Original Article

Reproductive performance of buffalo cows (*Bubalus bubalis*) at small farms in Sukoharjo Regency, Central Java, Indonesia

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Abstract

Objective: The buffalo population in Indonesia has generally increased in the last decade except in some regencies. This is because the farming activity is majorly dominated by smallholder farmers. Therefore, this study aims to obtain information about the reproductive performance of buffalo cows in small farms at Sukoharjo Regency, Central Java, Indonesia. It was conducted from April-September 2021 using a total of 33 respondents with 62 buffalo cows spread in Tawangsari, Sukoharjo, Mojolaban, Grogol, Baki, and Kartasura.
Methods: The research method used is a survey method with the technique of determining the location and sampling used is purposive sampling. The materials used were buffalo farmers as respondents spread across 6 sub-districts. Mating system was natural mating. The data was collected from this sample include gestational age, age at first calving, service per conception (S/C), calving interval (CI) and post partum mating. The data obtained are then recorded and tabulated for the calculation of the average and standard deviation which is then presented as a percentage based on each parameter.
Results: The results showed that the average length of gestation was 324.2±29.0 days, age at first calving 3.7±0.9 years, service per conception 1.1±0.4 times, calving interval 467.1±85.8 days, and post-partum mating was 128.5±69.3 days.
Conclusions: It can be concluded that the reproductive performance of buffalo cows in smallholder farms at Sukoharjo Regency is relatively good.

Keywords: Buffalo; First calving; Length of gestation; Service per conception

INTRODUCTION

Buffalo (*Bubalus bubalis*) is a wild animal usually hunted in ancient times for meat consumption and the skin can be used as clothing. The meat contains high-quality protein, vitamin B complex, and several minerals [1]. Indonesia has 2 domesticated types, namely mud (Swamp) and river (Reverine) buffalo. The majority or approximately 95% are swamp buffalo, while the rest amounting to 5% are reverine clumps which are mostly found in North Sumatra [2].

According to the Central Bureau of Statistics in 2021, the buffalo population in Indonesia has decreased by 8.9% in the last decade. One of the reasons for this decline is the problem of reproductive management. Good buffalo reproduction management will potentially increase the population to meet the animal protein requirement of Indonesians which is still

relatively low. Komariah *et al.* [3] stated that buffaloes can support the meat self-sufficiency program and national food security.

Meat self-sufficiency can be obtained in 2 ways, namely by increasing the productivity of livestock per individual, or by raising the population through efficient reproduction. This is related to the reproductive appearance of the livestock in question. Furthermore, the productivity of buffalo in Indonesia can be influenced by several factors, including maintenance management which is generally still traditional, subsistence livestock rearing, and the low diversity of production and reproduction. The development also has several obstacles, including unplanned and targeted reproductive management and selection programs, reduced grazing land, high slaughter which culminates in shortages of productive females, high calf mortality of 10%, and the low productivity [4].

Various problems faced by several buffalo farmer have led to a decline in the population at several regions in Indonesia including Sukoharjo Regency located in Central Java Province, with an area of 446.7 km2 and a population of over 0.9 million people in 2020. It also consists of 12 districts, 17 sub-districts, and 150 villages. In 2020, the buffalo population in this Regency was 605 with 216 young and 389 adults [5]. These values are lower compared to the total population 10 years ago, which was 2,519 with 962 young and 1,557 adults [6]. The decline is presumably caused by several factors, including reproductive performance. Currently, there are no investigations on the reproductive performance of productive buffalo cows in Sukoharjo Regency, Central Java, hence, this study is essentially needed.

Reproductive efficiency is defined as the ability of an animal to produce offspring during its lifetime. High livestock reproductive capacity coupled with good management will lead to efficient reproduction. In other words, adequate reproductive efficiency with a low number of disturbances can increase the rate of the livestock population.

Factors that influence the level of repro ductive efficiency in livestock include the rate of pregnancy or conception, calving interval, the interval from calving to conception, service per conception, and the calving rate. Reproductive efficiency in buffaloes can also be measured by paying attention to the calving interval. The shorter the distance, the more efficient the reproductive performance. The length of the calving interval is influenced by the fertility of the parent, male quality, S/C, postpartum estrus and consumption of nutritious feed.

From the description above, it can be concluded that the success of the buffalo business is strongly influenced by its reproductive performance, hence, an investigation into this factor is needed. The problem formulated in this study is the reproductive performance of adult buffalo cows at the level of community farms in Sukoharjo Regency.

Therefore, this study aims to obtain information about the state of reproductive performance of adult buffalo cows at the level of community farms in Sukoharjo Regency, Central Java Province. It is hoped that policies implemented in the future will be more in line with the needs of farmers in the context of improving the reproductive performance of buffaloes.

The results are expected to provide the description of the reproductive performance of buffaloes in improving maintenance and reproduction management. It is also hoped that the results will be used as consideration for the government and related agencies in formulating livestock policies for the future.

MATERIAL AND METHODS

This study on the reproductive performance of buffaloes in smallholder farms was carried out from April-September 2021 in Sukoharjo Regency, Central Java. The materials used were buffalo farmers as respondents spread across 6 sub-districts. Observations on the identity of the farmer, the management of livestock maintenance, and the reproductive performance were carried out through direct interviews with respondents using questionnaires.

The study was carried out in 2 stages, namely the pre-survey and survey, the pre-survey stage was conducted to determine the location and the number of samples. Meanwhile, the survey stage was performed to obtain primary data through direct interviews with buffalo farmers.

Location determination method
The location for the study was determined through purposive sampling, subsequently,

Tabel 1. Buffalo population in Sukoharjo Regency 2021

District	Yearling buffalo	Mature buffalo		Total (head)
		Female	Male	
Weru	-	-	-	-
Bulu	-	-	-	-
Tawangsari	8	10	4	22
Sukoharjo	7	13	3	23
Nguter	-	-	-	-
Bendosari	-	-	-	-
Polokarto	-	-	-	-
Mojolaban	5	4	1	10
Grogol	4	4	1	9
Baki	6	4	1	11
Gatak	-	-	-	-
Kartasura	34	27	5	66
	64	62	15	141

Sukoharjo Regency was selected due to its large buffalo population herded by farmers according to a field survey as shown in Table 1.

Sampling method

This study was conducted using the purposive sampling method, with the sample criteria which include farmers who had at least 2 buffaloes and were able to communicate. The samples consisted of 33 respondents with a total of 62 buffaloes spread over 6 sub-districts as shown in Table 2.

Table 2. Number of Buffalo Samples in Sukoharjo Regency

Districts	Number of buffalo cows	Number of respondents
Tawangsari	10	7
Sukoharjo	13	8
Mojolaban	4	2
Grogol	4	2
Baki	4	3
Kartasura	27	11
Total	62	33

Data collection

Data collection techniques used include: 1) Interviews conducted to obtain information from farmers/respondents face-to-face and by using a previously prepared questionnaire to collect primary data. 2) Direct observation to obtain data from farmers in the Sukoharjo Regency area. 3) Techniques for collecting data obtained from the literature both from books and from other library sources relevant to the study objectives.

Observed variables

The mating system of all buffaloes in the research's location was natural mating. The variables observed were duration of pregnancy, age at first calving, service per conception (S/C), calving interval (CI), and post-partum mating.

Data analysis

The data obtained were then analyzed descriptively, the primary data were recorded and tabulated to calculate the average and standard deviation which were then presented as a percentage based on each parameter.

$$\bar{x} = \frac{\Sigma x}{n}$$

Where:
$\bar{x}$ = mean
Σx = total data
n = number of sample

$$sd = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}}$$

Where:
sd = standart deviasion
x_i = data
$\bar{x}$ = mean
n = number of sample

Table 3. Characteristics of Buffalo Farmers in Sukoharjo District

No.	Characteristics	Number of respondents	%
1.	Age (years old)		
	a. <25	-	-
	b. 25-65	**21**	**64**
	c. >65	12	36
2.	Farming experience		
	a. <5	1	3
	b. 5-15	6	18
	c. >15	**26**	**79**
3.	Education		
	a. No formal education	7	21
	b. Elementary School	**17**	**52**
	c. Junior High School	4	12
	d. Senior High School	5	15
	e. Undergraduate School	-	-
4.	Occupation		
	a. Laborer	11	33
	b. Farmer	**15**	**46**
	c. Livestock Farmer	5	15
	d. Marketer	1	3
	e. Private employer	1	3
5.	Number of buffalo ownership		
	a. 1-4	**21**	**64**
	b. ≥5	12	36

RESULTS

Demographic characteristics of buffalo farmers

The general condition of buffalo farming in Sukoharjo Regency is demonstrated in several data which include the age of the farmer, experience of raising livestock, level of education, occupation of the farmer, and the number of livestock ownership as shown in Table 3.

Reproductive performance of buffalo cows

The reproductive ability of buffalo is influenced by two factors, namely internal and external. Several internal factors that must be considered in terms of reproduction include the duration of pregnancy, first calving, service per conception (S/C), calving interval (CI), and first marriage after giving birth or *post-partum mating* [16]. Data on the reproductive performance of buffaloes in Sukoharjo Regency are listed in Tables 4.

DISCUSSION

The majority of respondents in Sukoharjo Regency were of relatively productive age, according to Surahmanto *et al.* [7] which stated that a person with an age range of 25 to 65 years is in the productive age category. The highest average age was 25 to 65 years with a total of 21 respondents or 64%, while the lowest was over 65 years with a total of 12 or 36%. This

Table 4. Buffalo Livestock Reproductive Performance in Sukoharjo Regency

Reproductive parameters	Value
Length of gestation (days)	324.2±29.0
Age of first child (years)	3.7±0.9
Service per conception (times)	1.1±0.4
Calving interval (days)	467.1±85.8
Post partum mating (days)	128.5±69.3

n = 33 respondents

condition illustrates that farmers in Sukoharjo Regency are generally in the productive age category. According to Utami *et al*. [8], age is one of the factors that affect the number of buffalo livestock ownership, because farmers at the productive age have more energy and are stronger compared to the unproductive ones in running their livestock business. Additionally, age also affects the productivity and decisions of farmers in determining the volume of their livestock business, hence, the older the farmer, the lower the productivity and volume of the livestock.

The experience in raising livestock was counted from when the farmer started the business until the period in which the data was taken. Based on the results, the highest average husbandry experience for buffalo farmers in Sukoharjo Regency is more than 15 years with a total of 26 respondents or 79%. Farmers with experience in raising buffalo for more than 15 years have better knowledge than others and were more predominant. Syaiful *et al*. [9] stated that experience is an important capital for the success of a livestock business. The greater the experience, the wiser the farmer in making important decisions. Moreover, Fanani *et al*. [10] added that the more experience a farmer has, the greater the ability to raise livestock.

The education level of the respondents was mostly elementary with a total of 17 or 51.5% which implies that most of the farmers have low education. This can affect the knowledge of livestock business management. Low education will hamper the implementation of adequate management and business patterns. This is consistent with Waris *et al*. [11] which stated that the level of education achieved by farmers, both formal and non-formal, will influence the perception of their livestock business, in terms of management and sustainable patterns, rationality as well as the ability to take advantage of every available economic opportunity. A higher level of education usually culminates in better management due to the ease of accepting and applying new technology. Rusdi *et al*. [12] added that farmers with higher education generally have better knowledge and a higher desire to learn, thereby increasing the knowledge in raising livestock compared to those with low education.

On average, the main occupation of the respondents was farming with a total of 15 or 45.5%. Generally, the buffalo farmers in Sukoharjo

Regency carry out their maintenance business in a traditional way and the reproductive management aspect has not been managed properly and correctly. According to Manhitu *et al*. [13], the livestock is only used as a side business, where the proceedings are used as additional savings for the family while some livestock were inherited from their parents.

The highest number of livestock owned ranged from 1 to 4 with a total of 21 respondents or 64%, while the lowest was 5 and above with a total of 12 or 36%. The data obtained show that the number of livestock is mostly in the range of 1 to 4 buffaloes which are classified as small-scale ownership. This is because most of the livestock owned in Sukoharjo Regency are only side businesses. According to Nurdiyansyah *et al*. [14], most livestock businesses have the characteristics of a relatively small scale comprising only 1-5 animals. Anggraini and Putra [15] stated that this is caused by several factors, including limited capital, perceiving farming as a side business, and the use of traditional maintenance methods.

The average length of pregnancy ranged from 324.2±29.0 days or 10.8 months, this is consistent with Samsuandi *et al*. [17] which stated that the length of pregnancy in buffalo ranges from 300-334 days. Moreover, this statement is relatively similar to the results of Suhendro *et al*. [18] which showed that the average length of pregnancy for buffalo in Malang Regency ranges from 11-12 months. Differences in the length of gestation in some livestock can be caused by maintenance management, environmental climate, or the feeding system. Most of the buffaloes in Sukoharjo Regency have a normal length of pregnancy which indicates good reproductive abilities.

The overall average age at birth was 3.7±0.9 years with the highest being 3 to 4 years at 73%. The data obtained are almost the same as Mufiidah *et al*. [19] which stated that the average age of buffalo in Tempursari District, Lumajang Regency is 43.57±3.44 months or approximately 3.6 years. However, the average age at first calving is slightly longer compared to the results obtained by Suhendro *et al*. [18] which showed that the average age was 45.6±2.0 months or approximately 3.5 years. The difference is probably due to traditional maintenance management and the use of improvised feed without considering

the quality of the ingredients. This statement is supported by Isnaini and Fazrien [20] which stated that the difference in age at first calving of livestock can be caused by several factors including feed quality, breed, age, estrus detection, season, and maintenance management.

The average S/C of buffalo in Sukoharjo Regency was 1.1±0.4 times, this is almost similar to the results obtained by Lumbantoruan and Sihombing [21] which showed that the service per conception of mud buffalo in Siborong-Borong District, North Tapanuli Regency with the natural mating method is 1.17±0.43. The S/C in this study is in the good range according to Suhendro et al. [18] which stated that the lower the value, the higher the fertility of female animals and vice versa. The average buffalo mating method in this study location is natural. Mating with natural methods is equally good as the Artificial Insemination (IB) in producing optimal S/C ratio values in buffaloes [21]. Based on the results of another study by Sophian and Gunawan [22], the average S/C of buffalo with IB was 2.

The highest Calving Interval (CI) ranged from 400 to 600 days, which amounted to 73% with an overall average of 467.1±85.8 days or about 15.3 months. The data obtained are almost similar to Putra et al. [23] which stated that the average distance between buffalo calving in Ulakan Tapakis District, West Sumatra Province is 16.20 months or approximately 493 days. Muhakka et al. [24] also added that the average calving distance or CI of buffalo in Pampangan District, South Sumatra Province is 14 months or 420 days. Based on the comparison of data from previous studies, the CI value of buffalo in Sukoharjo Regency is classified as normal.

The overall average post-partum mating value was 128.5±69.3 days or approximately 4.2 months. This result is consistent with Muhakka et al. [24] which reported that buffalo can conceive again 3-4 months post-partum when the management of the feed provided is good enough. The data obtained indicate that the distance between birth and calving is relatively faster compared to the results of Komariah et al. [25] which showed that the average period required for buffalo to re-service after giving birth is 6 months. Based on the comparison of the two statements, buffalo in Sukoharjo Regency have an average post-partum mating which is still relatively good.

The several variables observed generally show that the reproductive performance of buffalo in the study location is good. This is presumably because the majority of farmers use a semi-intensive maintenance system. According to Isnaini and Fazrien [20], the semi-intensive maintenance pattern is most appropriate for maintenance as it suits the behavior of the buffalo that likes to wallow in the water to cool the body. Additionally, it helps to protect them from heat stress due to their low tolerance. The feed given also needs to be considered because it affects reproductive performance. Buffalo in Sukoharjo Regency are fed with forage which mostly comes from rice straw and field grass. Kuswandi [26] stated that highly nutritious and concentrated forage feeds can accelerate the age of puberty in livestock. Moreover, buffaloes have the advantage of utilizing fiber-rich feed more efficiently as well as a better metabolic capacity compared to other ruminants.

CONCLUSION

The reproductive performance of buffalo cows in smallholder farms at Sukoharjo Regency is relatively good, as indicated by the average length of gestation, age at first calving, service per conception (S/C), calving interval (CI), and post-partum mating which were in the normal range.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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