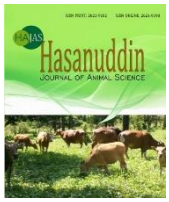

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Reproductive Performance of Bali Cows through Artificial Insemination Program in Polewali Mandar, West Sulawesi

Muslimiah Muslimiah[a*], Rudy Priyanto[b], Jakaria Jakaria[a]

[a]Magister Program, Department of Animal Production and Technology, Faculty of Animal Husbandry IPB University
[b]Department of Animal Production and Technology, Faculty Of Animal Husbandry IPB University , IPB Dramaga Campus , Bogor Indonesia

*Corresponding author: E-mail: abumuslimiah@apps.ipb.ac.id

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ABSTRACT

Intensification of artificial insemination (AI) in Bali cattle is a government program to increase the population and productivity of local cattle. The objective of this study was to examine the reproductive performance of Bali cows through the AI program in Polewali Mandar Regency, West Sulawesi. The study was conducted in two different locations, i.e. in the low lands (<300mASL) including Wonomulyo and Campalagian Districs, and high lands (>300mASL) including Limboro and Bulo Districts. Data collection was carried out on farmers and inseminators profiles, and cow's reproductive parameters including service per conception (S/C), conception rate (CR), calving rate (CvR), calving interval (CI) and Calf Mortality (CM). These data were calculated and analyzed descriptively. The cows in this study were raised by farmers in small-scale farm, mostly under 5 heads. The cattle breeding through AI program was carried out by inseminators with over 10 years of experience. In the lowlands, S/C values were 1.26-1.17 and CI were 360 to 366.31 days, respectively. Bali cows that were inseminated using Bali bull semen had a CvR of 75.69% which were higher than those using Simmental bull semen (CvR 49.69%;). While in the highlands, Bali cows that were inseminated with Bali bull semen tended to have higher S/C (1.30) and CI (356.95 days) values but had CvR of 61.00% and CR 77.00% which was also higher than that of Simmental bull semen (S/C 1,50; CI 412,86 days; CvR 50.00%; CR 66.67%). The high S/C in the highlands (1.50) is due to location constraints or the distance between the livestock and the inseminator's residence which is quite far, so it takes time to carry out AI services and is one of the factors that can cause the provision of AI services for female cows in heat is not optimal. In the highlands, most of the cattle are grazed in the grazing areas, making it difficult for breeders to detect estrus. In general, Bali cattle produced by AI in the low lands of Polewali Mandar district tended to have better reproductive performance than those in the high lands. The S/C in the low lands (1.26 and 1.17) is lower than that in the high lands (1.3 and 1.5).

Keywords: AI, Bali cows, lower land, high land reproductive performance

INTRODUCTION

The need for meat in Indonesia continues to increase in line with population growth, increased income and people's welfare and the increasing level of public awareness of the importance of animal protein needs which continues to increase from year to year. However, the availability of local cattle has not been able to meet domestic demand for meat. In 2021 the beef deficit was recorded at 223.1 thousand tons or around 32% of the total beef demand and this shortage had to be imported from abroad both in the form of frozen meat and feeder cattle [1]. Increasing the availability of beef in the country continues to be pursued by increasing the population and productivity of local cattle through the Upsus SIWAB (special efforts for cows pregnant) program in 2016 and continued with the SIKOMANDAN (Cattle and buffalo of country mainstay) program since 2017 [2]. This program was developed to increase calving rate, productivity, food safety and quality, as well as distribution and marketing which are integrated and mutually supporting processes into one continuous activity.

Production of cattle can be improved by increasing the number of cows owned and their genetic quality. The AI program for Bali cattle using superior bull semen that has been tested for quality can produce better offspring. Artificial Insemination (AI) as a reproductive technology has long been known by the farmers of Polewali Mandar because it can increase the population and genetic quality of livestock. Through the SIKOMANDAN program, namely by implementing the AI program from superior bulls semen, AI acceptors in this area in 2021 are targeted at 6,000 heads, with 5,480 pregnant cows. Therefore, it is necessary to pay attention to the factors that influence the successful implementation of AI in order to increase the achievement of the SIKOMANDAN target [2].

Factors that influence the success of the AI program include the response of the farmers to the implementation of AI [3]. The ability of inseminators to carry out AI, handling semen in the field, the ability of farmers to detect heat and reporting to inseminators. The reproductive condition of AI acceptor cows also needs to be evaluated by calculating reproductive performance outcomes such as service per conception (S/C), duration of pregnancy, calving interval (CI), calving rate (CvR) and initiation of estrus after calving. Inseminators have an important role in supporting the successful implementation of Artificial Insemination insemination

The success of AI is determined by the expertise and skills of inseminators in estrous detection, equipment, handling of frozen semen, proper thawing, and the ability to perform Artificial Insemination [4]. Indicators of reproductive efficiency in cows can be determined based on Service per Conception (S/C), Conception Rate (CR) and Calving Interval (CI) [5]. Reproductive efficiency is supposed to be good if a cow can produce one calf in one year [6], The success of AI is also influenced by environmental factors, including topography [7], Based on this description, it is necessary to conduct a study that related to the implementation of the AI program in Polewali Mandar Regency, West Sulawesi. The objective of this study was to

analyze the reproductive performance of Bali cows through the AI program in Polewali Mandar Regency, West Sulawesi, especially in the low land and high lands.

MATERIALS AND METHODS

Location and Materials of The Study

The study was carried out in Wonomulyo, Campalagian, Limboro and Bulo Districts, Polewali Mandar Regency, West Sulawesi Province from September to December 2021. The primary and secondary data were collected from the related stakeholders. The materials used in the present study were Bali cows that kept by the small holder farms as the acceptors of AI in the region. Questionnaires were presented to 130 farmers as respondents with 150 of Bali cows as acceptors. For this purpose, Inseminators were also occupied in the lowlands of 9-13 people and highland of 1-4 people.

Determination of Study Location and Sources of Data

Determination of the study location was based on the following considerations: (1) Bali cattle population centers and (2) topography (height above sea level). The area that became the study location consisted of the Limboro and Bulo sub-districts which were at an altitude of >300 m above sea level, and the Wonomulyo and Campalagian sub-districts which were in the lowlands with an altitude of <300 m above sea level.

Quantitative data collected was in the form of primary data obtained through interviews using questionnaires with farmer respondents and inseminator in two sub-districts in the lowlands and two sub-districts in the highlands. The questionnaire contained information about farmer profiles, inseminators and breeding cattle reproductive data as material for interviews. Secondary data was obtained from the Animal Husbandry Service and Artificial Insemination Station, Polewali Mandar Regency, West Sulawesi.

Bali cattle as acceptor were identified based on: 1) Bali cows that inseminated with frozen semen from Bali bulls at highland and lowland locations. 2) Bali cows that inseminated with frozen semen from first generation of Simmental bulls at highland and lowland locations.

Reproductive Parameters and Data Analysis

The observed variables related to reproductive performance in Bali cattle were Service per Conception (S/C), Conception Rate (CR), Calving Rate (CvR), Calving Interval (CI), and calf mortality.

Respondent profile data (farmers and inseminators) was analyzed descriptively. The mean and standard deviation of the reproductive parameters of Bali cattle that were AI with the semen of Bali and Simmental bulls at two different altitudes were also calculated and analyzed descriptively.

RESULTS AND DISCUSSIONS

Climatic Characteristics of Study Locations

The total area of Polewali Mandar Regency is recorded at 2,022.30 km² which includes 16 (sixteen) sub-districts. Most of Polewali Mandar Regency has hilly topography (>41%) and mountainous (>39%) and the remaining 20% has flat topography. The characteristics of the climate and rainfall of the study location is are presented in Table 1.

Table 1. Characteristics of The Climate, Rainfall and THI of Low land and high land Research Locations in 2021

Description	Time	Low land	Category	Haigh land	Category
Temperature (°C)	Morning	25.36		24.50	
	midday	29.36		27.86	
	Afternon	28.14		26.93	
	Average	27.62		26.43	
Humidity (%)	Morning	85.00		85.29	
	midday	78.79		77.93	
	Afternon	78.21		76.71	
	Average	80.00		81.00	
THI	Morning	80.06	Moderate stess	78.84	Light stress
	midday	82.04	Moderate stess	79.03	Moderate stess
	Afternon	79.69	Moderate stess	76.69	Light stress
	Average	80.59	Moderate stess	78.19	Light stress
Altitude (dpl)		0-70		300-700	
Rainfall (mm)		1,683		1,712	

Source: Primary data and statistics Agency of Polman Regency, 2021. THI: Temperature Humidity Index

Characteristics of Respondents

In Table 2, most of the farmers raised the cattle under 5 heads, with details of the percentage of farmers in the lowlands of 77.08% and 83.33% in the highlands, respectively. This low holder scale shows that Bali cattle farming in both locations is still as a part-time business. Most of the respondents mixed their farm businesses, namely farming-livestock. Respondents who run mono-enterprises either farming, livestock or other businesses occupy a low proportion below 17%. According to Hadi and Ilham [8], the characteristics of farmer's beef cattle breeder, both breeding and fattening businesses, are characterized by very small holder scale, namely 1-3 heads. Meanwhile, according to Aryogi *et al*. [9], most farmer's beef cattle is a hereditary business with a maintenance pattern in accordance with the ability of breeders, especially in terms of providing forage which varies in type and amount.

Table 2. Characteristics of Respondents at Different Locations

Profile of Respondent	Category	Composition (%)	
		Lowland	Highland
Farmer			
Age (Year)	<20	0	0
	20-40	14.6	33.3
	>40	85.4	66.7
Education	Elementary School	56.3	8.3
	Junior High School	18.8	58.3
	Senior High School	20.8	33.3
	University	4.2	0
Job	Cattle Farmer (CF)	12.5	16.7
	Field Farmer (FF)	4.2	0
	CF and FF	77.1	83.3
	Other	6.3	0
Experience (Year)	<5	8.3	0
	5-10	45.8	41.6
	>10	45.8	58.3
Number of cattle (Head)	<5	77.1	83.3
	5-10	22.9	16.7
	>10	0.1	0
Inseminator			
Age (Year)	<20	-	-
	20-40	50	30.7
	>40	50	69.2
Education	Senior High School	100	61.5
	Diploma	0	7.8
	University Graduated	0	30.7
Experience (Year)	<5	-	-
	5-10	-	7.7
	>10	100	92.3
Training experience	Artificial Insemination	100	100
	Pregnancy Diagnosis	80	50
	Assistant Reproductive Technician	36.7	-

Raising cattle in the lowlands and highlands was conducted by adult farmers over the age of 20 years and most of them are over 40 years old. They have taken formal education (100%) and most have completed elementary to high school education. Respondents in the lowlands who have completed elementary school education (56.25%) occupy the highest proportion, while in the highlands, most of the respondents who have completed junior high school education (58.33%). This situation will affect the maintenance of Bali cattle managed by

the farmers, especially regarding the handling of productive cattle. Maintaining productive cattle properly and appropriately, including improving the quality and quantity of feed according to the needs and conditions of the cows prior to mating and giving birth, so that the cow is ready to accept pregnancy and lactation. Apart from that, farmers can also easily accept breeding technology and improve the genetic quality of cattle through the AI program. According to Mosher [10], individual education is important and influential in absorbing innovations and new ways in agriculture or animal husbandry. According to Riwukore and Habaora [11], education does not affect the sustainability of the livestock business, but rather the experience of raising livestock and the number of cattle raised.

The inseminator staff in Polewali Mandar Regency are tasked with the successful implementation of the AI program. The implementation of AI at the study location was carried out by adult inseminators aged 20 years or more with an adequate level of education ranging from high school to diploma, especially for inseminators in the highlands. All inseminators have at least received AI training; in the lowlands 80% of inseminators have attended training for pregnancy diagnosis and 36.7% of inseminators have attended Assistant Reproductive Technician (ART) training, while in the highlands, 50% of inseminators have attended training for pregnancy diagnosis. Adequate educational level of inseminators can support the successful implementation of AI in the area.

Reproductive Performance of Bali Cows

The reproductive performance of Bali cows that were artificially inseminated with the semen of Bali and Simmental bulls is presented in Table 3.

Table 3. Reproductive Performance of Bali Cows That Inseminated Using Bali and Simmental Bulls Semen in The Low lands and High lands

Reproductive Parameter	Low land		High land	
	Bali semen	Simmental semen	Bali semen	Simmental semen
Service per Conception	1.26	1.17	1.30	1.50
Calving Interval (day)	366.31	360.00	356.95	412.96
Conception Rate (%)	79.43	85.71	77.00	66.67
Calving Rate (%)	75.69	49.69	61	50
Calf Mortality (%)	5.24	16.90	2.08	0

Service per Conseption (S/C) and Conception Rate (CR)

Bali cows that inseminated using Bali bull semen had an average of S/C value was 1.26 for the low lands and 1.30 for the high lands, respectively. While those inseminated using Simmental bull semen had S/C values was 1.17 for the lowlands and 1.50 for the highlands (Table 3). This S/C value is within the normal range [11] In line with the results of research by Nubatonis and Dethan [12] S/C 1.45. The S/C value in this study indicated that Bali cows had relatively high fertility becoming pregnant with only first Artificial Insemination. It is suspected

that the cause of the high S/C value in the high lands (1.50) t) due to that the location relatively far from the farmers, consequently affect the farmers in detecting cows in heat. Likewise, partially cows are grazed in the fields and in gardens, which makes it difficult for farmers to detect estrus of the cows, especially cows kept on the high lands. According to Sulaksono *et al*. [13] stated that one of the factors that influence the high or low value of S/C is the knowledge of breeders in detecting heat

In the low land, the implementation of AI of Bali cows using the semen of Bali and Simmental bulls had relatively the same of S/C values, while in the high lands the implementation of AI in Bali cows using the semen of Simmental bulls tended to produce better S/C values, i.e. 1.17. In general, the value of S/C in cows is more influenced by age, feed and climate. Relative S/C values are better estimated because (1) the intensive rearing system which makes it easier to detect heat (2) the right time for insemination and semen position which involves inseminator skills (3) the temperament of cows which tended to be more docile making it easier to carry out IB.

The conception rate is measured as the percentage of pregnant cows at the first insemination. Good CR values in AI cows range from 60-66.74% [14]. Fanami *et al*. [15] stated that a good CR value reaches 60-70%. Nuryadi and Wahyuningsih [16] reported the reproductive performance of Ongole cross cows and Limousin cross cows in the low lands and high lands of Malang Regency, with the calculated CR values respectively of 91.26% and 83.33%. The pregnancy rates found in the study area for both Bali and Simental bulls semen were in a good range. The pregnancy rate is considered good when it reaches 60% which indicates the accuracy of the farmers in detection of heat and reporting to inseminators. The ability of cows to become pregnant during the first insemination is influenced by environmental variations the condition of the barn and the temperature of the barn [16].

Calving Interval (CI) and Calving Rate (CvR)

Calving interval is the time interval between one calving and the next calving. The CI indicator is important to know because the regularity of calving spacing produced in each individual shows continuity in producing calves during the productive period of breeding cows [17]. The results showed that in the low lands the Bali cows that were AI with semen from Bali and Simmental bulls had relatively the same CI, namely 366.31 days and 360. days, respectively, whereas In high land Bali cows inseminated with Simmental bull semen tended to produce a longer CI than those inseminated using Bali bull, i.e. 412,96 days and 356.95 days respectively. Cows in the low lands produce a good CI, which is around 360-366 days, which is in accordance with the study of Wahyudi [18]. The normal value of the Calving Interval is 365-400 days [19].

The traditional system in rearing the cattle is still the cause of the long CI value in the high lands in Bulo District besides the location which is very far to reach. Luthfi *et al*. [20] stated that the CI value was significantly influenced by the bulls group, location and calving season which was related to feed availability. Meanwhile, Riwukore and Habaora [11] reported factors influencing CI including the length of gestation and the days open of the cow.

In Table 3, in the lowlands and highlands, the Bali cows that were inseminated using Bali bulls semen produced a higher calving rate (CvR) than those that were inseminated using Simmental bulls semen. This shows that at the study location in Polewali Mandar Regency, West Sulawesi with a tropical climate, Bali cows have better fertility than Simmental cows. The calving Rate (CvR) of Bali cows in the low lands was higher than that in the high lands, both inseminated using Bali and Simmental bulls. This could be due to several factors, including a greater number of acceptors and better inseminator skills in implementing Artificial insemination in the lowlands. On the other hand, the low calving rate (CvR) in the high lands can be caused by inseminators who were less accurate in placing semen into the reproductive tract, poor farmer observation of signs of heat and late reporting to inseminators which caused delays in AI services.

Calf Mortality (CM)

The results of research related to infant mortality can be seen in Table 4, in the low lands the mortality rate (CM) of calves with Simmental bulls was much higher than that of Bali bulls with CM values of 16.90% and 5.24% respectively. In accordance with the opinion of Sumadi and Siliwolu [22] reported a relatively low calf mortality rate, which was 5.62%. On the other hand, in the high lands, the calf mortality rate for Bali cattle was 2.08%, while there were no deaths in calves produced by crosses with Simmental males. The high calf mortality rate is 16.69. The high calf mortality rate from crosses of Simmental bulls in the low lands is due to (1) partly due to the large number of calves born with the risk of dystocia, (2) Bali cows giving birth for the first time with low milk production, (3) lack of additional feed for pre-weaning calves (4) lack of knowledge of breeders about the incidence of livestock diseases

CONCLUSIONS

The Artificial Insemination Program on Bali cows in Polewali Mandar, West Sulawesi, has relatively good reproductive performance. The Service Per Conception (S/C) value is very good, which on average shows below 1 time of insemination, the Conception Rate (CR) is very good because it is obtained above 75%, except in the high lands (BxS) of 66.67 (good). Calving Interval (CI) plateau (BxB) and low ideal category because the CI reached an average of 12 months, except for the plateau CI (BxS) CI was not ideal because the high CI reached 412.86 days, the mortality rate high in the low lands of 16.69% (BxS). In general, Bali cattle produced by AI in the low lands of Polewali Mandar district tended to have better reproductive performance than those in the high lands. The S/C in the low lands (1.26 and 1.17) is lower than that in the high lands (1.3 and 1.5).

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