



# Etawah Crossbreed Goat Farming for Income Enhancement of Households in Purworejo District, Indonesia

MIGIE HANDAYANI<sup>1\*</sup>, DWIDJONO HADI DARWANTO<sup>2</sup>, JAMHARI JAMHARI<sup>2</sup>

<sup>1</sup>Candidate of the Doctor in Agricultural Science, Gadjah Mada University; Senior Lecturer in Agribusiness Program, Universitas Diponegoro, Indonesia; <sup>2</sup>Faculty of Agriculture, Gadjah Mada University, Indonesia.

**Abstract** | This study analyzes the income and the factors influencing Etawah crossbreed goat farming in Purworejo, Central Java, Indonesia. The study employed a survey method. The study purposely selected three sub-districts in the Purworejo District as the study sites. A quota sampling method was applied to select 90 respondents in each sub-district, resulting in 270 respondents. Data and information in the study were measured on an annual basis. Data were analyzed using a combination of quantitative descriptive and inferential analyses with a multiple regression model. The results show that, on average, goat ownership was 11 goats, with annual production costs of about IDR 7,140,000, annual revenue of IDR 16,501,000, and annual income of IDR 9,361,000. Factors influencing goat farming income include the sale of livestock, feed costs, number of livestock, feeding management, marketing management, and adoption of feed technology. The implication of this study is an arrangement of management livestock training by the local Government and encouragement of farmers to engage in such management training, with practical topics on feed technology and management and marketing management.

**Keywords** | Feed management, Feed technology, Livestock management, Small ruminants, Smallholder livestock farm, Veterinary and animal husbandry

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**\*Correspondence** | Migie Handayani, Candidate of the Doctor in Agricultural Science, Gadjah Mada University; Senior Lecturer in Agribusiness Program, Universitas Diponegoro, Indonesia; **Email:** migiehandayani@live.undip.ac.id

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## INTRODUCTION

Livestock has a significant role in the Indonesian economy, particularly in the agricultural sector. At the prevailing price, the contribution of the sub-sector of livestock to national income in 2023 was about 1.56%, which was slightly higher than that of the horticultural sub-sector (BPS, 2024). The contribution of about 16.15 % to the GDP of the agricultural sector in a narrow sense, or it accounted for IDR 298.0 trillion in 2022 (MOA, 2023). At the provincial level in Central Java, one of Indonesia's centers of livestock production, the subsector contributed about 2.49%. For comparison, the estate crop sub-sector

and food crops sub-sector contributed about 1.37% and 3.93%, respectively (BPS, 2024).

Small livestock are classified as goats, sheep, and pigs. Goats are divided into three types: Local goats, Native goats, and Imported goats. Goats are small ruminant livestock that are very popular in Indonesian society. The following are population figures for small livestock in Indonesia. The goat population in Indonesia in 2015 was recorded at 19.01 million heads and continued to grow sluggishly until it reached 19.23 million heads in 2021. Regionally, the highest goat population is on the island of Java. On average, the goat population also experienced positive growth of

0.23 percent per year. The sheep population experiences a positive growth yearly, with an average growth of 0.97 percent (BPS, 2023).

Small ruminant farming also serves as a food source for Indonesian citizens, particularly for providing animal-based proteins. The industry functions as the primary source of protein, along with poultry farming (Setiadi *et al.*, 2021), vegetable farming (Wijaya *et al.*, 2021a, b), and functional foods (Saeri *et al.*, 2022) support the achievement of Sustainable Development Goals (SDGs) ratified by the country, particularly for SDGs #1: zero poverty, #2: zero hunger and #3: good health and well-being.

Several studies have recorded and reported the role as a source of income for small ruminants. Smith (2018) conducted a study that provides an in-depth analysis of the contribution of livestock to household income in rural areas of Indonesia. This study uses household survey data to evaluate the direct and indirect impacts of livestock activities on income levels, considering variations in business scale and livestock types. Utama (2020) overviews livestock activities' social and economic impacts, focusing on the East Java region. This study involved interviews with livestock farmers and analysis of socioeconomic data to understand the role of livestock in improving household welfare at the local level. Kusumastuti (2019) explored the relationship between livestock and poverty alleviation in Indonesia, especially in Central Sulawesi. This study uses qualitative and quantitative approaches to assess the contribution of livestock in reducing poverty levels and increasing household income. Pradana (2021) examines the impact of animal husbandry on rural life, focusing on West Kalimantan. This study combines survey data and statistical analysis to assess animal husbandry's role in improving local communities' income and living conditions. Muladno and Agatha (2023) discuss the challenges and opportunities in running sustainable livestock in Indonesia. This study provides insight into how sustainable livestock practices can improve economic and environmental sustainability at the household level.

Goat productivity depends on many factors. An integrated system is one way to overcome the availability of forage by utilizing plants or plant waste as a source of forage (Mansyur *et al.*, 2005). One type of cultivated goat is the Etawah crossbreed goat (Peranakan Etawah (PE)). PE goats result from a cross between Kacang (local breed) and Etawah goats. PE goats have a dual purpose: Simultaneously producing milk and meat. PE goats can produce around 1-2 liters of milk/day (Jamaluddin, 2018). Latif *et al.* (2014) discuss efforts to increase the production and health of PE goats. This study analyzes livestock health and strategies to increase meat production and reproduction. Sudradjat *et al.* (2021)

focused on breeding PE goats to increase resistance to limited rearing conditions. The discussion includes aspects of genetics and breeding management. Purwantari *et al.* (2017) provide information about the characteristics of PE goats and study breeding and germplasm development, which includes aspects of genetic diversity and increased productivity. Anggraeni (2021) discussed PE goat breeding strategies to achieve sustainable meat production. The strategy includes evaluating breeding performance and the potential for increased production. Utomo (2013) presented the study results by comparing PE goats' maintenance levels and productivity in coastal and mountainous areas.

PE goats are widely cultivated in the Purworejo District and are called PE Kaligesing goats. PE Kaligesing goat is an iconic livestock farm in Purworejo District, which must continue to be sustained to have sufficient PE Kaligesing goat breeds due to high demand (Sudrajat *et al.*, 2021). The local Government is carrying out a development program for PE Kaligesing goats by creating rural source areas for Kaligesing goats outside Kaligesing District, which have the same topography as Kaligesing area so that it is expected that PE Kaligesing goats can be maintained and preserved.

The Government's efforts to maintain the quality and purity of the PE Kaligesing goat are performed by issuing a Decree that specifies that goats with qualities of A and B are prohibited from leaving the Purworejo area. PE Kaligesing goats have advantages in adaptation, high production, and reproductive power. It is expected that the quality of the PE Kaligesing goats is well maintained, and this will further increase the farmer's motivation to raise PE Kaligesing goats, increase the selling value of livestock products, and increase the income and welfare of farmer households.

The development of the goat farming business is related to an increase in farmer income. Increased income will motivate farmers to do their livestock business with the highest performance. A successful goat farming business is influenced by livestock management technology and innovation to achieve the maximum income level. The amount of production, production costs, and income are essential aspects that need attention in the livestock business. Production costs incurred to produce products and revenues are the value or proceeds from sales of products produced from a livestock business (Daniel, 2002), along with feed management and technology. Based on the justification above, this particular study aims to analyze the income of the PE Kaligesing goat farming business and the factors that influence the income of the PE Kaligesing livestock business, Purworejo District.

The study was conducted in Purworejo District in 2022-2023. This method utilized a survey method with a unit study of sub-districts. The locations selected for this study included three sub-districts, namely Kaligesing, Bruno, and Gebang, which were selected using a purposive sampling method for the farmers who operated PE goat farming. The sub-districts were selected since they were the center of the livestock industry, with a particular focus on PE goats. This study determined a quota of 270 samples to fulfill the requirement of 10 variables in the model analysis. The sample is expected to provide statistical power, where the number of variables in the model analysis is at least multiplied by  $27 > 25$  (Ghozali, 2007). Also, the number of respondents is more than 200, which minimizes problems in statistical power of significance (Crocker and Algina, 1986). The total of selected 270 respondents was distributed evenly in each sub-district using random sampling among the farmers with criteria. Thus, the number of samples in each sub-district was 90 farmers, considered representative of the region. Primary and secondary data and information for this study were gathered using interviews and observation of the farmers and related institutions. Validity and reliability tests were carried out on the questionnaire used for interviews. The validity test results showed validity, and the reliability test showed reliability, which was indicated by the value Cronbach alpha  $> 0.6$  (Ghozali, 2007). The tests of validity and reliability can be seen in the Supplementary Material.

The fundamental theory used for analysis is the microeconomic theory of production, particularly the profit function derived from the production function. The producers are assumed to maximize profit given production inputs and the existing technology (Nicholson and Snyder, 2008; Pindyck and Rubinfeld, 2013). In theory, producers seek income maximization of the farms using

available inputs, management skills, and technology. The underlying theory is justifiable at the farm level and fits the real condition. The profit (or income) function derived from the optimization of the production function can be modeled as follows:

$$Y = \beta_0 + \sum_{i=1}^9 \beta_i X_i + \varepsilon \dots (1)$$

Where  $Y$  is annual income generated from goat farming;  $\beta_0$  is constant;  $X_i$  is a vector of influencing factors including 1: feed costs, 2: number of livestock sold, 3: number of goats, 4: farming experience, 5: forage management, 6: feed management, 7: marketing management, 8: group activeness, and 9: feed technology;  $\varepsilon$  is disturbance error. The data were analyzed using a multiple linear regression model (Verbeek, 2003). Multiple linear regression analysis is a powerful instrument for determining factors influencing income when the regression model is correctly formulated based on appropriate theory (Verbeek, 2017).

Table 1 shows the definition and measurement of the variables included in this study's analytical model.

A hypothesis proposed in this study can be formulated as

$$H_0: \beta_i = 0$$

$$H_1 = H_0 \text{ is not true}$$

The hypothesis was tested using simultaneous and partial manners at the significant levels of 0.1, 0.05, and 0.01. The regression model was run using statistical package software. A statistical package of software was used to run the regression model. The regression model was tested using a diagnostic procedure to detect multicollinearity and heteroscedasticity problems and obtain the best linear unbiased regression estimators (Ghozali, 2007).

**Table 1:** Definition and measurement of variables.

| Variables                  | Description  | Measurement   |
|----------------------------|--|---------------|
| Income                     | The total annual income earned by the farmer                         | IDR*          |
| Number of livestock sold   | Number of goats sold in a year                                       | Head          |
| Feed costs                 | Annual expenditure for feed and other materials                      | IDR*          |
| Total livestock ownership  | Number of goats in the farm  | Head          |
| Farming Experience         | Time spent on livestock farm management                              | Year          |
| Forage management          | Farmer applies forage management                                     | Score: 3-15** |
| Additional feed management | Farmer applies additional feed management                            | Score: 3-15** |
| Marketing management       | Farmer implements marketing management                               | Score: 4-20** |
| Group activeness           | Farmers actively engage in farmer group                              | Score: 3-15** |
| Feed technology            | Farmers adopt fermented coffee waste materials for feed supplements. | Yes=1, No=0   |

Note: \*IDR is Indonesian Rupiah, IDR 1~ US\$15,000.; \*\* The lowest score is 3, and the highest is 15, resulting from the three indicators of each variable.

Purworejo district is a center for PE Kaligesing goat farming. Farming with PE Kaligesing goats is dual-purpose, meaning they are cultivated for meat and milk production. PE Kaligesing goats are dairy goats capable of producing 1-2 liters of milk/per day.

The characteristics of farmer respondents in terms of categorical and statistical measurement units are presented in Tables 2 and 3, respectively.

**Table 2:** Socio-demographic characteristics of selected respondents.

| Description                    | Number | Percentage (%) |
|--------------------------------|--------|----------------|
| <b>Age group (year)</b>        |        |                |
| < 30                           | 18     | 6.67           |
| 31- 40                         | 63     | 23.33          |
| 41 - 50                        | 69     | 25.56          |
| 51 - 60                        | 83     | 30.74          |
| > 60                           | 37     | 13.70          |
| <b>Education level</b>         |        |                |
| Drop out of elementary school  | 8      | 2.96           |
| Elementary school              | 126    | 46.67          |
| Junior high school             | 62     | 22.96          |
| Senior high school             | 68     | 25.19          |
| Tertiary high school           | 6      | 2.22           |
| <b>Farmer group membership</b> |        |                |
| Active                         | 217    | 80.37          |
| Inactive                       | 4      | 1.48           |
| Non-member                     | 49     | 18.15          |

**Source:** Data analysis.

Table 2 shows that about 75% of farmers were in productive

ages, and thus, they could still carry out their livestock business optimally. Age is related to the farmers' mindset when determining the management system applied in business activities, as shown in a study by Mariyono (2018a). Farmers at productive ages can influence their ability and work performance both physically and in the farmer's motivation.

Most respondents' education was completed in elementary school (46.67%). Low education may inhibit technology adoption (Mariyono *et al.*, 2013, 2018b). Most of the respondent farmers are active in group membership (80.37%), and this is a good situation that might offset the education factors as the extension service offers updated knowledge and technology innovation for the farmers. Although the respondent farmers had low education, they were active in group membership to develop a good farming mindset and influence decision-making regarding their livestock business.

Table 3 shows the average measures of the selected variable. The standard deviation of each variable was relatively high, indicating variation. In particular, the average farming experience of respondents was about 13 years, and the average livestock ownership was 11 head/year. Experience is a good teacher; with such experiences, farmers can manage livestock farming effectively and efficiently.

Based on an annual basis, the livestock farming of PE goats has incurred production costs of about IDR 7,140,000, resulting in gross revenue of around IDR 16,501,000. The annual net income earned by farmers resulting from livestock farming was about IDR 9,361,000. Note that the income earned was not the same for all farmers. The income varied across farmers, and many factors determined it. Table 4 shows the estimated multiple regression model indicating factors influencing farmers' income variation.

**Table 3:** Summary statistics of selected variables.

| Variables                            | Mean    | Std. Dev | Max       | Min       |
|--------------------------------------|---------|----------|-----------|-----------|
| Income (Y)                           | 9361854 | 20905321 | 105607500 | -41105000 |
| Number of livestock sold ( $X_1$ )   | 3.66    | 4.15     | 17        | 0         |
| Feed costs ( $X_2$ )                 | 3693749 | 8654268  | 51804000  | 0         |
| Total livestock ownership ( $X_3$ )  | 11.13   | 7.14     | 41        | 2         |
| Farming experience ( $X_4$ )         | 13.34   | 8.98     | 50        | 1         |
| Forage management ( $X_5$ )          | 12.11   | 1.58     | 15        | 9         |
| Additional feed management ( $X_6$ ) | 10.78   | 3.53     | 15        | 3         |
| Marketing management ( $X_7$ )       | 15.87   | 3.55     | 20        | 10        |
| Group activeness ( $X_8$ )           | 7.77    | 3.26     | 15        | 3         |
| Feed technology ( $X_9$ )            | 0.39    | 0.48     | 1         | 2         |

**Source:** Authors' analysis



**Table 4:** Estimated model of multiple linear regression.

| Variables                            | Coefficients | Significance        |
|--------------------------------------|--------------|---------------------|
| Constanta                            | -6,685,367   | 0.250 <sup>ns</sup> |
| Number of livestock sold ( $X_1$ )   | 3,512,550    | 0.000***            |
| Feed costs ( $X_2$ )                 | -1.11        | 0.000***            |
| Total livestock ownership ( $X_3$ )  | 567,118      | 0.000***            |
| Farming experience ( $X_4$ )         | -14,966      | 0.842 <sup>ns</sup> |
| Forage management ( $X_5$ )          | -936,869     | 0.061*              |
| Additional feed management ( $X_6$ ) | 385,512      | 0.235 <sup>ns</sup> |
| Marketing management ( $X_7$ )       | 690,144      | 0.008***            |
| Group activeness ( $X_8$ )           | -151,807     | 0.702 <sup>ns</sup> |
| Feed technology ( $X_9$ )            | -3,630,964   | 0.020**             |
| #Observations                        | 270          |                     |
| R <sup>2</sup>                       | 0.776        |                     |
| F-value                              | 99.634***    |                     |

**Note:** Dependent variable (Y) is annual income; Multicollinearity problem is absent since the VIF<10, and heteroscedasticity tests show insignificance since no specific pattern of residual; ns: not significant; \*: significant at 0.1; \*\*: significant at 0.05; \*\*\*: significant at 0.01 (Ghozali, 2007). Source: data analysis.

Based on Table 4, the squared-R value is 0.776. The number indicates that about 78% of income variation can be explained by the variations in the number of livestock sold, feed costs, farming experience, number of livestock ownership, application of forage management, application of additional feed management, application of marketing management, group role and use of feed technology. In comparison, other factors beyond this study explained the remaining 22%. The significant value of F is very small,  $0.000 < 0.01$ , by means that all regressors simultaneously significantly influence income as dependent variables. Based on the diagnostically econometric procedure, the estimated regression model was free of multicollinearity and heteroscedasticity problems such that the regression estimators were robust (Ghozali, 2007).

Partially, the number of sold goats, feed costs, number of livestock owned, forage management, marketing management, and use of feed technology partially influence income. The factors of farming experience, application of additional feed management, and group role partially did not affect the income variable. Both significant and insignificant ones can be explained and justified in detail as follows.

The number of livestock sold ( $X_1$ ) has a significant value of  $0.000 < 0.01$  and a regression coefficient of 3,512,550. This value indicates that the number of livestock sold significantly affects income; when one head of livestock is sold, the farmer's income will increase by IDR 3.5 million. This phenomenon is obvious since the income is directly

related to the sales. The market plays an essential role in the case of price matters in the dairy supply chain market (Setianti *et al.*, 2017).

Feed costs ( $X_2$ ) have a significant value of  $0.000 < 0.01$  and a regression coefficient of -1.11. This significance strongly indicates that feed costs have an authentic partial effect on income, where feed costs increase by ID 1, leading to a decrease in the farmer's income by Rp. 1.11. This condition is fair since the costs encumber the income. The number is greater than unity, indicating an inefficiency in feed management. This finding aligns with a study by Purbajanti *et al.* (2016), which suggests that nutrition matters in feed management.

Total livestock ownership ( $X_3$ ) has a significant value of  $0.000 < 0.01$  and a regression coefficient of 567,117. This means that the amount of livestock ownership has a highly significant effect on income. Whenever the number of livestock owned increases by 1, the farmer's income will increase by IDR 567,117. This finding is understandable since more livestock will likely cause farmers to sell livestock in the market. In a microeconomic theory, this is related to the economy of scale.

The application of forage management ( $X_5$ ) has a significant value of  $0.061 < 0.1$  and a regression coefficient of -936,869. This means that the application of forage management reduces the income. This is quite surprising, and the effect is unexpected. However, it could be because forage management needs labor to handle it. It has been studied that farming is a lot of drudgery for daily preservation. Fail in this stage. The labor will increase the indirect costs of labor that manage the forage. This phenomenon corresponds to the finding of feed costs that indicate inefficiency. Mukson *et al.* (2017) suggest that local resources can be utilized to support forage management such that the feed is efficient. However, utilizing local resources for feed material needs extra caution since not all resources are suitable for feeding PE goats. Farmers should select the local resources carefully.

The application of marketing management ( $X_7$ ) has a significant value of  $0.008 < 0.01$  and a regression coefficient of 690,143. The significant value shows that the implementation of marketing management has a highly significant effect on income. Marketing plays a significant role since it tries to get fair prices for the producers. Selecting an appropriate marketing channel to sell the product improves income (Mariyono *et al.*, 2020).

The use of feed technology ( $X_9$ ) has a significant value of  $0.020 (p < 0.05)$  and a regression coefficient value of -3,630,964. This particular finding shows that the use of feed technology significantly affects income, and farmers

who applied feed technology earned about IDR3,630,000 lower than those who did not apply. Similar to forage management, this finding is surprisingly unexpected. The reason is also similar: Feed technology, which applies fermented coffee waste, needs extra labor to make it. Although the coffee waste might increase the weight of the goat (Londra and Sutami, 2013), the value of additional weight does not offset the costs of preparing the coffee waste as an alternative feed. Aswanto *et al.* (2023) show the potential of coffee waste for feed material. However, the potential of coffee waste is dependent on the freshness. The fresher the coffee waste, the higher the potential. Fermentation of coffee waste can improve nutrition, particularly fiber and protein (Karyono and Novita, 2021). However, the fermented coffee waste might not be suitable for PE goats. It should be noted that coffee waste is not the feed source. However, farmers tried to utilize it because coffee waste was abundant, and they also operated coffee farms. Despite the fact that coffee waste has been fermented to increase its digestibility and palatability, the level of fermentation of this particular material for PE goat has yet to be discovered. It has been studied by Nusantara *et al.* (2024) and Nuswantara *et al.* (2024) suggesting that the digestibility of feed has physiological effects on goat performance. Thus, fermented feed applied to farming still needs further supplemented feed studies, as Santoso *et al.* (2017) conducted.

Farmer experience (X4), additional feed management (X6), and group role (X8) have significant values of greater than 0.1, indicating no effect of the variables on household income. It could be the case that experiences in livestock farming are already saturated. Farmers are experienced and familiar with such businesses. The findings correspond to the activity of farmers in the farmer's group, which does not affect household income. Feed technology and forage management have offset additional feed management, which unexpectedly affects income. Additional feed for livestock receives little attention from farmers. This additional feed costs to obtain. Therefore, most farmers only provide forage. This finding implies that integrated feed management still requires further studies to find the most appropriate for small ruminants, particularly crossbred Etawah goats.

## CONCLUSION AND RECOMMENDATIONS

Livestock production by smallholder farmers is considered an important source of income for Indonesian households in rural areas. Livestock farming, particularly with small ruminants, is expected to provide a substantial contribution to the economy at regional and household levels. Farming of crossbred Etawah is one of the potential small

ruminants that have been developed in Central Java, and Purworejo district is one of the centers. The potential of crossbred Etawah farming in providing income can still be optimized by discovering the influential factors. This study was conducted to determine the substantial factors that influenced the income of crossbred Etawah goat farmers in three sub-districts of Purworejo District of Central Java, Indonesia. By using an income function derived from production and estimated using a regression model, the study shows that farmers who operated crossbred Etawah goat farming earned about IDR 9,361,000. This additional income was considered high and can be an important source of household income. The additional income resulted from gross revenue values at IDR16,502,000, with production costs of around IDR7,140,000. The annual income earned by farmers can still be increased by improving factors influencing farm management. Factors that influence management include the number of livestock sold, feed costs, number of livestock owned, implementation of marketing management, implementation of forage management, and use of feed technology. Improvement of livestock farming management is a way to increase household income. As the center of livestock farming focusing on crossbred Etawah goats, the district of Purworejo is considered the farmers' representative. This study recommends that the management of livestock farming of crossbred Etawah still needs enhancement, particularly for feed management and feed technology. Forage management needs to be further analyzed, particularly for suitability for this crossbred Etawah goat. As well the use of coffee waste for additional feed also needs further analysis since it shows an adverse impact on income. This can be conducted by sending the samples of feed to livestock research centers or universities to analyze its content and treatments so that the feed is suitable for the particular goat. Other improvements that can be made to increase income include training programs regarding feed management and feed technology for farmers since feed is one of the most important factors that is costly in livestock farming.

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## NOVELTY STATEMENT

Smallholder farming of crossbred Etawah goats is vital for rural development. This study's novelty is its focus on

improving farm performance through marketing feed management and feed technology components.

## AUTHOR'S CONTRIBUTION

MH: Writing review and editing, writing original draft, validation, resources, project administration, methodology, investigation, funding acquisition, formal analysis, data curation, conceptualization. DHD: Writing original draft, supervision, formal analysis, data curation, conceptualization. JJ: Writing original draft, supervision, validation, investigation, formal analysis. All authors contributed to this manuscript as follows.

## SUPPLEMENTARY MATERIAL

There is supplementary material associated with this article. Access the material online at: <https://dx.doi.org/10.17582/journal.aavs/2024/12.7.1273.1280>

## CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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