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Evaluation of Reproductive Performance of Bali Cattle on Semi-Intensive in Field Station of School for smallholder community (SL-SPR) Sungai Lilin, Musi Banyuasin District, South Sumatera

Evaluasi Performa Reproduksi Induk Sapi Bali pada Pola Pemeliharaan Semi Intensif di Stasiun Lapang Sekolah Peternakan Rakyat (SL-SPR) Sungai Lilin, Kabupaten Musi Banyuasin, Sumatera Selatan

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ABSTRACT

Empowering smallholder cattle farmers through the Field station of School for Smallholder Community (SL-SPR) Program is one of the efforts to improve the reproductive performance of Bali cattle in smallholder farmers. This research aims to evaluate the reproductive performance of Bali cattle reared semi-intensively in SL-SPR Sungai Lilin, South Sumatra. Data on reproductive performance were collected from the observation method through direct observation and interviews with respondents in the community. The respondents was totally 45 smallholder farmers, with a total number of Bali cattle observed of as many as 150 cattle and 372 heads of cow-calf. The data were analyzed using descriptive analysis of variance mixed model using SAS 9.2 software. The results showed that Bali cattle reproductive performances average first calving (AFC) was 971.09 ± 246.47 days. The average calving interval (CI) value was 381.90±72.33 days, while the average days open (DO) value was 111.90±72.33 days. However, the values of AFC, CI and DO had no significant differences (P>0.05) based on differences in season, sex, year of birth, and the interaction between the year of birth, and parity. Bali cattle reproductive performance in SL-SPR Sungai Lilin is in the ideal category.

Keywords: Bali cattle, reproductive performance, SL-SPR Sungai Lilin

ABSTRAK

Salah satu upaya untuk meningkatkan performa reproduksi sapi Bali di peternakan rakyat yaitu dengan memberdayakan peternak melalui Stasiun Lapang Sekolah Peternakan Rakyat (SL-SPR). Penelitian ini bertujuan untuk mengevaluasi kinerja reproduksi induk sapi Bali yang dipelihara secara semi intensif di SL-SPR Sungai Lilin Sumatera Selatan. Penelitian menggunakan metode observasi melalui pengamatan langsung dan wawancara dengan peternak responden yang dilengkapi dengan borang. Jumlah responden sebanyak 45 orang dengan total jumlah ternak induk yang diobservasi sebanyak 150 ekor dan bakalan sebanyak 372 ekor. Data dianalisis dengan menggunakan analisis deskriptif varians mixed model menggunakan software SAS 9.2. Hasil analisis performa reproduksi induk sapi Bali untuk average first calving (AFC) 971.09±246,47 hari. Rata-rata nilai calving interval (CI) 381.90±72.33 hari, sedangkan rata-rata nilai days open (DO) 111.90±72.33 hari. Namun nilai AFC, CI dan DO, tidak memiliki perbedaan yang signifikan (P>0.05) berdasarkan perbedaan musim, sex, tahun lahir, dan interaksi antara tahun lahir, musim dan paritas. Performa reproduksi indukan sapi Bali di SL-SPR Sungai Lilin termasuk kedalam kategori ideal.

Kata kunci: performa reproduksi, sapi Bali, SL-SPR Sungai Lilin

INTRODUCTION

Cow-calf operation is essential for the sustainability of beef cattle farming because the availability of feeders and breeders are the primary inputs to the beef cattle production process. According to Hajirin *et al.* (2020), the availability of cowin cattle development is crucial to support population increase. The main problem in beef cattle breeding is that reproductive performance needs to be maximized according to genetic potential. Hence, the profit obtained from breeding is relatively tiny compared to the fattening business. In addition, the money turnover in this business could be faster, so the beef cattle breeding business is less attractive to large companies (Maryono *et al.* 2013). In Indonesia, beef cattle breeding is generally managed by small-scale community farms with the motive of only being a side business and minimal technological input.

One of the efforts to empower smallholder farms in the development of beef cattle can be made with collective businesses. Since 2013, LPPM IPB launched the School for Smallholder Community (SPR), which aims to improve the Human Resources (HR) of smallholder farms in managing cattle businesses from various aspects, both technical and non-technical aspects that underlie the realization of collective companies in one management managed by a manager to increase the competitiveness of their business to increase income and welfare (Muladno *et al.* 2019). This SL-SPR has been adopted and developed in several Indonesian farming regions, such as Musi Banyuasin, Ogan Komering Ilir, Muara Enim, Muara Bungo, Koba, Barito Kuala, Sigi, Bojonegoro Kediri and Jombang.

One of the SPRs that has passed the participatory learning process in the SPR-IPB program and has excellent group performance is located in Sungai Lilin District, Musi Banyuasin Regency, South Sumatra. The cattle development system in SL-SPR Sungai Lilin has started since 2013, and its existence has been intensely felt by the community in terms of cattle development, farmer institutions and unity in advancing collective businesses based on smallholder farming. However, the achievements that have been obtained need to continue to be improved through the evaluation of cattle reproductive performance. Improving the reproductive performance of beef cattle on smallholder farms is one of the critical objectives of SL-SPR implementation. Improving the quality of farmer human resources, improving production technology inputs, and improving business management that has been carried out through SL-SPR are expected to maximize the reproductive performance of beef cattle.

Assessment of beef cattle reproductive performance isesential to determine the quality of breeding stock in a population because good breeding stock can be seen from its reproductive performance profile. Ashari *et al.* (2021) it is reported that increasing cattle productivity can be achieved through improvements in breeding, feeding, and management, the achievements of which can be measured by reproductive performance and production. Reproductive parameters such as age at first calving (average per calving/AFC), calving interval (CI), and days open (DO) are some reproductive parameters that can be used to evaluate the reproductive performance of beef cattle (Irianto *et al.* 2020).

Research related to the reproductive performance of Bali cattle in the SL-SPR program has been conducted by Sari *et al.* (2021). The data obtained in the previous study is used as a basis for further research on different patterns. This study aims to evaluate the reproductive performance of Bali cattle reared semi-intensively in SL-SPR Sungai Lilin, South Sumatra.

MATERIALS DAN METHODS

Research Procedure

The data used in this studywere collected from SL-SPR Maju Bersama community in Cinta Damai Village, Sungai Lilin District, Musi Banyuasin Regency, South Sumatra Provincefrom February to July 2022. A total of 150 Bali cattle and 372 calf. The research location was determined by purposive sampling by considering the existence of SL-SPR and the availability of research materials.

Observation parameters

The parameters observed in this study included; age at first calving, calving interval, and days open. Age at first calving was calculated based on the difference between the date of first calving and the mother's birth date (Murdani *et al.* 2017). The lambing interval is obtained by calculating the difference between the dates of two consecutive births (first and second litter, and so on) (Titterington *et al.* 2017). The empty period is obtained by calculating the difference between the time the cow gave birth and the mating that resulted in pregnancy or known by calculating the difference between the calving interval that has been obtained and the length of gestation of Bali cattle which is 286 days (based on the Decree of the Minister of Agriculture No. 325/Kpts/OT.140/1/2010).

Data Analysis

Data were analyzed using descriptive statistical analysis with mixed model variance using SAS 9.2 software to calculate the mean and standard error of reproductive performance in the form of AFC, CI, and DO. Descriptive analysis is used to interpret objects according to the data obtained (Steel dan Torrie 1993). The results of data processing are presented descriptively using a mixed method that uses quantitative and qualitative approaches to obtain comprehensive facts and understanding (Taguchi 2018).

RESULTS AND DISCUSSION

Profile of Respondent Farmers

Generally, smallholder cattle farming systems are dominated by elderly human resources with low education levels. Smallholder beef cattle farming is intensively and traditionally managed by rural communities at a scale fromone to two with limited resources, making it vulnerable to various problems (Amam and Harsita 2019). These makes the pattern of animal husbandry in Indonesia still has many shortcomings that require attention, guidance and

assistance. Cattle business is generally only a side business that is maintained as savings (investment) that can be sold at any time. Indicators of the pattern of animal husbandry in Indonesia can be seen through the profile of smallholder farmers.

Table 1. Respondent Profile

Respondent characteristics	Total (person)	Percentage (%)
Age level (year)		
26-35	5	11
36-45	15	33
46-55	13	29
>55	12	27
Education background		
Not in School	9	20
Elementry school	15	33
Junior high school	16	36
Senior high school	5	11
Bachelor	0	0
Main occupation		
Farmer	32	71
Breeders	10	22
Swasta	1	2
Staff	2	4
Farming experience (years)		
<4	17	38
8	11	24
12	7	16
>16	10	22

The profile of the farmers who are members of SL-SPR Sungai Lilin with semi-intensive system maintenance is 45 people. The average age is dominated at 36-45 years old by 33%, the majority of educational background is a junior high school at 36% with the main job as a farmer at 71% and breeding experience <4 years by 38%. Based on (Table 1) it can be concluded that the running of the breeding program on smallholder farms is influenced by productive age and education level. Fitrini *et al.* (2012) stated that at a productive age, a person still has the physically vitalto do a job. Even though the experience of raising cattle is relatively low, they can implement and apply collective business in the congregation.

Cultivation Patterns Applied in SL-SPR

Cattle rearing patterns in SL-SPR are divided into three types, namely; 1) intensive 13.55%, 2) semi-intensive 76.29%, and 3) extensive 10.16%. These three patterns have their advantages and disadvantages. This is usually followed by the readiness of the farmers to cultivate their cattle, so these patterns become the choice. In SL-SPR Sungai Lilin, the semi-intensive system is dominant because it is more profitable and easier to manage.

Reproduction Management (mating system, bull availability, and artificial insemination)

The mating system of Bali cattle in Sungai Lilin SL-SPR is dominated by natural breeding with a percentage of 6.17%, and artificial insemination (AI) at 3.38% (Table 2). The choice of natural breeding in smallholder farms is considered more economical. The disadvantage of the artificial insemination system is that cattle experience more pregnancy failures due to several factors, including the lack of experience of the inseminator, the end of the lambing cycle, and expensive mating costs. The advantages of natural breeding, namely very low mating costs and smooth pregnancy in sires so that in one year, it is inevitable that cattle will give birth. Natural breeding also has weaknesses, namely the high value of inbreeding.

The presence of males accelerates the value of pregnancy in dams. The research results at SL-SPR Sungai Lilin showed 46.74% of bull and 53.26% heifer (Table 2). The number of female breeders dominates this value, so it is expected to be able to become productive broodstock as an acceleration of cattle breeding. Cattle births based on the season in SL-SPR Sungai Lilin are percentages in the rainy season which will later become feeders in SPR Sungai Lilin differ by 44.25%, while in the dry season, 55.75%. The

Table 2. Percentage of matings at birth of Bali cattle calves

Description	Number (cattle)	Percentage (%)
Mating System		
AI	20	3.83
Natural	502	96.17
Winter		
Rain	231	44.25
Dry	291	55,75
Cow-calf		
Bull	244	46.74
Heifer	278	53.26

Table 3. Reproductive performance of Bali cattle cow in SPR Sungai Lilin

Reproductive performance dams	Range	Mean (±SD)	Normal[a]
Age first calving (day)	395-1727	971.09±246,47	958.7-1110.64
Calving interval (day)	293-501	381.90±72.33	350.46-455.68
Days open (day)	23-231	111.90±72.33	90.1-169.4

[a]Sumber: (Siswanto *et al.* 2013; Supriyantono 2015; Adrial *et al*. 2018; Pian *et al*. 2019; Sari and Muladno 2019; Hairudin and Hartini 2021; Sari *et al.* 2021).

Table. 4 Fixed and Random Effects Used For Data Analysis

Traits	Fixed Effects	Random Effects
Age First Calving	Season	Bali Cattle Cow
	Birth Year	
Calving Interval	Season	
	Birth Year	Bali Cattle Cow
	Parity	
Days Open	Season	
	Birth Year	Bali Cattle Cow
	Parity	

success indicator for the breeding program is the increase in cattle in an area.

Reproduction Performans

Age First Calving

The average first calving (AFC) of Bali cows in a semi-intensive rearing pattern has an average value of 971.09±246.47 days (Table 3). The low value can be attributed to cattle rearing management. However, the average first calving of these cows was not affected by the year of birth and season. These different from the research of Gunawan *et al.* (2011), there was a significant difference

Table 5. lLeast squares Mean and Standart Error (SE) on AFC

Factor			N	Age First Calving (day)
Season	Rain		63	958.04±243.19
	Dry		87	980.54±251.54
Sex	Heifer		73	961.12±224.98
	Bull		77	980.54±267.88
Season Year	2016	Rain	6	873.17±100.62
		Dry	4	1057.39±129.90
	2017	Rain	4	806.00±123.23
		Dry	9	1035.12±82.50
	2018	Rain	6	921.64±103.03
		Dry	10	874.37±82.35
	2019	Rain	8	904.34±91.53
		Dry	15	871.53±66.32
	2020	Rain	19	940.93±56.57
		Dry	28	1003.07±47.75
	2021	Rain	15	1111.42±64.34
		Dry	13	1104.71±69.23
	2022	Rain	5	976.40±111.11
		Dry	8	958.38±88.89
Year of Birth	2016	Female	6	922.56±129.90
		Male	4	1008.00±100.62
	2017	Female	7	940.65±103.6
		Male	6	129.90±98.42
	2018	Female	5	939.08±76.31
		Male	11	856.93±110.96
	2019	Female	11	913.35±81.22
		Male	12	862.51±74.50
	2020	Female	19	952,27±47.75
		Male	28	991,73±56.57
	2021	Female	17	1160,15±74.43
		Male	11	1055,98±59.83
	2022	Female	8	861.38±88.89
		Male	5	1073.40±111.11

There were no differences (P>0.05) in AFC in Bali cattlecows based on season, calf sex, and the interaction between year of birth and season

Table 6. Least squares Mean and Standart Error (SE) on CI

Factor			N	Calving Interval (day)
Spring	Rain		168	378.97±76.98
	Dry		204	384.31±31.86
Sex	Heifer		206	382.79±78.24
	Bull		166	380.79±64.72
Year Season	2016	Rain	2	364.13±52.06
		Dry	2	368.67±74.22
	2017	Rain	8	365.60±26.85
		Dry	6	356.72±30.95
	2018	Rain	11	359.05±22.67
		Dry	14	360.43±20.93
	2019	Rain	15	362.35±19.14
		Dry	25	389.84±15.02
	2020	Rain	29	386.67±13.98
		Dry	34	387.31±12.63
	2021	Rain	51	382.48±10.69
		Dry	57	394.47±10.26
	2022	Rain	45	380.89±10.99
		Dry	50	379.41±10.56
	2023	Rain	7	379.41±30.40
		Dry	16	379.82±19.17
Year of Birth	2016	Heifer	1	369.82±86.80
		Bull	3	362.98±45.11
	2017	Heifer	7	361.46±29.27
		Bull	7	360.86±28.57
	2018	Heifer	8	357.98±26.14
		Bull	17	361.50±18.16
	2019	Heifer	16	358.30±18.65
		Bull	24	393.89±15.35
	2020	Heifer	37	400.73±12.10
		Bull	26	373.25±14.61
	2021	Heifer	72	391.75±8.81
		Bull	36	385.20±12.42
	2022	Heifer	54	370.87±10.09
		Bull	41	389.43±11.50
	2023	Heifer	11	389.00±27.04
		Bull	12	366.83±21.30
Parity	1		153	374.06±8.26
	2		99	377.62±9.97
	3		120	374.82±9.51

There was no difference (P>0.05) in CI in Bali cattle based on season, year of birth and the interaction between year of birth, season and parity

Table 7. Least squares meand and Standart Error (SE) on DO

Factor			N	Days Open (day)
Spring	Rain		168	108.97±76.98
	Dry		204	114.31±68.56
Sex	Heifer		206	112.79±78.24
	Bull		166	110.79±64.72
Year Season	2016	Rain	2	97.56±52.06
		Dry	2	98.66±74.22
	2017	Rain	8	95.60±26.85
		Dry	6	86.72±30.95
	2018	Rain	11	89.05±22.67
		Dry	14	90.42±20.93
	2019	Rain	15	92.35±19.14
		Dry	25	119.84±15.02
	2020	Rain	29	116.67±13.98
		Dry	34	117.95±12.63
	2021	Rain	51	112.48±10.69
		Dry	57	124.47±10.26
	2022	Rain	45	110.89±10.99
		Dry	50	109.41±10.56
	2023	Rain	7	106.01±30.40
		Dry	16	109.82±19.17
Year of Birth	2016	Heifer	2	99.82±86.80
		Bull	2	92.97±45.11
	2017	Heifer	8	91.46±29.27
		Bull	6	90.86±28.57
	2018	Heifer	11	87.98±26.14
		Bull	14	91.49±18.16
	2019	Heifer	15	88,3±18.65
		Bull	25	123,89±15.35
	2020	Heifer	29	130,73±12.01
		Bull	34	103,25±14.61
	2021	Heifer	51	121.75±8.81
		Bull	57	115.20±12.42
	2022	Heifer	45	100.87±10.09
		Bull	50	119.43±11.50
	2023	Heifer	7	119.00±27.04
		Bull	16	96.83±21.30
Parity	1		140	111.50±80.02
	2		95	112.57±65.06
	3		114	111.85±68.53

There was no difference (P>0.05) in DO in Bali cattle based on season, year of birth, and parity

(P<0.01) between mating type and calvingyear. It can be speculated that the low average first calving value is due to the rearing pattern and some other inputs such as health and feed.

The average age of first calving in Bali cows with semi-intensive breeding in the rainy season was 958.04±243.19 days and dry season was 980.54±251.54 days, and the average first calving value between sexes was 961.12±224.98 days for females and 980.54±267.88 days for males (Table 5). Differences between seasons and sex had notindicated a significant difference (P>0.05) in the average first calving value of Bali cattle in semi-intensive rearing patterns.

Calving Interval

Bali cattle's calving interval (CI) in SL-SPR Sungai Lilin averaged 381.90±72.33 days (Table 3). Mating and cattle maintenance patterns can influence the high and low values of the calving interval. Efforts to accelerate the acquisition of the next calf are certainly through measured mating. Measured mating can reduce the high value of the calving interval and increase the output of breeding results. Saputra *et al.* (2019) reported that the faster the calf production, the higher the maintenance efficiency value because the population will increase.

The study results obtained a uniform calving interval value between seasons, sex and parity. In the rainy season, the average was 378.97 ± 76.98 days, and in the dry season, 384.31 ± 31.86 days. While the birth of cattle based on sex between bulls and heifers had a value of 382.79 ± 78.24 days in heifers and bulls 380.79 ± 64.72 days. Comparison between parities had values; (1) 374.06±8.26 days, (2) 377.62±9.97 days and (3) 366.83±21.30 days (Table 6). The absence of influence between seasons, sex and parity on the value of calving interval is likely due to the weather and climate at the research site is relatively the same from 2016-2022.

Days Open

Days open (DO) or empty period in the dams was found to average 111.90 ± 72.33 days (Table 3). The results of this study on farms with semi-intensive patterns obtained constant values and were not influenced by season, sex and parity (P>0.05). The value in the rainy season was 108.97±76.98 days and in the dry season was 114.31±68.56 days, while the value in the heifer sex was 112.79±78.24 and 110.79±64.72 in the bull. Days open between parity 1. 111.50±80.02 days, parity 2. 112.57±65.06 and parity 3. 111.85±68.53 days (Table 7).

The value of days open in broodstock with semi-intensive rearing patterns is relatively small due to the availability of males in the field. Budiawan *et al.* (2015), the reported length of days open value is influenced by; weaning too long, a long period making the empty period long and the failure of high cases of artificial insemination failure. The low value of days open can be related to the management system mastered by farmers or good human resources and several other supporting factors.

CONCLUSION

Reproductive performance in the semi-intensive system in terms of AFC, CI, and DO can be considered in a good management. These three parameter values were not affected by differences in season, sex of offspring and the interaction of year of birth and season. There were no differences in CI and DO base on differences in season, parity, sex of offspring, the interaction of year of birth, season and parity. The quality of Bali cattle reproduction in SL-SPR Sungai Lilin with a semi-intensive rearing system is in the ideal category.

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