed Technology Laboratory, Department of Animal Science, State Polytechnic of Jember, Indonesia, following the standard methods of AOAC (2019). The chemical composition of the complete diet, as determined by proximate analysis, is presented in Table 1.

Table 1. Nutrient content of complete diet

DM (%)	CP*(%)	TDN*(%)	NDF*(%)	ADF*(%)
58.6	14.51	68.51	42.51	28.06

*Based on 100% dry matter; DM = dry matter; CP = crude protein; TDN = total digestible nutrients; NDF = neutral detergent fiber; ADF = acid detergent fiber.

Data Collection

Production performance was evaluated based on morphometric traits, feed intake, average daily gain (ADG), and feed conversion ratio (FCR). Morphometric measurements included chest girth, body length, and height at withers. Body measurements were recorded during a three-day measurement period using standard livestock measurement procedures. Feed intake was recorded daily throughout the 29-day experimental period. The amount of feed offered and feed refusals were weighed every morning using a digital hanging scale. Daily feed intake was calculated as the difference between the amount of feed offered and the feed refused according to the following equation:

$$\text{Feed intake(g/head/day)} = \text{Feed offered} - \text{feed refused}$$

The average daily feed intake for each animal was calculated by dividing the total feed intake during the 29-day observation period by the number of observation

days. Average daily gain (ADG) was determined using the following equation:

$$\text{ADG (g/h/day)} = \frac{(\text{Final Body Weight} - \text{Inisial Body Weight})}{29}$$

Feed conversion ratio (FCR) was calculated as:

$$\text{FCR} = \frac{Average\ daily\ feed\ intake}{Average\ daily\ gain}$$

Morphometric Measurement

The tabulated data will be analyzed using Analysis of Variance (ANOVA). If the results show significant or highly significant differences, the Multiple Duncan's Range Statistic (MDRS) will be used.

Observed Variables

1. Body Length (BL)

   Body length was measured from the spinous process of the thoracic vertebrae to the pin bone (tuber ischii) using a measuring tape and expressed in centimeters (cm) (Irfan et al., 2015).
2. Chest Girth (CG)

   Chest girth was measured by placing a measuring tape around the circumference of the chest immediately behind the forelegs and passing over the withers. The measurement was recorded in centimeters (cm) (Ashari et al., 2015).
3. Height at Withers (HW)

   Height at withers was measured as the vertical distance from the highest point of the withers to the ground surface using a measuring stick and expressed in centimeters (cm) (Maylinda et al., 2023).

The morphometric measurements of sheep are illustrated in Figure 1.

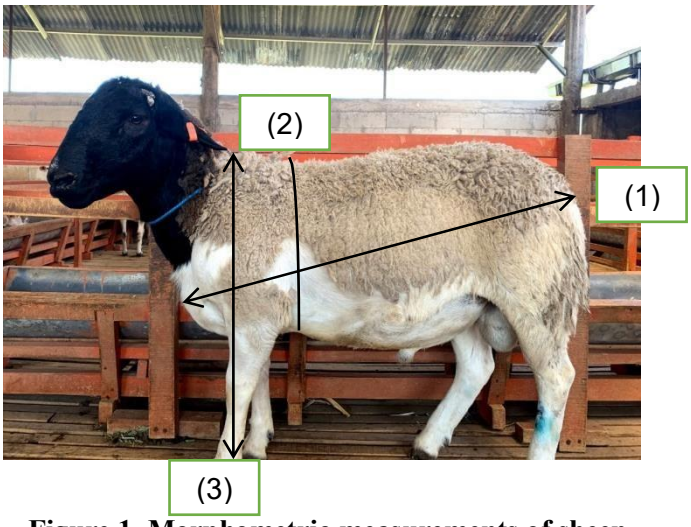

Figure 1. Morphometric measurements of sheep showing (1) body length, (2) chest girth, and (3) height at withers

Statistical Analysis

The experiment was arranged using a Completely Randomized Design (CRD) with three genetic groups as the treatments, namely Fullblood Dorper, F1 Dorper, and F2 Dorper. Each treatment consisted of 10 male sheep, resulting in a total of 30 experimental units. The observed variables included morphometric traits (chest girth, body length, and height at withers), dry matter intake (DMI), average daily gain (ADG), and feed conversion ratio (FCR). According to Sudarwati et al. (2019), the Completely Randomized Design (CRD) is appropriate for experiments conducted under relatively homogeneous experimental conditions, where treatments are randomly assigned to experimental units to evaluate treatment effects. Data were analyzed using one-way analysis of variance (ANOVA) to determine the effect of genetic group on the measured variables. When the ANOVA indicated significant differences among treatments ($P < 0.05$), the treatment means were further compared using Duncan's Multiple Range Test (DMRT) at the 5% significance level (Sudarwati et al., 2019).

RESULTS AND DISCUSSION

After 29 days of feeding, Table 2 presents the average body measurements for Fullblood, F1, and F2 Dorper rams. Fullblood Dorper sheep demonstrated the largest body size, with mean chest girth, body length, and height at the withers of 100 cm, 87 cm, and 73 cm, respectively. F1 Dorper sheep exhibited smaller measurements, averaging 87 cm, 84 cm, and 71 cm, while F2 sheep displayed intermediate values of 89 cm, 86 cm, and 73 cm. The superior body dimensions observed in Fullblood Dorper sheep align with the breed's genetic characteristics as a specialized meat breed. Dorper sheep are known for rapid skeletal growth, enhanced muscular development, and a larger mature body size compared to many other sheep breeds. Previous studies have reported that adult Fullblood Dorper sheep possess average chest girth, body length, and height at the withers of 85.68 cm, 69.73 cm, and 61.58 cm, respectively, while adult Texel sheep have corresponding values of 72.87 cm, 57.24 cm, and 59.57 cm (Maylinda et al., 2023). Although these measurements vary with age, sex, nutritional management, and production system, Dorper sheep consistently exhibit a larger body frame than Texel sheep, which supports the findings of the present study.

The larger body measurements observed in F2 sheep compared to F1 sheep indicate that a higher proportion of Dorper genetics contributed positively to skeletal growth and body development. As F2 animals possessed a greater proportion of Dorper inheritance

than the F1 generation, their phenotypic characteristics more closely resembled those of Fullblood Dorper sheep. This observation is consistent with Hardjosubroto (1994), who reported that the phenotypic expression of crossbred livestock is strongly influenced by the genetic contribution of the parental breeds. Similarly, Pikan et al. (2018) demonstrated that animals with a greater proportion of superior genetic inheritance generally exhibit enhanced body development.

Body measurements are influenced by both genetic background and environmental factors, such as nutrient intake, feed quality, health status, housing conditions, and management practices. Adequate nutrition and effective management allow sheep to express their genetic potential, while nutritional deficiencies, disease, heat stress, and suboptimal management can suppress skeletal growth and overall body development. Consequently, the superior morphometric performance observed in Fullblood and F2 sheep in this study likely reflects the combined effects of favorable genetic composition and appropriate management under the production system at Barokah Farm.

Table 2. Average body measurements of Fullblood, F1, and F2 Dorper rams.

Genetic Group	Chest girth (cm)	Body length (cm)	Height at withers (cm)
Fullblood	100.50^{c}± 2.53	87.20^{b}±1.78	73.33^{b}±1.21
F1	87.68^{a}± 2.11	84.34^{a}±2.05	71.17^{a}±1.48
F2	89.50^{b}± 2.34	86.46^{ab}±1.89	73.67^{b}±1.27

Note: Different superscript letters within the same column indicate significant differences (P < 0.05).

After the 29-day feeding period, Table 3 presents the average dry matter (DM) intake for Fullblood, F1, and F2 Dorper rams. Fullblood Dorper sheep demonstrated the highest average DM intake at 1,493 g/head/day. F2 sheep followed with 1,425 g/head/day, while F1 sheep had the lowest intake at 1,271 g/head/day.

The higher feed intake observed in F2 sheep compared to F1 sheep can be attributed to their greater Dorper genetic makeup. F2 sheep in this study were produced by backcrossing F1 females with Fullblood Dorper rams, resulting in approximately 75% Dorper inheritance. In contrast, F1 sheep possessed roughly equal proportions of Dorper and Texel genetics. As a result, the feed intake of F2 sheep more closely resembled that of Fullblood Dorper sheep, indicating a stronger influence of Dorper genetics on growth potential and nutrient requirements (Andri et al., 2026; Febriana et al., 2026).

Table 3. Average dry matter intake of Fullblood, F1, and F2 Dorper rams

Genetic Group	Dry Matter Intake (g/head/day)
Fullblood	$1{,}493^{b}$±112.21
F1	$1{,}271^{a}$±101.62
F2	$1{,}425^{b}$±180.45

Different superscript letters within the same column indicate significant differences (P < 0.05).

Feed intake in sheep is determined by both genetic and environmental factors. Animals with superior genetic potential typically exhibit greater voluntary feed intake, thereby supporting accelerated growth and increased tissue deposition (Safari et al., 2005). Feed intake is also closely linked to body weight, growth rate, nutrient requirements, diet quality, palatability, health status, and environmental conditions (NRC, 2007; Schreurs & Kenyon et al., 2017). Thus, the higher dry matter intake observed in Fullblood and F2 sheep in this study likely resulted from their enhanced genetic potential for growth and the consistent feeding and management conditions maintained during the experimental period.

F1 Dorper sheep were generated by crossing Fullblood Dorper rams with Fullblood Texel ewes. F2 Dorper sheep resulted from mating F1 Dorper ewes with Fullblood Dorper rams, representing a backcross. As a result, F1 sheep possessed approximately 50% Fullblood Dorper and 50% Fullblood Texel genetics, whereas F2 sheep contained approximately 75% Fullblood Dorper and 25% Fullblood Texel genetics (Sumantri & Hardjosubroto, 1994).

Feed intake is affected by multiple factors, such as body weight, feed digestibility, feed quality and quantity, palatability, environmental conditions, and genetic background (Pikan et al., 2018; Madi et al., 2023). Animals with greater body weight and higher genetic potential for growth typically exhibit greater voluntary feed intake to meet increased nutrient requirements. Furthermore, Armiani and Basuki (2021) found that dry matter intake increases with age, sex, and body weight, provided that diets are formulated to meet nutritional needs. These findings align with the present study, where Fullblood and F2 Dorper sheep exhibited higher dry matter intake than F1 sheep, indicating greater growth potential and larger body size. After the 29-day feeding period, the average daily gain (ADG) of Fullblood, F1, and F2 Dorper rams was measured. The results are shown in Table 4.

The average daily gain (ADG) of Fullblood Dorper, F1, and F2 Dorper rams following the 29-day

feeding period is presented in Table 4. Fullblood Dorper sheep exhibited the highest ADG, averaging 316 g/head/day, followed by F2 sheep at 240 g/head/day, while F1 sheep recorded the lowest ADG at 198 g/head/day. The ADG of Fullblood Dorper sheep observed in the present study was comparable to that reported by Yeaman et al. (2013), who found that Fullblood Dorper sheep could achieve an ADG of approximately 340 g/head/day under intensive management conditions. In contrast, Fullblood Texel sheep have been reported to exhibit an ADG of approximately 200 g/head/day (Kuntjoro et al., 2009). The lower ADG observed in F1 sheep may be attributed to their genetic composition, which consists of approximately 50% Dorper and 50% Texel inheritance, whereas the F2 sheep contained approximately 75% Dorper genetics through backcrossing with Fullblood Dorper rams. Consequently, the growth performance of F2 sheep more closely resembled that of Fullblood Dorper sheep.

Table 4. Average daily gain (ADG) of Fullblood, F1, and F2 Dorper rams

Genetic Group	Average Daily Gain (g/head/day)
Fullblood	316^{c}±21.51
F1	198^{a}±19.78
F2	240^{b}±22.43

Different superscript letters within the same column indicate significant differences (P < 0.05).

Average daily gain is influenced by the interaction of genetic and environmental factors. Genetic background determines the animal's growth potential and its capacity to utilize nutrients efficiently, whereas environmental factors—including birth type, nutrition, feed quality, health status, housing conditions, and overall management—affect the extent to which this genetic potential is expressed (Hernaman et al., 2022). Sheep with superior genetic potential generally exhibit greater feed utilization efficiency and faster tissue deposition, resulting in higher growth rates. Therefore, the superior ADG observed in Fullblood and F2 sheep in the present study likely reflects both their greater proportion of Dorper genetics and the favorable management conditions implemented throughout the experimental period.

Following the 29-day feeding period, the average feed conversion ratio (FCR) of Fullblood, F1, and F2 Dorper rams was determined, and the results are presented in Table 5. Table 5 shows the average feed conversion ratio (FCR) for Fullblood, F1, and F2 Dorper rams after 29 days of feeding. Fullblood Dorper sheep had the lowest FCR (4.72), followed by F2 sheep (5.90) and F1 sheep (6.42). The lower FCR observed in Fullblood Dorper sheep indicates a greater efficiency in converting feed into body weight than the F1 and F2 groups. The superior feed efficiency observed in Fullblood Dorper sheep can be attributed to their greater genetic potential for rapid growth and efficient nutrient utilization (Andri et al., 2026). F1 sheep have about half Fullblood Dorper and half Fullblood Texel genetics, while F2 sheep have about 75% Fullblood Dorper genetics from backcrossing. Both F1 and F2 sheep had higher FCRs, showing they were less efficient than Fullblood Dorpers (Hardjosubroto, 1994). Earlier studies found FCRs of about 4.30 for Fullblood Dorper sheep and 9.01 for Fullblood Texel sheep (Armiani & Basuki, 2021). The results from this study show that F2 sheep had feed efficiency between Fullblood Dorper and F1 sheep.

Table 5. Average feed conversion ratio (FCR) of Fullblood, F1, and F2 Dorper rams

Genetic Group	Feed Conversion Ratio (FCR)
Fullblood	4.72^{a}±0.17
F1	6.42^{c}±0.34
F2	5.90^{b}±0.21

Different superscript letters within the same column indicate significant differences (P < 0.05).

Many factors affect feed conversion ratio, including genetics, body weight, growth rate, nutrient digestibility, feed quality, health, and management practices (Septiani et al., 2016). Animals with better genetics usually convert feed into body tissue more efficiently, resulting in lower FCRs. A higher FCR means more feed is required per unit of weight gain, indicating lower efficiency (Wulandari et al., 2014; Sandi et al., 2019). The lower FCRs seen in Fullblood and F2 sheep suggest they use feed more efficiently and have better production potential at Barokah Farm.

CONCLUSION

Based on the results of this study, it can be concluded that Fullblood Dorper sheep exhibited superior production performance compared with F1 and F2 Dorper sheep, as demonstrated by their larger body dimensions, higher dry matter intake, greater average daily gain (ADG), and more efficient feed conversion ratio (FCR). Among the crossbred groups, F2 Dorper sheep exhibited production performance that more closely resembled that of Fullblood Dorper sheep, reflecting the greater contribution of Dorper genetics to growth and feed utilization. These findings indicate that, under the management conditions implemented at Barokah Farm, crossbreeding Fullblood Dorper sheep with Fullblood Texel sheep has not yet produced offspring with production performance exceeding that of Fullblood Dorper sheep.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper. The authors have no financial or personal relationships that could have appeared to influence the work reported in this study.

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