

Genetic evaluation of Anglo-Nubian goats on the performance of their crossbreeding results

Wenny Ladhunka Nur Aliyya^{1*}, M. Khairul Anam², Arif Aria Hertanto¹, Dwi Fatmawati³, and Dony Yusuf³

¹Department of Animal Husbandry, Faculty of Fisheries and Animal Husbandry, Universitas Islam Lamongan, Lamongan East Java, Indonesia 62211

²Department of Fisheries Agribusiness, Faculty of Fisheries and Animal Husbandry, Universitas Islam Lamongan, Lamongan East Java, Indonesia 62211

³Students of Department of Animal Husbandry, Faculty of Fisheries and Animal Husbandry, Universitas Islam Lamongan, Lamongan East Java, Indonesia 62211

*Corresponding author: wennyl@unisla.ac.id

ARTICLE INFO

Received:
13 December 2025

Accepted:
20 June 2026

Published:
22 October 2026

Keywords:
Anglo-Nubian goats
Evaluation
Genetics
Qualitative traits
Quantitative traits

ABSTRACT

This study was conducted to evaluate the genetic potential of male Anglo-Nubian goats when crossed with Peranakan Etawa (PE) goats, by examining the phenotypic traits of their offspring. The research comprised 20, 18-month-old female F1 crossbred goats. The study was conducted in the Tuban, Lamongan, and Gresik regencies using purposive sampling. Data on phenotypic and quantitative traits were grouped by age and sex, then analyzed for the mean, standard deviation, and coefficient of variation. The evaluation of qualitative traits, milk production data, and the reproduction of the Anglo-Nubian goat crossbreeding population using the mean, standard deviation, and frequency of variation; each variable was calculated using a t-test. The results of the Anglo-Nubian goat crossbreeding study showed an average body weight of 57 kg, an average of pelvic breadth of 74 cm, an average of leg length of 73 cm, an average thigh breadth of 75 cm, and an average udder circumference of 29 cm. The dominant color ranges from white to black and brown, while the dominant leg color was white and black, with a convex, flat, and long-horned head. The milk production and reproductive performance of the Anglo-Nubian crossbred goats is superior to that of PE goats.

INTRODUCTION

Goats are a type of livestock that can provide meet the need for animal protein at an affordable price and they are widely available (Aliyya et al., 2023). They can be used as a source of income through both milk and meat production (Setyawan., 2023). According to BPS data, Indonesia's goat population reached 19,398 million, in 2023 (BPS, 2024) marking

as 539 thousand head increased from the previous year (BPS, 2022). Goat meat and milk offer many benefits. Milk can increase growth and help to prevent cardiovascular diseases such as atherosclerosis, heart attacks, strokes, and coronary heart disease (Anam et al., 2022) as well as reducing stunting rates in toddlers (Wibowo et al., 2023). Increasing goat production and reproduction in Indonesia can be achieved through environmental



This work is licensed under a Creative Commons Attribution ShareAlike 4.0 International License.
Copyright © 2026 Jurnal Ilmu Peternakan Terapan

improvements and breeding programmes, such as crossbreeding and selection (Nurgiartiningih, 2011).

The Anglo-Nubian (AN) dairy goat originates from England (Stemmer et al., 2009) and produces 2.65 litres, with an annual lactation period of 305 days (Supriyati et al., 2017). They have been widely used in breeding-programmes to increase milk and meat production. Adult female AN goats are around 30 cm tall and weigh approximately 60-139 kg, while male AN goats weigh around 60-175 kg (Rusdiana et al., 2021). Crossbreeding Anglo-Nubian goats with local breeds, such as Java Randu is expected to increase the farmers' income of the economic value of their heads.

Goat milk production often fluctuates, and farmers often face the problem of inadequate genetic approach to both production and reproduction, which can then impact goat production. Production levels can be influenced by genetic and environmental factors, such as the effectiveness and efficiency are used, including tools, land, feed, labour, and technology. Therefore, the genetic evaluation of AN goats as feeders requires further research, including an examination of the performance of livestock phenotypic traits, consisting of both qualitative and quantitative traits of the offspring.

Smallholder farmers in East Java Province, particularly in the regencies of Gresik, Lamongan, and Tuban Regencies, still face challenges in increasing dairy production. Genetic evaluation and improvement are necessary to boost production and income. However, this method is not widely used, particularly on smallholder farms. Therefore, it is necessary to determine the performance of F1 female offspring from cross between AN and local goats (PE) and to inform further selection and genetic improvement.

MATERIALS AND METHODS

Research Location and Research Material

The research was conducted in the Tuban, Lamongan, and Gresik regencies from July 11 to 29 July, 2025. The study uses first-generation (F1) goats, which were produced

by crossbreeding 20 local female goats with Anglo-Nubian males. These goats were raised intensively raised on a diet of concentrate and forage feed.

Research methods

This research used two methods: surveys and direct observations in the field. The sample was selected using purposive sampling. The sample consisted of a first-generation goat resulting from a cross between an 18-month-old Anglo-Nubian male goat. The observed variables are phenotypic traits (both quantitative and qualitative). According to (Aliyya et al., 2023), quantitative trait consist of: body weight (BW) which measured directly in kg. Chest circumference (CC) is measured around the chest cavity through the back and behind the shoulder joints (The scapula) using the tape measure in centimetres. Body length (BL) is measured from the shoulder joint of the pelvis (spinous process), and is expressed in centimetres. Shoulder Height (SH) is measured perpendicular to the ground from the thoracic vertebrae in centimetres. The outer circumference of the udder is measured around the top in centimetres (Ardiansyah et al., 2022). Meanwhile, the qualitative characteristics observed include the diversity of goat hair colours, head shapes, horn shapes, and leg colors (evaluated on the four lower legs, up to above the nails) (Hutu et al., 2020).

Data Analysis

Quantitative trait data in the form of body measurements were grouped by age. These data were then analyzed to obtain the mean, standard deviation, and coefficient of variation.

Qualitative trait data are tabulated, and phenotype frequencies are calculated. These are calculated using the following formula:

$$\text{Frequency of trait A} = \frac{\text{number of properties A}}{N} \times 100\%$$

Information: A = One of the qualitative traits of Boerka goats, N = total number of Boerka goat samples observed

The evaluation data for the milk production of Anglo-Nubian cross goat milk production includes the average milk production volume, frequency of variation, and lactation length.

$$\text{Your test score (KV)} = \frac{\text{Standard Deviation}}{\text{Sample mean}} \times 100\%$$

Reproductive evaluation data for the of the Anglo-Nubian crossbred goats observed included the average service per conception, days open,

and age at the first mating. The t-test (Sudjana, 2005) was used to analyze the differences in each variable.

RESULTS AND DISCUSSION

Quantitative Traits of the crossbred Anglo-Nubian Goats

The results of the quantitative trait calculations on the body measurements of crossbred Anglo-Nubian goats with PE goats are presented in Table 1.

Table 1. The average, standard deviation (SD), and coefficient of diversity of Anglo-Nubian crossbred goats with local goats (PE) female goats

Parameters	Age (months)	Mean	SD	CV %
Body weight	18	57	4.11	0.07
Body length		74	1.09	0.03
Chest circumference		73	2.04	0.03
Body height		75	2.75	0.04
Udder circumference		27	3.90	0.14

Note: SD (Standard deviation), CV (Coefficient of variance)

A comparison based on the data in Table 1, comparison can be seen in Table 3. It is known that the body weight of an adult Anglo-Nubian goat crossbreed is 57 cm, a value close to the standard weight of an adult female Anglo-Nubian goat, which is 60 kg (Suyitno, 2023). This suggests that F1 crossbreeding has a significant impact on body weight. However the average body length (BL) of the Anglo-Nubian goat crossbreed is 74 cm, which is shorter than the standard body length of pure Anglo-Nubian goats (81.22 cm) (Bilyaro et al, 2024).

In this study, the average of chest circumference in the Anglo-Nubian goat crossbreed is 75 cm, which still far from the (Bilyaro et al, 2024) standard of 88.01 cm. These differences in body size are partly due to variations in growth rates (Mardhianna et al., 2015), influenced by genetics and environmental factors resulting from maintenance management (Hikmawaty et al., 2019). The height in this study was 75 cm, which falls within the standard range of 70-80 cm reported by (Suyitno, 2023). The outer udder circumference was measured

at 29 cm, which is still far from the standard of 39.92 cm proven in the study by (Ardiansyah et al., 2022). The main cause of this difference are genetics and poor management.

Qualitative Characteristics of Anglo-Nubian Goats

Figure 1 presents the results of the calculation of the qualitative characteristics of the Anglo-Nubian goat cross.

Hair colour

Observations of the coat colour patterns of crossbred Anglo-Nubian goats revealed white, black, and reddish-brown. The white-black pattern was derived from the local goat color pattern (PE). The black-reddish-brown and white pattern was derived from the colour pattern of Anglo-Nubian goat (Suyitno, 2023). Figure 2a shows a graph of coat color diversity. The crossbred results show that black, brown, white, and a combination of three colours are dominant.

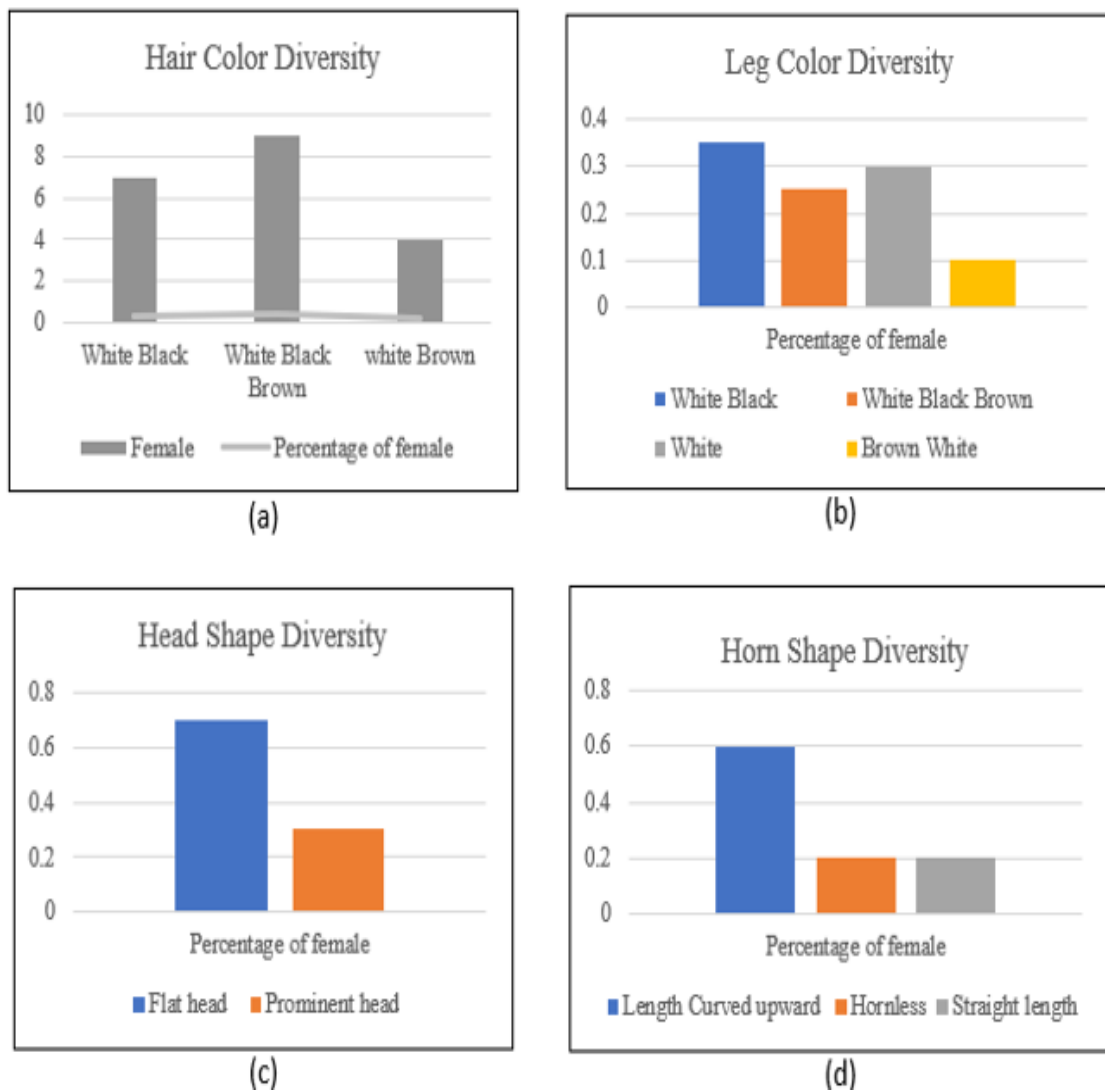


Figure 1. Results of the analysis of qualitative characteristics from Anglo-Nubian goat crossbreeding with PE goats.

Leg Colour

The leg colour diversity pattern consists of black and white, white, black and brown, and reddish-brown. Anglo-Nubian goats have leg colour pattern of black, red, and white (Suyitno, 2023). Crossbred Anglo-Nubian goats have a leg colour pattern dominated by black and white. Figure 2(b) illustrates the diversity in leg hair colour of crossbred Anglo-Nubian goats.

Head shape

The head shape of Anglo-Nubian goats can vary, ranging from a prominent head to a

flat head (Hastuti, 2023). The protruding head shape is the dominant variation resulting from crossbreeding Anglo-Nubian goats with PE goats. Figure 2c shows a graph of the resulting head shape diversity.

Horn shape

The defining feature of the Anglo-Nubian goat is its lack of horns (Suyitno, 2023), whereas local goats typically have horns. Crossbreeding Anglo-Nubian goats generally produces offspring with long, upward-curving horns. Figure 2d shows the diversity of horns.

Table 2. Milk production values and lactation duration of Anglo-Nubian crossbred goats

Parameter	$\bar{X}$ (%)	SD (%)	CV (%)
Livestock milk production volume	5.19	0.5	28.17
Lactation period of livestock	5.94	0.5	8.35

Note: X: Mean, SD: Standard of deviation, CV: Coefficient of variance

The evaluation of Anglo-Nubian cross goat milk production

Based on the results of the calculations and analysis of the production of the Anglo-Nubian goat crossbreed, a milk production coefficient of variation (CV) of >15% indicates moderate production, whereas a lactation duration CV of <15% indicates low production. A CV value of less than 15% indicates good farm management (diversity) and that there is no potential for genetic improvement. Nugraha et al. (2024), stated that a low CV value means maintenance management has established a homogeneous and good state.

A moderate value could be caused by insufficient additional silage feed, resulting in nutritional deficiencies in production, as stated by Sitepu et al. (2023). Dairy goat feed needs to contain energy, vitamins, water, protein and minerals for growth and production, some of which can be obtained from silage feed. The results of the milk production values and lactation duration of Anglo-Nubian crossbred goats are presented in Table 1.

The reproductive evaluation of Anglo-Nubian cross goats

Based on the analysis of the data presented in Table 3, it can be concluded that there is a

difference in milk production between Anglo-Nubian crossbred goats and PE goats in S/C and Age at First Marriage (T count > T table). However, the analysis of the data presented below shows no difference in the days open and lambing interval (T count < T table). The average coefficient of variation of the reproductive data of Anglo-Nubian crossbred goats is 19.38%.

Based on the analysis of the data presented in Table 3, it is known that there is a difference (T count > T table) between the milk production of Anglo-Nubian crossbred goats and PE goats in S/C and age at first marriage. In the days open and lambing interval, the analysis results of the data presented above show no difference (T count < T table). The average coefficient of variation of the Anglo-Nubian crossbred goat reproductive data is 19.38%.

Age at first mating

The average age at which Anglo-Nubian goats first mate is 391.00 days, compared to 393.63 days for PE female. Anglo-Nubian crossbred goats attain sexual and physical maturity early. Goats should ideally be mated when they reach maturity, i.e., 10-12 months of age, with an average weight of 60-70% (Winaya et al., 2019).

Table 3. The reproductive of Anglo-Nubian goats, Anglo-Nubian crossbred, *Peranakan Etawa*

Production performance	Types of goats		
	Anglo-Nubian	AN crossbreed	PE
Age at first mating (days)	391.00	391.75	393.63
Service per conception	1.50	1.28	1.61
Days open (days)	115.54	138.09	189.07
Lambing interval (days)	266.94	327.00	338.71

Note: AN: Anglo-Nubian, PE: Peranakan Etawa

Service per conception (S/C)

The average service per conception for Anglo-Nubian crossbred goats is lower than for PE goats. The breed factor is also estimated to be another cause of the lower service per conception of Anglo-Nubian crossbred goats. According to Robert (1996), one factor influencing high or low service per conception is the goat's ancestry or breed.

Days open

The average open day for Anglo-Nubian crossbred goats at the research site was 110.09 days longer than for the PE goats (Winaya et al., 2019). Longer open days in goats affect the lactation period and milk production of goats. Open days directly impact the calving interval during the current lactation period, which ultimately affects milk production throughout the goat's lifetime (Makin et al., 2012).

Lambing interval

The average lambing interval for Anglo-Nubian goat crosses is shorter than PE goats. The longer calving interval also reduces the productive period of the goat (El Akbar et al., 2019). The average lambing interval of Anglo-Nubian crossbred goats is shorter than of PE goats because the days open and the number of services per conception are lower in Anglo-Nubian crossbred goats than in PE goats. This is in accordance with the opinion of (Akbari et al., 2022), who stated that the shorter the empty period or the faster the animal becomes pregnant again after calving, the shorter the calving interval will be.

CONCLUSIONS

Quantitative and qualitative production performance traits showed that the Anglo-Nubian goat crossbreed was closer to the phenotypic traits observed in the Anglo-Nubian goat than the PE goat. However, the reproductive performance of the crossbreed was not as good as that of the pure breed Anglo-Nubian goat.

ACKNOWLEDGMENTS

We express our gratitude and high appreciation to the Directorate of Research,

Technology and Community Service (DRTPM) of the Ministry of Education and Culture, Research, Technology and Higher Education of the Republic of Indonesia for the approval of the 2025 PDP Research grant funding. We also convey the same greeting to LL Dikti 7 East Java, and Research and Development of Pemas, Lamongan Islamic University who also facilitated this activity so that it could run smoothly.

REFERENCES

- Akbari E., Musavi S A A., & Haidari. N. (2022). Survey of reproductive indices in Dairy Farms of Kabul City, Afghanistan. *Voice of the Publisher*, 8(4), 2022. <https://doi.org/10.4236/vp.2022.84008>
- Aliyya, W. L. N., Amin, M. F., & Atma, A. A. (2023). Karakteristik morfometrik Kambing Boerka pada berbagai tingkatan umur di UPT. Agri Science Technopark Unisla. *Wahana Peternakan*, 7(1), 1–6. <https://doi.org/10.37090/jwputb.v7i1.718>
- Anam, C., Aziz, F., Febrina, F., & Dian. N. (2022). Manfaat susu kambing etawa bagi masyarakat kampung ekologi Temas Kota Batu. *Jurnal Aplikasi dan Inovasi Ipteks Solidaritas*, 5(1), 149–154. <https://doi.org/10.31328/js.v5i1.3583>
- Ardiansyah, E. A., Suranindyah, Y. Y., Maharani, D., & Darmawan, M. A. (2022). Korelasi antara ukuran tubuh dan karakteristik ambung terhadap produksi susu Kambing Saanen di daerah tropis. *Journal of Applied Agriculture, Health, and Technology*, 1(1), 27–33. <https://doi.org/10.20961/jaht.v1i1.281>
- Bilyaro, W., Endang, S., Muhammad, D., & Aziz, A. (2024). Estimasi bobot badan kambing perah Anglo Nubian di peternakan lobi farm, Pondok Kubang, Bengkulu Tengah. *Buletin Peternakan Tropis*, 2(2), 90–97. <https://doi.org/10.31186/bpt.5.2.158-163>
- BPS. (2022). *Livestock and Animal Health Statistics 2019*. Jakarta: Directorate General of Animal Husbandry and Animal Health, Ministry of Agriculture.
- BPS. (2024). *Livestock and Animal Health Statistics 2019*. Jakarta: Directorate

- General of Animal Husbandry and Animal Health, Ministry of Agriculture.
- El Akbar, R. R., Indrijani H., & Salman, L. B. (2019). Analisis perbandingan performa reproduksi Kambing Saanen dan Peranakan Etawa (Kasus di BBPTU-HPT Baturaden). *JANHUS Journal of Animal Husbandry Science*, 3(2), 27-32. <https://doi.org/10.52434/janhus.v3i2.683>
- Hikmawaty, H., Bellavista, B., Mahmud, A. T. B. A., & Salam, A. (2019). Korelasi bobot badan dan variabel-variabel ukuran tubuh sebagai dasar seleksi calon induk Sapi Bali. *AGROVITAL: Jurnal Ilmu Pertanian*, 3(1), 11-13. <https://doi.org/10.35329/agrovital.v3i1.214>
- Hutu, I., Oldenbroek, K., & derWaaij, L. V. (2020). *Animal Breeding and Husbandry. Timisoara Rumania*: Agroprint Publishing House.
- Makin, M., & Suharwanto, D. (2012). Performa sifat-sifat produksi susu dan reproduksi sapi perah Fries Holland di Jawa Barat. *Jurnal Ilmu Ternak*, 12(2), 39-44. <https://doi.org/10.24198/jit.v12i2.5128>
- Mardhianna, I., Sukarno, D. S., & Dilaga, I. W. S. (2015). Hubungan antara ukuran- ukuran tubuh dengan bobot badan kambing Jawarandu jantan berbagai kelompok umur di Kabupaten Blora. *Animal Agriculture Journal*, 4(2), 264-267. <https://ejournal3.undip.ac.id/index.php/aaj/article/view/11814>
- Nugraha, D. A., Alhuur, K. R. G., & Indrijani, H. (2024). Evaluation of accuracy of body weight estimation of female Garut Sheep using winter, school, and Arjodarmoko formulas. *Bulletin of Applied Animal Research*, 6(1), 137-144. <https://doi.org/10.36423/baar.v6i2.2050>
- Nurgiartiningih, A. (2011). Evaluasi potensi genetik galur murni boer. *JiIP (Jurnal Ilmu-Ilmu Peternakan)*, 21(1), 16-22. <https://jiip.ub.ac.id/index.php/jiip/article/view/104>
- Robert H., F. (1996). Review: Dairy cattle reproductive physiology research and management-past progress and future prospects. *Journal of Dairy Science*, 79(6), 980-990. [https://doi.org/10.3168/jds.S0022-0302\(96\)76449-4](https://doi.org/10.3168/jds.S0022-0302(96)76449-4)
- Rusdiana, S., & Adiati, U. (2021). Pengelolaan sumber daya genetik kambing sebagai potensi biologik dan nilai ekonomi. *Jurnal Sain Peternakan Indonesia*, 16(2), 222-227. <https://doi.org/10.31186/jspi.id.16.2.222-227>
- Setyawan, M. R. (2023). Sistem pakar deteksi penyakit kambing menggunakan certainly factor berbasis android. *Journal Wahajana Information*, 8(1), 36-43. <https://doi.org/10.51544/jurnalmi.v8i1.4008>
- Sitepu, S. A., Marisa, J., Rianto, A. A., & Suhut, A. (2023). Socialization of goat and sheep reproduction management in Bulu Cina Village, Indonesia. *Asian Journal of Community Service (AJCS)*, 2(11), 975-982. <https://doi.org/10.55927/ajcs.v2i11.6911>
- Stemmer, A., Siegmund-Schultze, M., Gall, C., & Záirate, A. V. (2009). Development and Worldwide Distribution of the Anglo Nubian Goat. *Tropical and Subtropical Agroecosystems*, 11(1), 185-188. <https://www.revista.coba.uady.mx/ojs/index.php/TSA/article/view/31>
- Sudjana. (2005). *Statistical Methods*. Bandung: Tarsito
- Ningsih A. P., Hidayat, H., & Akbarillah T. (2022). Performa kambing *Anglo Nubian* jantan muda yang diberi pakan mengandung lumpur minyak sawit (*solid material ex decanter*). *Bulletin of Tropical Animal Science*, 3(2), 121-128. <https://doi.org/10.31186/bpt.3.2.121-128>
- Suyitno. (2023). *Optimalisasi Beternak Kambing Melalui Evaluasi Kecukupan Pakan Dan Analisis Ekonomi*. Cilacap: Dinas Pertanian Kabupaten Cilacap.
- Wibowo, J. W., & Yuniarti, H. (2023). Pencegahan stunting dengan pemberian susu kambing pada balita di Dusun Ketawang Magelang. *Jurnal ABDIMAS-KU: Jurnal Pengabdian Masyarakat Kedokteran*, 2(3), 93. <https://doi.org/10.30659/abdimasku.2.3.93-101>
- Winaya A., and Coy. S.P. F. N. (2019). The evaluation of estimated breeding value and the most probable producing ability for the basis selection of Etawa crossbred goat (*Capra hircus* sp.) at Malang, East Java, Indonesia. 2nd International Conference on Natural Resources and

Life Sciences (NRLS) 2019. Surabaya:
*IOP Conference Series: Earth and
Environmental Science*. 293. [https://doi.
org/10.1088/1755-1315/293/1/012008](https://doi.org/10.1088/1755-1315/293/1/012008)