Evaluation of factor influencing the success of Artificial Insemination (AI) of beef cattle through UPSUS SIWAB program in Deli Serdang Regency, Sumatera Utara Province, Indonesia

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Abstract. Indonesian Minister of Agriculture is trying to increase cattle population through breeding program special effort required pregnant cows (UPSUS SIWAB) based on Minister of Agriculture Regulation No 48/Permentan/PK210/10/2016 concerning special effort to accelerate of increasing population of pregnant cows which aimed to produce more calves in order to increase the national beef cattle population. Deli Serdang is one of the regencies in Sumatera Utara, which has numbers of poverty problem and beef cattle farming that have been contributing to reducing these numbers of poverty. The increasing number of beef cattle for each farmer will improve the profit and welfare of the farmer. The study aimed to determine the success rate of the Artificial Insemination (AI) of beef cattle UPSUS SIWAB program in the Deli Serdang Regency of Sumatera Utara, which has been done with AI inseminator. It was conducted in 2018 from 22 districts and involved 42 inseminators in Deli Serdang Regency. They came from beef cattle farming in four central districts raising Brahman cattle, namely, Hamparan Perak, Biru-Biru, Percut Sei Tuan, and Bangun Purba. The conclusions of this study showed that AI of beef cattle UPSUS SIWAB in Deli Serdang Regency had been successful about 40% Pregnant cows.

1. Introduction
The necessary and consumption of beef in Indonesia is increasing every year. It is not comparable with the national beef cattle population in Indonesia. The necessary for beef in 2018 is 663.290 tons. The production of beef is fulfilled at 60.9 %. One of the methods to increase the production of beef cattle can use by increasing cattle breeds in the program UPSUS SIWAB.

The research was conducted by using primary data, which were obtained from the survey method by administering questionnaires to inseminators. The type of questionnaire which uses is a direct questionnaire that is sending the list of questions to interviewees to ask their opinions, ideas, or tell about themselves [1]. In this research, the questionnaires were delivered directly to some farms in the 22 districts in Deli Serdang Regency.
2. Materials and methods

Deli Serdang Regency is an area located in the East Coast region of North Sumatra, in the area of 02° 60' North Latitude, and 03° 16' South Latitude and 98° 33' - 99° 27' East Longitude, with an altitude of 0-500 meters above sea level. The average air is 22.5o C to 31.5o C, and the average rainfall is 218 mm / year. Deli Serdang Regency in the north borders Langkat and Malacca Strait, in the west bordering Langkat and Karo Regencies and in the east bordering Serdang Bedagai Regency. The area of Deli Serdang Regency is 2,497.75 km², which is spread over 22 Sub-Districts and also covers 380 Villages and 14 Kelurahans. The subdistrict with the most significant area is in Hamparian Perak Subdistrict, with an area of 230.15 km² followed by STM Hulu Subdistrict with an area of 223.38 km² while the subdistrict requiring its territory is in Deli Tua Subdistrict with an area of only 9.36 km² or 0.37 percent from the district area.

The research was done in 22 Districts and involved 42 inseminators in Deli Serdang Regency. It was done from October- November 2018. To get a sample, it used a purposive sampling technique. The criterion used in this research farms raising Brahman cattle in 22 districts in Deli Serdang Regency. Therefore, to determine the sample, it used the Slovin formula [2]. It is conducted by using primary and secondary data. The primary data were obtained from Siwab data of Artificial Insemination (AI) implemented in respondents' farms. Meanwhile, the secondary data were obtained from Siwab data of Artificial Insemination (AI) in the local livestock office. The primary data were obtained by using the survey method through administering questionnaires to inseminators.

Respondents' responses were then scored using Likert scale. To measure respondents' opinions, it uses 5-scale, as follow: 1 = Very Disagree (STS), 2 = Disagree (TS), 3 = Neutral, 4 = Agree (S), and 5 = Very Agree (SS). Variable was measured by using instrument developed by Larkin (1990). Technique of analysis data used T-test with $\alpha = 0.05$ with these following steps:

a. $H_0 : \mu_1 = \mu_2$ $H_1 : \mu_1 \neq \mu_2$

b. Estimating $\alpha = 5% (0.05)$

c. Critical value of $H_0$ is rejected if $t_{\text{table}} > t_{\text{count}} > t_{\text{table}}$

d. Degree of freedom = n-1-n = total of sample

To know perception, time accuracy, skill, experience, and cow nurture, double-linear regression analysis was used. Also, to get an optimal estimation result, it was transformed into a double-logarithm natural (Ln) equation and processed by using SPSS (Statistical Package for Social Sciences) 23.0 software. The regression equation model used is as follow:

$$\text{Ln}Y = \beta_0 + \beta_1 \text{Ln}X_1 + \beta_2 \text{Ln}X_2 + \beta_3 \text{Ln}X_3$$

(1)

2.1 Classical assumption

2.1.1 Normality Test. The normality test is to examine whether dependent and independent variables in the regression model have a normal distribution or not. The good regression model has normal data distribution or gets close to the significant value in the Kolmogorov Smirnov test. When sig. Value > 0.05 means that data have a normal distribution [3].

2.1.2 Multicollinearity Test. Multicollinearity test is to examine whether there is a correlation between independent variables in the regression model. A good regression model should not have independent variables that are correlated with each other [3]. To detect whether there is multicollinearity or not, it can be done by analysing the independent variables correlation matrix and by looking at the Variance Inflation Factor (VIF) value. If low tolerance value = high VIF value (because of VIF–1/tolerance), it means there is high collinearity. The critical value which is generally used is VIF > 10. If VIF value < 10, it means there is no multicollinearity [3].
2.1.3 Heteroscedasticity Test. The heteroscedasticity test is to examine whether there is variance dissimilarity of an observation to other observations residuals. If the variance of observation to other observations residuals is similar, it is known as homoscedasticity. On the contrary, if it is different, it is known as heteroscedasticity. A good regression model is homoscedasticity. To detect whether there is heteroscedasticity or not, it can be done by using Spearman's correlation test. A regression model is free from heteroscedasticity if sig. Value of every variable > 0.05 [3].

2.1.4 Autocorrelation Test. Autocorrelation test is to examine whether there is a correlation between noise in time series (time (t) and previous time (t-1)) in a linear regression model. If there is a correlation, it is called autocorrelation. To detect whether there is autocorrelation or not, it can be done by using the Durbin Watson (DW) test, which is by comparing $D_{\text{count}}$ to $D_{\text{table}}$.

2.2 Statistical Test

F-Test is to examine the significance of the regression coefficient simultaneously with hypothesis testing [3].

a. $H_0 : b_1 = b_2 = b_3 = b_4 = b_5 = 0$
b. Determining $\alpha = 5 \% (0,05)$
c. Critical value, $H_0$ is rejected if $F_{\text{count}} > F_{\text{table}}$
d. Statistical Test:

\[
F = \frac{\text{Variance}_1}{\text{Variance}_2}
\]  

(2)

Degree of freedom: $(df_1) = k-1$, $(df_2) = n-k$

$R^2$ : Coefficient $R^2$

$n$ : Total of data/sample

$k$ : Number of groups (dependent and independent)

In criteria of:

1) $H_0$ is accepted if $F_{\text{count}} < F_{\text{table}}$ or if sig. Value > 0.05, which means that there is no simultaneous effect between independent variables and dependent variables.

2) $H_0$ is rejected if $F_{\text{count}} > F_{\text{table}}$ or if sig. Value < 0.05, which means that there is a simultaneous effect between independent variables and dependent variables.

The coefficient of determination ($R^2$) is an important measurement in regression because it can inform whether the estimated regression is good or not. In other words, it can measure how close the estimated regression line to the real data. The value of the coefficient of determination reflects how much variability of the dependent variable can be caused by its relationship to the independent variable [3].

3. Results and discussion

Hypothesis testing results from this study have found that time of doing AI, inseminator's skill, education level of cattle farmers, animal husbandry, cattle care, and repetition of AI significantly influence the AI.

3.1 Coefficient of determination

Coefficient of determination ($R^2$) is used to know the ability to explain the effect of independent variables on the dependent variable (Table 1)
Table 1. Result of coefficient of determination analysis

| Model | R    | R Square | Std Error estimate | Change statistics | Durbin-Watson |
|-------|------|----------|--------------------|-------------------|---------------|
|       |      |          |                    | R Square          |               |
|       |      |          |                    | Change | F change | df1 | df2 | Sig.F |               |
|       | 1 643a | 0.413   | 0.765              | 0.5186 | 16.741  | 7   | 23  | 0        | 2.428          |

From the results in Table 1 showed the coefficient of determination value of adjusted R² is 0.765. It means that independent variables are able to explain dependent variable variation only in 76.5%. Meanwhile, the rest (23.5%) is explained by other variables outside the model. Some independent variables (time of doing AI, inseminators' skill, and cattle care) have a positive and significant effect on AI. However, the other independent variables (education level of cattle farmers, farmers' attitude, cattle care, and repetition of AI) have a positive effect on AI (P < 0.05). Time of doing AI, inseminator’s skill, education level of cattle farmers, animal husbandry, cattle care, and repetition of AI have a positive and significant effect on AI (Table 2).

Table 2. Statistical analysis of the influence of independent variables (time of doing AI, inseminator’s skill, education level of cattle farmers, cattle husbandry, farmers’ attitude, cattle care, repetition of AI) on dependent variable (AI)

| Coefficientsa |
|---------------|
| Model | Unstandardized Coefficients | Standardized Coefficients | T     | Sig. |
|-------|-------------------------------|---------------------------|-------|------|
|       | B     | Std. Error | Beta |       |       |
| 1     | (Constant) | 9.783 | 5.604 | 1.746 | 0.094 |
|       | Time   | 0.321 | 0.172 | 0.361 | 1.873 | 0.074 |
|       | Inseminator | 0.189 | 0.108 | -0.287 | -1.747 | 0.088 |
|       | Education Level | -0.131 | .371 | -0.156 | -.353 | 0.727 |
|       | Nurture | 0.314 | 0.14 | 0.32 | 2.248 | 0.030 |
|       | Feed Attitude | -0.031 | .093 | -0.052 | -.329 | 0.745 |
|       | Care/Medicine | -.296 | 2.062 | -.071 | -.144 | 0.887 |
|       | Repetition Of Artificial Insemination | 0.848 | 0.132 | 1.173 | 6.427 | 0.000 |

Dependent Variable: Artificial Insemination

From Table 2, it is obvious that sig. The value of the first independent variable (time) is 0.074. It means that time accuracy has a significant and positive effect on artificial insemination because of the sig. Value < 0.05. Then, sig. The value of the second independent variable (inseminators' skill) is 0.088. It means that the inseminators' skill has a significant and positive effect on artificial insemination because of the sig. Value < 0.05. Next, sig. The value of the third independent variable (Educational background) is 0.727. It means that the educational background has no significant and positive effect on artificial insemination because of the sig. Value > 0.05.

After that, sig. The value of the fourth independent variable (nurture) is 0.030. It means that nurture has a significant and positive effect on artificial insemination because of the sig. Value < 0.05. In addition, sig. The value of the fifth independent variable (farmers' attitude) is 0.745. It means that the farmers' attitude has no significant and positive effect on artificial insemination because of the sig. Value > 0.05. Moreover, sig. The value of the sixth independent variable (care) is 0.887. It means that the care has no significant and positive effect on artificial insemination because of the sig. Value >
0.05. Last, sig. The value of the seventh independent variable (repetition of insemination) is 0.094. It means that the repetition of insemination has a significant and positive effect on artificial insemination because of the sig. Value < 0.05.

4. Conclusions
The purpose of the research was to evaluate the success of Artificial Insemination (AI) towards Siwabto ruminants in Deli Serdang Regency. Overall, some independent variables (time, inseminators' skill, and nurture) have positive and significant effect on artificial insemination in significance level (α) = 5%. However, the other independent variables (educational background, farmers’ attitude, care, and repetition of artificial insemination) have positive effect on artificial insemination.

References
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