EVALUATION OF MILK PRODUCTION AND FARM MANAGEMENT PRACTICES: THE CASE OF SELECTED DAIRY CATTLE FARMS IN JOHOR, MALAYSIA

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ABSTRACT. As Malaysia stands among the largest global milk importers, it is essential to evaluate the performance of dairy cattle farms to bolster the country's milk production. This study aims to evaluate the current performance of four selected dairy cattle farms located in Johor, operating in both intensive and semi-intensive farming systems. The assessment includes determining the average dairy cattle milk production, lactation length, calving percentage, calving interval, and feeding management practices. Respondents were selected through purposive sampling, with farmers possessing over eight years of experience. A survey was conducted to gather information on the dairy cattle farms' performance. The pure breed groups consist of Friesian, Jersey, and Brown Swiss, while the crossbred group was Friesian-Jersey. The results indicated that all farms involved exhibited moderate performance, with an average daily milk production of 10.19 litres per day and an average lactation length of 270 days per cow. A t-test was used to compare the types of farming systems with respect to milk production and lactation length per cow. The analysis revealed no significant difference ($p>0.05$) in mean milk production per cow in either intensive or semi-intensive farming systems. Moreover, all farms managed to achieve an ideal average calving percentage of over 75 %, except for Farm A.

Keywords: dairy cows, milk production, farm management, intensive, semi-intensive

INTRODUCTION

According to the Department of Statistics Malaysia (2019), the agriculture sector in Malaysia contributed 7.3 % (RM99.5 billion) to the gross domestic product (GDP) in the year 2018, with 14.9 % coming from the livestock sub-sector. In 2019, there were 34,874 dairy cattle in Peninsular Malaysia, with Johor reporting the highest population, followed by Selangor, Pahang, and Perak. Malaysia produced 27.8 million litres of milk in 2019, marking a 0.2 million litres increase from the previous year. Furthermore, the self-sufficiency ratio (SSR) of milk in 2019 was recorded at 63.03 % nationwide (DVS, 2020). Dairy cattle farms in Malaysia are categorized into three scales; (a) small-scale (fewer than 30 cows), (b) semi-commercial scale (30-50 cows), and (c) commercial-scale (more than 50 cows). In 2020, it was estimated that over 77 % of dairy cattle farmers in Malaysia practiced small-scale farming systems, contributing to a shortage in milk production in the country.

Malaysia stands as one of the major global importers of milk, primarily due to the ongoing challenge in the local dairy industry, which struggles to meet the increasing demand (Maria Cynthia, 2019). One of the crucial factors influencing milk production is the genetic capability of the cattle (Boniface *et al*., 2007). Unfortunately, the majority of dairy cattle breeds in Malaysia, particularly those on commercial farms, are imported, making it difficult to acclimate to the local climate. The high temperatures prevalent in Malaysia can have adverse effects on both the quantity and quality of milk (Saadiah *et al*., 2019). Consequently, implementing systematic farm management practices to minimise livestock stress becomes imperative to ensure optimal milk production.

To enhance the country's milk production, it is important to assess the performance of dairy cattle farming. Therefore, this study is conducted to evaluate the current performance of selected dairy cattle farms in Johor operating under both intensive and semi-intensive farming systems. The evaluation involved determining the average milk production, lactation length, calving percentage, calving interval, and examining feeding management practices.

MATERIAL AND METHODS

Pilot Test

Structured questionnaires were constructed for data collection, aligning with the objective of this study. In March 2022, a pilot test was conducted in three farms located in Kluang to pre-test the survey forms. The aim was to assess whether the questionnaire design required any revisions or modifications. Based on the findings, a few questions were either eliminated or reworded to mitigate respondent misunderstandings. The survey forms comprised 40 questions, encompassing aspects of the farm's background (such as the rearing system, number of cowsheds, year of operation, pasture area, and workforce), the farm's output (including breed, milk yield, and lactation length), technology employment (covering the cooling system, indoor temperature, and relative humidity) and management practices (focusing on reproductive and feeding management).

Farms Selection and Management

In June 2022, actual surveys were conducted on four commercial-scale dairy cattle farms located in Kluang, Mersing, and Johor Bahru. Respondents were selected through purposive sampling, specifically targeting farmers with over eight years of experience for participation in this study.

Table 1. Characteristics of the dairy farms

Farm	GPS Coordinates	N[a]	Breed	Farming system
Farm A	1.96939, 103.22316	152	Friesian-Jersey	Intensive
Farm B	1.63503, 103.82861	70	Brown Swiss / Friesian / Jersey	Intensive
Farm C	2.40874, 103.82732	92	Friesian / Jersey	Semi-intensive
Farm D	2.13825, 102.73782	80	Friesian-Jersey	Semi-intensive

[a]Number of cows from each farm

The study took place at two intensive and two semi-intensive system farms as detailed in Table 1. In an intensive farming system, cows are confined and unable to roam outdoors for pasture grazing and water intake. The cows are fed on a cut-and-carry basis, where chopped grass is provided according to its present requirements. In contrast, a semi-intensive farming system allows cows access to pasture grazing during certain times of the day.

METHOD AND ANALYSIS

Farm visits were conducted to observe the actual operation of each farm. Four farmers were briefed on the study's objective and were assured that the confidentiality of the farm identities would be maintained. Raw data on farm production and other pertinent information were primarily acquired through face-to-face interviews using a pre-tested survey form. Each interview lasted

between 45 and 60 minutes, with all conducted by the researchers to ensure consistency. All primary data obtained were entered into Microsoft Excel for effective data management. Meanwhile, secondary data, including milk production by breed, reproductive performance, and feeding management, were sourced from existing publications. The collected data were organised and subjected to both quantitative and qualitative analyses using IBM SPSS version 26.0. A t-test was used to compare the means of the two groups, with comparisons between the types of farming systems with respect to milk production and lactation length per cow analysed using a t-test at a significance level of $p < 0.05$. The results were expressed as a mean and standard deviation (SD).

RESULTS AND DISCUSSION

Milk production and lactation length

The typical parameters that are commonly used for evaluating dairy cattle production performance include average milk production and lactation length. Among the farms, Farm B recorded the highest average milk production, while Farm C had the lowest (refer to Table 2). Across all farms, the average daily milk production and lactation length were 10.19 litres and 270 days, respectively. During the farm visit, it was observed that Farm B still utilised portable milking machines, whereas Farms A, C, and D employed a milking parlour system for milking cows. Milking occurred twice a day on each farm, both in the morning and the evening.

Table 2. Average milk production (litre/cow/day) and lactation length (day) according to farm

Farm	Milk production (litre/cow/day)	Lactation length (day)
Farm A	10.00	285
Farm B	11.50	225
Farm C	8.00	280
Farm D	11.25	290

According to Boniface *et al*. (2007), dairy cattle producing more than 12 litres of milk per day are considered to have good performance, those producing 6 to 12 litres per day are considered moderate, and those producing less than 6 litres per day represent poor performance. The findings of this study indicate that dairy cattle demonstrated a moderate level of production performance. Azhar *et al*. (2016) reported that a milk cow in small-scale farms in Indonesia typically produces 10 to 12 litres of milk per day, slightly higher than the average milk production level observed in the commercial-scale farms in this study. In Vietnam, 80 % of small-scale dairy cattle farms are capable of producing 14 to 15 litres of milk per cow per day (Nguyen *et al*., 2021). Meanwhile, milk production in Thailand has gradually increased, averaging approximately 12 litres per cow per day (Pornpamol *et al*., 2022; Koonawootrittriron *et al*., 2012). This suggests that the commercial-scale dairy farms in this study were unable to achieve average milk

production levels comparable to farmers in Indonesia, Vietnam, and Thailand. One potential factor contributing to this disparity is Malaysia's high temperatures and relative humidity. The imported dairy cattle's inadaptability to the local climate might be affecting the performance of the dairy cattle, particularly in high-yielding breeds (Claudia *et al*., 2022; Saadiah *et al*., 2019).

Based on the collected data, the temperature within cowsheds on each farm ranged from 28.6 °C to 33.3 °C. As noted by Mohamed (2009), heat stress becomes a concern when the temperature exceeds 25 °C. Meanwhile, the relative humidity on the farms ranged between 69.3 % and 73.0 %, falling within the optimal range of 40 to 80 % (Claudia *et al*., 2022). It is worth noting that all farms employed an open cowshed design, a common practice among dairy cattle farmers in Malaysia. However, this design leaves the cowshed temperature entirely dependent on the ambient conditions and lacks control, as seen in enclosed or semi-enclosed cowsheds. To address this, it is recommended to explore cowshed designs that offer a controllable environment, especially in managing high temperatures and relative humidity for the well-being of the cows and optimum productivity (Hamed *et al*., 2019). Additionally, implementing cooling methods, such as fans, can contribute to a comfortable environment for the cows. However, during field visits, it was observed that none of the fitted fans were in operation, with farmers aiming to minimise operational costs. While cost considerations are important, it is crucial to prioritise the comfort zone of milking cows as heat stress can lead to reduced milk production due to factors such as decreased feed intake, slowed metabolism, and increased respiratory rate and body temperature (Koonawootrittriron *et al*., 2012; Settivari *et al*., 2007). Thus, farmers are encouraged to consider the potential benefits of investing in cooling methods to enhance overall productivity.

Farm B previously demonstrated the capacity to produce more than 12 litres of milk per cow daily. However, in 2022, a significant proportion of the cows were pregnant, contributing to a decline in daily milk production. It also affected the lactation length, with the farm recording an average of 225 days. This falls short of the optimal lactation length for dairy cows, which is typically 305 days (Boniface *et al*., 2007). Furthermore, the practice of using the same bulls for breeding purposes on this farm raises concerns about potential inbreeding. Inbreeding can have detrimental effects on milk production, fertility, and calving performance, as highlighted by McParland *et al.* (2007). This emphasises the importance of having breeding strategies to mitigate the negative consequences associated with inbreeding.

Farm C, experiencing the lowest average milk production at 8 litres per cow per day, encountered similar challenges. A significant number of both cows and bulls on the farms were over seven years old, negatively impacting their performance, particularly in terms of milk production and fertility. In the past, cows on Farm C were capable of producing more than 12 litres of milk per day on average. However, in line with observations by Boniface *et al*. (2007), milk production in cows typically starts to decline around the age of eight. Recognising the impact of age on productivity, Farm C decided to address the issue by planning to replace the bulls and unproductive cows. This proactive approach aligns with the understanding that maintaining a healthy and productive herd involves managing the age composition to sustain optimal performance.

Farms A and D, featuring the same crossbred, demonstrated average daily milk

production of 10 litres and 11.25 litres per cow, respectively. Farm A experienced an increase in milk production compared to previous years, attributed to enhanced feed and nutritional programs implemented by the farm management. It is worth noting that both Farm A and Farm D exhibit good milk production levels, especially when compared to a farm in Selangor with the same crossbred. This Selangor farm recorded an average daily milk production of only 6.83 litres per cow (Azhar *et al*., 2016).

Farming system

The comparisons between the two types of farming systems with respect to mean milk production per cow and lactation length per cow were subjected to a t-test, and the results are presented in Table 3. Notably, no significant differences ($p > 0.05$) were observed in mean milk production per cow between intensive and semi-intensive farming systems. However, the mean milk production in the intensive system was marginally higher compared to the semi-intensive system, possibly attributed to the larger herd size in the intensive system. Additionally, the longer lactation length in the semi-intensive system, though not significantly different ($p > 0.05$), might influence the average amount of milk production per herd. This observation aligns with findings from a previous study by Bandara *et al*. (2011), which similarly reported the effect of farming systems on milk production and lactation length.

Table 3. Effect of farming system on milk production and lactation length

Measures	Intensive	Semi-intensive
Milk production (litres/cow/day)	$10.75^{a} \pm 1.06$	$9.63^{a} \pm 2.30$
Lactation length (days/cow)	$255^{a} \pm 42.43$	$285^{a} \pm 7.07$

[a]Mean values with same superscript are not significantly different ($p < 0.05$)

Even though cows reared intensively may exhibit higher milk production, from an animal welfare perspective, it is preferable for dairy cattle to be reared semi-intensively. This approach enables the cows to express natural behaviours such as walking freely for grazing and exploring, indirectly contributing to enhanced livestock health (Michela *et al*., 2020).

Reproductive Performance

The calving interval is one of the major components of reproductive performance, that has an impact on livestock production systems. The findings show that Farm B exhibited the highest pregnancy rate, with cows naturally bred at a bull-to-cow ratio of 1:35. In this farm, bulls and cows are allowed to roam freely in an area near the shed, without proper supervision of the cattle's mating activity. Consequently, most cows became pregnant twice a year, resulting in an average calving interval of 11 months. The recorded calving interval was slightly shorter compared to the optimal calving interval of one calf per cow per year (Migbnesh *et al*., 2022). Farm B also has a high calving rate, and the number of calves born per cow correlates positively with milk production (Table 4).

Table 4. Average pregnancy rate, calving rate, and calving interval of each farm

Farm	Pregnancy rate (%)	Calving rate (%)	Calving interval (months)
Farm A	65.0	65.0	14
Farm B	90.0	92.5	11
Farm C	51.1	97.8	14
Farm D	60.0	80.0	18

According to the results, Farm C has the highest calving rate (97.8 %), despite having the lowest pregnancy rate at 51.1 %. As previously mentioned, the advanced age of the majority of bulls and cows on Farm C, over 7 years old, might have had an impact on the cows' reproductive performance (Boniface *et al*., 2007). Studies have suggested that replacing both bulls and cows can improve farm productivity, subsequently improving reproductive performance in the dairy cattle industry (Hamed *et al*., 2019). The results also showed that all farms, with the exception of Farm A, achieved an optimum average calving percentage of over 75 % (Azhar *et al*., 2016). In an interview, Farmer A expressed an intention to implement Artificial Insemination (AI) as part of the breeding strategy, instead of relying solely on natural breeding techniques. The adoption of AI is recommended, as it has been proven to increase livestock productivity by improving the genetic component of the cattle (Azizah *et al*., 2014).

Feeding Management

All farmers participating in this study provided natural grasses as the primary feed for the cattle, ensuring that milking cows received a minimum of 30 kg per day. According to Koonawootrittriron *et al*. (2012), it is recommended that a dairy cow should be fed a minimum of 10 % of its body weight daily, which translates to 30-40 kg per day. In addition to natural grasses, supplementary feeds such as soybean meal, copra, cornmeal, molasses, minerals, and other concentrates were given to provide various nutrients for the cows to increase milk production. During the farm visits, it was observed that cows in Farm B were placed in individual cubicles equipped with a manger and watering equipment, facilitating easy access to feed and water. The time spent and ease of access to feed can positively influence cow milk production (DeVries *et al*., 2005).

Despite similar feeding management practices across all farms, Farm C and Farm D encountered additional challenges. These farms had to source grass from external suppliers, leading to raised expenditures. Feed costs constituted a significant portion, ranging from 50 % to 60 % of overall milk production costs. Studies have indicated that pasture grazing can contribute to lowering production costs, whereas an increased reliance on supplementary feed can elevate these costs (Saadiah *et al*., 2019). Recognising the impact of rising feed prices, Farm C intends to replant Napier grass, a strategic move to mitigate losses and optimise feed costs. Conversely, Farm D faces challenges such as a shortage of land for grass cultivation and a lack of manpower to efficiently manage livestock and the farm. These factors compound the management challenges for Farm D, emphasising the need for innovative solutions in addressing resource constraints.

A sufficient supply of high-quality feed is important for the success of milk production in dairy cows. While it is possible for dairy cows to be sustained solely on grass if the grass is of good quality, the situation is different in tropical regions where forage and grass tend to be less nutritious. In addition, local farmers have difficulty obtaining a sufficient supply of high-quality feed at an affordable price, since most of the feed is imported (Hamed *et al*., 2019). In such cases, farmers must supplement the diet with feeds that are rich in protein, energy, and minerals to ensure optimal milk production and maintain the health of the cows (Chubashini *et al*., 2015; Hamed *et al*., 2019). Addressing this concern and finding ways to provide nutritional feed in a cost-effective manner are critical considerations for Malaysian dairy farmers looking to thrive in the industry.

Limitations of the Study

The limitations of this study include difficulties in obtaining quality, complete, and consistently formatted data due to improper record-keeping practices. This issue may impact the comprehensive analysis of data and the accuracy of interpretations and conclusions regarding all the factors involved.

CONCLUSION

Each farm in the study demonstrated a moderate milk production range of 8.0 to 11.5 litres per cow per day. There was no significant difference in mean milk production per cow in both intensive and semi-intensive farming systems. With the exception of Farm A, all farms achieved an optimal calving percentage of more than 75 %. Cowshed temperatures in all farms exceeded 25 °C, indicating a high risk of heat stress in cows. To address this, the design of cowsheds, particularly for imported breeds, should prioritise providing an appropriate environment. The use of climate control barns is recommended to optimise both milk production and reproductive performance in cows. Moreover, there is a need to strengthen extension services to educate and encourage farmers on the importance of comprehensive data recording as the research findings can significantly aid farmers in the development of the dairy industry.

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