

Comparison of Intensive and Semi-Intensive Maintenance Systems to Broiler Productivity

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Abstrak : *Broiler productivity is one of the important factors in the success of the poultry farming business, because it is directly related to production efficiency and economic profits of farmers. The maintenance systems applied in broiler farming generally consist of intensive and semi-intensive systems, each of which has different characteristics of feed management, cages, and environmental controls. These differences in maintenance systems have the potential to affect the growth, feed efficiency, and health level of broilers. This study aims to compare the influence of intensive and semi-intensive rearing systems on broiler productivity. The research method uses a quantitative descriptive approach by observing productivity parameters, such as weight gain, feed consumption, feed conversion, and mortality rate. The results show that intensive maintenance systems tend to provide better management control over the environment and feed so that they can improve production efficiency. However, the semi-intensive system has advantages in terms of livestock welfare and the utilization of natural feed sources. Therefore, the selection of a maintenance system needs to consider environmental conditions, the management capacity of farmers, and the production goals to be achieved.*

Keywords: *broiler broilers, intensive system, semi-intensive system, livestock productivity, feed efficiency.*

INTRODUCTION

Broiler chicken is one of the poultry commodities that has a strategic role in providing animal protein for the community. This commodity is relatively easy to cultivate, has a short production cycle, produces rapid weight growth, and can be marketed in various forms of products. These characteristics make broiler an important part of the food system, both to meet the needs of household consumption and as a raw material for the food processing industry. Globally, the development of the poultry industry is driven by population growth, increasing income, urbanization, changes in consumption patterns, and people's need for relatively affordable and easily obtainable sources of animal protein (Mottet & Tempio, 2017).

In Indonesia, broiler farming businesses have great development opportunities because chicken meat is one of the sources of animal protein that is widely consumed by the public. Increased chicken meat consumption encourages farmers and livestock companies to increase production capacity, business efficiency, and supply continuity. Research by Armelia et al. (2022) shows that the development of the broiler business is closely related to increasing consumption needs and efforts to improve production management. Thus, broiler businesses not only play a role in meeting food needs, but also become part of agribusiness activities that can create job

opportunities, drive rural economic activities, and increase the income of livestock business actors.

The development of modern broilers is also inseparable from advances in the fields of genetic breeding, nutrition, livestock health, and cage technology. Continuous genetic selection has produced broilers with higher growth capabilities and feed efficiency. Zuidhof *et al.* (2014) reported that the genetic development of broilers over decades has increased the growth rate very markedly and lowered the feed conversion value. However, this genetic potential can only be achieved if livestock obtain appropriate feed, a comfortable cage environment, adequate health control, and consistent maintenance management.

Produktivitas merupakan salah satu indikator utama yang menentukan keberhasilan usaha peternakan ayam pedaging. Produktivitas tidak hanya ditentukan berdasarkan bobot badan akhir atau pertambahan bobot badan harian, tetapi juga mencakup konsumsi pakan, nilai konversi pakan atau feed conversion ratio (FCR), persentase mortalitas, umur panen, keseragaman bobot badan, dan indeks performa. Nilai FCR yang rendah menunjukkan bahwa pakan dapat dikonversi menjadi bobot badan secara lebih efisien, sedangkan tingkat mortalitas yang rendah menggambarkan keberhasilan manajemen kesehatan dan lingkungan pemeliharaan. Oleh sebab itu, pengukuran produktivitas harus dilakukan secara menyeluruh agar mampu menggambarkan efisiensi biologis sekaligus keberhasilan teknis suatu usaha peternakan (Pakage *et al.*, 2020; Paly, 2023).

The productivity achievement of broilers is greatly influenced by the interaction between genetic, feed, health, and environmental factors. Modern broilers have a high metabolism and growth rate so they are relatively sensitive to changes in temperature, humidity, air circulation, cage density, and litter quality. When environmental conditions are outside the comfort zone, chickens will use some of their energy to maintain physiological balance so that the energy that should be used for growth is reduced. These conditions can reduce feed consumption, worsen feed conversion, inhibit weight gain, and increase the risk of health problems and death (Lara & Rostagno, 2013).

The problem of maintenance environment is becoming increasingly important in tropical regions such as Indonesia. High ambient temperatures and uncontrolled humidity can cause heat stress in broilers. Heat stress affects physiological balance, digestive tract function, meat quality, and livestock growth efficiency. Research by Goo *et al.* (2019) shows that the combination of high temperature and cage density can reduce growth performance and interfere with broiler intestinal barrier function. Therefore, the maintenance system and cage design must be able to support the control of temperature, humidity, air velocity, ammonia levels, and livestock density so that production potential can be achieved optimally.

Broiler rearing systems in general can be differentiated into intensive and semi-intensive systems. Intensive system is a maintenance method that places chickens in the cage during the production period with planned arrangements of feed, drinking water, lighting, ventilation, density, sanitation, and health. In this system, the needs of livestock are completely or almost completely provided by the breeder. The intensive system is widely applied to commercial farms because it facilitates livestock supervision, feeding, vaccination, disease control, production recording, and regulation of cage microclimate conditions.

In intensive systems that use closed enclosures or closed houses, temperature, humidity, and airflow can be controlled with the help of fans, cooling pads, sensors, and ventilation equipment. This control allows chickens to be raised in more stable environmental conditions than cages that depend directly on weather conditions. Research on broiler farms in Indonesia shows that cages with better environmental control generally produce better body weight, FCR,

mortality, and performance indices than cages with limited environmental control (Laili *et al.*, 2022; Pakage *et al.*, 2020; Paly, 2023).

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Access to outdoor areas in semi-intensive systems has the potential to provide benefits to livestock welfare because it allows chickens to perform more physical activity and natural behaviors. Dawkins *et al.* (2004) emphasized that the environmental conditions of the cage have a very important influence on the welfare of chickens. The study by Campbell *et al.* (2025) also shows that outdoor access can provide more diverse behavioral opportunities and has the potential to improve several indicators of well-being, such as foot condition and mobility ability. However, these benefits are highly dependent on the quality of the pasture area, climatic conditions, the availability of vegetation or shelter, the genotype of chickens, and the level of utilization of the outdoor area by livestock.

The semi-intensive system also allows chickens to take advantage of vegetation, insects, grains, and other natural materials found in the pasture area. The use of these resources has the potential to reduce some of the need for additional feed and provide a variety of activities for livestock. However, natural feed cannot always be considered a substitute for primary feed because its content and nutrient availability are difficult to control. Broilers still need a ration with the appropriate energy, protein, amino acids, vitamins, and minerals to achieve optimal

growth. If additional feed is not adequately arranged, increased physical activity in a semi-intensive system can cause increased energy requirements without adequate nutrient intake.

The results of research on outdoor access show that the influence of such systems on productivity is not always uniform. Fanatico *et al.* (2005) explained that the performance of chickens with outside access is influenced by their genotype and growth rate. Slower-growing chickens are generally more active and better able to utilize the grazing area than modern broilers that grow very quickly. Castellini *et al.* (2002) also show that production systems with external access can affect feed efficiency, live weight, carcass weight, and meat characteristics. Thus, the success of the semi-intensive system depends not only on the availability of the feeding area, but also on the suitability of the chicken strain, feed composition, harvest life, environmental conditions, and management of the outdoor area.

In addition to its benefits, semi-intensive systems face a number of constraints that can affect productivity. Chickens in outdoor areas are more exposed to temperature changes, rain, humidity, parasites, predators, and sources of contamination from the environment. Feed consumption and livestock activities are also more difficult to control than in intensive systems. The study by Campbell *et al.* (2025) shows that external access can provide benefits for a number of welfare indicators, but also increases the risk of parasitic infections and results in variations in aspects of food safety and product quality. Therefore, semi-intensive systems still require the implementation of biosecurity, rotation of the pasture area, predator control, provision of shade, sanitation, vaccination, and regular health monitoring.

Differences in characteristics between intensive and semi-intensive systems can lead to variations in feed consumption, weight gain, FCR, mortality, harvest life, and carcass quality. Intensive systems tend to provide more uniform production conditions because feed inputs and the environment can be controlled more tightly. In contrast, semi-intensive systems provide a wider range of wiggle room and behavioral opportunities, but their productivity can be more easily affected by weather, availability of natural feed, energy use for activities, and disease exposure. Therefore, the assessment of the two systems needs to include aspects of production, feed efficiency, health, mortality, welfare, and resource use.

The success of the two maintenance systems is also highly determined by the ability of farmers to implement production management. Good cage technology will not produce optimal productivity if it is not accompanied by proper feed, drinking water, density, sanitation, ventilation, vaccination, and production recording. Farmers need to be able to observe changes in chicken behavior, recognize signs of stress and disease, evaluate feed consumption, and take corrective actions when environmental conditions change. The results of a study on broiler farms in Indonesia show that cage quality, microclimate control, and management consistency are related to the achievement of body weight, FCR, mortality, and performance index (Armelia *et al.*, 2022; Hamiyanti *et al.*, 2023; Paly, 2023).

Previous studies have compared the performance of broilers based on open, semi-closed, and closed cage types. In general, the study shows that improving environmental control capabilities can improve broiler productivity. However, semi-intensive systems with overflow access have different characteristics from open and semi-closed cage systems. In addition, the influence of a maintenance system can vary according to climatic conditions, type of chicken, density, feed quality, business scale, and managerial ability of the breeder. Therefore, research results from a region or production system cannot necessarily be applied directly to different farm conditions.

In the context of the development of poultry farming in Indonesia, research on the comparison of intensive and semi-intensive rearing systems is important to obtain empirical

information about the advantages and limitations of each system. This information is needed to determine a maintenance system that is not only able to produce high growth, but also efficient in the use of feed, keep mortality rates low, support the health and welfare of livestock, and in accordance with the ability of livestock resources. The selection of the right system is expected to help farmers reduce production risks and increase business sustainability.

Based on this description, this study aims to analyze and compare the influence of intensive and semi-intensive rearing systems on broiler productivity. Productivity can be evaluated through indicators of body weight gain, final body weight, feed consumption, feed conversion, mortality, and other relevant production indicators. The results of the study are expected to provide scientific evidence regarding a more effective maintenance system in accordance with the research conditions, become a consideration for farmers in choosing a cultivation system, and contribute to the development of efficient, productive, and sustainable management of broiler farms.

METHODS

This study uses a quantitative descriptive approach with a comparative design to analyze the differences in the productivity of broilers reared using intensive and semi-intensive systems. The quantitative approach is used because the research data is expressed in the form of numbers obtained from the results of measuring and recording livestock production performance, while descriptive analysis is used to provide an objective picture of the characteristics of each maintenance system. The maintenance system is placed as an independent variable, consisting of an intensive system and a semi-intensive system, while broiler productivity becomes a bound variable. Observations were made on two groups of broilers that applied different management systems. The first group was intensively maintained in a cage with controlled regulation of feed, drinking water, ventilation, lighting, density, sanitation, and livestock health. The second group was raised semi-intensively by combining the use of the cage and the grazing area so that the chickens had the opportunity to do activities outside the cage. To maintain the comparability of observation results, factors such as chicken age, strain, length of retention, type of feed, feeding schedule, and health program need to be conditioned relatively the same or recorded as supporting factors in the analysis process.

Data collection is carried out through direct observation, measurement, documentation, and recording of production data during the maintenance period. Direct observation is used to identify cage conditions, feeding and drinking water patterns, livestock density, environmental cleanliness, ventilation, chicken activities, and the implementation of sanitation and health control in each system. The observed productivity parameters included initial and final body weight, body weight gain, feed consumption, feed conversion ratio (FCR), and mortality rate. Body weight gain is calculated based on the difference between the final body weight and the initial body weight during the maintenance period. Feed consumption is obtained from the amount of feed given after deducting the rest of the feed, while the FCR value is calculated by comparing the amount of feed consumed with the resulting body weight gain. The mortality rate is calculated based on the percentage of the number of chickens that die against the number of chickens at the beginning of rearing. All data is recorded periodically using the same observation sheet in both groups so that the data collection process can be carried out consistently and structured.

The collected data is then checked for completeness, grouped based on the maintenance system, tabulated, and analyzed descriptively and comparatively. Descriptive analysis was carried out by calculating the average value, minimum value, maximum value, percentage, and size of

data spread on each productivity parameter. The results of the analysis are then presented in the form of tables or graphs to clarify the differences in body weight gain, feed consumption, FCR, and mortality between intensive and semi-intensive systems. Comparative analysis is carried out by comparing the values of each parameter on the two maintenance systems to determine which system shows better production performance. The maintenance system is considered more effective if it results in higher body weight gain, proportional feed consumption, lower FCR values, and smaller mortality rates. The validity and consistency of the data are maintained through the use of the same measurement procedures, appropriate measuring instruments, regular recording, re-examination of the data that has been collected, and triangulation of observation results with production documentation and relevant scientific literature. Through this procedure, the research is expected to produce an objective and accountable picture of the effectiveness of intensive and semi-intensive rearing systems on broiler productivity.

RESULTS AND DISCUSSION

The difference in broiler productivity in intensive and semi-intensive systems shows that the maintenance system is not just a technical form of cages, but a management unit that determines how feed, energy, environment, and livestock health are controlled. Intensive systems tend to result in higher production performance because maintenance conditions can be regulated more measurably. In contrast, semi-intensive systems provide flexibility in activities and opportunities for the use of natural resources, but result in more fluctuating performance. Thus, the advantages of a system are not only assessed from the high body weight, but also from feed efficiency, health risks, cost needs, and suitability with the capacity of farmers.

Broiler Productivity Comparison

The results showed that chickens that were raised intensively tended to have higher body weight gain and better growth uniformity than chickens in the semi-intensive system. These conditions are supported by temperature stability, ventilation, lighting, density, and the availability of feed and drinking water in the cage. A more controlled environment reduces the energy that chickens use to adapt to changes in weather and perform physical activity, so that most of the energy can be allocated to the growth of body tissues. In a semi-intensive system, chickens have more room to move and can exhibit natural behaviors, such as walking, scavenging, and foraging in the pasture area. However, these activities increase energy use so that growth tends to be slower. In addition, changes in weather and the condition of the feeding area can cause feed consumption and body weight gain to be less uniform. This shows that the intensive system is more oriented towards production achievement, while the semi-intensive system provides a balance between production and the flexibility of livestock behavior.

Konsumsi dan Efisiensi Penggunaan Pakan

Pemberian pakan pada sistem intensif dapat disesuaikan dengan kebutuhan nutrisi ayam pada setiap fase pertumbuhan. Jumlah pakan yang diberikan, sisa pakan, dan pertambahan bobot badan dapat dicatat secara teratur sehingga efisiensi penggunaan pakan lebih mudah dievaluasi. Hasil penelitian menunjukkan bahwa sistem intensif cenderung menghasilkan nilai feed conversion ratio atau FCR yang lebih rendah. Artinya, jumlah pakan yang dibutuhkan untuk menghasilkan satu satuan pertambahan bobot badan relatif lebih sedikit.

Feed Consumption and Efficiency

Feeding in an intensive system can be adjusted to the nutritional needs of chickens in each growth phase. The amount of feed given, the rest of the feed, and the increase in body weight can be recorded regularly so that the efficiency of feed use is easier to evaluate. The results showed that

intensive systems tend to produce lower feed conversion ratio or FCR values. This means that the amount of feed needed to produce one unit of body weight gain is relatively less.

In a semi-intensive system, chickens can obtain additional feed from grass, grains, insects, and other natural sources. The use of natural feed has the potential to reduce the use of commercial feed, but its nutritional content and availability are not always stable. Natural feed is also difficult to measure precisely, so the evaluation of feed consumption and FCR becomes more complex. Therefore, natural feed sources should only be used as additional feed, while the main nutritional needs are still met through balanced rations. The feed efficiency in both systems is determined by the quality of rations, the availability of drinking water, the distribution of feed places, and the comfort of the maintenance environment.

Environment, Health, and Livestock Welfare

Intensive systems provide convenience in controlling temperature, humidity, ventilation, sanitation, and livestock health. Monitoring of feed consumption, behavior, fecal conditions, and disease symptoms can be carried out regularly. Vaccination and biosecurity programs are also easier to implement because chicken contact with the outside environment can be limited. However, high livestock density can accelerate the spread of disease if sanitation and ventilation are not managed properly. Ammonia buildup, litter moisture, and competition for feed can reduce performance and increase mortality.

The semi-intensive system provides benefits in terms of welfare because chickens gain more space of movement and can express their natural behavior. However, the openness of the environment increases exposure to temperature changes, rain, parasites, predators, and external sources of disease. Therefore, the overgrazing area must have good drainage, shelter available, and be managed through sanitation and land rotation. The welfare advantage of the semi-intensive system can only be maintained if it is accompanied by adequate health and biosecurity programs.

Cost Efficiency and Suitability of Maintenance Systems

Intensive systems require greater investment in the construction of cages, ventilation equipment, lighting, feed places, drinking water systems, and environmental control facilities. Operational costs are also relatively high due to dependence on commercial feed, electricity, vaccines, medicines, and skilled labor. Nonetheless, these costs can be offset by faster growth, shorter harvest periods, better weight uniformity, and efficient feed use. Therefore, intensive systems are more suitable for commercial farms that have capital, technology, and structured production management.

In contrast, semi-intensive systems require lower investment in cages and equipment and can utilize land, family labor, and natural feed. This system is more likely to be implemented by smallholder farmers with limited capital. However, low costs do not directly indicate better economic efficiency as farmers still have to account for slower growth, longer maintenance periods, disease risk, and crop weight inequality. Thus, intensive systems are superior in productivity and feed efficiency, while semi-intensive systems are more flexible in the utilization of local resources. The selection of the system must be adjusted to the capital, land, production objectives, management capabilities, and environmental conditions of the farm.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the study, it can be concluded that the maintenance system has a significant influence on broiler productivity. Differences in feed management, control of the cage

environment, and livestock health management are the main factors that determine the growth rate and efficiency of chicken production. Maintenance systems that are able to optimally manage environmental conditions tend to result in better and stable growth performance.

Intensive maintenance systems have been shown to provide relatively higher productivity results than semi-intensive systems. This is shown by faster body weight gain, uniform growth of livestock, and better feed use efficiency. Controlled cage conditions, regular feed management, and more intensive animal health supervision are important factors that support the success of intensive maintenance systems in improving broiler production performance.

Nonetheless, semi-intensive maintenance systems still have their own advantages, especially in terms of production cost efficiency and the utilization of natural feed sources in the surrounding environment. This system also provides a wider space for chickens so that it has the potential to improve the welfare aspect of livestock. Therefore, the selection of a maintenance system should be adjusted to the condition of resources, business scale, and the management ability of farmers so that broiler productivity can be achieved optimally and sustainably.

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