Original article

Time estimation for mating peak and calving of Bali cattle in semi-arid area in Netemnanu village Kupang district

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ABSTRACT

Bali cattle have advantages in terms of adaptation and fertilization rates, but tend to have slow growth rate because the rearing system is still grazing so that livestock growth becomes uncontrollable. This study aims to determine the peak of mating and calving estimation of Bali cattle (*Bos sondaicus*) that did not experience reproductive disorders, aged 4-7 years, belonging to smallholder farmers. The cattle were reared in semi-arid area of Netemnanu village, South Amfoang district, Kupang regency, Nusa Tenggara Timur. The method used was interviews with farmers, diagnosis of pregnancy through rectal palpation and ultrasonography. The results showed that the pregnancy rate was 86.20% (50/58). Based on pregnancy data, it was known that the peak of mating would occur in December 2021 and estimated calving would reach its peak in September 2022.

Keywords: calving, mating, pregnancy rate, rectal palpation, ultrasonography

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INTRODUCTION

Bali cattle, which was designated as one of Indonesia's germplasms through the Decree of the Minister of Agriculture Number 325/Kpts/OT.140/1/2010, needed to be developed and preserved. Bali cattle have the advantage of being able to produce the best quality meat compared to other local cattle (Tahuk *et al*., 2018). Bali cattle have been reared in several areas in Indonesia for centuries (Astiti *et al*., 2021). Several places in Indonesia are dominated by dry land. The province of Nusa Tenggara Timur (NTT) is a semi-arid area with a dry season between 8-9 months, while the rainy season is around 3-4 months (Husen, 2015).

Bali cattle were reared in NTT with semi-intensive and extensive system. Cattle were reared with unplanned, unrecorded and unmeasured free spacing (Tophianong *et al*., 2021). Cattle productivity fluctuated seasonally, no costs for cattle feed and minimum labor needed (Godde *et al*., 2021). This extensive rearing system caused significant pre-weaning mortality, reaching 15–50% (Talib, 2002). In another study it was stated that out of 150,000 calving a year, 50,000 (around 33.3%) of them died due to lack of forage and lack of water during the dry season (Priyanto, 2017). Calf

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death could also occur after weaning. Post-weaning calf mortality could not be minimized due to a lack of feed during the dry season (Tophianong *et al.*, 2021). Study on mating peak of Bali cattle reared in semi-arid areas have not been well documented. The benefit of this study is as a database for the application of mating management.

MATERIALS AND METHODS

This research is an observational study on community farms in Netemnanu village, South Amfoang district, Kupang regency (Figure 1). This research was conducted on 20-25 May 2019. The rearing system for Bali cattle in this study was semi-intensive grazing without recording. Mating occured naturally between estrous cows and bulls in grazing groups. Data were obtained from direct field observations, interviews with cows' owners and pregnancy diagnosis in cows.

Figure 1 Map of the study area (Netemnanu village, South Amfoang district, Kupang regency, Nusa Tenggara Timur)

Pregnancy diagnosis

Changes in uterine size, texture and location of the uterus, presence of amniotic fluid and chorioallantois in the uterine lumen, murmur of blood flow of the median uterine artery (fremitus) were indications of pregnancy (Jedrzej *et.al,* 2019). Pregnancy diagnosis by rectal palpation was confirmed using transrectal ultrasonography (USG), a rectal linear probe with a frequency of 6.5 MHz (Figure 2).

Research variables

The pregnancy rate was measured based on the number of pregnant cows divided by the total number of cows multiplied by 100% (Yendraliza *et al.*, 2019). The peak of mating was counted backwards based on the gestational age at the time examination and counted forward to determine the estimated birth. The data obtained from the research are presented descriptively.

Figure 2 Pregnancy diagnosis; A: rectal palpation; B: Ultrasound image showing cotyledons (red arrows) and fetus (yellow arrow).

RESULTS

Cows reared in the study area were 58 Bali cows aged 4-7 years, with minimum parity of two, naturally mated. Pregnancy diagnosis showed that 50 out of 58 Bali cows were pregnant at 2-8 months, and five cows at 1-3 months postpartum (Table 1). Pregnancy rate was 86.21% (50/58), days open was 112 days, and calving interval was 13 months or 390 days. Based on the distribution of gestational ages (Table 1), the months of mating and calving can be estimated (Table 2).

Table 1 Reproductive status based on the results of rectal examination

no.	pregnancy (month)	number of cows	%
1	1	0	0.00
2	2	1	1.72
3	3	3	5.17
4	4	2	3.45
5	5	7	12.07
6	6	12	20.69
7	7	14	24.14
8	8	11	18.97
9	9	0	0.00
postpartum			
1	1	5	8.62
2	2	2	3.45
3	3	1	1.72

DISCUSSION

Pregnancy rate, days open, and calving interval for Bali cows at the study site were 86.21% (50/58), 112 days, and 13 months (390 days), respectively. These days open was in range of 109.25 ± 8.57 days, while the calving interval was better than the 457.25 ± 8.75 days of Bali cows reared in Sekolah Peternakan Rakyat Field Station in Sungai Lilin District, Musi Banyuasin regency, South Sumatra Province (Sari *et al.,* 2020). This pregnancy rate was better than the report of smallholder farms in the savanna and the prairies of South Africa with an annual rainfall range of 400 to 1600 mm which achieved an average pregnancy rate of 50%, with days open and calving interval of 334 and 608 days, respectively (Nkadimeng *et al.,* 2022).

Table 2 Number of mating and estimated calving throughout the year

	mating estimation (2021)	calving estimation (2022)
January	7	0
February	3	0
March	3	0
April	0	0
May	0	0
June	0	11
July	0	11
August	0	3
September	11	12
October	11	7
November	3	3
Desember	12	3

The pregnancy rate of Bali cows in this semi-arid area was 86.21% (50/58). The pasture environment was one of the factors that influence the availability of feed. Semi-arid condition with seasonal fluctuations and limited availability of feed in NTT indicated that Bali cattle have adapted well to the environment so that they have a fairly good reproductive performance

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(Tophianong *et al*, 2021). These results indicated that the days open of approximately 112 days for Bali cattle in Netemnanu village, South Amfoang district, Kupang regency was relatively good. These results were supported by research by Ishan (2010) which stated that good cows have DO only around 85-115 days. Days open were influenced, among other things, by nutritional intake. Malnutrition in the dry season causes a delay in the first post-partum estrus (Asker *et al.*, 2021). In addition, feeding low-energy feed in the last 45 days before parturition has an impact on poor growth, low immunity, and low antioxidant capacity in calves. Increasing maternal energy intake during late gestation was expected to improve the reproductive health of cows (Chen *et al.*, 2022).

The calving interval of Bali cows in this study was 13 months or 390 days. The ideal calving interval was between 12 and 15 months. The ideal calving interval of 12 months, could be divided into 9 months of pregnancy and 3 months of nursing (Nuryadi and Wahjuningsih, 2011). Calving interval was influenced by several factors such as undernutrition conditions of postpartum cows, causing delays in egg cell formation. The profitability and sustainability of a cow–calf operation were dependent on the longevity of each breeding female and the production of a live calf every year. If a heifer calves earlier in the calving season (first 21-day period), they have more time to heal and resume cycling before the next breeding season commences in order to maintain a 365-d calving interval (Damiran *et al.*, 2018).

Mating peak in this study was calculated based on gestational age obtained from pregnancy diagnosis through rectal palpation and ultrasonography (Table 1). Patterns of mating and calving are important factors in reproductive management. In an extensive pastoral system, mating occured naturally. The bulls in the grazing group will immediately mate with the cows in estrus (Tophianong *et al.*, 2021), unknown to farmers so they were not recorded. Subsequently, data related to mating and calving estimation were not available. In this study, mating pattern and estimated calving were

calculated based on the results of the pregnancy diagnosis and the age of the last calf. Mating patterns could be supplemented with data on pregnancy rates, days open and calving interval to predict reproductive performance (Temesgen *et al.*, 2022).

Bali cattle mating throughout this study reached its peak in December (Table 2). The province of NTT is a semi-arid area with low rainfall, where the rainy season was only lasts three to four months with an average annual rainfall of between 800 and 3,000 mm (Husen, 2015). In these conditions the quality and quantity of feed could meet the needs of reproductive activity which was characterized by the occurrence of estrus and mating. Feed is an important factor in livestock reproductive performance. Good nutrition would maintain the endocrine activity of the hypothalamus-pituitary-ovarian for the development of ovarian follicles followed by an increase in estrogen levels that trigger estrus (Montiel and Ahuja, 2005). Inadequate nutritional intake would affect metabolic compounds, and hormones such as insulin and insulin-like growth factor-I which affected the response of the hypothalamus and pituitary to the ovaries as well as the sensitivity of gonadotropin hormones in the pituitary so that the body's energy would suppress the release of gonadotropin-releasing hormone (GnRH) and affect the frequency of luteinizing hormone (LH) pulses required for follicular growth (Zhao *et al.*, 2021). Malnutrition would cause delayed puberty because the follicles did not develop into atretic dominant follicle or ovulatory dominant follicle, in addition to causing decreased in ovarian function or ovarian hypofunction (Budiyanto *et al.*, 2016).

Throughout this study, it was estimated that the peak of calving would occur in September 2022 assuming there were no disturbances during pregnancy. Calves born in September faced big problems due to limited forage during the dry season. Forage as a source of feed was vegetation that grows and dominated pastures during the rainy season (only four months a year), while during the dry season the vegetation tends to dry up (Priyanto, 2017). In the dry

season, cattle would experience a decrease in body condition scores because feeding relies on field grass which was of low quantity and quality. In conditions of malnutrition, the body was unable to meet physiological needed for nutrients needed for maintenance, care and production (Daros *et al.*, 2021). Calves born outside the calving season (when pasture production was not supportive) reduce the dam's ability to raise calves due to low milk production (Astiti, 2018).

CONCLUSION

The peak time for mating for Bali cattle in the semi-arid area of Netemnanu village, South Amfoang district, Kupang regency, Nusa Tenggara Timur was reached in December and they were expected to give birth in September the following year. Mating should be done in January-April so that calving would not occur during the dry season by releasing males only from January to March. If calving occured in October - January, then the availability of feed in the pasture was still very sufficient, so that post-weaning calf mortality due to lack of feed could be minimized.

AUTHORS' CONTRIBUTIONS

Marianus Yakobus Magul Datur (MYMD), Tarsisius Considus Thopianong (TCT), Cynthia Dewi Gaina (CDG), Nancy Diana Federika Katarina Foeh (NDFKF). MYMD: conceived the designs of study, collecting data, writing manuscript drafts. NDFKF and CDG: data interpretation and analysis. TCT: supervising the study concept and design, revising manuscript for content improvement. All of the authors approved the final draft.

CONFLICTS OF INTEREST

The authors declare that they have no competing interests regarding this study.

REFERENCES

Asker AS, Aremmt MK, Ahmed AT, Omar AA, Majeed AF, Hammoodi OT. 2021. Factors affecting days open in dairy cattle. Ann Romanian Soc Cell Biol. 25: 564-8.

Astiti NMAGR, Madewi NK, Rukmini NKS. 2021. Profiles and characteristics of Balinese cattle breeders in the Covid-19 era in the village of Ayunan Badung, Bali. Sustain Environ Agric Sci. 5: 29-36.

Astiti NM, Ayu GR. 2018. Sapi Bali dan pemasarannya. 1st Ed. Denpasara: Warmadewa University Press. Denpasar, Indonesia.

Budiyanto A, Tophianong TC, Triguntoro, Dewi HK. 2016. Gangguan reproduksi sapi Bali pada pola pemeliharaan semi intensif di daerah sistem integrasi sapi - kelapa sawit. Acta Vet Indones. 4: 14-8.

Chen H, Wang C, Huasai S, Chen A. 2022. Effect of prepartum dietary energy density on beef cow energy metabolites, and birth weight and antioxidative capabilities of neonatal calves. Sci Rep. 12: 4828. doi: 10.1038/s41598-022-08809-6.

Damiran D, Larson KA, Pearce LT, Erickson NE, Lardner BHA. 2018. Effect of calving period on beef cow longevity and lifetime productivity in western Canada. Transl Anim Sci. 27: S61-S65.

Daros RR, Havekes CD, DeVries TJ. 2021. Body condition loss during the dry period: Insights from feeding behavior studies. J Dairy Sci. 104: 4682-91.

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Godde CM, Mason-D'Croz D, Mayberry DE, Thornton PK, Herrero M. 2021. Impacts of climate change on the livestock food supply chain; a review of the evidence. Glob Food Sec. 28: 100488.

Husen H. 2015. Pemerintah Provinsi Nusa Tenggara Timur, Dewan Ketahanan Pangan, Kementerian Pertanian Republik Indonesia. Peta Ketahanan dan Kerentanan Pangan Nusa Tenggara Timur 2015. https://documents.wfp.org/stellent/groups/public/documents/ena/wfp285131.pdf. 10 October 2022.

Jedrzej M Jaskowski, Michal Kaczmarowski, Jakub Kulus, Bartlomiej M Jaskowski, Magdalena Herudzinska, Marek Gehrke, 2019. Rectal palpation for pregnancy in cows: A relic or an alternative to modern diagnostic methods. Med. Weter. 75: 259-64.

Montiel F, Ahuja C. 2005. Body condition and suckling as factors influencing the duration of postpartum anestrus in cattle: A review. Anim Reprod. 85: 1-26.

Nkadimeng M, Van Marle-Köster E, Nengovhela NB, Ramukhithi FV, Mphaphathi ML, Rust JM, Makgahlela ML. 2022. Assessing reproductive performance to establish benchmarks for small-holder beef cattle herds in South Africa. Animals (Basel) 12: 3003.

Nuryadi N, Wahjuningsih S. 2011. Penampilan reproduksi sapi Peranakan Ongole dan Peranakan Limousin di kabupaten Malang. Jurnal Ternak Tropika, 12: 76–81.

Priyanto D. 2017. Strategi pengembalian wilayah Nusa Tenggara Timur sebagai sumber ternak sapi potong. Jurnal Litbang Pertanian 35: 167-78.

Sari DAP, Muladno M, Said S. 2020. Potential and reproductive performance of female Bali cattle for supporting breeding business at field station of Sekolah Peternakan Rakyat. Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan 8: 80-5.

Tahuk PK, Budhib SPS, Panjono P, Baliartib E. 2018. Carcass and meat characteristics of male Bali cattle in Indonesian smallholder farms fed ration with different protein levels. Trop Anim Sci J. 41: 215-23.

Talib C. 2002. Sapi Bali di daerah sumber bibit dan peluang pengembangannya. Balai Penelitian Ternak 12: 100-6.

Temesgen MY, Assen AA, Gizaw TT, Minalu BA, Mersha AY. 2022. Factors affecting calving to conception interval (days open) in dairy cows located at Dessie and Kombolcha towns, Ethiopia. PLoS One 17: e0264029.

Tophianong TC, Gaina CD, Utami T. 2021. Pola perkawinan dan estimasi kelahiran berdasarkan hasil diagnosis kebuntingan sapi Bali pada sistem pemeliharaan semi intensif di daerah lahan kering. Acta Vet Indones. 9: 64-71.

Yendraliza Y, Lia L, Handoko J, Harahap AE. 2019. Estrus performance and pregnancy rate in types of local cows on different estrus synchronization protocols. Anim Prod. 21: 71-80.

Zhao C, Yunlong Bai Y, Fu S, Ling Wu L, Xu C, Xia C. 2021. Follicular fluid proteomic profiling of dairy cows with anestrus caused by negative energy balance. Ital J Anim Sci. 20: 650-63.