Comparison of Aceh cow’s performance on different mating systems at BPTU HPT Indrapuri, Aceh Province, Indonesia

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Abstract. This research aimed to compare Aceh cow's performance on different mating systems at BPTU HPT Indrapuri, Indonesia. This research uses 202 Aceh cows with varying systems of mating: natural mating (164 cows), and artificial insemination (AI; 38 cows). Cow's performance data included birth weight, postpartum mating, calving interval, weaning weight, Cow Reproduction Index (CRI), and Cow Production Index (CPI), obtained from the recording in 2014-2019 and calculation. This research uses the Oneway Anova test to analyze the cow’s performance between mating systems. The results of the cow’s performance included birth weight, postpartum mating, calving interval, weaning weight, CRI, and CPI for natural mating system were 14.32±1.41 kg, 265.61±260.0 days, 558.21±260.07 days, 54.32±19.32 kg, 0.69 calf/cow/year and 37.48 kg/cow/year respectively, while for AI system were 14.98±1.38 kg, 289.34±285.06 days, 581.94±285.06 days, 59.10±21.83 kg, 0.70 calf/cow/year dan 41.37 kg/ kg/cow/year. The results showed that the performance of the Aceh cows with natural mating dan artificial insemination was relatively the same.

1. Introduction
Aceh cattle is a cattle breed designated as native Indonesian cattle in 2011 by the Minister of Agriculture of the Republic of Indonesia through the Decree of the Minister of Agriculture Number 2907/Kpts/OT.140/6/2011 [1]. As germplasm, Aceh cattle need more attention because they are Indonesia's genetic resources. One of the important traits that need to be maintained is the cow's reproductive performance, which is formed as a result of adaptation to various factors from generation to generation. Reproductive performance can be assessed from many indicators and is strongly influenced by the method of mating performed.

It is known that in ancient times, the cows mating system was only done naturally. However, due to various considerations, artificial insemination (AI) technology was developed. Although the Indonesian
was not easily accepted AI technology, nowadays, is widely used. For future programs, scientific data on the performance of cows using these two mating systems are needed. This research was conducted as a basis for determining which method is appropriate to be utilized. This research was based on a study conducted at the Balai Pembibitan Ternak Unggul Hijauan Pakan Ternak (BPTU HTP) Aceh cattle, as the agency that has the mandate to maintain the quality and development of Aceh cattle in Indonesia.

This research aimed to compare the performance of Aceh cows mated naturally or using AI. Cow’s performance indicators include birth weight, post-partum mating (PPM), calving interval (CI), weaning weight, CRI, and CPI. The results of the study can be used as a consideration in the Aceh cattle development program.

2. Materials and methods
The research was conducted at the Balai Pembibitan Ternak Unggul Hijauan Pakan Ternak (BPTU HPT) Indrapuri, Aceh, from December 2019 to February 2020. Data recording from 2014 to 2019 from 164 Aceh cows mated naturally and 38 cows inseminated in BPTU HPT Indrapuri. The recording data included birth weight, date of birth, weaning weight, date of weaning, date of mating, CI, S/C, and mortality.

2.1. Sampling
Sample selection was carried out by purposive sampling, which was chosen from cows mated more than once.

2.2. Cattle maintenance
The cows were housed in the same type of communal pen without tightening. The pen for naturally mated cows has a selected bull. The ratio of bull and cows used was 1:20. There was no bull for those in pen using the AI system. All the cows fed consisting of forage and concentrate were given two times a day, morning and evening. Water for drinking was provided ad libitum. Water for drinking was provided ad libitum.

Artificial insemination was conducted by observing the cow's estrus behavior. Straw used for artificial insemination comes from Aceh bull semen processed at the Lembang Artificial Insemination Center. The cow that has been artificially inseminated was placed back in its pen.

The cows that have been mated naturally or AI would be checked for pregnancy three months after the mating program. The pregnant cow then moved to the pregnant pen, while the non-pregnant cow would be put back into the mating pen. The pregnant cow moved to the birth pen when the gestational age was more than six months.

After calving, the cow and calf are transferred to the breeding pen. There were two breeding pens, namely natural mating pens and AI pens. Observation of estrus behavior in a naturally mated pen was not specifically observed because the bull could detect and mate directly when the cow was in estrus. Observation of estrus behavior in AI pens was carried out routinely. When they were cows showing signs of estrus, they could be artificially inseminated.

Calf weaning was done by separating the calf from the dam when the calf was approximately six months. The data taken when weaning the calf was weaning weight.

2.3. Data collection
The data taken included birth weight, PPM, CI, weaning weight, CRI, and CPI.

Cow Reproduction Index was obtained by calculating the total number of live offspring from each cow per year. CPI was obtained from IRI multiplied by weaning weight.

\[ \text{CRI} = \text{LS} \times (1 - M) \times \left( \frac{365}{\text{CI}} \right) \]

\( \text{LS} \) = Litter Size (tail)
\( M \) = Mortality (%)
\( \text{CI} \) = Calving Interval (days)
3. Results and discussion

3.1. Cow performance
The research results on the performance of Aceh cows mated naturally and artificially inseminated at BPTU HPT Indrapuri Aceh can be seen in Table 1.

**Table 1.** Aceh cows’ performance

| Parameters          | Mating method | Natural (N=164) | AI (N=38)     |
|---------------------|---------------|-----------------|---------------|
| Birth weight        |               | 14.32±1.41<sup>a</sup> | 14.98±1.38<sup>b</sup> |
| PPM<sup>ns</sup>    |               | 265.61±260.0     | 289.34±285.06 |
| CI<sup>ns</sup>     |               | 558.21±260.07    | 581.94±285.06 |
| Weaning weight<sup>ns</sup> |         | 54.32±19.32     | 59.10±21.83    |

<sup>a, b</sup> Different superscripts at the same row indicated significant differences (P<0.05)
<sup>ns</sup> Non Significant

3.1.1. Birth weight. The birth weight of calves in Aceh cattle which were mated naturally with artificial insemination, was significantly different. Birth weight in AI was higher (P<0.05) because the straws used had undergone both quantitative and qualitative examinations. The birth weight of this research was bigger than the average birth weight from another research [2]; the average birth weight of male and female Aceh cattle was 12.83 kg and 12.77 kg. The result of birth weights was significantly different, presumably due to the semen used. The better the genetic quality of the bull, the higher the average birth weight of the offspring [3].

3.1.2. Post-partum mating. Postpartum mating (PPM) in Aceh cattle mated naturally with artificial insemination was not significantly different. The onset of the first estrus is influenced by the cow’s maintenance after calving, especially the adequacy of feed and nutrient content of the feed. In the BPUT HPT Indrapuri, the feed provided is no different, causing the cow’s body condition to be the same. Body condition was very influential on postpartum estrus, which also affects PPM. On average, cows were not mated at the first estrus after calving because the calves were still small and drink milk directly from the cow. The cows were mated when the calves already weaned. The late weaning can cause the ovulation will also be late so that the estrus cycle was longer. This was in accordance with another opinion [4], which states that suckling inhibits the first ovulation after calving through suppression of FSH and LH function.

3.1.3. Calving interval. The calving interval in Aceh cows which were naturally mated or with AI, was not significantly different. The average calving interval of naturally mated in this study was above the average result of another research [5], which states that the average calving interval mated naturally was 14 months or 420 days. The average calving interval of artificially inseminated was 12.36 months or equivalent to 370 days [6]. In this study, the average calving interval of artificially inseminated Aceh cattle was longer, caused by slow postpartum mating and more than two services per conception.

3.1.4. Weaning weight. The weaning weight of Aceh calves, which were mated naturally compared with the artificial insemination group, was not significantly different. There was a significant difference in birth weight because the males used in the two mating methods were different. The weaning weight in the two mating methods was relatively the same. It was suspected that the milk consumption given to the calves had the same nutrient content, same method and place of rearing. The result from another study shows that the weaning weights of male and female Aceh calves aged 205 days was 71.60±7.92 kg and 64.38±10.36 kg [7]. Weaning weight can be influenced by the age of the cows [8]; the 5 to 8-year-old cows was the most optimal period in their performance. Calves born from older cows had a higher weight than younger cows due to differences in the ability to produce milk; older cows more than
younger cows [9]. Cow's milk production greatly affects the weaning weight. The cow that was fulfilled with their nutritional requirement produces milk that can meet the calf's requirement [10]. Genetic factors also influence weaning weight. Cattle with good genetics had optimal performance [11].

3.2. Cow Reproduction Index (CRI) and Cow Production Index (CPI)
Both IRI and IPI in cows mated naturally with artificial insemination were not significantly different (Table 2).

| Parameters  | Mating method | Natural  | AI       |
|-------------|---------------|----------|----------|
| CRI         | Natural       | 0.78±0.33| 0.82±0.58|
|             | AI            | 42.09±22.61| 50.83±48.97|

Non Signifikan

Neither IRI nor IPI was not different because all indicators for the calculation were not different.

4. Conclusion
It can be concluded that the performance of Aceh cows mated naturally or artificially inseminated was relatively not different from postpartum mating, calving interval, weaning weight, CRI, and CPI. Thus, the selection of the mating method depends on technical considerations, including the availability of good bull and the good of inseminators.

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