USED OF TEST DAY RECORDS FOR GENETIC EVALUATION OF HOLSTEIN IN INDONESIA

Heni Indrijani, Asep Anang, Jan Alex Siwi

Faculty of Animal Husbandry, Padjadjaran UniversityBandung Indonesia
e-mail: nalit70@yahoo.com

Abstract

This research addressed to study the use of test day records for genetic evaluation of dairy cattle at Indonesia. Total of 6698 records from first lactation and 5504 records from second lactation, resulted from 1293 dams and 69 bulls were evaluated. The results indicated that estimates of heritability ranged from 0.06 to 0.41. Genetic merit can be raised by mass selection. Based on the correlation of breeding values among test day records. Selection of animals at Taurus Dairy Farm can be conducted based on full test day records of first lactation plus one test day record in the second lactation, whereas selection for bull is extended into second test day in the second lactation, but selection of animals at BPPT Cikole Lembang can be conducted based on full test day records of first lactation plus six test day record in the second lactation, whereas selection for bull is extended into eigth test day in the second lactation. It conclude that the best model to estimate breeding value was fixed regression test day model (FRTDM) because the evaluation can be conducted simultaneously on the same day although the level of lactation among dairy cows was different.

Key words: dairy cattle, test day, heritability, breeding value, fixed regression

INTRODUCTION

Evaluation of the genetic merit of dairy cows for milk production can be based on Breeding Value. Breeding Value is a reflection of genetic potential of livestock held for a particular trait, given the relatively depend on the position in a population. Breeding value can not be measured directly, but it can be predicted or estimated. On the Estimated Breeding Value (EBV) is required milk production curve. Use of the milk production curve must go through a test because the curve can not necessarily appropriate to describe the milk production of dairy cows in different places.

The method used to estimate genetic parameters (heritability and breeding value) depend to what we needs and also the availability of data in the field, but at Indonesia it is still difficult to do because not all breeders do recording. Evaluation of genetic quality can only be done in large companies, which generally keep records of milk production on a regular basis.

The aim of this experiment is to simplify the pattern of milk production records and improve opportunities for all cows to be recorded, without reducing accuracy in evaluating the genetic quality, so the selection of cows can be done more efficiently.

RESEARCH METHOD

Milk production test day records were collected at Taurus Dairy Farm and BPPT Cikole Lembang based on first and second lactation. The parameters that will be estimates as follows:

a. Heritability, and Breeding Value (NP) of milk production based on various patterns of test day records.

b. Spearman Rank Correlation between Breeding Value (BV) based on various patterns of test day records.

Estimation of Heritability

Estimation of genetic parameters based on Test Day records (TD) using Fixed Regression Test Day Model (FRTDM). In this model, test day records were analyzed as the same trait and needed milk production curve as a covariate. Milk production curve that is used is determined based on accuracy of test results of milk production curve in the previous test. Models generally are as follows:

$$y_{ijklm} = L_i + F_j + \sum R_{ik} + a_l + pe_l + e_{ijklm}$$

Description: y_{ijklm} = Test Day records; L_i = lactation periode; F_j = influence of fixed effects (rainy days, humidity, and temperature); R_{ik} = the best regression of milk production curve depend on the previous test results (regression Ali-Schaeffer), a_l = the additive effect; pe_l = permanent environmental effects, and e_{ijklm} = error.

Estimated Breeding Value (EBV)

Breeding value predicted by Animal Models-Best Linear Unbiased Prediction (BLUP). The programs used in this study is the VCE 4 (Groeneveld, 2003), PEST (Groeneveld, 1999), and SAS 9. Calculation of Spearman Rank correlation made between breeding value based on various patterns of test day records. Determination of the possibility of recording patterns that can be applied, based on high correlation values (> 0.9).

RESULTS AND DISCUSSIONS

Total of 6698 records from first lactation and 5504 records from second lactation, resulted from 1293 dams and 69 bulls were evaluated. The average daily production in first and second lactation at PT. Taurus Dairy Farm is 9.74 kg and 11.26 respectivelly, and at BPPT Cikole is 14.16 kg and 16.42 kg respectively.

The results of fixed effect that is affecting milk production, such as temperature, rainy days, and humidity indicate that external environmental factors showed no meaningful significance. This can be happen because even in Indonesia there are two seasons are called the rainy and dry seasons, but differences in the two seasons relative not drastic or extreme as happened in subtropical areas. In Indonesia, the minimum temperature range is usually between 14-15^{0}C, and the maximum temperature is usually between 34-35^{0}C, thus the range is only equal to 21^{0}C (Badan Meteorologi dan Geofisika, 2006).

In general, production in first lactation period is the lowest and will increase in the next lactation period. Effect of lactation period on milk production based on the test day in all study sites is significant. Observations in Indonesia showed, although many reports note the peak production occurs around the third to fifth lactation, but several farms showed a decrease in production occurred after the first lactation period. It accur because of poor feeding (giving the same amount of feed for dairy cows for different lactation periode) is the main factor causing the decline of production after the first lactation.

Heritability values are very dependent on the additive genetic diversity of a population. This causes the value of heritability of the same trait will vary within a particular population as happened in this study, ranging from 0.06 to 0.41 (Table 1). Mass selection is the most appropriate method to improve the genetic potential for kind of trait that have a moderate to high heritability values, whereas for traits with low heritability value can be used the outcrossing method to improve the genetic potential of livestock (Indrijani, 2008).

Table 1. Heritability (h^2), and Standard Error (se) from Milk Production Based on Test Day Records

No	Taurus Dairy Farm			BPPT Cikole Lembang		
	TD Record	Heritability		TD Record	Heritability	
1.	T-L111	0,414 ±	0,075	C-L112	0,281 ±	0,141
2.	T-L111 - L21	0,351 ±	0,069	C-L112 - L21	0,209 ±	0,143
3.	T-L111 - L22	0,294 ±	0,066	C-L112 - L22	0,110 ±	0,113
4.	T-L111 - L23	0,241 ±	0,060	C-L112 - L23	0,084 ±	0,095
5.	T-L111 - L24	0,242 ±	0,056	C-L112 - L24	0,059 ±	0,082
6.	T-L111 - L25	0,236 ±	0,058	C-L112 - L25	0,065 ±	0,092
7.	T-L111 - L26	0,233 ±	0,059	C-L112 - L26	0,078 ±	0,108
8.	T-L111 - L27	0,231 ±	0,058	C-L112 - L27	0,121 ±	0,130
9.	T-L111 - L28	0,234 ±	0,057	C-L112 - L28	0,214 ±	0,234
10.	T-L111 - L29	0,226 ±	0,058	C-L112 - L29	0,224 ±	0,022
11.	T-L111 - L210	0,218 ±	0,058	C-L112 - L210	0,228 ±	0,021
12.	T-L111 - L211	0,213 ±	0,058	C-L112 - L211	0,231 ±	0,021

Description:
T = Taurus; C = Cikole; L1= First Lactation; L2= Second Lactation; Number= Test Day Records

Animals that have a high heritability value, then it can be expected that offspring will have advantages in the same traits. But on the contrary, if the value of inheritance are low, meaning that the offspring will not necessarily have the advantage in this trait because only a small fraction that can be passed on to offspring (Noor, 1996). In such case, the livestock had been largely affected by environmental factors. In other words, can also be said that the selection of high heritability values will give a higher response.

The advantages of the evaluation based on fixed regression model is the time of the test can be done anytime, so the test can be done one day at the same time for all cattle in a ranch, although the level of lactation between cows are different. This is not a problem because the lactation curve will be included in the calculation model (Ptak and Schaeffer, 1993; Indrijani, 2001; Cho, et al., 2006). Because of these benefits then this model is widely used to evaluate the genetic merit of dairy cattle in many countries (Swalve, 1998; Swalve, 2000; Cho, et al., 2006).

The breeding value can be vary depend on the method and the numbers of record. The aim of this correlation is to determine the pattern of test day records which have a high correlation with the complete test day for second lactation, so it can speed up the evaluation for selection purposes. Animal's breeding value only applies in places and in populations where the breeding value was calculated.

Table 2. Correlation Coeficient Between Estimation Breeding Value (EBV) from Different Test Day Records at First and Second Lactation.

No	Taurus Dairy Farm			BPPT Cikole Lembang		
	Test Day Record	Animal	Bull	Test Day Record	Animal	Bull
1	T-L111	0,894	0,881	C-L112	0,861	0,907
2	T-L111-L21	**0,923**	0,893	C-L112L21	0,915	0,865
3	T-L111-L22	0,944	**0,927**	C-L112L22	0,887	0,789
4	T-L111-L23	0,958	0,950	C-L112L23	0,852	0,700
5	T-L111-L24	0,969	0,963	C-L112L24	0,838	0,658
6	T-L111-L25	0,980	0,975	C-L112L25	0,874	0,716
7	T-L111-L26	0,986	0,981	C-L112L26	**0,921**	0,802
8	T-L111-L27	0,991	0,990	C-L112L27	0,959	0,865
9	T-L111-L28	0,996	0,993	C-L112L28	0,982	**0,947**
10	T-L111-L29	0,998	0,997	C-L112L29	0,992	0,991
11	T-L111-L210	1,000	0,999	C-L112L210	0,997	0,998
12	T-L111-L211	1,000	1,000	C-L112L211	0,999	1,000

Coefficient of correlation between breeding values (Table 2), shows the increasing tendency for each additional test day on second lactation. Evaluation of genetic merit in Taurus Dairy Farm on the basis of full lactation first with one test day on second lactation seems good enough to evaluate all cows with correlation values above 0.90, whereas to evaluate bulls, it seems evaluation should be extended until two test day on second lactation. At BPPT Cikole Lembang, evaluation of genetic merit on the basis of full lactation first with six test day on second lactation seems good enough to evaluate all cows with correlation values above 0.90, whereas to evaluate bulls, it seems evaluation should be extended until eight test day on second lactation.

Animals which in the beginning have not too much milk production, but at the peak or shortly after reaching the peak of lactation showed that milk production is high enough can be change the ranking in the population based on it's breeding value. In the other hand, cows that has pretty good milk production at the beginning, but at peak production, increased milk production only slightly, thus ranking the cow in the population displaced by other cows whose production is higher, which may decrease the value of correlation.

CONCLUSIONS

1. Evaluation of the genetic merit of the recording can be done based on test day at first lactation plus the first sixth test day in second lactation.

2. The best model to estimate genetic parameters and breeding value is fixed regression test day model (FRTDM) with milk production curve into account as a covariate, so that evaluation of genetic merit can be conducted simultaneously on the same day although the level of cows lactation was different.

REFERENCES

[1] Badan Meteorologi dan Geofisika. 2006. http://iklim.bmg.go.id/indeks.jsp

[2] Cho, K.H., S.H. Na, K.S. Seo, B.H. Park, J.G. Choi, Y.C. Lee, J.D. Park, S.K. Son, S. Kim, T.J. Choi, and A. Salces. 2006. Estimation of Genetic Parameters for Change of Test Day Records on the Milk Production and SCS Using Random Regression Model of the Holstein Cattle in Korea.

8th WCGALP, CD-ROM Communication no.: 01-51

[3] Groeneveld, E. 1999. PEST User's Manual. Institute of Animal Husbandry and Animal Behaviour, Federal Agricultural Research Centre, Germany.

[4] Groeneveld, E. 2003. VCE4 User's Guide and Reference Manual Version 4.2. Institute of Animal Husbandry and Animal Behaviour, Federal Agricultural Research Centre, Germany.

[5] Indrijani, H. 2001. Penggunaan Catatan Test Day untuk Mengevaluasi Mutu Genetik Sapi Perah. Tesis Magister Sains. Pascasarjana Program IPB, Bogor.

[6] Indrijani, H. 2008. Penggunaan Catatan Produksi Susu 305 Hari dan Catatan Produksi Susu *Test Day* (Hari Uji) Untuk Menduga Nilai Pemuliaan Produksi Susu Sapi Perah. Disertasi. UNPAD.

[7] Noor, R. R. 1996. Genetika Ternak. Swadaya Publisher. Jakarta.

[8] Ptak, E. and L. R. Schaeffer. 1993. Use Of Test Day Yields For Genetic Evaluation Of Dairy Sires and Cows. Livest. Prod. Sci., 34:23-34.