Selection of beef cattle type characters in Bali young bull from smallholder farms through individual control for the purpose of artificial insemination

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Abstract. Some of the male Bali cattle kept at the Artificial Insemination Center are the result of selection from the weaning process to become bulls. Therefore, this study aimed to determine the extent bulls selected from smallholder farms have the same quality spermatozoa as the males raised by the Institute for Artificial Insemination. The research method began in 2016-2018, which selected the performance of 50 heads, followed by a selection of biological characters, ejaculation, and livestock health in young bulls. Selected bulls were trained to collect their sperm and the quality of their sperm was examined macroscopically and microscopically. The results showed that 15 young bulls were selected by performance selection and four bulls were selected for selection based on the quality of frozen semen. Three bulls passed the selection to meet the frozen semen requirements of the Indonesian National Standard. The conclusion of this study is that the provision of males to the Institute for Center of Artificial Insemination can be done by selecting the best bull belonging to the farm community.

1. Introduction

Bali cattle is one of Indonesian local breed that potentially used to fulfill meat self sufficient. For that reason, a sustainable breeding program must be implemented. Currently, livestock farming in Bali cattle is still based on small-scale farms, which are characterized by small business, simple management, improper use of technology, unfocused locations, and not yet implemented agribusiness systems and businesses. As a result, there is no well-organized long-term nursery and no planned and systematic local stockbreeding (Bali cattle) based on scientific principles. Bali ranching business development policy should focus on an area that is either a specific area or incorporated into other commodities and focus on one area to facilitate the guidance, guidance, and supervision in developing a good beef breeding business. The current breeding system in Bali cattle breeding is only limited or not structured at all. Breeding generally takes place randomly without objective selection criteria and with the only minimal subjective selection of the breeding animals [1].

One of the efforts to develop the Bali ranching business is to provide superior bulls from Bali cattle, which is the source of frozen semen at the Artificial Insemination (AI) Center. The current Bali bulls at the AI center are still reliant on shopping at cattle contest events. The bulls that win the competition are

usually bought by the government or AI center for their good morphology and husbandry. A superior male is rarely based on the selection from the start, from weaning to age at first ejaculation, and a Zuriat test is done. While the role of the bulls in the herd's reproductive efficiency is well known. The decline in cattle fertility results in enormous economic losses, particularly in cattle with extensive production where the breeding scheme consists of several bulls for a female herd [2]. Therefore, basic reproductive health assessment techniques, including male breeding behavior, clinical examination, and overall semen assessment, have been used to study potential male fertility and to be useful in identifying males with low fertility potential [3]. The selection of bulls should be made on the basis of growth and dimensions of body size, the efficiency of feed use, animal health, characteristics of biological activity, quality of ejaculate, and the production of frozen semen.

Due to the problems mentioned above, the livestock program in Bali must be carried out holistically and sustainably. The article provides an overview of the bull that came from small-scale farms, the results of the selection carried out in 2016-2017 and then surveyed at the Center for Artificial Insemination and the quality of the frozen semen.

2. Materials and methods

2.1. Materials

The initial selection of young bulls from people's farms, four superior bulls kept in UPTD PIBPS, and the results of the selection from smallholder farms come from research 2016-2017 [4], which included 55 head were selected on people's farms.

2.2. Methods

The method of selection for bull seed candidates is viewed from different angles: growth rate, body condition, height, normal reproductive organs, and libido. Bull candidates are selected using the "Breeding Soundness Examination (BSE)" technique described by the Society of Theriogenology (SFT) [5,6].

The selection activity is carried out in two stages: (1). The first stage is the performance selection process based on the growth in body weight and body size (based on the Indonesian National Standard for Bali cattle breeds and the efficiency of feed use, and (2) The second stage, the sperm quality test of selected males is carried out in the first stage (figure 1).

The number of young bulls selected was 15 with an average age of 8 - 9 months, the selection of bulls started gradually on the growth rate and body size by giving concentrate for 8 weeks, the numbers were controlled (figure 1). At the beginning of the selection, weaned bulls were fed limited concentrate feed to achieve moderate growth rates, namely the body weight gain of 0.42 ± 0.15 kg. In the next stage, the young male group was given unlimited concentrate feed for 4 weeks to achieve maximum growth and finally given concentrate as much as 30% of the total body weight for 4 weeks to achieve a height growth of 0.75 ± 0.25 kg (figure 1).

Bodyweight and measurements are weighed and measured once a month, and maintenance is carried out semi-intensively when fresh elephant grass plus 1-2.5 kg of concentrate is given ad libitum in the morning and evening, depending on the stage of treatment. The ration protein content is around 14%. After the male is over 20 months old (after reaching a weight of 230-280 kg), holding training is carried out by approaching the cow anglers. Since the sexual character of the libido of the Bali cattle is quite low, young bulls are initially not interested in female anglers but are continuously trained and combined with estrus cows. Finally, Bali bulls can be housed by farms. Protection training is then carried out without heat females. Selection and classification of the selected breeding bulls in order to obtain a certificate of approval for the seedlings. In addition, the selected bulls will be submitted and reared to the AI Center to collect their ejaculate and produce frozen semen.

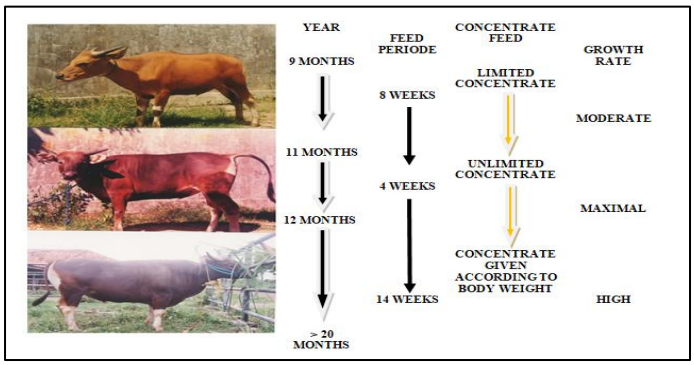

Figure 1. Schematic of local Bali bulls selection ranging from ± 5 months to> 20 months of age.

3. Results and discussions

3.1. Performance of young Bali bulls from the smallholder farm

The average body weight and height of selected young bulls and cows aged 4 to 12 months are shown in figure 2.

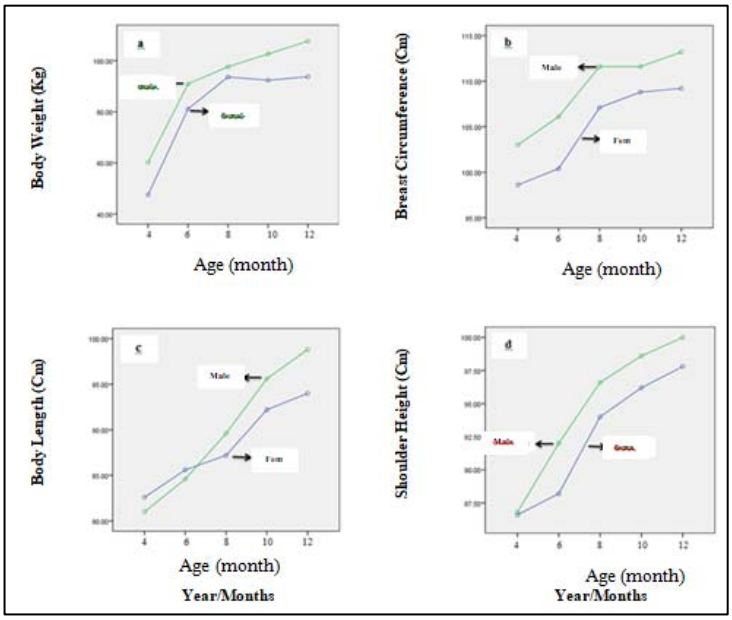

Figure 2. Bodyweight and body size of Bali cattle aged 4 months to 1 year.

Based on the analysis of variance, it shows that the age of Bali cattle weaning has a very significant effect on body weight ($P<0.01$), but sex treatment and the interaction of age and sex have no significant effect. In this study, body weight increases drastically on average at the age of 4-5 months. However, the body weight of females at 12 months of age only ranges 45-90 kg, while the bulls have a range from 60-100 Kg. This data is lower than the research of Latulumanina (2013), Bali male and female aged 0-1 years in the weaning, with the average body weight of Bali cows weaning 100.43±53.15 and the average for male weaning is range 160.3±39.69 [7]. Praharani and Elizabeth (2005) reported the mean body weight at 190 days according to sex was 95.24 kg and 87.95 kg for males and females, respectively, while the average body weight at 350 days was 148.35 kg and 133.09 kg [8]. Differences in age groups have a significant effect on daily body weight gain. This is due to the age of the cattle where the higher

the age, the higher the bodyweight [9]. The increase in body weight is an accumulation of the average daily body weight gain which is presented in table 1.

Table 1. Average initial weight, final weight, and body weight gain weaning of male and female Bali cattle.

Gender	First weight (kg/head)	Final weight (kg/head)	Average daily gain g/head/day
Male	61.00	107.60	316±44.38
Female	47.50	93.70	308±10.01
Average	53.85	100.65	312±30.36

Table 1 showed that the weight gain of male Bali cattle is higher than that of female, although it is not statistically significant. Male body weight gain is greater than that of females due to the presence of the hormone testosterone which stimulates protein anabolism in the body [10]. Where anabolism is the formation of simple molecules into more complex molecules. This is in accordance with the opinion Kay and Haoussemen (1975), who stated that the androgen hormone (testosterone) in male animals can stimulate growth so that male cattle are larger than females [11].

As the animals got older, the body size increased significantly ($P<0.01$). The chest circumference in this study, for females aged 4-12 months, ranged from 98-110 cm, and in bull, weaning ranged from 102-113 cm. The body length in males is around 81-99 cm and females are about 82-94 cm., While the height of the shoulders in males is around 87-100 cm and in females 87-97.50 cm, this figure is higher than the study Made et al., (2014) in the weaning of male and female Bali cattle at the age of 4-6 months in Bali province, the height of the shoulders in males is around 95-105 cm and in females, it is around 85-95 cm [12]. The difference in measurement results can be caused by different maintenance areas and different maintenance management.

The results of research Arlina and Khasrad (2003), which state that the body length of male Bali cattle aged >1 year 120±8.6 cm and age >1-2 years 120.67±0.81 cm [13]. The body length of male Bali cattle at the age of >1-2 years and >2-3 years was 103.62±3.76 and 115.50±2.60 cm. Measurement of chest circumference according to the results of research Kay and Haoussemen (1975), namely 170.14±1.35 cm and 170.53 for males and 150.88 cm for females [11].

Male calf calves with an age range of 0-6 months have faster shoulder height growth compared to female Bali cattle calves, but are not statistically significant [12]. This is because the hormone androgens stimulate the accumulation of salt in the bones which causes bone growth to increase, while the hormone estrogen is more effective in causing the pipe to close [11]. However, the hormone has not been active because it is not yet mature, so the growth rate is not significantly different between male and female Bali calves.

The research made Made et al., (2014) states that age has a very significant effect on the calf height dimensions of Balinese cattle, while gender does not significantly affect the dimensions of calf shoulder height for Bali cattle [12]. This shows that there is a difference in the height dimension growth between male and female Bali calves, in which the calf growth of male Bali cattle is faster than that of female Bali calves.

3.2. The appearance of a bull from the smallholder farm

There were 4 bulls who passed the selection for libido abilities, biological characteristics, and livestock health. The next process after the quantity and quality of the ejaculate shows a stable, continuous, and suitable number to be processed into frozen semen, the ejaculate from this bull is processed into frozen semen manually. The maintenance of the males is then submitted to the Regional Artificial Insemination Center of PIBPS Maros Regency to produce semen and turn it into frozen semen.

At the beginning of January - February, a laboratory accreditation assessment was carried out by the LS Pro for Livestock Seeds and Seeds in accordance with the provisions of PSP-BBT 101: 2015, MOA 10/2016 concerning Production Process and Circulation of semen Frozen Cattle. Out of the four bulls selected from smallholder farms, only three passed the selection according to the SNI. This certificate of conformity to the Indonesian National Standard (SNI) allows the commodity of frozen semen from selected bull cattle to be mass produced and sold commercially in various regions or offered to Regional Governments in Indonesia and if necessary exported abroad. The results of measurement and testing of semen quality during the January-February 2019 period showed that there was no significant difference in the quantity and quality aspects of semen produced by the two groups (tables 2 and 3).

Table 2. Comparison of average frozen semen quality of Bali bull from center of Artificial Insemination PIB-PS and smallholder farm during January to April 2019.

Origin of Bull	Bull Name	Code Bull	Semen quality (Motility)					
			Fresh semen volume (mL)	Fresh semen	Before freezing	PTM 0 hour	PTM 12 hours	PTM 24 hours
Center of Artificial Insemination (PIB-PS)	Sinyo	11522	4.30±1.93	62.22±2.48	48.33±9.43	40.56±4.64	39.44±4.64	39.44±4.64
	Singo	15221	3.83±1.69	64.69±2.14	55.31±6.24	50.63±5.27	46.25±4.84	45.63±4.28
	Dewa	11538	3.76±0.21	53.67±1.17	44.24±1.24	38.95±0.22	37.39±0.47	37.13±0.43
	Arjuna	11434	4.74±1.05	64.29±1.75	55.00±4.63	50.71±3.19	49.49±3.19	49.29±3.19
	Herkules	11129	9.13±1.68	62.50±2.50	55.00±4.08	50.00±2.89	49.17±1.86	47.50±2.50
Average			5.15±1.31	61.47±2.01	51.58±5.12	46.17±3.24	44.31±3.00	43.80±3.01
Smallholder farm	Lewa	11540	4.53±1.84	62.50±3.67	52.50±4.12	47.50±4.81	44.50±4.54	44.50±4.29
	Rewa	11539	5.96±1.76	65.71±1.75	55.71±4.95	50.00±4.63	47.86±3.64	47.14±3.14
	Maiwa	11641	3.75±1.25	65.00 ±0.00	52.50±2.50	45.00±5.00	45.00±5.00	45.00±5.00
Average			4.75±1.62	64.40±1.81	53.57±3.86	47.50±4.81	45.79±4.39	45.55±4.31

Source: Analysis data of semen production during the period of January-April 2019.
PTM = post-thawing motility

The results of the analysis of variance showed that the average volume of fresh semen, the motility of the frozen semen-making process; Starting from fresh semen motility to post-freezing motility test, there was no significant difference ($P<0.05$) between two of the selected males having relatively the same volume mean, as well as other variables such as fresh semen motility, pra-freezing, post-thawing motility 0 hours, 12 and 24 hours, the results are relatively same. Comparison of the quality of bulls semen selected from smallholder farms and accredited PIB-PS bulls that have no different comparison results prove that the provision of males as a source of frozen semen at the Regional Artificial Insemination Center can come from local bulls raised by smallholder farms.

The motility of male fresh semen from the farm community in this study was 64.4% versus 61.47% for the bull from Center of Artificial Insemination. The motility of bovine spermatozoa below 40% indicates poor semen values and is often associated with infertility. Semen with motility of more than 50% is suitable for processing as frozen semen [14,15]. Most fertile males have 50-80% motile spermatozoa, progressively active. The speed of movement of spermatozoa for each male is different and varies according to ejaculate frequency, medium conditions, and ambient temperature. Differences in motility may be due to differences in species, age, frequency of storage, collection techniques, feed, and maintenance management [16]. At each stage of the freezing process, the percentage of spermatozoa motility has decreased due to the less number of spermatozoa that have sufficient energy reserves to be used to move when experiencing cold shock which can cause membrane destabilization [16].

From the point of view of the amount of frozen semen production in the group average for 4 months (table 3), the average number of straw productions per month from January to April 2019 was not significantly different ($P>0.05$) (table 3). In the first month, production was higher in the Center of Artificial Insemination (PIB-PS) group of bulls, but at the end of the observation, the average straw production of the selected males was higher. Individually, the males in the two groups of straw

production fluctuated depending on the amount of ejaculate producing and the mobility of the fresh semen.

Table 3. Comparison of frozen semen production selected from smallholder farms with the bull from AI center (PIB-PS) from January to April 2019.

Origin of Bull	Bull name	Bull code	Straw production			
			January	February	March	April
Center of Artificial Insemination (PIB-PS)	Sinyo	11522	1,888	1,110	1,112	1,137
	Singo	15221	1,677	1,108	747	139
	Dewa	11538	1,142	1,137	852	114
	Rowa	11232	1,686	949	903	1,097
	Arjuna	11434	132	1,495	1,176	863
	Bima	11033	842	1,055	239	1,162
Average			1,227.83	1,140.66	838.16	752
Smallholder Farm	Lewa	11540	1,387	863	1,070	700
	Rewa	11539	298	765	1,005	839
	Maiwa	11641	287	537	358	925
Average			657.33	721.66	811	821.33

The production of frozen semen or mini straw is strongly influenced by the volume of fresh semen, motility, and concentration of spermatozoa per milliliter. Good quality semen will produce high frozen semen and is thought to be closely related to male fertility [17].

4. Conclusion

The quality of fresh and frozen semen selected by smallholder farms was not different from that of Center of Artificial Insemination, as was the number of straws produced. The provision of bull to regional artificial insemination centers can be done by selecting the best bull from smallholder farms.

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