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To cite this article: A U A Nirwana *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **788** 012139

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Pregnancy rate of Artificial Insemination in beef cows after estrous synchronization at different region

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Abstract. This study aimed to determine the pregnancy rate of artificial insemination (AI) in beef cows after estrous synchronization using prostaglandin (PGF2α). A total of 398 beef cows were used in the present study; 183 in Bantaeng (BT) region and 215 beef cows in Bulukumba (BK) region, respectively. Out of 398 beef cows, 201 were randomly subjected to estrous synchronization in both regions and inseminated after estrus was detected, and the remaining 197 beef cows were inseminated after natural estrus. The data were compared using the Chi-square test. The results of this study showed that the overall pregnancy rate with and without estrous synchronization was 52.8%; consisted of 58.7% and 46.7% of pregnancy rate with and without estrous synchronization, respectively. The pregnancy rate of AI in beef cows after synchronized the estrus in BT was significantly (P<0.05) lower than in BK (51.0% vs. 66.3%), but did not show significantly different for the pregnancy rate in beef cows without estrous synchronization. In the BK region, the pregnancy rate of the cows synchronized the estrus was significantly (P <0.05) higher than without estrous synchronization but did not in BT region. It can be concluded that there was a tendency that beef cows synchronized the estrus had a higher 12.0% pregnancy rate than without estrous synchronization.

1. Introduction

South Sulawesi is a province in Indonesia that acts as a center for beef cattle production. One of the areas in South Sulawesi that is quite strategic in developing beef cattle is Bantaeng Regency and Bulukumba Regency. The population of beef cattle in these two districts is still relatively low when compared to the population in other beef cattle development centers. Therefore, to increase the beef cattle population in the two districts, efforts have been made to improve the application of reproductive technology through the artificial insemination (AI) program, where it is hoped that the two districts can make a large contribution, especially beef cattle in South Sulawesi Province and in Indonesia.

In several previous studies have shown the success of artificial insemination. As was reported by Hastuti [1] on beef cattle terms of the pregnancy rate is quite good because the value of the pregnancy rate obtained was 63.55%. This value is in the range stated by Hunter [2] that the pregnancy rate after AI in cows ranges from 60 to 73% with an average of 71%. Furthermore, the results of the study conducted by Marlini and Haima [3] showed that the pregnancy rate was 80.85%. Efforts to increase the beef cattle population through AI are still facing obstacles in the field, such as the difficulty of detecting heat in cattle and the unscheduled detection of heat by breeders or farmers, while the thing

that most determines the success of AI is the accuracy of detection of heat because detection of heat can be determined when it is time appropriate to carry out insemination services when female cattle are at their peak fertility.

Estrus detection is usually carried out for 25 minutes, 2-3 times a day and the majority of standing heat occurs between 4:00 - 6:00 p.m. 5:00 - 7:00 a.m., however, the phenomenon of silent heat makes detection of estrus is difficult. Therefore, efforts are made to facilitate the detection of estrus by synchronizing the estrous in cows using the PGF2α hormone. This effort is supported by the opinion of De Rensis and Lo´pez-gatius [4] that one way to overcome the problem of difficulty in estrus detection is by applying the estrous synchronization technique, either by using progestagens or prostaglandins (PGF2α). Estrous synchronization is the act of generating heat, followed by fertile ovulation in a group or individual of cattle with the main aim of synchronizing the reproductive conditions of female cattle and producing pregnancy or the pregnancy at almost the same time. The optimum pregnancy rate is the goal of the application of estrous synchronization [5]. Synchronization of estrus can solve the problem of difficulty in estrus detection because there are some female cattle that experience silent heat, and this technique can speed up the post-calving return to heat, shorten days open and shorten calving interval. The success of AI with synchronized estrous and AI with natural heat in cattle is generally of the same quality, but the extent of these similarities and differences in success is not clear. Therefore, this study is needed to determine the success rate of AI with synchronization techniques in estrus and cows in natural heat in an effort to increase the population of beef cattle, and what factors influence it.

2. Materials and methods

2.1. Cows and management
This study was conducted in two different regions; Bantaeng and Bulukumba Regencies, South Sulawesi Province, Indonesia. In general, the material used in the study was 398 cows that showed signs of estrus and were bred using artificial insemination (AI). Generally, the cows are kept by the farmers in the small-holder farm with several types of housing and feeding systems. The types of housing used were loose (coral paddock), loose barn, night paddock, and tie stall. Whereas the type of feeding system implemented by the farmers was only grazing, grazing plus concentrate, and sometimes supplemented with minerals and vitamins.

2.2. Stages of the study
The study was conducted in two stages with a total of 398 cows. The first stage of the study was used 197 beef cows. At this stage, a total of 87 cows were conducted in Bantaeng (BT) Regency (Group I) and 110 cows were conducted in Bulukumba (BK) Regency (Group II). The cows that showed signs of estrus without any treatment were inseminated using frozen-thaw semen. In the second stage, there were 201 cows in which 100 cows were located in Bantaeng Regency (Group III) and 101 cows were located in Bulukumba Regency (Group IV). In this stage, the cows were examined clinically by rectal palpation in order to determine the reproductive status. Cows that were not pregnant and showed a luteal phase in the ovary were then administered using prostaglandin (PGF2α) intramuscularly to induce estrus.

The cows showing signs of estrus within three days after injection, they were then inseminated using frozen-thaw semen by a designated inseminator. However, those cows that did not show signs of estrus in the first PGF2α administration, the second injection of PGF2α were performed on day-10 or -11. The cows showing signs of estrus after the second injection were then inseminated by the inseminator. Likewise, for the cows that did not show signs of estrus until three days after the second PGF2α administration, the AI was still performed on day-3.

2.3. Parameters of the study and data analysis
All data collected in this study were tabulated in Excel program for windows and analyzed using Excel program and SPPS 16 for windows. The pregnancy rate was in percentage and it was calculated by the number of cows who become pregnant divided by the total number of cows and multiply by 100. The

differences in pregnancy rate of beef cows in both regions (Bantaeng and Bulukumba) with and without subjected to estrous synchronization using PGF2α were analyzed using the Chi-square test. Likewise, the Chi-square test was used also to differentiate the pregnancy rate of the cows with estrous synchronization and without estrous synchronization in the same region. The difference between the two groups was considered significant if the probability value was less than 0.05.

3. Results and Discussion

3.1. Pregnancy rate of the cows with and without estrous synchronization
The pregnancy rate of beef cows used in this study in both regions (Bantaeng and Bulukumba) with and without subjected to estrous synchronization using PGF2α is presented in figure 1.
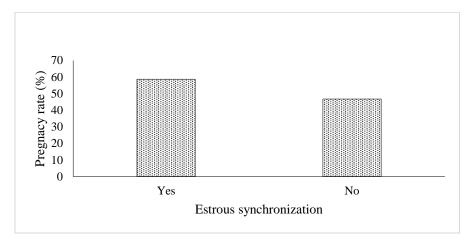

Figure 1. Pregnancy rate of the beef cows with and without estrous synchronization.

Figure 1 shows that the overall pregnancy rate for the two regions with and without being subjected to estrous synchronization was 52.8%. This pregnancy rate shows a normal value, as stated by Toelihere [6] that the success rate of AI for conditions in Indonesia of 50% is considered normal and if it is below 50%, it means that the area has probably infertile cows.

The pregnancy rate of cows after synchronized estrus had significantly ($P<0.05$) higher than the cows without estrous synchronization (58.7 vs. 46.7%). The lower pregnancy rate for the cows without estrous synchronization is probably caused by inappropriate detection of estrus during the estrus period. Furthermore, cows that were subjected to insemination were not in proper time.

3.2. Effect of different regions on pregnancy rate in beef cows
The pregnancy rate of beef cows with and without estrous synchronization at different regions during the study period is shown in figure 2. The pregnancy rate in BT region did not show significant difference between a group of cows synchronized estrus and those cows without estrous synchronization 51.0 vs. 51.7%). However, in BK region, those cows synchronized estrus had a higher ($P<0.05$) pregnancy rate in comparison to the group of cows without estrous synchronization (66.3 vs. 42.7%) (figure 2). This pregnancy rate is classified as normal as stated by Fanani et al. [7] that the value of a good pregnancy rate reaches 60-70%. It is quite understandable that for the situation in Indonesia by considering natural conditions, management and distribution of beef cows is considered good if the pregnancy rate reaches up to 45-50%. A higher pregnancy rate in BK region may be due to the adequate supply of feed in the region which was more sufficient to maintain the cows for the fulfillment of the energy needs that are needed by the cows. As stated by Nuryadi and Wahjuningsih [8] that the ability

of cows to become pregnant at the first insemination is strongly influenced by several factors such as dietary nutrition that is subsequently can influence the conception rate.

Bormann et al. [9] also stated that the nutritional feed received by cows before and after calving also affects the conception rate. Furthermore, they stated that nutritional deficiencies before calving can cause delays in the estrous cycle. In addition, the semi-intensive housing system (day-time in the paddock and evening-time in the housing) is widely applied by the farmers in BK region. This provides opportunities for cows to get additional feed-in grazing fields during the day-time and to take advantage of sunlight to maintain muscle activity, and take advantage of natural grass. Likewise, the signs of estrus shown by the cows in BK region were clearer than the cows in BT region. This was an opportunity for making it easier by the farmers and inseminators to detect estrus in the appropriate time. Signs of estrus such as mucus discharge from the vagina in BK region had higher than in BT region; 78.9% vs. 62.3%. Proper detection of estrus of the cows' makes artificial insemination will work better. As stated by Intan [10], the most important factor in the implementation of insemination is the timing of the insertion of semen at the peak of cow fertility. The peak of cow fertility is at the time before ovulation so that the farmers, and especially for the inseminators must know and understand when the proper symptoms of the cows must be inseminated without delay. Another thing that may cause pregnancy rate in BK region showed higher than in BT region, it was probably caused by the implementation of double PGF2α injection was higher than the implementation of single PGF2α injection. Double PGF2α injection is more effective because it is caused by a prostaglandin compound that is able to simultaneously regress the corpus luteum during the period from mid to late estrus and is only effective when there is an active corpus luteum. Therefore, two injections with an interval of 8-12 days are needed to synchronize a herd of cattle [11].
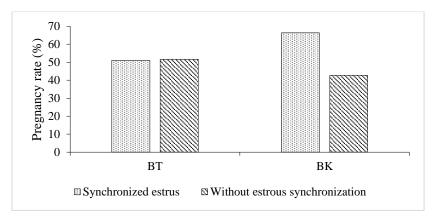

Figure 2. Pregnancy rate of the beef cows with and without estrous synchronization at different regions

In figure 2, it can also be seen that the pregnancy rate of beef cows that inseminated without estrous synchronization was 46.7%, which is divided into 51.7% in BT region and 42.7% in BK region, respectively. Although there was showing no significant difference in pregnancy rate between the two regions, the pregnancy rate in BT region tended to be 9% higher than the pregnancy rate in BK region. The most probably reason for this difference is the location of the farmers as well as cows in BK region is in a small and remote rural area, so that the route to that location is far, and there are several ascent and descent on the way to, so that the inseminators often delay doing AI for the cows in estrus. Furthermore, due to this reason, there will be an inaccuracy in the timing of the implementation of the AI which subsequently makes it difficult for the cows to become pregnant.

The pregnancy rate of the cows without estrous synchronization in BK region was 42.72%. This pregnancy rate is higher in comparison to the pregnancy rate of the beef cows that the study conducted by Darma (Personal interview) in the same region, in which the pregnancy rate was 36%. Another study

also has conducted in another region using 252 cows, the pregnancy rate was 37.3% (Personal interview). This suggests that in BK region, there was an increase in pregnancy rate when estrous synchronization was involved in the program to maintain a high pregnancy rate in the region, especially the cows under small-holder farms that are usually conducted by the most farmers in the region. The increased pregnancy rate achieved in this study had still not reached the normal pregnancy rate in general. Therefore, efforts to improve the pregnancy rate in this region are necessary.

Figure 2 showed that at different regions, the pregnancy rate in BT region of the cows after artificially inseminated that were synchronized estrus in advance and without estrous synchronization did not show a significant difference (51.0% vs. 51.7%; P> 0.05). This means that in BT region the pregnancy rate with and without estrous synchronization was similar; suggests that the factors in which may contribute to the success rate of AI implementation in BT region can be avoided. This study also considers that the pregnancy rate of the cows about 50% after artificially inseminated is in normal value. However, to achieve a high rate of reproductive performance of the cows in the herd, particularly in small-holder farms as used in the present study, this achievement of pregnancy rate must be increased regularly time by time to the optimum value. Nonetheless, the pregnancy rate achieved in this study that above 50% can be a bridge to achieve an optimum pregnancy rate in the future in this region through the improvement of a certain program.

Contrary, in BK region as shown in figure 2, the pregnancy rate of the cows after artificially inseminated and that were synchronized estrus in advance had higher about 24% than the pregnancy rate of the cows without estrous synchronization (66.3 vs. 42.77%). The low pregnancy rate for the group of cows without estrous synchronization was thought to be caused by the factor of farmers that did not pay attention to the time in estrus of their cows resulting in delayed to inform to inseminator. This might be due to the location of cows grazing and farmers' house is far, as the result, the cows were late to be inseminated by the inseminator. The high pregnancy rate in the cows subjected to estrus synchronization in comparison to the cows without estrous synchronization was strongly affected by the attention of the farmers to their cows particularly in detecting estrus and to be inseminated. The role of the inseminator in advising the farmers was also noted.

4. Conclusions

Based on the results and discussion, it can be concluded that there was a tendency that beef cows synchronized the estrus had a higher 12.0% pregnancy rate than without estrous synchronization. Therefore, it is suggested that to improve the pregnancy rate in small-holder farms, the involvement of estrous synchronization is necessary.

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