

The Influence of Maintenance Management on the Production of Dairy Cows on the Scale of People's Livestock

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Abstract : Dairy cow milk production is one of the main indicators of the success of the dairy farming business, especially on the scale of people's farming. The milk production rate is not only influenced by genetic factors of livestock, but also greatly influenced by the application of maintenance management which includes feed management, livestock health management, cage maintenance system, and milking techniques. In many smallholder farms in Indonesia, the productivity of dairy cows is still relatively low compared to the genetic potential of the cattle. This condition shows that the implementation of maintenance management that is not optimal is one of the factors causing low milk production. This study aims to analyze the influence of maintenance management on dairy cow milk production on the scale of smallholder farms. The research approach was carried out by analyzing various aspects of maintenance management related to livestock productivity, such as feed quality, cage cleanliness, health management, and milking techniques. The results of the study show that the implementation of good maintenance management can significantly increase milk production. Quality feed factors, comfortable cage environment, and good livestock health management play an important role in improving dairy production performance. Thus, strengthening maintenance management on smallholder farms is one of the important strategies to increase the productivity of dairy cows in Indonesia. Increasing the capacity of farmers through training, counseling, and the application of modern livestock technology is needed to support the sustainability of the dairy farming business.

Keywords: dairy cows, maintenance management, milk production, folk farming

INTRODUCTION

Dairy farming is one of the livestock subsectors that has an important role in supporting the provision of food from livestock, especially milk as a source of animal protein for the community. Cow's milk has high nutritional value because it contains protein, fat, lactose, vitamins, and minerals that play a role in growth, maintenance of body tissues, and improving the quality of human health. Therefore, the development of the dairy business is not only oriented towards increasing production, but is also closely related to efforts to strengthen national food security and improve the welfare of farmers, especially on the scale of people's farming.

In Indonesia, dairy cattle businesses are still largely managed by smallholder farmers with a relatively small scale of livestock ownership. This condition causes milk productivity to be greatly influenced by the ability of farmers to implement proper maintenance management. Several studies show that the productivity of people's dairy cows is highly determined by the implementation of good livestock practices, including aspects of feed, livestock health, milking, cage cleanliness, livestock welfare, and livestock environmental management (Susilorini et al., 2022; Komala et al., 2022). The implementation of Good Dairy Farming Practices on smallholder farms is considered important because it can improve production efficiency, maintain milk quality, and reduce the risk of losses due to diseases and mismanagement.

Dairy cow milk production in Indonesia is still relatively low when compared to milk-producing countries that have implemented modern management systems. The low milk production is caused by various factors, including the genetic quality of livestock, the availability and quality of feed, the cage system, disease control, milking techniques, and the conditions of the maintenance environment. In smallholder farms, limited capital, technology, access to information, and knowledge of farmers often cause maintenance management to not be implemented optimally. As a result, the genetic potential of dairy cows has not been able to produce milk production optimally.

Maintenance management is the main factor that determines the success of a dairy farming business. The management includes feeding according to the nutritional needs of livestock, providing sufficient drinking water, setting up comfortable cages, implementing good sanitation, a hygienic milking system, and planned disease control. Good management will help livestock maintain body condition, improve metabolic efficiency, improve reproductive performance, and produce more stable milk production. On the contrary, improper management can cause stress, decreased appetite, health problems, low milk quality, and decreased livestock productivity.

Feed is the most important component in the dairy farming system because it directly affects milk production and quality. Dairy cows need feed with a balanced content of energy, protein, fiber, minerals, and vitamins according to their physiological phase. The balance between forage and concentrate is an important factor because it is related to rumen activity, nutrient availability, and the formation of milk components. Feeding that is not according to needs can reduce milk production, interfere with rumen health, and cause a decrease in the condition of the livestock's body. Therefore, feed management needs to be carried out in a measurable manner based on age, body weight, lactation period, milk production level, and livestock health conditions.

In addition to feed, the condition of the cage also plays an important role in supporting the productivity of dairy cows. A good cage must be able to provide comfort for livestock, have sufficient ventilation, non-slippery floors, good drainage, and maintained cleanliness. A humid, dirty, and non-air-circulating cage environment can increase the risk of heat stress, skin diseases, foot disorders, and microbial contamination of udders and milk. Comfortable environmental conditions will help livestock reduce stress, increase feed consumption, and support optimal milk production.

Milking management is also an important aspect of the dairy business because it is directly related to the quantity and quality of milk. Milking that is carried out cleanly, regularly, and according to procedures can reduce the risk of microbial contamination and prevent mastitis from occurring. The cleanliness of milking hands, milking equipment, udders, and milk shelters must be considered so that the quality of milk is maintained. Farmers' awareness of milk quality parameters, such as the number of bacteria, the number of somatic cells, fat content, and total solids, is an important part of improving milk quality in smallholder dairy farms (Fadillah *et al.*, 2023).

The aspect of livestock health is no less important in determining dairy milk production. One of the diseases that often reduces the productivity of dairy cows is mastitis, which is inflammation of the udder that can cause a decrease in milk production, changes in milk composition, an increase in the number of somatic cells, and economic losses for farmers. Prevention of mastitis can be done through cage sanitation, milking hygiene, udder health checks, good feeding, and management of a clean and comfortable environment. Thus, livestock health programs should be an integral part of dairy cattle maintenance management.

In people's dairy farms, the implementation of good maintenance management still faces various obstacles. Some farmers still apply traditional maintenance systems, have not recorded

production regularly, have not paid attention to milking hygiene standards, and have not fully understood the relationship between feed, cages, health, and milk production. This condition suggests that the increase in milk production depends not only on the number of livestock or the genetic quality of the cows, but also on the quality of management applied by the farmer in daily maintenance activities.

Based on this description, research on the influence of maintenance management on dairy cow milk production on the scale of smallholder farms is important to be carried out. This research is expected to provide an overview of the relationship between maintenance practices and milk productivity, so that it can be the basis for improving the management system of people's dairy cows. The results of the research are also expected to contribute to farmers, extension workers, academics, and policy makers in formulating strategies to increase milk production that are more effective, efficient, and sustainable.

RESEARCH METHODS

This study uses a quantitative descriptive approach to analyze the influence of maintenance management on dairy cow milk production on the scale of smallholder farms. The quantitative descriptive approach was chosen because this study seeks to objectively describe the conditions of the implementation of maintenance management carried out by farmers and examine its relationship with the level of milk production produced by dairy cows. Through this approach, data obtained from the field can be presented in the form of numbers, percentages, averages, and trends in the relationship between variables, so as to be able to provide a more measurable picture of the conditions of maintenance management in smallholder dairy farms. This approach is also suitable to be used to identify the extent to which maintenance practices that include aspects of feed, cage, livestock health, and milking are related to the milk productivity produced by livestock (Sodiq *et al.*, 2017).

This research was carried out on a smallholder dairy farm that was the observation location, with an analysis unit in the form of dairy farmers and lactating dairy cattle that were kept. The selection of the research location was based on the existence of a smallholder dairy cow business that is still actively carrying out daily milk production activities. People's farms were chosen because the maintenance system on this scale is generally still greatly influenced by the ability, knowledge, experience, and habits of farmers in managing their livestock. Thus, the location of the study is considered relevant to illustrate the relationship between maintenance management and dairy cow milk production on the business conditions of smallholder farms.

The data used in this study consisted of primary data and secondary data. Primary data was obtained directly from the field through observation, interviews with farmers, and recording of livestock maintenance conditions. Observations were carried out to see firsthand the maintenance management practices applied by farmers, including feeding methods, cage conditions, environmental cleanliness, handling livestock health, and milking procedures. Interviews were conducted with farmers using question guidelines or questionnaires that had been prepared according to the research variables. This interview aims to obtain information about the habits of farmers in managing dairy cows, livestock experience, the number of livestock ownership, feeding patterns, frequency of milking, disease prevention measures, and obstacles faced in maintenance activities. Meanwhile, secondary data were obtained from livestock documentation, milk production records, livestock health records if available, and literature sources relevant to the research.

The main variables observed in this study include feed management, cage management, livestock health management, milking system, and daily milk production. Feed management is

observed based on the type of feed given, frequency of feeding, amount of feed, balance between forage and concentrate, and availability of drinking water. This aspect is important because feed is the main factor that affects the ability of dairy cows to produce milk. Feed that is given adequately and according to the physiological needs of livestock will support metabolic processes, maintain body condition, and increase milk production. On the other hand, inappropriate feeding can lead to decreased nutrient consumption, health problems, and low livestock productivity.

Cage management is observed based on the physical condition of the cage, cage cleanliness, ventilation, lighting, cage floor, drainage, livestock density, and comfort of the maintenance environment. A good cage serves to protect livestock from weather disturbances, provide enough room for movement, and reduce the risk of stress and disease. Cage cleanliness is also an important factor because a dirty and humid environment can increase the risk of health problems, especially diseases of the udder, feet, and skin. Therefore, observations of cage management are carried out to find out whether the maintenance environment has supported the comfort and productivity of dairy cows.

Livestock health management is observed through the efforts of farmers in maintaining the health of dairy cows, such as checking the condition of livestock, preventing diseases, providing vitamins or medicines, handling sick livestock, environmental sanitation, and the involvement of animal health workers in the event of health problems. The health aspect of livestock needs to be observed because dairy cows that experience health problems tend to experience a decrease in milk production. Diseases such as mastitis, indigestion, reproductive disorders, and other infections can affect the condition of the livestock body and reduce the quality and quantity of milk. Thus, good health management is an important part of supporting the success of the people's dairy business.

The milking system was observed based on the frequency of milking, the time of milking, the cleanliness of the milking hands, the cleanliness of the udder, the cleanliness of the milking apparatus, the method of milking, and the handling of milk after milking. Milking is one of the important stages in milk production because it is directly related to the quantity and quality of milk obtained. Regular, clean, and procedural milking can help maintain the health of the udder and reduce the risk of microbial contamination. Conversely, unhygienic milking can increase the risk of mastitis and lower milk quality. Therefore, the milking system is one of the important variables in assessing dairy cow maintenance management.

Daily milk production is used as the main indicator in assessing the productivity level of dairy cows. Milk production data was obtained from recording the amount of milk produced every day by lactating dairy cows. Milk production can be calculated based on the average production per head per day or based on the total daily milk production at the farm level. This indicator is used because milk production is the end result of various maintenance management factors implemented by farmers, including feed, cages, health, and milking. Thus, daily milk production is an important measure to determine the effectiveness of maintenance management in smallholder dairy farms (Utami *et al.*, 2020).

The data collection technique was carried out through three main methods, namely field observation, interviews, and documentation. Field observations are carried out by directly observing the condition of the farm and the maintenance practices applied by the farmers. Interviews were conducted to explore information that could not be obtained only through observation, especially regarding the habits, experiences, and decisions of farmers in managing livestock. Documentation is carried out by collecting written data or records related to milk production, number of livestock, health history, and maintenance activities. These three methods

are used in an integrated manner so that the data obtained is more complete and able to describe the actual conditions in the field.

Data analysis was carried out using descriptive analysis and intervariable relationship analysis. Descriptive analysis was used to describe the characteristics of the farmer, the condition of the farm, the application of maintenance management, as well as the milk production level of dairy cows. The data obtained are presented in the form of tables, percentages, average scores, and descriptive descriptions according to the needs of the research. This analysis aims to provide an overview of the maintenance management conditions in smallholder dairy farms. Furthermore, the analysis of the relationship between variables was used to determine the relationship between maintenance management variables and daily milk production. Through this analysis, it can be found whether the aspects of feed management, cages, livestock health, and milking have a relationship with the level of milk production produced.

To maintain the validity of the data, this study uses source triangulation and method triangulation. Source triangulation is carried out by comparing information obtained from farmers, production records, and field conditions. Meanwhile, the triangulation method was carried out by comparing the results of observations, interviews, and documentation. This effort is made so that the data used in the study has a better level of trust and does not depend only on one source of information. With triangulation, the data obtained is expected to be more accurate, objective, and in accordance with real conditions on smallholder dairy farms (Widi *et al.*, 2019).

Overall, this research method is designed to provide a systematic overview of the application of maintenance management and its relationship with dairy milk production on the scale of smallholder farms. Through data collection involving observation, interviews, and documentation, this study is expected to be able to produce comprehensive information on management factors that play a role in increasing milk productivity. The results of this method are expected to be the basis for formulating strategies for improving the management of people's dairy cattle so that milk production can be increased more effectively, efficiently, and sustainably.

RESULTS AND DISCUSSION

The results of the study show that the application of maintenance management has a significant influence on the level of dairy milk production on people's farms. Farms that implement good maintenance management tend to produce higher milk production compared to farms that still implement traditional maintenance systems. This difference shows that dairy cow productivity is not only determined by the genetic factors of the livestock, but is also greatly influenced by the quality of daily management carried out by the farmer. Maintenance management, which includes feeding, cage management, livestock health, milking techniques, and the integration of the maintenance system, are important factors in determining the success of the people's dairy business. Thus, the better the maintenance management implemented, the greater the chance for farmers to obtain more optimal, stable, and sustainable milk production.

The Effect of Maintenance Management on Dairy Milk Production

The results of the study show that maintenance management plays an important role in determining the level of dairy cow milk production on smallholder farms. Farms that implement maintenance management in a more regular, measurable, and according to livestock needs show higher milk production compared to farms that are still managed in a simple or traditional manner. This shows that the productivity of dairy cows depends not only on the number of cattle reared, but also on the ability of farmers to manage maintenance factors that are directly related to livestock performance.

Good maintenance management includes various important aspects, such as providing adequate and quality feed, providing drinking water, cleaning the cage, disease control, and milking that is carried out hygienically and regularly. Each of these aspects is interrelated and affects the physiological condition of dairy cows. Cows that get enough feed, are raised in a comfortable cage, and have good health conditions will be better able to produce milk optimally. On the other hand, livestock that are raised in poor conditions tend to experience stress, decreased feed consumption, health problems, and finally experience a decrease in milk production.

In people's farms, the application of maintenance management is still very varied. Some farmers have implemented better maintenance systems, such as regular feeding, maintaining the cleanliness of the cages, and paying attention to the health of the livestock. However, there are still farmers who implement a maintenance system based on habits, without careful planning and without regular production recording. This condition causes differences in milk production levels between farmers. Farmers who pay more attention to management aspects tend to get better production results because the basic needs of livestock can be met optimally.

Thus, the results of this study reinforce that maintenance management is a key factor in increasing dairy milk production. Increased productivity cannot only rely on an increase in the number of livestock, but must be accompanied by improvements in the quality of maintenance. Therefore, the implementation of good maintenance management needs to be the main concern in the development of smallholder dairy farms.

The Influence of Feed Management on Milk Production

One of the main factors that affect dairy cow milk production is feed management. Feed is the main source of nutrition for livestock and plays a direct role in supporting metabolic processes, energy formation, body tissue growth, and milk production. The results of the study show that farmers who provide feed with a balanced nutritional composition, both in the form of forage and concentrate, are able to significantly increase dairy cow's milk production (Sudrajat & Adiarto, 2019). This shows that the quality and quantity of feed greatly determine the ability of dairy cows to produce milk.

Good feed management is not only related to the amount of feed given, but also pays attention to the nutrient content, type of feed, frequency of feeding, and the balance between forage and concentrate. Forage acts as an important source of fiber to maintain rumen function, while concentrate serves as an additional source of energy and protein to support milk production. If the balance between forage and concentrate is not observed, livestock can experience indigestion, decreased appetite, and decreased milk production.

Farmers who provide feed regularly and according to the needs of livestock tend to obtain more stable milk production. Dairy cows that are in the lactation period require higher nutrition than cows that are not in production. Therefore, feeding must be adjusted to the physiological phase of the livestock, body weight, age, and milk production level. Feed that does not meet nutritional needs will cause cows to use their body's energy reserves, so that the body's condition decreases and milk production cannot reach its optimal potential.

In addition to the type and composition of feed, the availability of drinking water is also an important part of feed management. Dairy cows need a sufficient amount of water because milk is mostly composed of water. Lack of drinking water can lead to a decrease in feed consumption and have a direct impact on a decrease in milk production. Therefore, the provision of clean, sufficient, and easily accessible drinking water needs to be considered by farmers. With good feed management, dairy cow milk production on smallholder farms can be increased more effectively.

The Effect of Cage Conditions on Livestock Productivity

In addition to feed management, the condition of the cage also has a considerable influence on the productivity of dairy cows. The cage is a place for livestock to rest, eat, drink, and carry out daily activities. Therefore, good cage conditions will provide comfort for livestock and support increased milk production. The results of the study show that cages that have good ventilation, maintained cleanliness, and adequate sanitation systems are able to create a more comfortable maintenance environment for livestock. Good environmental conditions will reduce the level of stress in livestock so that milk production can increase (Prasetyo *et al.*, 2021).

An unqualified cage can cause a variety of problems for livestock. Poor ventilation can increase the temperature and humidity in the barn, making it easier for livestock to experience heat stress. Heat stress can reduce feed consumption, increase energy requirements to maintain body temperature, and reduce milk production. In addition, dirty and damp cages can be a breeding ground for disease-causing microorganisms. This condition can increase the risk of skin diseases, foot disorders, udder infections, and decreased milk quality.

The cleanliness of the cage is one of the important indicators in dairy cattle maintenance management. Farmers who clean their cages regularly tend to be able to create a healthier environment for livestock. Cleaning dirt, regulating drainage, replacing cage mats, and managing livestock waste are part of efforts to maintain cage sanitation. Good sanitation is not only beneficial for the health of livestock, but also affects the quality of milk produced, especially in preventing microbial contamination during milking.

In addition to cleanliness, the comfort of the cage is also affected by the size of the cage, floor conditions, lighting, and air circulation. Slippery barn floors can cause cattle to slip easily and injure themselves. Poor drainage can lead to waterlogging and increase the humidity of the cage. Therefore, cage management must be carried out thoroughly so that livestock are in a comfortable condition. With good cage conditions, dairy cows can reduce stress, increase feed consumption, maintain body health, and produce more optimal milk production.

The Effect of Livestock Health Management on Milk Production

Livestock health management is an important factor in supporting dairy milk production. Healthy dairy cows will have better metabolic ability, normal appetite, and more stable milk production. Conversely, health problems can lead to decreased milk production, decreased milk quality, and increased medical costs. The results of the study show that diseases such as mastitis can reduce milk production and affect the quality of milk produced. Therefore, the implementation of livestock health programs that include routine health checks and the administration of vaccines is very necessary in the dairy farming business (Widi *et al.*, 2019).

Mastitis is one of the diseases that is often the main problem in dairy farms. This disease attacks the udder and can cause inflammation, decreased milk production, changes in milk composition, as well as an increase in the number of somatic cells. In smallholder farms, mastitis often occurs due to lack of cage cleanliness, unhygienic milking techniques, and lack of regular udder health checks. Therefore, the prevention of mastitis must be carried out through the application of good sanitation, correct milking, cleanliness of milking equipment, and observation of udder conditions before and after milking.

The livestock health program also includes disease prevention measures through vaccination, vitamin administration, parasite control, and rapid handling of livestock that show symptoms of illness. Regular health check-ups allow farmers to detect health problems early before the disease progresses more severely. Early detection is very important because diseases that are treated late can reduce livestock productivity and cause economic losses. Therefore, the

involvement of animal health officers or livestock extension workers is very necessary to assist farmers in implementing better livestock health programs.

Good livestock health management is also closely related to the feed and cage aspects. Cattle that get a balanced nutritious feed will have a better immune system, while a clean cage can reduce exposure to disease agents. Thus, the health of livestock cannot be separated from the overall maintenance system. Farmers need to understand that disease prevention is more effective and more economical than treatment. Therefore, livestock health management must be a major part of efforts to increase the production of people's dairy cows.

The Effect of Milking Techniques on Milk Quantity and Quality

In addition to feed, cages, and livestock health, milking techniques also affect dairy cow milk production. Milking is an important process because it is directly related to the amount of milk obtained and the quality of the milk produced. Milking that is carried out hygienically, regularly, and according to procedures can improve the quality and quantity of milk. On the other hand, unhygienic milking techniques can cause milk contamination and increase the risk of disease in livestock, especially mastitis.

Good milking must pay attention to several aspects, including the cleanliness of the milking hands, the cleanliness of the udder, the cleanliness of the equipment, the time of milking, and the method of milking. Before milking, the udder should be cleaned to reduce the risk of impurities and microorganisms entering the milk. Milking equipment and milk storage containers must also be in clean condition so that the milk is not contaminated. Cleanliness in the milking process is very important because milk is a food ingredient that is easily contaminated and easily degrades in quality if not handled properly.

The frequency and regularity of milking also affect milk production. Milking carried out at a relatively fixed time can help maintain the stability of milk production. Irregular milking time can cause discomfort in livestock and interfere with the milk production process. In addition, incomplete milking can cause residual milk to be left in the udder, potentially increasing the risk of mastitis. Therefore, farmers need to apply the correct milking techniques so that milk production can be obtained to the maximum.

Hygienic milking techniques also have an impact on the quality of milk produced. Milk that is milked in a clean manner tends to have a lower risk of microbial contamination. This is important because milk quality is one of the indicators of the success of the dairy farming business. Good quality milk has a higher economic value and is safer to consume. Thus, improving milking techniques needs to be an important concern in the management of people's dairy cow maintenance.

In general, the results of the study show that good maintenance management has a close relationship with increased dairy cow milk production. The implementation of proper feed management, good cage management, optimal livestock health management, and hygienic milking techniques are the main factors in increasing the productivity of the smallholder dairy farming business. These four factors are interrelated and inseparable from each other. If one aspect of management is not implemented properly, the milk production produced can decrease. Therefore, increasing milk production on smallholder farms needs to be done through the improvement of comprehensive maintenance management.

CONCLUSIONS AND SUGGESTIONS

Based on the results and discussions, it can be concluded that maintenance management has a significant influence on dairy milk production on people's farms. Farms that implement

maintenance management well tend to produce higher milk production compared to farms that still implement traditional maintenance systems. Factors that play an important role in increasing milk production include feed management, cage conditions, livestock health management, and milking techniques. Balanced feed is able to meet the nutritional needs of livestock, clean and comfortable cages can reduce stress, maintained livestock health can maintain productivity, and hygienic milking can improve the quality and quantity of milk. Thus, increasing the production of people's dairy cows must be done through the implementation of integrated and sustainable maintenance management.

The suggestion that can be given is that smallholder dairy farmers need to improve the implementation of maintenance management in a more planned manner, especially in the aspects of feeding, cage sanitation, disease prevention, and milking procedures. Farmers need to pay attention to the balance of forage and concentrate, provide enough drinking water, maintain the cleanliness of the cages, conduct regular livestock health checks, and implement clean and regular milking. In addition, an active role of extension workers, animal health workers, cooperatives, and the government is needed in providing technical assistance to farmers so that the implementation of maintenance management can run more optimally. These efforts are expected to increase milk productivity, improve milk quality, reduce losses due to disease, and support the sustainability of the people's dairy farming business.

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