

# Comparison of the Performance of Feed A and Feed B on Productivity and Cost Efficiency at Surodadi Farm, Sleman

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**Abstract:** This study aims to evaluate the productivity and feed efficiency of laying hens through a comparative analysis of two commercial feed types, Feed A and Feed B. A quantitative approach was employed, utilizing independent samples t-test and Revenue to Cost (R/C) ratio analysis. Sample size was determined using Slovin's formula based on uniform criteria of flock size, age, and cage dimensions, resulting in a minimum requirement of 385 hens. To improve accuracy, 2952 Lohmann Brown hens (35–54 weeks old) were used, distributed equally in two cages of 1476 hens each. Key performance indicators included Hen Day Production (HDP), egg mass (g/hen/week), Feed Conversion Ratio (FCR), and net income. The results showed that Feed B provided better performance across all metrics. HDP for Feed B reached 91.49%, higher than Feed A at 88.75%. Total egg mass produced per cage for Feed B was 1638 kg, exceeding Feed A at 1554 kg. Feed B also recorded a more favorable FCR (2.14 vs. 2.25), indicating more efficient feed utilization. Economically, although Feed B was slightly more expensive (IDR 6,352/kg) than Feed A (IDR 6,268/kg), it generated a higher net income of IDR 6,434,870 for the total flock (2952 hens) over the study period. The R/C ratio for Feed B was 1.21, compared to 1.15 for Feed A, indicating relatively greater profitability. These findings suggest that Feed B is a more efficient and economically advantageous option for commercial layer operations aiming to optimize productivity and returns.

**Keywords:** Cost efficiency; Egg mass; Feed Conversion Ratio (FCR); Hen Day Production (HDP); Laying hen productivity

## Introduction

The rapid development of Indonesia's poultry sector plays a critical role in supporting national food security, with laying hens providing affordable animal protein through egg production. Driven by population growth and rising nutritional awareness, the demand for eggs continues to increase. However, poultry farms face challenges such as rising feed costs, input volatility, and regulatory constraints, which undermine production efficiency. To sustain productivity and profitability under these pressures, optimizing feed management and operational inputs is essential (Sarlan & Sulkiah, 2024). Their study emphasized that optimizing feed and labor inputs is crucial for maintaining productivity in commercial layer operations under economic pressures.

One of the primary determinants of success in layer farming is feed selection. Feed accounts for 60–70% of total production costs and has a direct impact on biological performance indicators such as Hen Day Production (HDP), Feed Conversion Ratio (FCR), and egg mass, which are critical to evaluating productivity and cost efficiency. According to Purnamasari et al. (2022) optimizing feed usage by aligning it with the actual nutritional needs of laying hens can significantly improve production efficiency. Their study, which observed parameters such as feed intake, HDP, egg weight, FCR, and feed cost, concluded that selecting the most appropriate and efficient feed formulation can maximize productivity while minimizing input costs.

At Surodadi Farm, located in Yogyakarta, two types of commercial feed A and feed B, are utilized during the

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layer phase. These feeds present notable differences in nutritional content and cost. Feed B contains higher crude protein (18–18.50%) compared to feed A (17.50%) and the Indonesian National Standard (Standar Nasional Indonesia, 2024) minimum of 16.50%. In terms of energy, feed B also meets the SNI requirement of 2700 kcal/kg and exhibit similar levels of crude fat, fiber, calcium, phosphorus, and amino acids. However, Feed B is priced slightly higher at IDR 6,322/kg, versus Feed A at IDR 6,265/kg. Given that protein and energy levels are critical determinants of laying hen performance and cost efficiency, these differences warrant a comparative evaluation under real farm conditions (Wang et al., 2017).

The evaluation focuses on Hen Day Production (HDP), Feed Conversion Ratio (FCR), egg mass, and feed cost efficiency—metrics widely recognized in poultry science as reliable indicators of laying performance and feed utilization. These parameters offer a balanced framework for assessing the impact of feed composition and cost on layer productivity under practical farming conditions (Salami et al., 2020). This approach not only addresses the gap in empirical evaluation between commercial feeds with similar formulations but also supports informed decision-making for optimizing input allocation in commercial layer operations. As emphasized by Lukanov et al. (2023), the Egg Production Efficiency Index (EPEI), which integrates HDP, egg mass, and FCR, serves as a comprehensive measure for evaluating both biological and economic aspects of egg production, highlighting the importance of such integrated metrics in practical feed performance assessment.

This study introduces a novel approach by integrating biological and economic indicators through a structured evaluation model. Unlike prior studies that typically focus only on productivity or cost analysis, this research offers a holistic comparison based on real-time farm data and management practices. Surodadi Farm was selected due to its consistent flock size, standardized management across housing units, and use of a dual-feed system, making it an ideal site for comparative feed evaluation. The use of egg mass—combining egg weight and production rate—provides a more accurate measure of total egg output than average egg weight alone (Nasikin et al., 2022). Performance benchmarks for the Lohmann Brown strain, including Hen Day Production (HDP) of 82–85%, annual egg mass per hen housed of 19.50–20.50 kg, and a Feed Conversion Ratio (FCR) of 2.10–2.20, were used as reference standards (Lohmann, 2023). These benchmarks serve as standardized reference points for evaluating the biological effectiveness of feed under real-farm conditions.

The study was conducted between July and November 2024, utilizing weekly production data from two sample cages with uniform chicken age and flock size. Retrospective analysis completed in early 2025 ensured that results reflected actual field performance without projection bias. The study compared Feed A and Feed B based on HDP, FCR, egg mass, and cost efficiency, aiming to provide practical insights for optimizing feed selection and resource use in commercial poultry operations.

## Method

This study employed a mixed-method approach, integrating both quantitative and qualitative analyses to provide a comprehensive evaluation of feed performance. The qualitative component involved descriptive analysis based on direct field observations and semi-structured interviews with key stakeholders, including the farm owner and field supervisor. These qualitative data were used to contextualize production conditions, management practices, and environmental factors observed at Surodadi Farm. Meanwhile, the quantitative analysis utilized an independent two-sample t-test and the Revenue-Cost (R/C) ratio to assess differences in productivity and economic efficiency between the two commercial feed types administered during the observation period.

The sampling technique applied was non-probability sampling, specifically purposive sampling, based on predetermined criteria such as the number of chickens, age uniformity, and cage size. From six cages that met these criteria, two cages were selected for the study. These two cages were chosen because they were managed by the same labor force, ensuring consistency in management and maintenance practices. Additionally, the selected cages had the same size, the number of chickens, age distribution of hens, and similar environmental conditions. The only difference between the cages was the type of feed provided, with one group receiving feed A and the other receiving feed B. A total of 2952 hens were selected, with 1476 hens in each group. Weekly observations were conducted using production data collected from the farm's daily records.

Hen productivity was evaluated using three key indicators: Hen Day Production (HDP), egg mass, and Feed Conversion Ratio (FCR). HDP was calculated using the following formula (Nanlohy et al., 2024).

$$\text{HDP (\%)} = \frac{\text{Total number of eggs produced}}{\text{Total number of live hens}} \times 100\% \quad (1)$$

Egg mass was calculated by multiplying the average egg weight by the Hen Day Production (HDP) percentage. The formula used is (Nanlohy et al., 2024).

$$\text{Egg Mass} = \text{Average Egg Weight} \times \text{HDP} (\%) \quad (2)$$

Feed efficiency was measured using the Feed Conversion Ratio (FCR), calculated as (Tistiana et al., 2023).

$$\text{FCR} = \frac{\text{Total feed consumption (kg)}}{\text{Total egg mass produced (kg)}} \quad (3)$$

To assess the economic performance of each treatment, a cost-efficiency analysis was conducted using the Revenue-Cost Ratio (R/C ratio), defined as (Nugroho & Mas'ud, 2021).

$$\text{R/C Ratio} = \frac{\text{Total revenue}}{\text{Total cost}} \quad (4)$$

An R/C ratio greater than 1 indicates a profitable operation, while a ratio less than 1 suggests a financial loss. The statistical significance of differences between the two feed treatments was tested using the independent two-sample t-test, performed with the assistance of IBM SPSS Statistics 26 software.

## Result and Discussion

### Result

#### Uji T Dua Sample

This study aims to determine the effect of feed type on the productivity of laying hens, measured through three key performance indicators: Hen-Day Production (HDP), egg mass, and Feed Conversion Ratio (FCR). The research hypothesis posits that if the t-statistic  $\geq$  t-table

value or the significance value (p-value) is  $< \alpha$  (0.05), then the alternative hypothesis ( $H_a$ ) is accepted, indicating a statistically significant effect. Conversely, if the t-statistic  $\leq$  t-table or the significance value is  $> \alpha$  (0.05), then the null hypothesis is retained, suggesting no significant effect.

Before conducting the independent samples t-test, preliminary assumption tests were performed, including normality and homogeneity tests, to ensure that the data met the requirements for parametric statistical analysis. Once the data were confirmed to be normally distributed and homoscedastic, the t-test was conducted.



Figure 1. Condition of the cage

The weekly productivity data of layer hens from cages 2A and 2B (representing Feed A and Feed B respectively) are presented in Table 1.

Table 1. Weekly performance data from cage 2A (feed A) and 2B (feed B)

Week	HDP (%)		Egg Mass (g/hen/week)		FCR	
	A	B	A	B	A	B
35	85.03	86.33	50.16	52.49	2.36	2.26
36	85.40	86.71	50.27	52.66	2.36	2.24
37	86.33	89.94	51.96	54.46	2.29	2.19
38	87.12	89.24	52.72	53.90	2.26	2.20
39	90.43	90.11	54.16	54.79	2.21	2.15
40	90.90	90.67	54.29	55.30	2.21	2.15
41	91.23	91.40	54.54	55.74	2.20	2.14
42	91.02	91.90	53.99	56.10	2.22	2.14
43	90.79	92.64	54.21	57.10	2.22	2.11
44	90.65	93.34	53.85	57.16	2.24	2.13
45	89.26	92.50	53.55	56.83	2.25	2.12
46	88.98	92.72	53.65	57.17	2.25	2.11
47	89.37	92.97	53.87	57.39	2.24	2.11
48	88.74	92.61	53.76	57.55	2.25	2.09
49	88.37	92.50	53.79	56.85	2.25	2.12
50	88.24	92.43	53.69	56.79	2.26	2.12
51	88.60	92.47	54.54	57.39	2.23	2.09
52	88.79	93.03	54.13	83.65	2.25	2.09
53	88.16	93.57	54.15	83.89	2.25	2.09
54	87.66	92.80	53.49	83.43	2.28	2.10

Source: Surodadi Farm (2024)

*Normality Test*

The normality test was conducted using the Kolmogorov-Smirnov method to determine whether the dataset follows a normal distribution. The decision criterion is that if the significance value is greater than 0.05, the data are considered normally distributed.

**Table 2.** Results of normality test

Parameter	K-S Statistic	Sig. (p-value)
HDP	0.13	0.07
Egg Mass	0.15	0.06
FCR	0.13	0.09

Source: Processed Data (2024)

All significance values exceed the 0.05 threshold, indicating that the data for all three variables are normally distributed. This result satisfies the assumption of normality, thereby validating the use of parametric tests such as the independent samples t-test.

*Homogeneity of Variance Test*

The test of homogeneity of variance was carried out using Levene's Test, which is commonly employed to evaluate whether the variances across different groups are statistically equal. Levene's Test assesses the null hypothesis that the variances of the compared groups are equal. If the significance value (p-value) resulting from the test exceeds 0.05, it indicates that the assumption of homogeneity has not been violated,

**Table 4.** Independent sample T-test results

Parameter	T-Statistic	T-Table ( $\alpha = 0.05$ )	Sig. (p-value)
HDP	4.45	2.02	0.00
Bobot Mass	5.78	2.02	0.00
FCR	7.99	2.02	0.00

Source: Processed Data (2024)

As demonstrated in Table 4, the calculated T-values for all analyzed parameters—HDP, egg mass, and FCR—were substantially higher than the critical T-value of 2.02 at the 5% significance level. Additionally, the associated p-values were all below the threshold of 0.05, signifying that the observed differences in productivity between the chickens fed with Feed A and those fed with Feed B are statistically significant. These findings suggest that the type of feed administered has a considerable impact on the overall productivity performance of layer hens.

*Productivity Performance of Layer Hens Based on Feed Type*

Observations on Lohmann Brown laying hens were conducted from 35 weeks of age between July 7 and November 22, 2024, focusing on Hen Day Production (HDP), egg mass, and Feed Conversion Ratio (FCR) based on daily field data. Differences in productivity

thereby validating the use of subsequent parametric analyses.

**Table 3.** Results of homogeneity test

Parameter	Levene Statistic	Sig. (p-value)
HDP	0.33	0.57
Egg Mass	3.28	0.08
FCR	0.72	0.40

Source: Processed Data (2024)

Since all variables display p-values above 0.05, the assumption of homogeneity of variance is met. These findings support the reliability of subsequent parametric testing using the independent samples t-test.

*Independent Sample T-Test Results*

An independent sample t-test was conducted to determine whether there were statistically significant differences in the productivity of layer chickens between two types of feed: A and B. This test was appropriate as the two groups of chickens were drawn from different populations but were homogenous in terms of age, population size, and management, as both cages were handled by the same personnel. The parameters analyzed included Hen-Day Production (HDP), egg mass, and Feed Conversion Ratio (FCR), which are the primary indicators of productivity performance in layer hens. The statistical results are presented in Table 4.

were analyzed concerning the nutritional composition of each feed (Table 5), where feed B exhibited higher crude protein content (18.00–18.50%) compared to feed A (17.50%) and the SNI minimum standard (16.50%). Since protein is essential for egg production, particularly in albumen and tissue synthesis (Fadillah, 2022), feed B's superior formulation likely contributed to better productivity outcomes. Moreover, feed B fulfilled the minimum SNI standard for metabolizable energy (2700 kcal/kg), ensuring sufficient energy intake, consistent with Purnamasari et al. (2024), who reported that optimized feed formulations, such as those incorporating *Hermetia illucens* maggot, significantly improved egg production and quality without adversely affecting hen health.

Inadequate fulfillment of nutritional requirements—particularly protein and essential minerals—can negatively affect the performance and

egg quality of laying hens. Utomo et al. (2021) emphasized that the protein content of feed significantly influences egg production levels. Proper protein intake not only affects the number of eggs produced but also impacts egg weight and overall egg mass (Maslami et al., 2023). Furthermore, insufficient levels of calcium and phosphorus have been shown to impair bone formation and eggshell quality. This is consistent with the findings of Li et al. (2016), Akter et al. (2017), and Gautier et al. (2017), who identified calcium and phosphorus as critical elements in the diet of laying hens, playing essential roles in bone development, eggshell formation, blood coagulation, muscle contraction, and nerve impulse transmission.

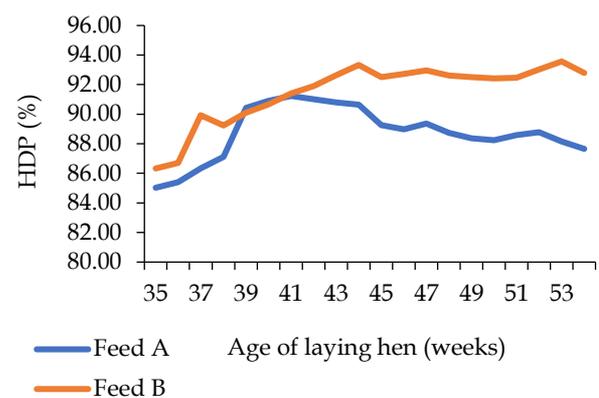
The findings of Padang et al. (2023) further support this argument, where the incorporation of alternative feed ingredients, such as durian by-products, showed no negative impact on the productivity and physiological conditions of livestock. Although conducted in goats, their results highlight the importance of formulating feed with adequate nutritional content to maintain optimal performance. Similarly, in this study, Feed B, with its higher crude protein content and compliance with SNI standards for metabolizable energy, demonstrated better productivity outcomes compared to Feed A. These results suggest that carefully designed feed formulations, rich in essential nutrients, can enhance production efficiency without compromising animal health.

**Table 5.** Nutritional composition of feed A and B

Parameter	SNI Standard	Feed A	Feed B
Water content (max) %	13.00	13.00	13.00
Ash (max) %	14.00	14.00	14.00
Crude protein (min) %	16.50	17.50	18-18.50
Crude fat (min) %	3.00	3.00	3.00
Crude fiber (max) %	7.00	7.00	7.00
Calcium %	3.25-4.25	3.25-4.25	3.25-4.25
Phosphorus (min) %	0.45-0.55	0.55	0.45
Aflatoxin (max) µg/kg	50	50	50
Amino acids			
Lysine (min) %	0.80	0.80	0.80
Methionine (min) %	0.40	0.40	0.40
Methionine + cystine (min) %	0.67	0.67	0.67
Tryptophan (min) %	0.18	0.18	0.18
Threonine (min) %	0.55	0.55	0.55
Metabolic energy (min) Kcal/kg	2700	-	2700

*Hen Day Production (HDP)*

The superior performance observed in chickens fed with Feed B aligns with previous findings that emphasize the importance of using high-protein alternative feed ingredients to improve production outcomes. Tamzil et al. (2024) demonstrated that the use of maggot meal as a protein source in poultry feed could significantly enhance production performance and egg quality without compromising the health status of the birds. In the present study, the higher crude protein content and compliance with the metabolizable energy standards in Feed B contributed to the improved and more consistent Hen-Day Production observed throughout the observation period. Jan et al. (2023) emphasized that optimizing feeding strategies and selecting superior breeding stocks can significantly impact production traits. Strategic nutritional management, as implemented with Feed B, plays a critical role in achieving higher and hen day production outcomes in layer operations.



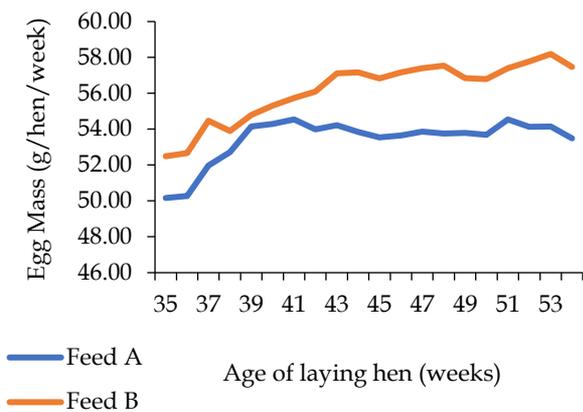
**Figure 2.** Average HDP of laying hens aged 35–54 weeks

*Egg Mas*

Egg mass serves as an essential indicator of production efficiency and marketable output. The analysis revealed that Feed B yielded a significantly higher average egg mass of 56.16 g/hen/week,

compared to 53.44 g/hen/week for the Feed A group (Figure 3). This result emphasizes the importance of feed formulation in influencing both the quantity and quality of egg production. The superior performance of Feed B may be attributed to its higher protein and nutrient density, which likely enhanced albumen and yolk formation, thus improving overall egg mass output. This finding aligns with the research by Horváth et al. (2024), which developed a more sustainable split feeding system for laying hens by optimizing protein and amino acid supply. Their study demonstrated that targeted nutrient delivery significantly improved laying performance and egg quality, supporting the notion that precise nutritional management, as implemented in Feed B, contributes positively to egg mass outcomes.

Furthermore, this result is in line with the findings of Indarsih et al. (2023), who emphasized that appropriate feed formulation and innovative management practices are crucial to optimizing poultry productivity, particularly in tropical regions where heat stress and environmental challenges can impact egg production. Their research underlined that technological innovations in feed and housing systems play a significant role in enhancing performance traits such as egg mass and production efficiency. These findings reinforce the importance of optimizing feed composition in layer farms to enhance productivity and economic efficiency.



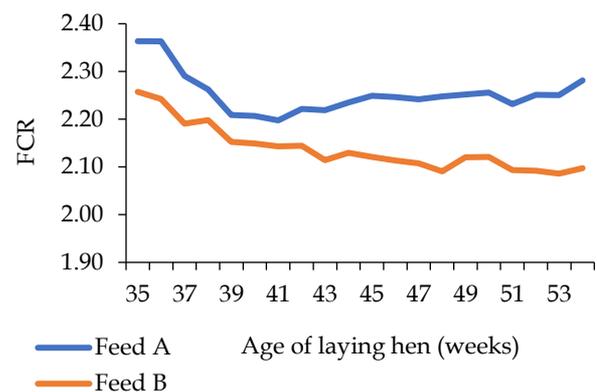
**Figure 3.** Average egg mass of laying hens aged 35–54 weeks

*Feed Conversion Ratio*

Feed efficiency as measured by the Feed Conversion Ratio (FCR) also favored Feed B. The average FCR achieved by Feed B was 2.14, more efficient than the 2.25 recorded for Feed A (Figure 4). A lower FCR indicates that fewer kilograms of feed are required to produce one kilogram of eggs, suggesting better nutrient utilization and metabolic efficiency. These outcomes are consistent with standard benchmarks for commercial layer

operations, in which an FCR below 2.2 is generally regarded as economically viable.

This result is further supported by Kobelski et al. (2024), who demonstrated that optimizing feed inputs, particularly through the integration of alternative high-protein sources such as Black Soldier Fly (BSF) maggots, can significantly improve feed conversion efficiency in poultry production. Their study highlighted that efficient utilization of alternative feed ingredients not only enhances nutrient absorption but also reduces overall production costs, which aligns with the improved FCR observed in the Feed B group. Thus, precise feed management strategies, including the careful formulation of feed components, play a crucial role in achieving higher productivity and cost efficiency in layer farms.



**Figure 4.** Average egg mass of laying hens aged 35–54 weeks

*Income Analysis*

Feed constitutes the largest component in the cost structure of layer poultry farming, often accounting for up to 70% of total production expenses, making it a critical determinant of overall farm profitability and financial sustainability (Kang et al., 2016). In this context, feed efficiency is not just about biological performance but also a key factor in economic returns, especially in commercial-scale operations where even marginal differences in feed cost and conversion can significantly impact income (Oluwabiyi et al., 2022). Given the economic pressures faced by poultry producers, optimizing feed is crucial to maintaining profitability. As a result, feed efficiency goes beyond performance metrics, influencing key financial outcomes such as total production costs, gross revenue, and net income, which are essential for assessing the long-term viability of a poultry operation.

The present study, therefore, undertakes a comparative analysis of the economic efficiency of two commonly used commercial feeds (Feed A and Feed B), specifically examining financial metrics like total

production costs, gross revenue from egg sales, net income, and the Revenue-Cost (R/C) ratio. These financial indicators collectively reflect the profitability and cost-effectiveness of each feed type under real-world farm conditions, providing practical insights for poultry producers aiming to optimize feed usage without compromising economic performance of farming.

**Table 6.** Revenue and cost between feed A and feed B (cages 2A and 2B)

Description	Feed A	Feed B
Total Egg Mass Produced (kg)	1554	1638
Price (IDR/kg)	23,000	23,000
Revenue (IDR)	35,739,040	37,666,870
Fixed Cost (IDR)	9,000,000	9,000,000
Variable Cost (IDR)	21,938,000	22,232,2000
Total Cost (IDR)	30,938,000	31,232,999
Net Income (IDR)	4,792,040	6,434,870
R/C Ratio	1.15	1.21

The analysis shows that hens fed with Feed B produced a 5.42% higher egg weight compared to those fed with Feed A, resulting in a 5.14% increase in revenue. Although Feed B incurred a slightly higher production cost (0.95%), the increased productivity led to a higher net income. The R/C ratio analysis indicates that Feed B was 5.20% more economically efficient than Feed A, with an R/C value of 1.21 compared to 1.15. An R/C ratio greater than 1.00 signifies a profitable enterprise, and Feed B demonstrated a superior return on investment.

## Discussion

### *Productivity Performance of Layer Hens Based on Feed Type*

The comparison between Feed A and Feed B showed notable differences in productivity performance. Chickens fed with Feed B exhibited higher total egg mass produced over the observation period, suggesting that Feed B may contain a more balanced nutrient profile to support optimum egg production. This aligns with findings by Mangisag et al. (2022), which emphasized that variations in feed composition, particularly in energy and protein content, can significantly influence laying hen performance.

Increased productivity in Feed B may be attributed to better digestibility and nutrient absorption. According to Li et al. (2021), improved feed formulations enhance the metabolic efficiency of laying hens, resulting in greater output in terms of egg weight and frequency. In addition, management uniformity such as identical cage design, flock age, and labor input strengthens the validity of these findings. The consistent increase in production with Feed B also demonstrates its

reliability across controlled field conditions. These results reinforce the importance of evaluating commercial feeds not just based on formulation labels but on actual field performance outcomes.

This productivity difference should encourage further research into the detailed nutritional makeup of commercial feeds to better understand which specific ingredients lead to superior hen performance. Studies by Al-sagheer et al. (2020) support the use of field trials to validate feed efficacy, noting that performance on commercial farms can differ significantly from controlled laboratory environments. Maskur et al. (2023) emphasized that feed quality and innovation in feed management, including the adoption of locally adapted feeding technologies, are critical to improving poultry productivity, especially under real-world farm conditions such as those in tropical regions. Therefore, combining nutritional research with practical feeding strategies may enhance both productivity and cost efficiency outcomes on commercial poultry farms.

### *HenDay Production and Egg Mass*

The hen-day production (HDP) rate serves as a critical indicator of laying performance. The observed HDP for chickens fed Feed B was consistently higher throughout the production period, reaching an average of 91.49%, compared to 88.75% for those fed Feed A. This finding is consistent with the research of Piccoli et al. (2020), which found that energy-dense and protein-rich feeds support higher laying rates due to enhanced follicular development and reproductive performance. In terms of total egg mass produced, Feed B outperformed Feed A by 5.42%, with a total egg mass produced of 1638 kg compared to 1554 kg for Feed A. According to Adeola & Zhai (2010) and Lemieux et al. (2021), total egg mass produced is more informative than average egg weight alone, as it incorporates both the size and frequency of egg production. This metric thus provides a more comprehensive view of laying hen productivity.

The slight differences in HDP and total egg mass produced, though statistically significant, reflect how subtle improvements in feed formulation can translate into economically meaningful differences at scale. While both feeds fall within acceptable commercial ranges, the superior results from Feed B suggest better support for sustained egg production over time. Given that feed remains the dominant variable affecting egg output, poultry producers should consider investing in feed performance trials before large-scale procurement. Integrating HDP and egg mass as complementary metrics ensures a more accurate appraisal of feed effectiveness in practical settings.

The importance of practical feed evaluation is reinforced by Tamzil et al. (2023) and Bollido (2021), who

demonstrated that alternative protein sources such as maggot-based feed can significantly contribute to poultry production efficiency under resource-constrained farm conditions. Their findings highlight that innovative and adaptive feed strategies are essential for sustaining poultry productivity, particularly in environments where conventional feed ingredients are costly or limited. Thus, practical field trials combining production metrics like HDP and egg mass remain vital tools for optimizing both productivity and cost efficiency in commercial egg production.

#### *Feed Conversion Ratio (FCR)*

Feed Conversion Ratio (FCR) is a key measure of feed efficiency. The analysis showed that Feed B achieved a lower FCR compared to Feed A of 2.14, while Feed A greater feed efficiency of 2.25. These findings are in line with the results by Lemieux et al. (2021), who noted that lower FCR values are correlated with improved nutrient digestibility and metabolic utilization. Similar results were also reported by Utami et al. (2024), where the inclusion of 22.5% fermented sword beans in quail feed significantly reduced the FCR, and by Zali (2024), who demonstrated that bamboo leaf supplementation improved feed consumption and productivity in goats. These results highlight that optimizing feed composition, whether by feed type or formulation, plays a critical role in improving production performance and cost efficiency.

A lower FCR means that chickens required less feed to produce one kilogram of eggs, which can substantially reduce overall feed costs. This is particularly important given that feed accounts for over 70% of total production costs in layer farms (Huda et al., 2021). The economic advantage of a lower FCR is thus both direct and significant. Additionally, FCR values below 2.20, as achieved with Feed B, are typically considered optimal for commercial egg production. This further supports the argument that Feed B contributes to better cost management without compromising production volume or egg quality. It is also essential to note that environmental factors, such as temperature, lighting, and flock health, were controlled during the study, ensuring that differences in FCR can be attributed primarily to feed composition. Future studies could examine how individual feed components influence conversion efficiency.

The importance of feed efficiency is also supported by findings from Herliani et al. (2025), who demonstrated that alternative protein sources such as duckweed can be effectively utilized to enhance feed conversion and carcass quality in poultry. Their research underscores that optimizing feed formulation, including the use of unconventional but nutritionally valuable ingredients, can further improve both biological

performance and cost efficiency in poultry production systems.

#### *Income Analysis*

Economic analysis revealed that Feed B resulted in a higher total revenue (IDR 37,666,870) and net income (IDR 6,434,870) compared to Feed A (IDR 4,792,040), despite a slightly higher variable cost of 0.95%. Specifically, the price per kilogram of Feed B was IDR 6352, slightly higher than Feed A at IDR 6268. However, this marginal cost difference was offset by improvements in egg mass and feed conversion ratio (FCR). These results are consistent with Zeigler & Markey (2019), who emphasized that increased feed costs can be economically justifiable when associated with higher production performance and profitability.

The Return-to-Cost (R/C) ratio further supports the financial advantage of Feed B. With an R/C ratio of 1.21 compared to 1.15 for Feed A, Feed B demonstrated a 5.20% higher efficiency in converting production costs into revenue. Both feed types yielded R/C values greater than 1.00, indicating profitable operations. However, Feed B yielded superior returns and higher income within the same production timeframe, suggesting a more efficient allocation of production inputs.

To ensure that the performance of Feed B is not only farm-specific but also meets broader commercial expectations, it was compared with the Lohmann Brown Management Guide. According to Lohmann (2023), laying hens in optimal conditions are expected to achieve a feed conversion ratio between 2.10 to 2.20 and an annual egg mass between 19.50 to 20.50 kg per hen housed. In this study, Feed B achieved an FCR of 2.14 and an total egg mass produced of 1638 kg per cage (equivalent to approximately 19.5–20 kg per hen per cycle), thereby aligning well with the Lohmann Brown standard. Feed A, on the other hand, recorded an FCR of 2.25, which slightly exceeds the optimal threshold and may indicate less efficient nutrient utilization.

Therefore, while Feed B performs effectively and meets international breed performance standards, it cannot yet be established as a definitive benchmark without further large-scale validation. Its performance in this case study suggests that it is a viable option under current farm management conditions, but it should be tested under various production systems before being considered a universal reference feed.

## **Conclusion**

This study aimed to evaluate the productivity and cost efficiency of two types of layer feed—Feed A and Feed B—through a comparative analysis. The findings indicate that Feed B outperformed Feed A in terms of

Hen-Day Production (HDP), egg mass, Feed Conversion Ratio (FCR), and feed cost efficiency. Feed B, which contains 18–18.50% crude protein, produced a total egg mass produced of 1638 kg with an FCR of 2.14, while Feed A, with 17.50% protein content, resulted in 1554 kg of total egg mass produced an FCR of 2.25. Furthermore, HDP under Feed B reached 91.49%, compared to 85.75% with Feed A. Economically, Feed B achieved a higher R/C ratio of 1.21 and generated greater net profit (6,434,870), indicating superior cost-effectiveness. Although the protein content difference between the feeds was relatively small, it contributed significantly to differences in performance, particularly during the peak production phase. These results emphasize the importance of optimal nutritional formulation in enhancing productivity and cost efficiency in layer farming operations. In conclusion, the research findings directly address the study's objective, demonstrating that Feed B is more effective in improving both production performance and economic returns. These insights can inform managerial decision-making regarding feed selection in commercial layer farms.

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#### Author Contributions

Conceptualization, methodology, validation, and formal analysis, data curation, writing - original draft preparation, and visualization, A.M.; resources, D.T.; writing - review & editing, W. and Y.L.P. All authors have read and agreed to the published version of the manuscript.

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#### Conflicts of Interest

No conflicts of interest.

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