Evaluation of farmer knowledge level on artificial insemination program and cow’s pregnancy in Central Java and Yogyakarta Provinces

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Abstract. This study was aimed to determine the level of knowledge of beef cattle farmers towards artificial insemination (AI) and to identify the success of the AI implementation by observing at the cow’s pregnancy rate. This study involved 400 farmers in Central Java and Yogyakarta Provinces as respondents selected by multistage random sampling. Statistical descriptive analysis was used in this study. Frequency distribution used to determine the farmers’ level of knowledge toward AI program and the success of pregnancy rate. The results showed that the farmers in this study had a low level of formal education (elementary school) and had a various understanding of AI benefit. Most of the farmers included in the medium category of understanding the benefits of AI and only 25.5% have a high understanding of the benefits of AI. In conclusion, farmers already knew the signs of estrus in cow and had applied it to determine the right time for AI, but the success rate of pregnancy for beef cattle in this study was still low (48.5%).

1. Introduction

Artificial insemination (AI) is the first largest biotechnology applied to improve reproduction in livestock [1]. This technology is one of the most important reproductive technologies because of its ease, economics, and success [2]. AI is believed to be an effective and efficient solution to increase beef cattle population. Human’s role in AI activities are important factors for the success of AI [3]. Thus, the success of AI is determined by the characteristics of farmers as AI users. One measurement of AI success is cow’s pregnancy.

Adoption of AI as a technology in agriculture is influenced by personal characteristics, social, cultural, economic factors, education level, capital, farmers’ income, farm size, access to information, environmental awareness, and utilization of social networks [4–5]. In addition, farmer adoption on AI as an innovation will be influenced by the perceptions and characteristics of the farmer itself [6]. Every farmer has a different educational background from each other, so their perceptions and acceptance of AI are likely to be different from each other [6–7]. Farmer’s perception towards AI is responses from farmer, which is seen from the level of knowledge of farmers, the farmer’s assessment and the interest of beef cattle farmers to the benefits of AI as an innovation for them [7]. This study
was aimed to determine the level of knowledge of beef cattle farmers towards AI and to identify the success of AI implementation by observing cows’ pregnancy rate.

2. Material and methods
The data were collected from February to August 2018 in 8 districts in Central Java (Grobogan District, Sukoharjo, Karanganyar, Sragen, Klaten, Rembang, Blora, and Wonogiri) and 2 districts in Yogyakarta (Gunungkidul and Bantul districts). These two provinces were selected as research locations since more than 60% of beef cattle belongs to smallholder farmers [8]. This study involved 400 farmers as respondents selected by multistage random sampling. Data collection was done through personal interviews using a questionnaire. Personal interviews were conducted on farmers having experience using AI in cows. Data analysis in this study was carried out descriptively with frequency distribution and cross tabulation.

3. Result and discussion

3.1. Farmer’s characteristics
The characteristics of farmers were illustrated by 5 factors, including age, education level, number of family members, number of cattle, and land size. The characteristics of the farmers are presented in Table 1.

| Factor                  | Mean ± S.D | Group Mean                     |
|-------------------------|------------|--------------------------------|
|                         |            | Pregnant (n=194) | Not-Pregnant (n=206) |
| Age (years)             | 50.6 ± 12.1| 51.03 ± 11.95 | 50.28 ± 12.20 |
| Education (years)       | 6.2 ± 3.5  | 6.20 ± 3.56  | 6.22 ± 3.36  |
| Family (people)         | 3.97 ± 1.67| 4.03 ± 1.59  | 3.92 ± 1.73  |
| Number of cattle (AU)*  | 1.94 ± 0.95| 1.98 ± 1.04  | 1.89 ± 0.86  |
| Land size (m²)          | 1823.1 ± 5.139.6 | 2277.37 ± 6965.82 | 1395.31 ± 2313.50 |

Source: Primary data processed (2019)
*AU = Animal Unit (1 AU if the livestock is adult beef cattle, while for a calf is calculated to be 0.25 AU)

Farmers participating in this study had an age of around 51 years and only completed education at the Elementary School level (6 years formal education), although in reality there were some farmers who did not take formal education, on contrary there were also a small number of farmers study until the higher educational degree. Farmers in this study had a family member of around 4 people in each household. Each farmer in this study had an average of 2 AU. Farmers owned land area less than 5,000 m². It is showed that farmers participating in this study categorized as a small-scale farmer [9–10].

3.2. Farmer’s knowledge rate towards AI program
The farmer’s education level in this study is presented in Table 2. It is seen that most farmers (60.25%) only completed elementary school education and as many as 8.75% did not have a formal education.

| Level of education     | Pregnancy status |          |          |
|------------------------|------------------|----------|----------|
|                        | Not pregnant     | Pregnant | Total    |
| Not graduated          | 18 (51.43%)      | 17 (48.57%) | 35 (8.75%) |
| Elementary school      | 119 (49.37%)     | 122 (50.63%) | 241 (60.25%) |
| Junior high school     | 50 (65.79%)      | 26 (34.21%) | 76 (19.00%) |
| High school            | 15 (36.58%)      | 26 (63.42%) | 41 (10.25%) |
| Higher education       | 4 (57.14%)       | 3 (42.86%)  | 7 (1.75%)  |
| Total                  | 206 (51.5%)      | 194 (48.5%) | 400 (100%) |

Table 2. Farmer’s level of education
Only a small number of farmers were educated to higher education (1.75%), the rest was farmers who completed education at the junior high school (19.00%) and high school (10.25%). The farmer's condition is less supportive in understanding the knowledge of AI. This is indicated by the low level of farmer’s education that are only elementary schools in average. The level of farmer’s education will affect the mindset, learning ability, and intellectual level of farmers, so this will affect the level of acceptance of farmers on an innovation [6–11].

The cow’s pregnancy rate in this study was known based on information regarding the cow which lastly being inseminated. Based on this research, it is known that there were 194 pregnancies (48.5%) of the cows that were last inseminated. While the remaining of 51.5% did not show pregnancy. Cows’ estrus sign were important to be known by farmers because it determines the success of AI. The farmers’ knowledge of estrus sign is presented in Table 3 which shows that 98.5% farmers knew the signs of estrus of their own cow. This means that farmers had been able to determine the right time to have their cow inseminated through AI.

Table 3. Farmer’s knowledge about estrus signs and beef cattle’s’ pregnancy status

| Estrus signs | Pregnancy status | Total       |
|--------------|------------------|-------------|
|              | Not pregnant     | Pregnant    |
| Do not know  | 5 (71.43%)       | 2 (28.57%)  | 7 (1.75%)   |
| Know         | 201 (51.14%)     | 192 (48.86%)| 393 (98.25%)|
| Total        | 206 (51.5%)      | 194 (48.5%) | 400 (100%)  |

In addition to measuring the signs of estrus and its application to detect the right time to do AI in their cow, the farmer's knowledge of the AI is also measured through several true-false questions regarding the benefits of AI. These questions are presented in Table 4.

Table 4. Measurement of Farmer’s knowledge about the benefit of AI

| The benefit of AI                                | Score |       |
|--------------------------------------------------|-------|-------|
| a. Improve the genetic quality of beef cattle    | 1     | 0     |
| b. Increase the number of births of beef cattle  | 0     | 1     |
| c. Facilitates the fertilization process in cow  | 0     | 1     |
| d. Shorten the calving interal                   | 1     | 0     |
| e. Lowering the cost of cow mating               | 0     | 1     |

The score obtained by the farmer depends on the accuracy of the answer to the right or wrong statement. The highest score was 5, while the lowest was 0. Based on the acquisition of the score, the farmers were classified into 3 categories, including farmers with low, medium, and high knowledge of AI benefits (Table 5).

Table 5. The level of farmer’s knowledge about the AI’s benefits

| Level of knowledge | Pregnancy status | Total       |
|--------------------|------------------|-------------|
|                    | Not Pregnant     | Pregnant    |
| Low (score 0-1)    | 12 (63.16%)      | 7 (36.84%)  | 19 (4.75%) |
| Medium (score 2-3) | 143 (51.25%)     | 136 (48.75%)| 279 (69.75%)|
| High (score 4-5)   | 51 (50.00%)      | 51 (50.00%) | 102 (25.50%)|
| Total              | 206 (51.5%)      | 194 (48.5%) | 400 (100%)  |

The success of AI in this study still in low category because the pregnancy that occurred following the AI was around 48.5%. This low pregnancy might be caused by various factors. Human factors are the most important in the AI program. The success of AI is determined by the ability of farmers to know and recognize signs of estrus, then the farmer must know when the best time to inseminate the
cow. In this study as many as 98.25% of farmers claimed to have known the signs of cow’s estrus. As for the signs of estrus that was often indicated by the cow, such as the vulva swells, dark red, and produces clear colored mucus, often lowing, restless, decreased appetite, and silent if riding another cow [12]. However, estrus signs in beef cattle cows are more difficult to observe than in dairy cows so it was difficult for farmers to determine the right time to do AI. After seeing the cow’s estrus sign, the farmer would immediately call the inseminator to do AI on their own cow [13]. In addition, farmers' understanding of the benefits of AI was very diverse (4.75% of farmers were included in the low category, then 67.75% of farmers were included in the medium category, and 25.5% of farmers were in the high category). Various understanding of AI’s benefit among beef cattle farmers can reduce the chance of successful AI in an area [7].

4. Conclusion
In conclusion, the farmers in this study had a low level of formal education and had a various understanding of AI benefit. Most of the farmers included in the medium category of understanding the benefits of AI. They already knew the signs of estrus in cow and had applied it to determine the right time for AI, but the success rate of pregnancy for beef cattle in this study was still low.

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