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Holstein Friesian Performance on highland and lowland environment affect reproduction ability in East Java Indonesia

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Dairy farming business as one of the livestock subsector which is very prospective market, follow as the prices of feed resources and milk. The objectives of this study was to determine the influence of highland and lowland toward reproduction ability of *Holstein Friesian* in East Java, Indonesia. The method was carried out by observing the environmental temperature and humidity during artificial insemination. We used non-return rate (NRR), conception rate (CR) and service per conception (S/C) parameters and analyzed using linear regression. The results showed that the average temperature in highland and lowland are $26.3 \pm 1.71^\circ\text{C}$ and $31.4 \pm 2.02^\circ\text{C}$, while the average humidity are $76.3 \pm 5\%$ and $62 \pm 9\%$. The value of NRR, CR, S/C, in highland obtained 85.5%, 71.1%, 1.38 and in lowland obtained 80%, 66.7%, 1.45. These data collections conclude that highland have better value for *Holstein Friesian* and there is linear correlation between environmental temperature and reproduction ability.

Keywords: *Holstein Friesian*, dairy cattle, environmental temperature, reproduction

INTRODUCTION

Dairy cattle breeding has become an increasingly international business worldwide. Over the last ten years a number of studies on reproductive and productive performance of dairy cows are undertaken Popov et al., 2016. Some of the results were too contradictory and impaired reproductive performances which inevitably lead to less productivity. However, new attention has been taken on milk production in selection program worldwide, which resulted in a decline in health and fertility traits LeBlanc, 2010. The previous documents showed that the ease level of productive efficiency in dairy farming has been

major global issues.

The overall, four parameters which determined cattle reproductive efficiency are age at first calving, services per conception number, days open and calving interval. Those parameters can be performed by clear understanding of reproductive process and factors that affect ability of reproductive Haworth et al. 2008; Moussavi, 2008.

The main issue to make essential reproductive performance of dairy breeds is the place where the genetic grown up Lui et al. 2007. Dairy breeds were particularly maintained in highland environment. *Holstein Friesian* is one the dairy breed that its production and productivity is

determined by genetic and environmental factors Wangchuk, 2016; Wondossen et al., 2018. Highland and lowland are two of the environmental component for *Holstein Friesian*. Highland is commonly found in 500 to 1500 m above sea level, like mountain area. Meanwhile lowland found in 0 to 500 m above sea level, like east coast area. Although the *Holstein Friesian* of the most popular breed, evaluations of environmental throughout life are rare Nurradis et al. 2011. The purpose of this study was to evaluate the reproductive performance level on highland and lowland of *Holstein Friesian*.

MATERIALS AND METHODS

The data for this study were obtained from the subdistrict Nongkojajar of Pasuruan, Pujon of Malang and sub-district Sendang of Tulungagung represent highland, whereas in sub-district Grati of Pasuruan, Surabaya and Gresik represent lowland, East Java Indonesia. Each sub-district was taken as many as 100 head samples, so that the total sample was 600 dairy cattles.

Data were collected from March to August 2019 on different temperatures and humidity during artificial insemination time. Additional data as non-return rate (NRR), conception rate (CR) and service per conception (S/C) parameters

were used to observe its effect for reproduction ability of Holstein-Friesian. The data were analyzed using linear regression.

RESULTS

Effect of environmental difference

The results of the average temperatures and humidity in two different places condition during artificial insemination time were $26.30 \pm 1.71^\circ\text{C}$; $76.30 \pm 5.00\%$ in highland and $31.40 \pm 2.02^\circ\text{C}$; $62.00 \pm 9.00\%$ (see Figure 1).

Non-Return Rate (NRR) and Conception Rate (CR) Value

Based on primary data which collected from the inseminator and breeders's interview, the results of NRR and CR value in highland and lowland were 85.5% (NRR); 71.1% (CR) and 80% (NRR); 66.7% (CR) (see Figure 2).

Service per Conception (S/C) Value

Service per Conception (S/C) were obtained from the inseminator's data. The results of S/C value in highland and lowland were 1.38 and 1.45 (see figure 3). This results can be influenced by the experience of a period of raising, ownership, and the incidence of abortion of *Holstein Friesian*.

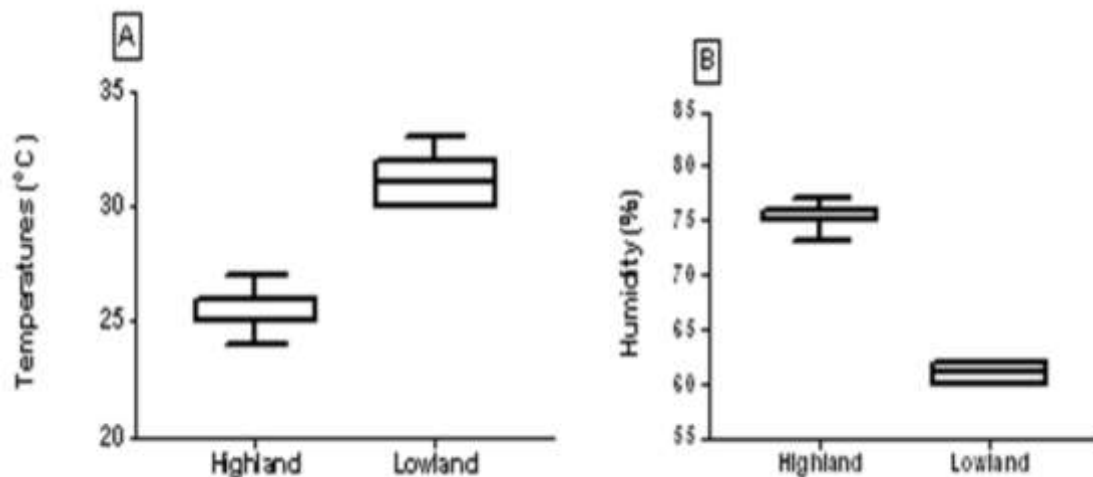


Figure 1: The comparison temperatures (A) and humidity (B) in highland and lowland

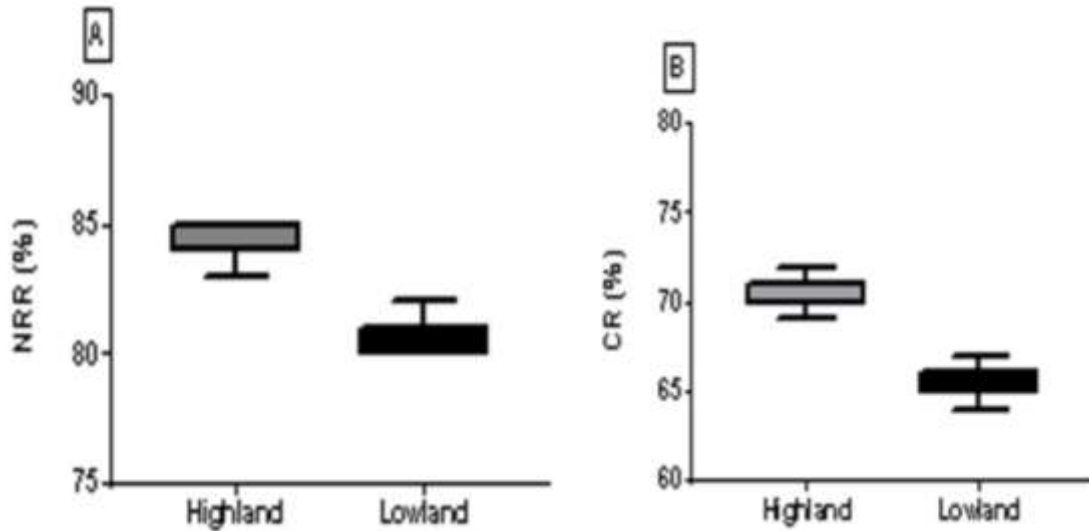


Figure 2: The comparison of NRR (A) and CR (B) values in highland and lowland

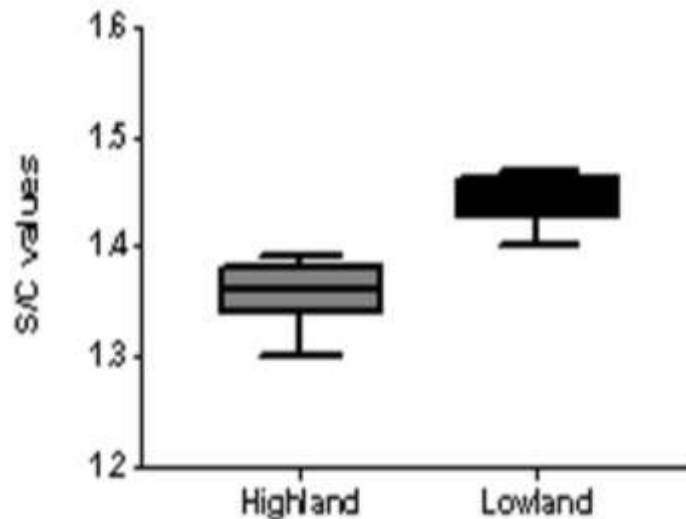


Figure 3: The comparison of S/C value in highland and lowland

DISCUSSION

The results of this study showed that consistency the air temperature in Indonesia that commonly between 24-34°C and the humidity was too high, 60-90%. If the condition keep continuing, it can cause heat stress of the cow's body, increase water intake, reduce milk production and feed consumption Hammami et al., 2009. The high air temperatures and humidity come from high solar radiation, thus the effective place for

dairy farm in Indonesia is about 800 m above sea level Salem et al., 2006; Pauler et al., 2019. In addition, the materials, ventilation, and size of the cage affect the heat productions of cow's body de Rensis et al., 2015; Worku et al., 2016.

Non return rate (NRR) values is the percentage of the cattle that were not re-estrous cycle for 30-60 days after artificial insemination Schüller et al., 2016. This NRR method is fastest measurement to observe the artificial insemination's implementation. The results of

NRR were influenced by the experience of a periode knowledge about breeding and soon call the inseminator if their cows started getting estrous cycle Muasya et al., 2014; Coffey et al., 2016.

Feeding is one of the factors hat determined the success of dairy farm. The cows will not produce good milk if they were not given enough consumption Lopez et al. 2004. The good cow's feeding consist green forage and concentrates, while we give high quality forage thus the concentrate comparation would be 64 : 36. The concentrate affect the cattle productivity Kumar et al., 2014.

The results of CR value is good or normal, however the highland value is better than lowland. CR might be affected by the feeding types, times, and concentrate. Decreasing the CR values can of breeding, the breeder will gain more be caused by several factors including fertility (sperm), accuracy of estrous cycle detection and artificial insemination techniques Berry et al., 2003; Allouche et al., 2018.

Based on satistical analysis, there is a correlation about the environment temperatures to non return rate (NRR) 10%, conception rate (CR) 11% and services per conception (S/C) 4%. Enviromental temperatures associated with endocrine glands Ngodigha et al., 2009. Heat stress affect endocrine system due to metabolic change Avendaño et al., 2010. This condition will interfere the tyroid glands that cause decreasing growth hormones and reproductive system Penev et al., 2014; Lilko et al., 2015.

CONCLUSION

In sum, the productivity of *Hosltein Friesian* in highland is better than in lowland. There is a colleration between enviromental temperatures, including NRR,CR and S/C to productivity ability. Further study is also needed to identify others factor that affect the productivity of *Hosltein Friesian*.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

SHW designed the experiment and wrote the script. TMS and AF conduct experiments in the field, data collection and data analysis. DKM and PS designed the experiment and reviewed the manuscript. All authors read and agreed to the final version.

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