

## **Breeding value of friesian holstein bulls in PT. Naksatra Kejora Rowoseneng, Temanggung, Central Java**

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**ABSTRACT:** The objectives of the study were to evaluate the Friesian Holstein dairy cows selection in PT.Naksatra Kejora Rowoseneng, Temanggung, Central Java based on the Breeding Value (BV) of bulls. To evaluate the BV, heritability and repeatability values of milk production are needed. The heredity and milk production records in 2002-2009 were converted in to mature equivalent (ME) and the lactation period was 305 days. Heritability of milk production was estimated by using paternal Halfsib Correlation method through Completely Randomized Design One-Way Classification. Estimation of heritability of milk production was based on interclass correlation method and intraclass correlation method. The calf-to-cow regression method. Estimation of repeatability of milk production was based on interclass correlation method. The results show that the estimation of heritability and repeatability of milk production were 0.39 and 0.43, respectively. BV of bulls was 452.76 to 210.26. Based on the BV, 4 of 9 bulls were recommended as the good bulls.

**Key words:** breeding value, heritability, repeatability, bulls

### **INTRODUCTION**

Dairy farming in Indonesia was started since Dutch Colonization, by bringing Friesian Holstein from the Netherland to fulfill the need of the Dutch at the time (Harjosubroto, 1994). Then, the dairy farming was developing. Since 1970s, Indonesian Government started to import dairy cows from Europe and America. The dairy cows population declined in 2002-2005, and started to increase in 2006. The highest population was in 2009 reached 487,000 heads and the milk production was 647,000 liter.

The increase in population means the increase of milk production can be reached by improving the genetic quality through selection and breeding control program. Selection can be done by selection the bulls in order to produce the high quality of dairy cows that have high milk production. Breeding program generally includes the crossbreeding strategy and to avoid inbreeding case. Genetic quality of dairy cows is measured by the BV, that the data of heritability and repeatability are needed.

The study was done in the dairy farming which uses natural breeding. Bulls are selected based on the performance. The results of the study can be used as the consideration in bulls selection based on the genetic quality.

#### ***Heritability***

Heritability ( $h^2$ ) is a ratio between additive genetic variance ( $\sigma^2_{ga}$ ) and phenotype variance ( $\sigma^2_p$ ). (Hardjosubroto, 1994).. Additive genetic variance is the most important variance in selection, due to dominant genetic variance and epistatic genetic variance is less important in selection process. According to Pirchner (1969) during meiosis genetic total is falling apart into additive genetic, dominant genetic and epistatic genetic, but only additive genetic that has an influence and is expected to emerge in the heredity. Dominant genetic, and epistatic does not have influence on the heredity. Dalton (1980) said that heritability in the amount of 0.00-0.10 is lower, 0.10-0.30 is medium, >0.30 is high. Heritability of milk production according to Lasley (1972), Hardjosubroto (1994), Warwick et al (1995), Falconer and Mackey (1996) is 0.36; 0.30; 0.20-0.30, 0.35 respectively. According to Kinghorn et.al (1993), heritability can be used to estimate breeding value.

$$h^2 = \frac{\sigma_a^2}{\sigma_w^2 + \sigma_e^2}$$

### **Repeatability (r)**

Repeatability is a measurement of cattle characteristic similarity repeatedly as long as the life of the cattle. Repeatability value of a characteristic is influenced by the same characteristics value of  $h^2$ . The higher the value of  $h^2$  the higher the repeatability value. Repeatability value ranges between 0 to 1 (Noor,2004).

Statistically, repeatability is a ratio between genetic variance ( $\sigma_g^2$ ) plus permanently environmental variance ( $\sigma_{ep}^2$ ) per phenotype variance ( $\sigma_p^2$ ) or statistically could be presence on  $r = (\sigma_g^2 + \sigma_{ep}^2)/\sigma_p^2$ . Environmental variance is differentiated between permanent ( $\sigma_{ep}^2$ ) and temporary ( $\sigma_{et}^2$ ). Permanent environmental variance is all of un genetically influences but influence to cattle productivity during their life, for example the influence of disease, malnutrition in early infancy and the influence of disease during pregnancy phase, while the temporary environmental variance is all of the environmental influence in addition to permanent environmental variance (Warwick et al,1987, Hardjosubroto,1994).

Repeatability value of a characteristic is influenced by the same characteristic of heritability value. The higher the heritability value is the higher the repeatability value. Repeatability value ranges from 0 to 1(Noor, 2004).

Repeatability is the upper limit of heritability, because the numerator in the repeatability formula has permanent surrounding factor and dominant and epistatic genetic influence, besides all additive genetic, so that the least value equals to heritability ( $h^2$ ) in narrow meaning and it can be a lot bigger depending on the amount of the factors (Warwick et al,1987)

Repeatability of milk production includes in low category if the value between 0 to 0.10, in medium if between 0.10 to 0.31 and in high if between 0.30 to 1.00 (Dalton,1980).According to Warwick and Legates (1979) the repeatability value of milk production ranges between 0.35 to 0.50. Based on the result of a study, the estimation of repeatability value according to Mulyadi (1994), at *Balai Besar Pembibitan Ternak Unggul Sapi Perah (BPPTU-SP)* Baturaden, Banyumas was  $0.30 \pm 0.05$ .

## **MATERIALS AND METHODS**

The study was conducted in December 2009 to February 2010 at PT Naksatra Kejora, Rowoseneng, Temanggung, Central Java. The materials were records of milk production records. To estimate the heritability value of milk production in the first lactation period records were used, while to estimate the repeatability value, the first, second and third lactation period records were used.

The data were used to make the estimation of the heritability among 68 dairy cows that the heredity of 16 bulls.

Milk production of each individual was firstly corrected in to 305 days of milking, 2 times of milking per day and age of mature equivalent (Hardjosubroto,1994). Heritability of milk production was estimated based on Paternal Halfsib Correlation Methods using completely Randomized Design one way classification while repeatability of milk production was estimated by using variance analysis based on Interclass Correlation and Interclass Correlation method. Breeding value of sires was estimated using Becker's formula (Hardjosubroto, 1994).

$$BV = \frac{nh^2}{1 + (n-1).r} (\bar{P} - \bar{\bar{P}}) + \bar{\bar{P}}$$

BV = breeding value

$h^2$  = heritability

r = repeatability

n = number of observation

## RESULTS AND DISCUSSIONS

### *Heritability*

Heritability value of milk production of Friesian Holstein dairy cows was  $0.497 + 0.52$ . It showed that 49.7% of milk production variance was influenced by the additive genetic factors, while 50.1% was influenced by non-additive genetic factors (dominant & epistatis) and environmental factors. It means that the ability to inherit milk production to its heredity can be categorized high and it means it can be used to estimate breeding value.

$$h^2 = \frac{\sigma_{ga}^2}{\sigma_p^2}$$

### *Repeatability*

The result of estimation of milk production based on Correlation Interclass Methods was 0.58, meaning that the difference of milk production between individuals and between lactation was 58%. It was caused by the genetic factors and 42% was caused by environmental factor. Repeatability based on Correlation Interclass Methods was 0.36 with error standard of 0.098. The difference result of estimation of milk production repeatability was assumed due to the difference method used to estimate repeatability. According to Warwick et al (1987) that estimation of repeatability value depends on methods, that was used in the estimation. But the repeatability is he upper limit of heritability, thus the estimation result of repeatability of milk production that was right and correct was 0.58 (Warwick,1987).

### *Breeding value*

Breeding value of each bull was about -452.76 to 210.26 or breeding value varies between one bull and another. Three bulls no.2818,2364,2902 have low negative breeding value. They were suggested to be culled. There were two sires no.2884,2360, having medium positive breeding value and there were 4 bulls, no.2826,2923,2804 having high positive breeding value.

According to Hardjosubroto (1994), breeding value has very important meaning, especially in the selection of bulls if their breeding value are known. It shows that a bull is mated with the random population in a normal population, the average performance of its heredity will show in the half of the bulls breeding value of its population.

## CONCLUSIONS

It was concluded that estimation of milk production heritability at PT. Naksatra Kejora,Rowo Seneng Temanggung was categorized high and based on the estimation of breeding value of four bulls with ear tag number of 2826,2932 and 2804, they may recommended as excellent bulls.

Based on estimation of breeding value of 9 bulls, 4 of them were recommended as excellent sires, two bulls as medium and 3 bulls had negative breeding value that can be culled as they were not expected to have the ability to inherit high production of milk. If milk production decreases from year to year, it is necessary to employ inbreeding. It is also necessary to estimate heritability and repeatability of milk production based on the days.

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