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Artificial Insemination in Local Beef Cattle Breeding Using Various Breeds of Males in West Lombok Regency: An Evaluation of Its Success Rate

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ABSTRACT

Penelitian ini bertujuan untuk mengevaluasi keberhasilan Inseminasi Buatan (IB) pada pembibitan sapi potong lokal dengan menggunakan berbagai bangsa pejantan berdasarkan *Service Per Conception* (S/C), *Non-Return Rate* (NRR), dan *Conception Rate* (CR) di Kabupaten Lombok Barat. Penelitian dilakukan menggunakan metode survei dan observasi terhadap 270 ekor sapi dengan masing-masing sebanyak 90 ekor akseptor IB per kecamatan dengan pejantan sapi Bali, Simmental, Limousin, Brahman, dan Angus. Peternak yang menjadi sampel ditentukan secara *quota sampling* dari 3 kecamatan di Kabupaten Lombok Barat. Data yang diperoleh ditabulasi dan dianalisis secara deskriptif untuk mendapatkan persentase S/C, NRR, dan CR. Hasil penelitian menunjukkan bahwa keberhasilan IB terbaik berdasarkan S/C adalah dengan menggunakan semen sapi Bali, Simental, dan Limousin (1,15, 1,16, dan 1,25), sedangkan untuk sapi Angus dan Brahman 1,30 dan 1,33. Semen sapi Bali, Simental, dan Limousin menghasilkan NRR (84,55; 78,84; 75,0%), sedangkan Angus 66,66%. Nilai CR untuk semen sapi Bali, Simental, Limousin, Brahman, dan Angus masing-masing adalah 79,41; 71,15; 72,5; 66,66; dan 69,69%. Sapi jantan Bali, Simental, dan Limousin merupakan pejantan terbaik untuk keberhasilan IB, sedangkan sapi jantan Brahman dan Angus kurang diminati (12,22 dan 3,30%). Disimpulkan bahwa tingkat keberhasilan Inseminasi Buatan yang paling tinggi ditunjukkan pada penggunaan semen sapi Bali dibandingkan dengan penggunaan semen sapi Simental, Limousin, Brahman, dan Angus.

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ABSTRACT

This study aims to evaluate the success of Artificial Insemination (AI) in breeding local beef cattle using various breeds of males based on Service Per Conception (S/C), Non-Return Rate (NRR), and Conception Rate (CR) in West Lombok Regency. The research was conducted using survey and observation methods on 270 Bali cows of AI acceptors with male Bali, Simmental, Limousine, Brahman, and Angus breeds. The cattle breeders in question were determined by quota sampling from 3 sub-districts in West Lombok Regency, each with 90 AI acceptors per sub-district. The data obtained were tabulated and analyzed descriptively to obtain the S/C, NRR, and CR percentages. The results showed that the best success of AI based on S/C was using Bali cattle semen, Simental, and Limousine (1.15, 1.16, and 1.25), while Angus and Brahman were 1.30 and 1.33. Bali cattle, Simental, and Limousine semen resulted in NRR (84.55, 78.84; 75.0%) and Angus 66.66%, respectively. The CR values for Bali, Simental, Limousine, Brahman, and Angus cattle semen were 79.41, 71.15, 72.5, 66.66, and 69.69%. Bali, Simental, and Limousine bulls were the best males for AI success, while Brahman and Angus bulls were less attractive (12.22 and 3.30%). It was concluded that the highest success rate of Artificial Insemination was shown in the use of Bali cattle semen compared to the use of Simental, Limousine, Brahman, and Angus cattle breeds.

INTRODUCTION

One of the efforts that can be made to improve the genetic quality of livestock is choosing males with high genetic quality by utilizing high-quality sperm from superior males with rapid body weight gain through the application of Artificial Insemination (AI) technology. AI technology makes it easier for farmers to access superior beef bulls such as Simental, Limousine, Brahman, and Brangus cattle. These cattle are classified as a large type of beef from abroad with good quality, large body shape, long, dense, compact, flat, and a high growth rate (Fania *et al*., 2020). This technology allows breeders to have quality livestock without having superior males (Muhyidin *et al*., 2019). High genetic quality cattle breeding plays an important and strategic role in building the economy of rural communities in West Nusa Tenggara (WNT).

The failure of estrus or anestrus in cattle is the main symptom, and many other factors affect the estrus cycle. Anestrus is often the cause of infertility in cows. Those reproductive disorders occur in cows after parturition or repeated mating without conception. Reproductive failure is one of the main factors that can hinder the rate of development of livestock populations. In addition, it is also influenced by the breeder's limited ability, time, and human resources to observe the emergence of livestock lust symptoms. Breeders are often too late to know the occurrence of lust in cows, so there is an inaccuracy in artificial insemination. Those conditions are often found in the field because the estrus cycles between individual cows vary (Pratami *et al*., 2019).

In connection with the development of AI-generated beef cattle in Indonesia, which on average show heterosis of production characteristics (body weight). Jurame & Womsiwor (2018) stated that crosses utilize heterosis resulting crosses in beef cattle can only increase production characteristics and not a reproduction. Therefore, implementing AI on Bali Cattle in WNT using frozen semen of various sub-tropical cattle breeds that have been going on since 1976 (Pasino *et al*., 2020) is very important to analyze both production (growth) and reproductive efficiency. However, information

regarding the success rate of artificial insemination based on NRR, S/C, and CR according to the breed of cattle used and the frozen semen source has not been revealed. Therefore, it is essential to conduct this research to determine the success of Artificial Insemination in beef cattle in West Lombok Regency.

METHODS

The study has been carried out for six months. The research location covers the area of West Lombok Regency by taking 3 (three) sub-districts as the location for data collection, following Gunung Sari, Narmada, and Gerung Districts: from each sub-district, 1 sample village is determined according to predetermined criteria. The study used local cows (Bali cattle) as AI acceptors in 3 sub-districts in West Lombok Regency, which had been AI-treated using frozen semen from Bali bulls, Simmental, Limousine, and Brahman bulls.

This study has been conducted with survey methods, and the data was carried out for a descriptive quantitative approach. A sampling of respondents used the quota sampling technique, which is a sampling technique based on the most significant number of populations carrying out AI using the frozen sperm of various males. This study's respondents were cattle breeders registered as AI acceptors in Gunung Sari, Narmada, and Gerung sub-districts.

The main variables observed in this study are Service per Conception (S/C), Non-Return Rate (NRR), and Conception Rate (CR), namely the percentage of cows who become pregnant after being in AI. Pregnancy examination is done by rectal palpation. The supporting variables are the breed of males from frozen semen used in breeding beef cattle with AI techniques, the interest of breeders in the breeds of males from frozen semen, feeding management, and the method of detection and reporting of cow lust to the inseminator.

The collected data were tabulated and analyzed using descriptive analysis to obtain the percentage and average calculation of Service per Conception, Non-Return Rate, Conception Rate, and the type of frozen semen used.

RESULT AND DISCUSSION

The educational level of respondents and procedures for raising AI receptor

Regarding the education level of respondents in this study, most of the farmers in West Lombok Regency have never attended school, which is 38.51%, followed by farmers who have a minimum education of 35.92% elementary school, 19.63% junior high school, and the rest the highest education of respondents is high school 5.92% (Table 1).

Table 1. Level of Education of the Respondent

Level of education	Number of respondents	Percentage (%)
Never school	104	38.51
Elementary school	97	35.92
Junior high school	53	19.63
Senior high school	16	5.92
Total	**270**	**100**

The level of education of a farmer is an indicator that reflects his ability to complete a type of work or responsibility. Differences in education levels will also cause differences in the ways and mindsets of farmers in adopting various innovations and technologies that can increase productivity and business efficiency. Education affects the way of thinking of farmers who will carry out their livestock business activities. As Weir (1999) described that the skills and the productive capabilities of the farmers could enhances by education. Moreover, Paltasingh & Goyari (2018) also stated that the education can help the farmers to calculate the costs and benefit of adopting a technology.

The rearing of AI acceptor cattle in the West Lombok District is almost entirely housed with a feed supply system with a cut-and-carry system where the forage comes from nearby farms and plantations. IB acceptor cattle are kept in communal cages, where several cows are housed together, with the amount of feed expected to cover their needs. The types of feed farmers in West Lombok Regency include native grass, elephant grass, legumes, rice straw, and banana stems. In general, farmers provide feed in the form of grass and legumes. Feeding is done 2 to 3 times daily to meet their needs, about 10% of their body weight. Legumes are a quality feed ingredient with high protein content and are very good for livestock. Feed affects all living activities of livestock, from body metabolism to growth and reproductive activities (Tethool *et al*., 2022).

The method of detecting and reporting lust by farmers in West Lombok Regency is that all respondent farmers already know how to detect lust in their cows, and farmers report to the inseminator by telephone. However, reports are often delayed by farmers. They are too late to discover that their cattle are in heat because most farmers work in farming, gardening, and raising livestock as a sideline. Dapasesi *et al*. (2019) stated that to face business risks such as product failure, farmers do side business as a source of income to meet their household needs. Lukmanhy *et al*. (2022) stated that knowledge and understanding related to reproduction are vital for farmers because this information allows them to provide appropriate care during pregnancy and prepare themselves adequately for delivery, thereby reducing perinatal losses.

Evaluation based on Service Per Conception (S/C)

The current results showed that the most widely used male breeds in AI acceptor cows in West Lombok Regency were Bali cattle, which was 50.37%, while semen from exotic cattle breeds such as Simental was used, Limousin, Brahman, and Angus was shown successively. Participate in 19.26, 14.81, 12.22, and 3.33% with S/C values of 1.15 in Bali cattle, 1.16 Simental, 1.25 Limousine, 1.33 Brahma, respectively, and 1.30 in Angus males, respectively (Table 2).

The choice of breeders to use exotic males on AI acceptors of Bali cattle is because the acceptors have given birth at least once with excellent conditions so that dystocia does not occur. Another consideration in choosing a male is that many factors influence, including the

condition of the acceptor that has not met the use of a superior male because of the risk at birth. Furthermore, Bali cattle have a high fertility rate with the best S/C of 1.15 compared to the others. Another reason is that the government wants to make the WNT area a place for refining Bali cattle. Nugraha *et al.* (2019) reported that the success of AI in breeding Bali cattle in the P3-Bali region showed an S/C of 1.34 times. The ideal S/C value is 1, and with good management, the S/C ranges from 1.3 to 1.6 and is not good if it is greater than or equal to 2.

Table 2. Service Per Conception (S/C) Value of AI Acceptors Based on the Breed of the Bull in West Lombok Regency

Breed of bulls	Number of acceptors (head)	Percentage (%)	S/C Value
Bali	136	50.37	1.15
Simental	52	19.26	1.16
Limousin	40	14.81	1.25
Angus	9	3.33	1.30
Brahman	33	12.22	1.33

The excellent value of S/C is because it is influenced by livestock fertility, inseminator, AI time, semen quality, and implementation. The lower the range of S/C values, the higher the fertility of the female cattle in the group. On the other hand, Mardiansyah & Prasetyo (2016) reported that the value of the S/C had a significant difference when heifer and cow were compared. The higher the S/C value, the lower the fertility of male and female livestock in the group (Guntoro & Supeli, 2022). According to Utama (2021), the S/C compares the times the matting is carried out until pregnancy. The value of S/C is strongly influenced by the factors of male, female, and human livestock, especially in the inseminator. Meanwhile, Hoesni *et al.* (2021) the high service per conception can have consequences for more prolonged birth compared to normal conditions with an interval of about 12 months.

Evaluation based on Non-Return Rate (NRR)

The non-return rate is the percentage of animals that do not return to mate or return to estrus after the first insemination (Yuliani *et al*., 2020). The average value of NRR for various bulls and acceptors in West Lombok Regency is shown in Table 3. The use of male Bali cattle occupying the highest use of acceptors is 136 heads with an NRR percentage of 84.55%, followed by Simental, Limousine, Brahma, and Angus. Mahfud *et al.* (2019) stated that the NRR value 60-90 days after insemination using Bali cattle liquid semen without treatment with Tocopherol was 77.5%. The percentage of NRR as a result of this study was slightly better in the male breeds of Bali and Simental cattle, while in the other bulls, the NRR value was almost the same. A high NRR value indicates that the number of cattle that request matting is minimal, so the NRR value for cattle inseminated with Bali cattle semen has a higher fertility rate than the semen of other exotic cows, but the NRR value for semen is still good.

Table 3. Non-Return Rate (NRR) Value of AI Acceptor based on the Breed of Bulls

Breed of bulls	Number of acceptors (head)	NRR (head)	NRR (%)
Bali	136	115	84.55
Simental	52	41	78.84
Limousin	40	30	75.00
Angus	9	6	66.66
Brahman	33	25	75.77
Total	**270**	**217**	**80.37**

The effect of frozen semen and acceptor cattle on the success of AI is based on the higher the NRR percentage, the better the success rate of AI. A high NRR value indicates that very few cattle are want to be re-mating. The high number of cattle want to be re-mating means the NRR value is decreasing (Lukmanhy *et al*., 2022). The calculation of NRR results from AI in West Lombok Regency shows almost the same results, not much different from the results of the study of (San *et al*., 2015) showed that the NRR result of 28-35 days in Patean District was 83.44% and in Plantungan District 86.66%. Furthermore, this study's results are also higher than Wibowo *et al*. (2016), who reported that the values of NRR from Ongole and limousin hybrid are 64% and 61%, respectively. Due to differences in breeds, this matter causes a response to artificial insemination differently but is also influenced by quality spermatozoa, semen deposition, type of semen, and inseminator skills. Mutmainna (2021) states that the NRR figure is generally higher than the conception rate. The NRR observation, with values range of 30-60 (mean percentage of the cow), has not repeated lust within 30-60 days or one cycle of lust (Wiranto *et al*., 2020).

Evaluation based on Conception Rate (CR)

Conception Rate (CR) is the percentage of pregnant cows in the first insemination determined based on the results of the pregnancy diagnosis through a pregnancy examination within 40 to 60 days after insemination (Putri *et al*., 2020). The pregnancy examination procedure is palpating the uterus through the rectal wall to feel the enlargement that occurs during pregnancy, the fetus, or fetal membranes (Berek *et al*., 2021).

The average Conception Rate (CR) based on rectal palpation on various types of bulls used in several acceptors in West Lombok Regency is shown in Table 4. The use of Bali cattle with the highest number of acceptors was 136 heads with a CR percentage of 79.41%, followed by Simental, Limousine, Brahma, and Angus, each with CR of 71.15%, Limousine 72.50%, Angus 66.66%, and Brahma 69.69%, respectively (Table 4). The percentage of CR research results is quite good. According to Laurestabo *et al*. (2022), the excellent CR value for a cattle population is 60-75%. The higher the CR value, the better, and vice versa. Furthermore, Dradjat *et al*. (2016) stated that the NRR value 60-90 days after insemination using Bali cattle liquid semen without -Tocopherol treatment was 77.5%. The low

demand for breeders in West Nusa Tenggara, especially in West Lombok Regency, for Angus and Brahman males is due to the low selling value of these cattle, unattractive coat colour, and low CR value (66.66%) compared to other types of bulls.

Table 4. Conception Rate (CR) value of AI Acceptor Based on the Breed of Bulls

Breed of bulls	Number of acceptors (head)	Acceptor pregnant (head)	CR (%)
Bali	136	108	79.41
Simental	52	37	71.15
Limousin	40	29	72.50
Angus	9	6	66.66
Brahman	33	23	69.69
Total	**270**	**217**	**80.37**

Bulls in great demand besides Bali bulls are Simental and Limousine bulls; these breeders are simple, have good growth, and have a reasonably high selling value. Most breeders have cattle breeds from crosses with Simental cattle because their large bodies have a high selling value. Simental cattle are a type of beef derived from the boss Taurus, which has the advantage of fast growth, so it is very popular with breeders. The result of the cross had a high birth weight reaching 44.1 kg (Fania *et al*., 2020). The CR value in Table 4 shows that cows inseminated using Bali cattle semen had a higher CR value than cattle inseminated using exotic cow semen. It can be concluded that cows inseminated using Bali cattle semen have a higher fertility rate than exotic cow semen. The conception rate is determined by three factors: male fertility, female fertility, and insemination techniques (Dako *et al*., 2022).

The conception Rate is the percentage of pregnant cows in the first insemination of the total number of inseminated cattle or conception rate (Amidia *et al*., 2021). Pregnancy is a physiological period after matting those results in conception, followed by the development of the embryo and then the fetus until the process of parturition, which lasts 278 days (Sumadiasa *et al*., 2021). Male fertility, one of which is the responsibility of the Artificial Insemination Center (AIC), which produces frozen semen in addition to storage management at the inseminator level. Female fertility is the breeder's responsibility, assisted by a veterinarian monitoring the cow's health. Meanwhile, the implementation of AI is the responsibility of the inseminator.

CONCLUSION AND RECOMMENDATION

The success rate of Artificial Insemination, which is assessed by Service per Conception (S/C), Non-Return Rate (NRR), and Conception Rate (CR) in breeding local beef cattle (Bali Cattle) in West Lombok Regency is determined by the breed of males from which semen is produced. The highest success was shown in the use of Bali cattle semen compared to the use of exotic beef cattle breeds (Simental, Limousine, Brahman, and Angus); Among exotic cattle breeds, the use of Simental Cattle gave the highest

AI success, while the use of Angus Cattle gave the lowest success. The use of Bali cattle semen as a source of the breed can provide a high success rate of artificial insemination with values of S/C 1.15, NRR 84,55%, and CR 79.41%.

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In this article, Lukmanhy acts as the main contributor and correspondence contributor, while Enny Yuliani, Lalu Ahmad Zaenuri, I Wayan Lanus Sumadiasa, Mardiansyah, and Ryan Aryadin Putra acts as a member contributor.

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