

Persistency of milk yield in Indonesian Holstein cows

N Widyas¹, F Y Putra¹, T Nugroho¹, A Pramono¹, A Susilowati², Sutarno² and S Prastowo¹

¹ Animal Science Department, Agriculture Faculty, Universitas Sebelas Maret, Surakarta, Indonesia

² Department of Bioscience, Graduate Program, Universitas Sebelas Maret, Surakarta, Indonesia

E-mail: nwidyas@gmail.com

Abstract. Milk yield is an important trait in dairy industry; thus, information regarding this phenotype is essential to measure the productivity of a farm. Total milk yield in one lactation period was often predicted using information from samples collected within certain time intervals. The rate of change of milk production between two-time intervals is defined as persistency. This article aims to estimate the persistency of milk yield between lactation 1, 2 and 3 in Indonesian Friesian Holstein (IFH) cows. Data was collected from Limpakuwus stable, Baturraden Dairy Cattle Breeding Centre, Central Java Indonesia. Records were obtained from cows which started lactating on 2013 until the end of third lactation around the beginning of 2016. Milk yield from the first (L1), second (L2) and third (L3) lactations of 21 cows were recorded in kilograms. Samples were collected in 30 days basis interval started from the 10th day of lactation up to the 10th month. In this population, the cows first calving was around February – April 2013; while the second and third calving occurred all over the relevant year. The mean of milk yield for L1, L2 and L3 were 17.77 ± 3.70 , 16.09 ± 5.17 and 13.73 ± 4.02 Kg respectively. The peak of milk yields was achieved at the second month of the lactation for L1, L2 and L3. The persistency from the second to the tenth test days were 97, 93 and 94% for L1, L2 and L3, respectively. Milk yield persistency is representing ability of cow in maintain milk production after peak during lactation period. The more persistent shows better performance of dairy cattle as well as farm management. For that, persistency value could be used as valuable information in evaluating the management in Indonesian dairy farms.

1. Introduction

Milk yield is an important trait in dairy industry as a measure of a farm's productivity. However, to keep milk production and farm's records daily is a tedious and labor-costly operation. In order to acquire data on their productivity, dairy farms conducted observations on certain days, on regular interval basis during the cow's lactation period. This procedure of obtaining dairy data is called the test day records. Test days data has been extensively used in dairy researches and proven to yielded reliable results [1–3].

Milk persistency is a measure of the rate of change of milk production between test days. It is defined as the milk yield at one test expressed as a percentage milk yield at an earlier test [4]. High persistency shows slow rate of milk decline, whereas low persistency is associated with rapid decline in milk yield [5]. In the economic importance, persistency will determine the shape of lactation curve. Persistency provides valuable information regarding the amount of milk produced during one lactation period which represents biological aspects of the cow, farm management and cost efficiency. Factors



influenced persistency are reproduction performance [6], energy in the diet [7,8], mastitis, metabolic disorder and also herd social interaction [4].

Holstein breed dominates the dairy cattle population in Indonesia (Indonesian Friesian Holstein = IFH). A government facility hosted this breed, the Baturraden Dairy Cattle Breeding Centre, Central Java, Indonesia which also served as test station. Within which dairy cows undergone various observations and treatments. Records from this station are used as standards for Indonesian Holstein population in the country. This paper aims to estimate milk yield persistency of IFH in the Baturraden breeding center for standard purpose. The result could be beneficial to evaluate the efficiency of IFH milk production under tropical management practice of dairy farm in Indonesia.

2. Methods

Data was collected from Limpakuwus stable, Baturraden Dairy Cattle Breeding Centre, Central Java Indonesia. Records were obtained from cows which started lactating on 2013 until the end of third lactation around the beginning of 2016. Milk yield from the first (L1), second (L2) and third (L3) lactations of 21 cows were recorded in kilograms per test day. Samples were collected in 30 days basis interval during the 10 months of a lactation period. Records for the first month of lactation were taken from the 10th day.

The average of milk yield across lactation months and every lactation period were plotted to visualize the trajectory of milk yield. A linear model was built to account for the possible effects of different lactation periods and calving months. Persistency is defined as how well the cows maintain their milk yield after the peak was reached. It is estimated in percent according to the following formula:

$$PERSISTENCY = \frac{\text{milk Kg in later test}}{\text{milk Kg in earlier test}} \times 100\%$$

3. Results and discussions

Baturraden Dairy Cattle Breeding Centre is an Indonesian government facility located in Central Java within which Holstein cows test herds were kept and observed. Indonesian Holstein were originated either as imported cows from Australia, Canada, New Zealand and USA [9,10] or Indonesian born which dams and sires were the aforementioned imported cattle. Recording from twenty-one cows which have recording from three lactation periods housed in the same stable were used in the analysis. Records were obtained on test day's basis, with 30 days interval spanning for 10 months of each lactation period. The mean of daily milk yield for L1, L2 and L3 were 17.77±3.70, 16.09±5.17 and 13.73±4.02 kg respectively. These findings were in agreement with previous study [10] whom observed that on average, test day milk yield in Indonesian Holstein cows were between 11.9 – 17.3 kg.

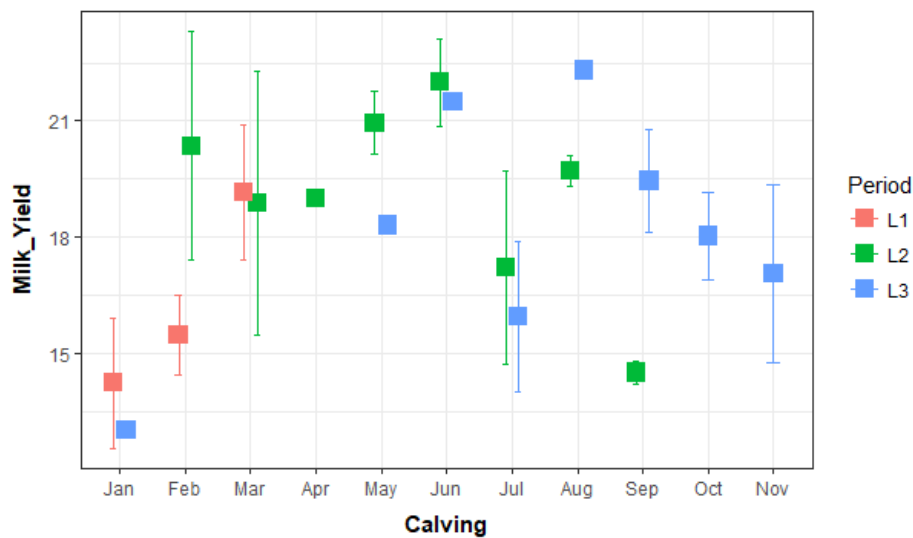


Figure 1. The effect of lactation period and calving month on milk yield

A linear model accounting for the effects of lactation period, calving month and their interaction on daily milk yield was build and presented in Figure 1. In this population, the cows first calving (and first lactation = L1) was around January – March 2013; while the L2 calving occurred on February – September 2014 and L3 calving occurred from May 2015 - January 2016. Analysis of variance (ANOVA) showed that both lactation period and calving month gave significant effect on milk yield whilst there was no interaction effect detected ($p > 0.05$). Despite the ANOVA results, there were no clear trends of milk yield across months as we would expect due to the different seasons. Our hypotheses were that 1) The weather variation in Indonesia is not differed greatly among seasons except for the rainfall; 2) the management and feed supply in this test station remained stable throughout the year hence environmental factors were minimum.

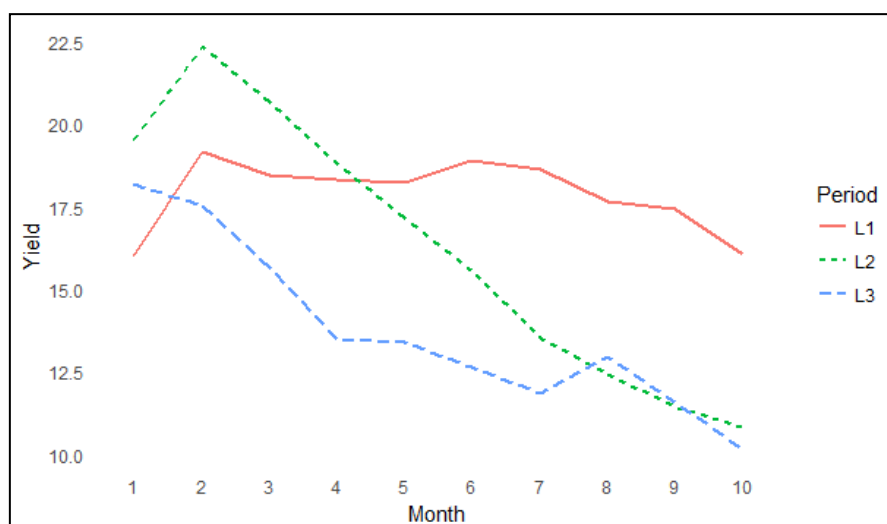


Figure 2. The trajectory of milk yield (lactation curve) during 10 months of lactation

Milk yield over 10 months of lactation period is presented in Figure 2. On X axes were the lactation months and on Y axis were the milk yield. It is seen that the peak of milk yield happened during the second month of lactation which values were 19.19 ± 4.04 , 22.39 ± 4.63 and 17.54 ± 3.32 kg per day for L1, L2 and L3 respectively. Whereas the persistency from the second to the tenth months were 97, 93 and 94% for L1, L2 and L3, respectively. Different persistency value across lactation

period could be interpreted as the influence of many factors, however in this study we can't account whether specific factor is the key player due to lack of data.

4. Conclusions

It is concluded that milk yield persistency of IFH in this study shows different value in different lactation periods. Numerous factor associated with environment and management might be interact each other in this regard. Moreover, the persistency value from this test station could be used as the standard in evaluation the productivity and efficiency of dairy farm in Indonesia.

Acknowledgment

The data presentation of this paper was funded by the International Collaboration Grant provided by Universitas Sebelas Maret Surakarta Indonesia in the fiscal year 2017. The grant title is "*Comparative genetic diversity analysis of local zebu, Fogera cattle of western Amhara, Ethiopia and Indonesian Friesian Holstein by using microsatellite markers for enhancing milk production and climate change adaptation in selected production and model sites*".

References

- [1] Jensen J 2001 Genetic evaluation of dairy cattle using test-day models *J. Dairy Sci.* **84** 2803–12
- [2] Machado S G, Freitas M A R and Gadini C H 1999 Genetic parameters of test day milk yields of Holstein cows *Genet. Mol. Biol.* **22** 383–6
- [3] Costa C N, De Melo C M R, Packer I U, De Freitas A F, Teixeira N M and Cobuci J A 2008 Genetic parameters for test day milk yield of first lactation Holstein cows estimated by random regression using Legendre polynomials *Rev. Bras. Zootec.* **37** 602–8
- [4] DHI 2017 *Persistency of milk production*
- [5] Jingar S, Mehla R K, Singh M and Roy A K 2014 Lactation Curve Pattern and Prediction of Milk Production Performance in Crossbred Cows *J. Vet. Med.* **2014** 1–6
- [6] Dobson H, Smith R F, Knight C H, Sheldon I M and Glasgow G 2007 The high producing dairy cow and its reproductive performance *Reprod. Domestic Anim.* **42** 17–23
- [7] Nørgaard J, Sørensen A, Sørensen M T, Andersen J B and Sejrsen K 2005 Mammary cell turnover and enzyme activity in dairy cows: effects of milking frequency and diet energy density *J. Dairy Sci.* **88** 975–82
- [8] Linde R Van Der, Groen A and Jong G De 1998 Estimation of genetic parameters for persistency of milk production in dairy cattle *Analysis* 1–4
- [9] Tabany A, Purwanto B P, Toharmat T and Anggraeni A 2011 hubungan masa kosong dengan produktivitas pada sapi perah Friesian Holstein di Baturraden, Indonesia *Med. Pet.* **34** 77–82
- [10] Anggraeni A 2012 Genetic Improvement of milk quantity and milk quality in Holstein Friesian cattle by selection *Wartazoa* **22** 1–11