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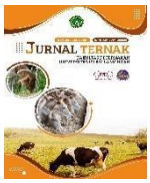

Quantitative Productivity Analysis Of Broiler Farming Business With System Closed House And System Open House

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ABSTRACT

This research was conducted in Banjarmasin City, South Kalimantan Province. The study was conducted in October 2023. The objective was to analyze the differences in quantitative productivity between broiler farms maintained under closed and open house systems. The subjects used in the study were 180,000 broilers raised in 15 cages each, each with a population of 6,000 birds per cage. This research was conducted at the broiler partnership farm of PT Mitra Sinar Jaya. The research method used a quantitative descriptive approach, with data obtained from the maintenance records of partner farmers. The number of recordings came from 6,000 broilers per cage, with 15 replications for each type of closed house and open house. The quantitative productivity observed in this study were depletion (mortality + culling), number of birds harvested, Feed Intake (FI), average harvest body weight (ABW), Feed Conversion Ratio (FCR), harvest age, cage density, and Performance Index (IP). Data were analyzed using an Independent t-test. Based on the results of the study, it shows that depletion, the number of harvested chickens, ABW, FCR, FI, broiler harvest age have no significant differences (P>0.05) between closed house and open house cages. While in quantitative productivity, cage density and IP there are differences between broilers raised with closed house and open house cage systems. From the average value there is a tendency for closed houses to be better than open houses seen from the depletion value which is better by 63 heads (174 heads vs. 237 heads); the number of harvested chickens is better by 63 heads (5826 heads vs. 5763 heads); FI is better by 0.034 (2.798 kg/head vs. 2.832 kg/head); ABW is better by 0.05 kg (1.79 kg and 1.74 kg); FCR is better by 0.068 (1.555 kg feed/kg bw vs. 1.623 kg feed/kg bw); A better cage density of 4 birds/m² (13 birds/m² vs. 9 birds/m²) and a 27-point higher Performance Index (PI) (350 vs. 323), except for the same harvest age (32 days vs. 32 days).The conclusion of this study is that the depletion value, number of birds harvested, Feed Intake (FI), ABW, FCR, and cage density of broilers using a closed house system tend to be better than those using an open house system. The success rate of broiler farming is achieved by farmers using a closed house system because the Performance Index (PI) value is higher than that of farmers using an open house system. Based on the research results, which show that closed houses tend to be 8.35% better than open houses, it is recommended that farmers using closed and open house systems improve the quality of human resources and record keeping as a basis for continuous management evaluation to achieve optimal productivity.

1. Introduction

Livestock is a component of the agricultural sector that needs to be developed and utilized optimally for the prosperity of the people. One livestock commodity with potential for development is broiler chickens. This is because broiler chickens produce meat, a vital source of protein for humans. Their benefits as a source of animal protein for humans have led to an increase in the population, production, and consumption of broiler chickens in Indonesia. Data from the Central Statistics Agency (2016) shows that Indonesian broiler chicken consumption

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tends to increase by 2.27% per year. The average national chicken meat consumption is 3.75 kg/capita/year. The national demand for broiler chicken meat reaches 3.3 kg/capita/year. Total demand for poultry meat is 4.6 kg/year. The need for animal protein derived from broiler chicken meat is 71.7%.

The two types of housing systems frequently used in partnerships are closed houses and open houses. Closed houses are based on the principle of providing well-ventilated housing conditions and minimizing human contact, ensuring livestock comfort and impacting productivity, according to Suasta et al. (2019). Open houses are more widely used in Indonesia, especially among small-scale or home-based farmers, because the initial costs are relatively low, and many farmers believe that the profits earned will be lower than the initial capital invested.

Both closed and open house systems have advantages and disadvantages. Previous research has shown that broiler rearing in closed and open cages affects feed consumption, body weight, and FCR, according to Andreas (2016). Furthermore, it was explained that broiler rearing in closed cages had better feed consumption, body weight, and FCR than in open cages. The higher the IP value obtained, the better the chicken's performance and the more efficient the use of feed, according to Fadillah (2007). The higher the IP achieved, the greater the profit. The broiler Performance Index in open houses ranges from 260-370, while in closed houses it is 400-420. The very important productivity of broilers is related to quantitative traits because it has high economic value, quantitative traits that affect the success rate of broiler farming businesses include the level of depletion (mortality + culling), the number of harvested chickens, Feed Intake (FI), the average body weight of harvested chickens (ABW), Feed Conversion Ratio (FCR), harvest age, cage density and Performance Index (IP). Based on the background, it is necessary to conduct research on "Quantitative Analysis of Productivity of Broiler Farming Businesses with Closed House and Open House Cage Systems".

2. Method

This research was conducted in Banjarmasin City, South Kalimantan Province. The implementation time was October 2023. This research method used a quantitative descriptive method with data obtained from maintenance recordings by the company's partner farmers with a total of 30 recordings of maintenance results. The variables to be observed in this study include: depletion (mortality + culling), number of harvested chickens, Feed Intake (FI), average body weight (ABW), Feed Conversion Ratio (FCR), harvest age, cage density and Performance Index (IP). The material used in the study was 180,000 broilers raised in 15 closed house and open house type cages each with a population of 6000 birds per cage. This research was conducted in the broiler partnership cage of PT Mitra Sinar Jaya. The results of the maintenance recording contain numbers that are used as a source of research data. Sampling was carried out at the broiler partnership cage of PT Mitra Sinar Jaya. The sample determination was based on the type of closed house and open house cages. The criteria used were closed house and open house cages with a capacity of 6000 birds.

3. Results and Discussion

Based on the analysis of the unpaired t test, it shows that during maintenance there is no difference in the depletion value of broilers maintained with closed house and open house cage systems. This is obtained from the calculated t value (-1.621) < t table 5% (2.048) so that H1 is rejected, but from the average value there is a tendency for depletion of broilers maintained with a closed house cage system to be 1.05% better than broilers maintained with an open house cage system.

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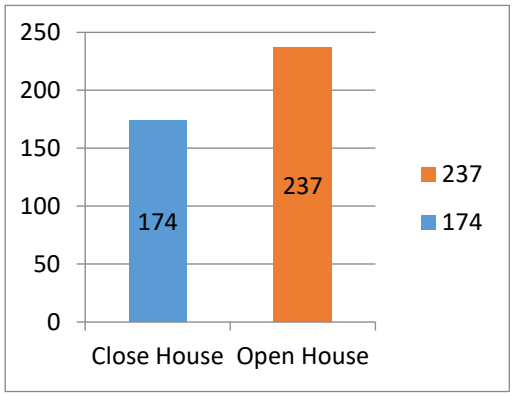
Depletion is a reduction in the number of chickens due to mortality and culling, which is an important indicator in improving the performance index. Based on the results of the study in Table 6, it can be seen that the depletion rate of broiler farming businesses with a closed house system with a difference of 0.67% from the company standard, while in open houses the difference was 0.38% above the standard. This is in accordance with the opinion of Hulzebosch (2004), who stated that high depletion in broilers can be influenced by the type of wall (ventilation) which can be distinguished into closed houses and open houses. Closed cages in broiler farming are one effort to achieve a comfortable environment, healthy air, and minimal stress conditions according to Alam (2018).

The results of the study presented in Table 6 show that the quantitative productivity of broilers based on the average percentage of better depletion comes from broiler farming using a closed house system with a value of 2.9% compared to the open house system with a value of 3.95%. This indicates that a lower depletion rate will further reduce the number of losses in broiler farming businesses. The results of the study above agree with Marom et al. (2018) who stated that the open house system tends to have a higher percentage of depletion than the closed house system. This is reinforced by the opinion of Kusandi (2006), who argues that the depletion rate can be influenced by several factors including cage and equipment sanitation, environmental cleanliness and disease. Breeders must also pay attention to the company's maintenance management standards. Breeding with open house cages also has disadvantages, including fluctuating environmental temperatures that cannot be controlled, so breeders must be able to work around if the temperature is too cold or too hot for broilers, so that this can also increase the risk of disease and death in livestock.



Gambar 3. Average Broiler Depletion (tail)

Based on the diagram in Figure 3, it can be seen that the average broiler depletion in the closed house cage system is lower, namely 174 birds compared to the number of broiler depletion in the open house cage system of 237 birds. According to Lacy and Vest (2000), they argue that the mortality rate is influenced by several factors, including body weight, breed, type of chicken, climate, environmental cleanliness, equipment and cage sanitation, and disease.

Based on the analysis of the unpaired t test, it shows that during maintenance there is no difference in the number of harvested chickens maintained with a closed house and open house cage system. This is obtained from the calculated t value (1.621) < t table 5% (2.048) so that H1 is rejected, but from the average value there is a tendency for the number of harvested broiler chickens maintained with a closed house cage system to be 1.05% better than broilers maintained with an open house cage system.

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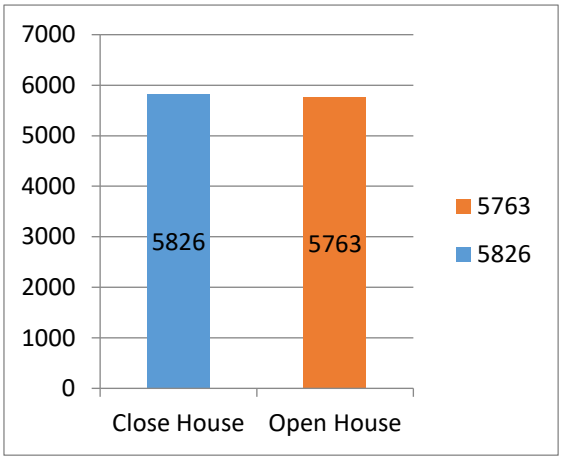
The temperature and humidity in tropical areas like the research location cause higher levels of heat stress, especially in open-house poultry houses. The results in Table 6 show that broiler quantitative productivity, based on the number of chickens harvested, from broiler farms using a closed-house system is 1.05% better than that from open-house systems. This is related to the higher and lower depletion rates in broiler farms using different housing systems.

Low depletion results in a higher number of harvested chickens, thus increasing live chicken sales, according to Mahardika (2020). This finding aligns with Kusnadi (2006), who stated that the level of depletion is influenced by several factors, such as body weight, cage sanitation, equipment, disease, stress levels, microclimate, and husbandry management. Therefore, efforts to prevent depletion will influence the number of harvested chickens.



Gambar 4. Average Number of Chickens Harvested (heads)

Based on the diagram in Figure 4, it shows that the high number of harvested chickens in broiler farming businesses with a closed house cage system, all of which occurs because of the comfort of the cage so that it creates comfortable conditions for chickens in the cage, by removing excess heat, excess water vapor and harmful gases such as carbon monoxide (CO), carbon dioxide (CO2) and ammonia (NH3) by providing the oxygen (O2) needed for broilers. Alam's opinion (2018) provides a good warning to broiler farmers with a closed house cage system, arguing that there is no guarantee for broilers raised with a closed house cage system to have a low mortality rate which is possible due to disease factors, cage building systems that are not in accordance with procedures and are not ideal, incorrect operation of closed houses and deviant management. This opinion is supported by Purwantoro (2015), who stated that in general the failure of closed houses is due to having human resources (HR) who do not understand the operation of cages with a closed house system.

Based on the analysis of the unpaired t test, it shows that during maintenance there is no difference in the feed intake value of broilers maintained with closed house and open house cage systems. This is obtained from the calculated t value (-0.273) < t table 5% (2.048) so that H1 is rejected, but from the average value there is a tendency for feed intake of broilers maintained with a closed house cage system to be better by 0.034 compared to broilers maintained with an open house cage system. Feed Intake or better known as feed consumption is the amount of feed consumed by livestock at a certain time. Based on the results of the study in table 6, it can be seen that broilers maintained using closed house and open house cage systems show no difference in feed consumption. This is caused by the type of feed used by broiler farmers with open house and closed house cage systems containing the same nutrients, namely type S10 during the starter period, S11 during the grower period and the finisher

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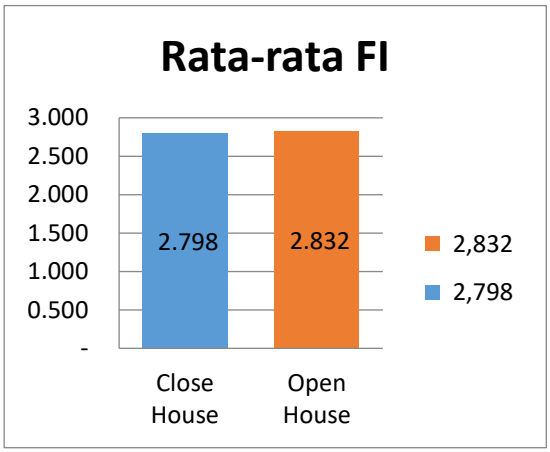
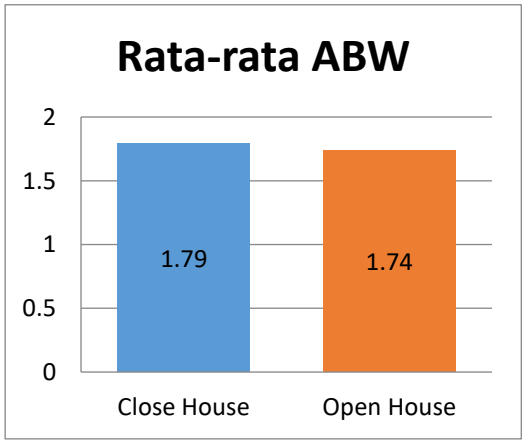
period using type S12, in broiler partnership efforts, feed quality is not included in the causes of high Feed Intake (FI) and FCR in closed house and open house cage systems (Laili et al., 2022).



Gambar 5. Average Feed Intake (FI)

Based on the research results diagram in Figure 5, the Feed Intake (FI) value of broilers during the 32-day maintenance period was 2,798 kg/head in the closed house system and 2,832 kg/head in the open house system. The Feed intake in both cage systems above is almost close to the Feed intake value according to Nuryati (2019) who stated that feed consumption for the standard Cobb 500 broiler at 32 days of age reaches 2.8 kg/head. These results are likely caused by several factors including environmental temperatures that do not match the needs of chickens, causing stress in chickens and problems with chicken health that can be caused by less than optimal sanitation of equipment and cages.

Based on the analysis of the unpaired t test, it shows that during maintenance there is no difference in the average value of the harvested chicken body weight (ABW) maintained with a closed house and open house cage system. This is obtained from the calculated t value (1.075) < t table 5% (2.048) so that H1 is rejected, but from the average value there is a tendency for the ABW of broilers maintained with a closed house cage system to be 0.05 kg better than broilers maintained with an open house cage system.



Gambar 6. Rata-rata ABW (Kg)

(ABW) is the average body weight of harvested chickens. In diagram 6, the ABW of chickens raised in a closed house system is higher, namely 1.79 kg compared to the ABW of the open house system, namely 1.74 kg. The difference in ABW between the two cage systems in the study was 0.05 kg. This ABW result is lower than the research of Nuryati (2019), Uman

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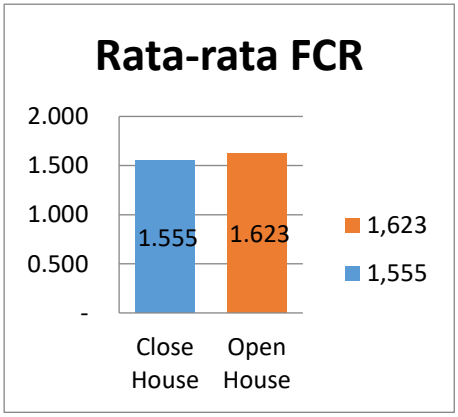
(2014) that at the age of 5 weeks, broiler chickens reached a weight of 1,900 – 2,002 grams. Research by Uman, et al., (2014), which obtained ABW in a stage cage of 1,890 kg/head and a tiered cage of 1,760 kg/head, as well as research by Budiarta, et al., (2014), in a Closed house cage of 1,718 kg/head and Susanti, et al., (2016), which was 1,962 kg/head.

Based on the results in Table 6, the average ABW for the two different housing systems was 1.77 kg. This result is lower than the standard for 32-day-old Cobb 500 broiler strains, which is 1.9 kg/bird. The ABW results in this study are higher than the results of Suasta (2019) who raised them in a closed house system, which was 1620 g/bird. This is likely due to the quality of the DOC, feeding management, environmental temperature, disease, and housing management.

Housing is one of the determining factors affecting the harvest weight of broiler chickens. Chickens will produce optimally when they are in a comfort zone. A closed house system is a cage that can be completely controlled automatically, starting from the ventilation system, feeding, drinking, temperature and humidity inside the cage. Such conditions allow conditions inside the cage to be unaffected by environmental conditions outside the cage such as air, heat, rain and wind according to Mellani (2022). This proves that the harvested body weight of broilers raised in a closed house system produces higher results than those in an open house system, although the difference between the two is not significant. Hue O (2011) added that closed house cages have sufficient good air circulation in closed house cages, which is better than open house cages that lack ventilation. Temperature and humidity in closed house cages will be lower, while in open house cages will be higher.

Based on the analysis of the unpaired t test, it shows that during maintenance there is no difference in the FCR value of broilers maintained with closed house and open house cage systems. This is obtained from the calculated t value (-1.623) < t table 5% (2.048) so that H1 is rejected, but from the average value there is a tendency for FCR of broilers maintained with a closed house cage system to be better by 0.068 compared to FCR of broilers maintained with an open house cage system.



Gambar 7. Rata-rata FCR (Kg feed/ Kg BW)

The Feed Conversion Ratio (FCR) is a measure of how efficiently chickens optimize feed for their growth. The lower the FCR, the more efficient the chicken's productivity. Based on the FCR diagram in Figure 7, it can be seen that the Feed Conversion Ratio (FCR) of broilers raised using a closed house system is more efficient with a value of 1.555 (Kg Feed/Kg BW) compared to those raised using an open house system, which is 1.623 (Kg Feed/Kg BW). The higher FCR value in broilers raised using an open house system in the study by Laili et al., (2022), which is 1.416 compared to those raised using a closed house system. This condition likely occurs because the chickens are stressed due to the increasing temperature in the cage,

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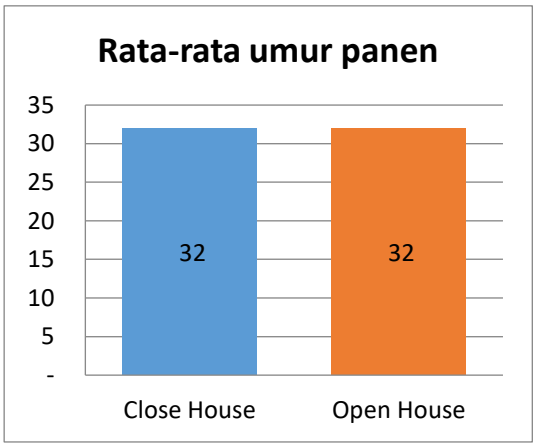
in line with the age of the chickens entering harvest age, so that appetite will slowly decrease. Environmental temperature affects body weight gain, the level of feed consumption, and feed conversion according to Mulyantini (2010).

The higher the FCR value (>2.0), the lower the performance where absorption in the intestine is not optimal, resulting in less than optimal conversion of feed into meat. Based on the results in table 6, it is known that the difference in FCR of broilers raised using the two different cage systems is 0.068, which means the FCR value is higher when compared to when using an open house cage, broilers are harvested at 30 days old with a weight of 1.8 kg and a feed conversion ratio (FCR) of 1.52 - 1.53 while when raised in a closed house cage with the same harvest age, the body weight can reach 2-2.1 kg with an FCR of 1.5. This is reinforced by the opinion of Pakage et al., (2020) who stated that the average feed conversion ratio (FCR) in broiler farming businesses with a closed house pattern is 1.60 and in an open house it is 1.77.

Based on the FCR value, the average farmer using a closed house system requires 1,555 kg of feed to produce 1 kg of live chicken weight, while farmers using an open house system require 1,623 kg of feed to produce 1 kg of live chicken weight. Therefore, the difference in performance, especially in achieving live broiler body weight and FCR, is suspected to be caused by the effect of the housing system due to the similarity of all production factors used in the production process and mentoring between the two groups of farmers (Pakage et al., 2020). This is due to the form of partnership business established between the two groups of farmers and the core company (Suwarta, 2011; Sjofjan and Djunaidi, 2016).

Based on the unpaired t-test analysis, it shows that during maintenance there is no difference in the harvest age value of broilers maintained in closed house and open house cage systems. This is obtained from the calculated t value (0.381) < t table 5% (2.048) so that H1 is rejected.

Harvest age is an important indicator in a broiler farming business. Based on the research results in Table 6, it can be seen that the harvest age of broilers raised using a closed house system and an open house system shows no difference, namely 32 days. The harvest age of broilers is closely related to the amount of ration consumption required by the livestock until harvest time, so it is expected to achieve a final weight that meets market demand and core company standards for broiler farming businesses with a partner system. In the study by Marom et al. (2017), the harvest age of broilers raised using a closed house system and an open house system is 35 days, resulting in a difference in feed usage of 70 kg for 10,000 birds per harvest period.



Gambar 8. Harvest Age (days)

Based on the results diagram in Figure 8, it can be seen that broiler breeders with open house and closed house systems harvest their livestock at 32 days of age with different

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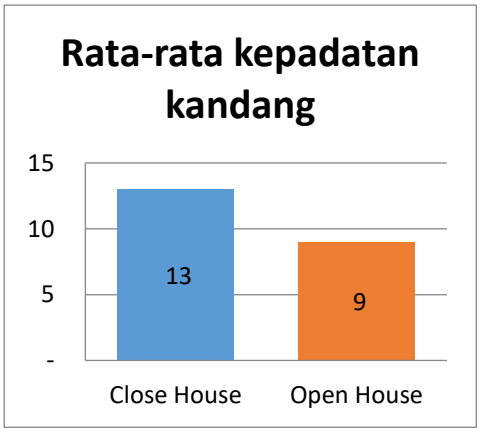
average body weights. Table 5 shows that the highest average harvest weight of broilers was produced by broilers with a closed house system, namely 1.79 kg. This agrees with the results of research by Pakage et al. (2020) which stated that the body weight of broilers in a closed house system was higher than in an open house system at an average harvest age of 32 days, with a better mortality rate in open house breeders than in closed house breeders.

Based on the analysis of the unpaired t test, it shows that during maintenance there is a difference in the density value of broiler cages maintained with a closed house and open house cage system. This is obtained from the calculated t value (8.751) > t table 5% (2.048) so that H1 is accepted, from the average value there is a difference in the density value of broiler cages maintained with a closed house cage system which is denser by 4 birds/m2 compared to broilers maintained with an open house cage system.

Cage density is one of the factors that determine the success of broiler farming. According to Permana et al. (2020), excessively high broiler density results in high depletion rates and uneven growth due to high competition for food and water, resulting in many chickens being culled. Conversely, if the cage density is too low, there will be wasted space where the chickens will move around a lot, thus wasting a lot of energy. Furthermore, excessively high cage density can lead to the emergence of one of the factors that trigger cannibalism. This is supported by Gustira et al. (2015) who stated that excessively dense cages will increase competition for rations, drinking water, and oxygen for broiler growth, so that this competition results in losers and winners, resulting in uneven growth and impaired reproductive organs.

Based on the research results in table 6, it can be seen that the highest cage density level is found in the closed house cage system, which is 13 birds/m² compared to the open house cage system, which is 9 birds/m². The high cage density was also produced in the study of Permana et al. (2020), regarding the cage density of broiler parent stock kept in open house cages with a postal floor system, showing that the average cage density for broiler parent stock is 11 birds/m². Both of the research results above are slightly higher than the opinion of Aryadi et al. (2009), who said that the capacity of broiler cages is according to the age level of broiler chickens for broilers over 2 weeks old, the broiler chicken density is around 8-10 chickens/m².



Gambar 9. Average cage density (heads/m²)

Based on the diagram in Figure 9, it can be seen that the higher the cage density, the higher the feed intake or feed consumption required (Table 6). According to Budiarta et al. (2014), the level of cage density has a significant effect (P <0.05) on feed consumption and a very significant effect (P <0.01) on body weight gain and feed conversion of broiler chickens. The difference in feed consumption at cage density during this study is thought to be related

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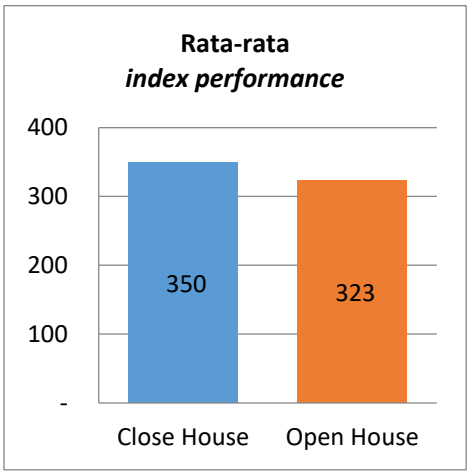
to the decreasing floor area available per chicken. Cage density will affect the movement of chickens in search of feed to meet adequate nutritional needs, in order to support the process of increasing body weight gain. Overcrowded cage conditions reduce the opportunity for chickens to get sufficient feed.

Based on the analysis of the unpaired t test, it shows that during maintenance there is a difference in the performance index value of broilers maintained with a closed house and open house cage system. This is obtained from the calculated t value (2.654) > t table 5% (2.048) so that H1 is accepted, from the average performance index (IP) value of broilers maintained with a closed house cage system is 27 points better than broilers maintained with an open house cage system.

Livestock business can be considered successful if the performance or productivity of the livestock is very good. Based on the results of the study in Table 6, it can be seen that the Performance Index (IP) value of broilers with a closed house system is 350. This value is higher when compared to the Performance Index (IP) value obtained for broilers with an open house system, which only reached 323. The average Performance Index (IP) value for both groups of farmers is included in the very good category. This is based on the opinion of Aryanti (2010), who stated that a Performance Index (IP) value above 301 can be categorized as very good. This is then reinforced by the opinion of Medion (2010), who stated that the standard Performance Index (IP) value is above 300, so the higher the Performance Index (IP) value, the higher the level of success of the livestock business.



Gambar 10. Rata-rata index performance (IP)

The success rate of broiler farming business is influenced by several factors including depletion, live weight, harvest age, FCR and cage density. Based on the results diagram in Figure 10 shows the Performance Index (IP) obtained from the closed house cage system is 350 and the open house cage system is 323. This is based on the research of Santoso and Sudaryani (2009), that the production index in broiler maintenance is classified into five groups, namely less if lower than 300, sufficient if in the range of 326-350, good if in the range of 351-400, and very good if it has a value of more than 400. According to Armelia et al. (2022), it is argued that the higher the quality of the cage produces a higher production index. This is influenced by environmental factors in the cage. According to Sufiriyanto et al. (2018), that the IP value of closed house cages is better than open houses because the temperature in closed house cages can be adjusted according to the standard temperature needs of chickens. Sujana et al. (2011), stated that extreme weather conditions cause the temperature and humidity of the cage to

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change drastically in open house cages and if not handled properly, this results in high mortality rates and decreased production results.

Conclusions

From the results of the t-test analysis on Quantitative productivity depletion, the number of harvested chickens, Feed Intake, average body weight, FCR, harvest age were not significantly different between broilers raised with closed house and open house systems. But from the average value, closed house tends to be better than open house, while the harvest age has the same value, namely 32 days. From the results of the t-test analysis on Quantitative productivity, cage density and Performance Index (IP) of broiler farming businesses were significantly different between broilers raised with closed house and open house systems. The level of success of broiler farming businesses was achieved by farmers with closed house cage systems because the Performance Index (IP) value was higher than that of farmers with open house cage systems.

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