Performance of female Bali cattle in different management systems at Field Station of Sekolah Peternakan Rakyat (SL-SPR) Kuamang Abadi

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Abstract. This study aims to evaluate the performance of Bali cows in different management systems in the Field Station of Sekolah Peternakan Rakyat (SL-SPR) Kuamang Abadi. The linear body measurement and reproductive performances of one hundred twenty-six Bali cows owned by 64 farmers located in 4 villages in SL-SPR Kuamang Abadi were measured and recorded. Survey and observation were done from October to November 2020. Data were analyzed using statistical and descriptive methods. The parameters of linear body measurement included chest circle (CC), body length (BL), and body height (BH). The reproductive performance included age first calving (AFC), calving interval (CI), days open (DO), and service per conception (S/C). The result of linear body measurement showed that the largest CC was in a semi-intensive system at 158.03 cm; the largest BL and BH in the intensive system were 119.35 cm and 111.2 cm, respectively. The result of the reproductive performance showed that cattle in the semi-intensive systems had lower averages AFC, CI, DO, and S/C, i.e., 958.7 days, 375.1 days, 90.1 days, and 1.7, respectively. The results obtained can be used as the basis for improving maintenance management and the development of breeding Bali cattle in SL-SPR Kuamang Abadi.

1. Introduction

Domestic beef production has not met the demand yet, so most of the demand gap comes from imports. The results of data collection on cattle and buffaloes in 2011 showed that 98% of the cattle population was owned by smallholder farmers, with an average ownership rate of 2-3 head per farmer [1]. Bali cattle are one of the local cattle breeds that are mostly raised by smallholder farmers. Its population is 4,789,521 heads or 32% of the total beef cattle population of 14,824,373 heads spread across 33 provinces in Indonesia [2]. The advantages of Bali cattle favored by farmers include high fertility rates, low mortality, adaptive traits, usage of low quality of feed, and high fertility, and a high percentage of carcasses [3,4]. However, it has recently been alleged that there has been a decline in the growth rate of Bali cattle and a decrease in production due to inbreeding and negative selection [5]. [6] reported that it is currently very difficult to find Bali cattle with slaughter weights above 500 kg.
Livestock productivity is influenced by genetic and environmental factors. Environmental factors that play an important role is a management system. The cattle maintained in a supportive and comfortable environment with the availability of good quality and quantity of feed will provide a good production and reproduction performance. Cattle with optimal performance are expected to be an added value for farmers. Cattle with superior performance can be used for selection and genetic improvement. Linear body measurement is an important indicator that is often used to evaluate growth [7]. The reproductive performance also determines the sustainability, profit, and productivity of the breeding business [8]. The reproductive performance such as age first calving, calving interval, days open, calving rate, and service per conception are important to know in supporting maintenance efficiency [9].

SL-SPR Kuamang Abadi is a community of smallholder farmers who have graduated from the participatory learning process of IPB University in 2019 through the Sekolah Peternakan Rakyat program, that located in Bungo Regency, Jambi Province, Indonesia. Bungo Regency has a large potential for beef cattle development, with the largest contribution to the beef cattle population in Jambi Province, about 23.9% [10]. Supported by a large palm oil plantation area of 60,265 ha, the province is very suitable for the development of cattle-oil integration. Bali cattle at the SL-SPR Kuamang Abadi are maintained in 3 systems, namely intensive, semi-intensive and extensive. The research aimed to evaluate the production performance based on the linear body measurement and reproduction of Bali cows in different management systems as the basis for improved management and referrals for the government to the development of the cattle population in SL-SPR Kuamang Abadi.

2. Materials and methods

2.1. Materials
The present study was conducted in October-November 2020 at SL-SPR Kuamang Abadi located in Bungo Regency, Jambi Province, Indonesia. The material used in this study was a population of female Bali cattle (>3 years) of 126 heads owned by 64 farmers in 4 villages in SL-SPR Kuamang Abadi including Tirta Mulya, Lingga Kuamang, Cilodang, and Sumber Harapan Villages.

2.1.1 Data collection. Data collection was carried out through interviews with farmers as respondents and observation of Bali cows to obtain primary data. Interviews were conducted with the owner of cattle using a questionnaire. Respondents were determined through the census method. The census method was used to obtain detailed and in-depth information regarding all population units so that it can produce quality statistical data [11].

2.1.2 Linear body measurement. Linear body measurements including chest circumference (CC), body length (BL), and body height (BH) of Bali cattle were measured according to [12]. The chest circumference (CC) was measured circularly around the chest cavity through the back of the hump and behind the shoulder joint (Os scapula). Body length (BL) was measured from the hip of the shoulder (humeral tuberosity) to the end of the sitting bone (tuber ischii). Body height (BH) was measured from the distance from the flat floor surface to the highest part of the shoulders passing through the scapula vertically.

2.1.3 Reproductive performance. The data on reproductive performance including age first calving (AFC), calving interval (CI), days open (DO), and service per conception (S/C) were obtained from cattle owner information and inseminator records. Calving interval (CI) was obtained by calculating the difference between the dates of two consecutive births [13]. Days open were obtained by calculating the time difference between the partus and the mating resulting in pregnancy [14]. Service per conception (S/C) was calculated by dividing the number of matings in a herd by the number of pregnant cattle [15].
2.2. Data analysis
The data were analyzed using the software Minitab 17. Non-parametric statistics (Kruskal Wallis) were used to analyze the effect of different management systems on the productive and reproductive performance of Bali cows [16]. The result of the data was shown as the percentage, mean ± SE (standard error Mean) and expressed by descriptive.

3. Results and discussion

3.1. The management system of female Bali cattle
The management system of Bali cattle in SL-SPR Kuamang Abadi was dominated by an intensive system of 54.8%, an extensive system of 24.6%, and a semi-intensive of 20.6% (Table 1). In the intensive system, Bali cattle were reared in cages by a system of feeding with cut and carry. The feed given provides forages such as natural grass, legume, and palm frond. The semi-intensive system was carried out by releasing the Bali cattle in the morning until the afternoon while keeping them in cages at night. Through grazing, the Bali cattle feed themselves under the palm oil and after come back to the cage, where they are still given legume forages by the owners. Meanwhile, in an extensive rearing system, the Bali cattle graze freely on palm oil plantations without any cages around the area.

Management system concerning the purpose of cattle management. Intensive systems are usually alternatives to obtain optimal performance and body measurement, especially for fattening business purposes [17]. Meanwhile, the grazing system with good control is one of the systems that have prospects for cattle breeding [18].

| Item       | Total number (heads) | Percentage (%) | Management system                                                                 | Type and system of feeding                                      |
|------------|----------------------|----------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Intensive  | 68                   | 54.8           | full in the cage                                                                 | - Cut and carry (nature grass, legume and palm frond)           |
| Semi-intensive | 32                | 20.6           | released in the palm oil area at morning until afternoon, in the cage at night   | - Grazing (forage under oil palm plantation)                     |
| Extensive  | 26                   | 24.6           | released in the palm oil area without a cage                                     | - Grazing (forage under oil palm plantation)                     |

3.2. Productive performance of female Bali cattle in a different management system
The average Bali cattle in the SL-SPR Kuamang Abadi were 5.5±0.22 years old (Table 2). The results showed that Bali cattle in the semi-intensive systems had bigger means of chest circle (CC) than those in intensive and extensive systems, namely 158.03±1.30 cm (Table 2). This result was bigger than that of research by [19] in Bali cows kept semi-intensively in Sumbawa (148.34 ± 8.82 cm), [20] in East Nusa Tenggara (150.91 ± 8.53 cm), and [21] in South Sulawesi (148.44±1.23 cm). The largest body length (BL) was Balin cattle reared with an extensive system of 122.6±2.70 cm (Table 2). The results of the study were larger than those of research [22] in Bali cattle kept extensively in Halmahera (115.8±130 - 120±1.58 cm). Meanwhile, the body height (BH) of the Bali cattle in the intensive system was higher than that of those in semi-intensive and extensive systems, namely 111.2±1.64 cm (Table 2). The results of the research were higher than those of [23] in Bali cattle kept intensively in smallholder farmers (101±0.72 - 106.58±2.23 cm) but smaller than [17] in BPTU Cows Bali, i.e., 121.90 ± 3.73 cm.

If compared with the standard for Bali cows [12], the Bali cows at the SL-SPR Kuamang Abadi have a good chest circle, body length, and body height and meet the standards for class I breeds. In the semi-intensive and extensive systems, the cattle have the opportunity to move from one place to another,
affecting muscle development. Besides, the nutritional factor of the feed is very influential on body measurement. The types and quality of feed tended not to differ between each management system, causing results that were not significantly different for the body measurement of female Bali cattle (P > 0.05).

Table 2. Performance of female Bali cattle in different management system at SL-SPR Kuamang Abadi.

| Performance                           | Management system | Average   |
|---------------------------------------|-------------------|-----------|
|                                       | Intensive | Semi-intensive | Extensive |          |
| Age average (years)                   | 5.0±0.24 | 6.6±0.62 | 5.3±0.38 | 5.5±0.22 |
| Productive performance                |          |           |          |
| Linear body measurement (cm)          |          |           |          |
| Chest circle                          | 157,87±1,66 | 158,03±1,30 | 157,72±3,13 | 157,8±1,13 |
| Body length                           | 119,35±2,53 | 117,08±1,43 | 122,6±2,70 | 119,4±1,34 |
| Body height                           | 111,2±1,64 | 110,4±1,16 | 109,3±1,02 | 110,4±0,80 |
| Reproductive performance              |          |           |          |
| Age first calving (days)              | 1015,6±19,79 | 958,7±31,29 | 1048,1±39,44 | 1007,8±15,85 |
| Calving interval (days)               | 378,9±7,27 | 375,1±8,35 | 397,4±11,84 | 382,1±5,15 |
| Days open (days)                      | 94,8±7,02 | 90,1±8,35 | 112,4±11,84 | 97,5±5,05 |
| Service per conception                | 1,9±0.33 | 1,7±0.37 | 2,7±0.60 | 2,0±0.24 |

3.3. Reproductive performance of female Bali cattle in a different management system
The results showed that Bali cattle in the semi-intensive system had a faster mean of age first calving compared to those in the intensive and extensive systems, namely 958.7±31.29 days (Table 2). This result was smaller than that of the research by [24] on Bali cattle raised semi-intensively in SL-SPR Maju Bersama, Musi Banyuasin Regency (1,060.6±13.2 cm), [25] and [26] at the Bali Cattle Breeding Centre 1104 days and 43.86 months, respectively. The AFC was influenced by the age of puberty. [27] reported that Bali cattle on Bali island have a puberty age of 18-24 months. The puberty age was influenced by feed nutrition during the early phases. Cattles raised semi-intensively were free to choose their feed when grazing and still get enough forages in the cage. Other factors influencing AFC were fertility and livestock health [28].

The average calving interval of Bali cattle in the semi-intensive system was smaller than that of the intensive and extensive systems, namely 375,1±8,35 cm (Tabel 2). This result was smaller than that of the research by [8] on Bali cattle raised semi-intensively in smallholder farmers in Kupang Regency (13.075 months), and [29] in Kepulauan Yapen Regency (31.92±0.19 months). [3] reported that Bali cattle in Indonesia in a semi-intensive rearing system range from 11 to 18 months. Cattle raised on grazing land were able to adjust the birth cycle with good fluctuation of grass productivity [30].

The average days open of Bali cattle in the semi-intensive system was smaller than that of intensive and extensive systems, namely 90,1±8,35 cm (Table 2). This result was smaller than that of the research by [31] on Bali cattle raised semi-intensively by smallholder farmers at SL-SPR Maju Bersama, Musi Banyuasin Regency (109.25±8.57 days) and [32] on Timor Island (0.8-1.1 years). The DO has a normal range between 60-90 days and is relatively normal if not more than 120 days [33]. DO was influenced by the length of calf weaning, where the longer the calf weaned, the longer the postpartum matting [31].

The average service per conception of Bali cattle in a semi-intensive system was smaller than that of the intensive and extensive systems, namely 1,7±0,37 cm (Table 2). This result was smaller than that of the research by [20] on Bali cattle in East Nusa Tenggara (1,88±0,21) and [34] in Southeast Sulawesi Province (2,12±0,86), but higher than that of [29] in Kepulauan Yapen Regency (1,49±0,09). The ideal
S/C is 1, with good management, it ranges from 1.3 to 1.6. It is considered bad if it is higher or equal to 2 [35]. Low quality and quantity of feed can disturb the reproductive process of livestock so that it can affect the delay of the fist of mating, age first calving, and mating success as indicated by S/C value [36]. [3] reported that Bali cattle raised in the semi-intensive systems in Bali and extensive systems in South Sulawesi and East Nusa Tenggara have superior reproductive capabilities.

4. Conclusion
The female Bali cattle in SL-SPR Kuamang Abadi have body measurements following breeds standard of Indonesian National Standard and good reproductive performance. The difference in maintenance systems had no significant effect on body measurement and reproductive performance. The results obtained can be used as a basis for improving maintenance management for Bali cattle breeding at SL-SPR Kuamang Abadi.

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