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The Effect of Non Genetic Factors on Milk Production in BBPTU HPT Baturraden Central Java

The Effect of Non Genetic Factors on Milk Production in BBPTU HPT Baturraden Central Java

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Abstract. The aim of the study was to identify non-genetic factors that influence milk production in dairy cows at the National Center Breeding for Dairy Cattle and Forage (BBPTU HPT) of Baturraden. The data examined were 1821 production records from 699 dairy cows that had completed 1-6 lactation. Non-genetic factors studied were season, lactation period, number of lactation days and age at calving. The effect of non-genetic factors is analyzed by multiple regression. The results show that number of days milked had highly significant effect (P <0.01) and the age at calving had significant effect (P <0.10) on milk production. It is concluded that the number of days milked and age of animals at calving are important factors which need to be included in genetic analysis of milk production to avoid misleading conclusion when evaluating animals.

Keywords: environment, dairy cattle, lactation, length of lactation, age of calving

1. Introduction

Each animal has genetic make up which is a random combination of its parents; half derived from the female and half from the male parent. The process causes the gene composition of each animal to differ from one another, which is further reflected by the difference in the production performance. Milk production of a dairy cow is the ultimate product of simultaneous effects between genetic and environmental factors too. Genetic factors are inherited individually from the parents and possessed from birth, while the environment is the influence of non-genetic factors. [1],[2],[3] states that the phenotypic appearance is influenced by environmental, genetic and interaction factorsenvironmental and genetic.

Improvement of management and control of environmental factors (non-genetics) is an effort to provide ideal conditions for dairy cattle. Control of non-genetic factors is expected to provide opportunities for livestock to live and have optimal production according to their genetic potential. Non-genetic factors include the age of the parent when giving birth, body weight, lactation period, and the number of days animals are milked.

The application of breeding technology to dairy cows needs to be supported by knowledge of non-genetic factors influencing the milk production. Such knowledge is needed because animal valuation is

based on their genetic potential according to the production performance. The production performance for dairy cows can be increased through management and genetic improvement. The external environmental stimuli (physical, chemical, climatic and biologic) to which animal respond interact with their genotypes to determine level of performance and all species respond to changing natural environments trough altering phenotype and physiology; in livestock production the situation become more complex since human intervenes influences both genetic and external environment [4].Knowledge of non-genetic factors affecting milk production is needed in an effort to improve management so that high milk production can be achieved.

The National Breeding Centre for Dairy Cows and Forage (BPTU HPT) of Baturraden is a government-owned institution run under the Directorate General of Animal Husbandry of the Ministry of Agriculture. The location is located 14 km north of the city of Purwokerto, precisely in the village of Kemutug Lor, Baturraden sub-district, Banyumas district. BPTU HPT Baturraden develops dairy cows (Holstein Friesian) and dairy goats (Etawa Cross; PE).

2. Methodology

Data of milk production records was extracted from BBPTU HPT Baturraden database. The variables studied were milk production, season when giving birth, the lactation period, the age of dams when giving birth and number of days milked. Milk production is the total daily milk production excluding colostrums during a lactation period, expressed in kg. Season is the season when cows give birth. The season is classified into two seasons which are generally accepted in Indonesia, namely the rainy season (October - March; coded 1) and the dry season (April - September; coded 2). Age when dam giving birth is expressed in days. The number of lactation days is the number of days during which the mother cows are milked excluding colostrums until it is dried in lactation period observed, expressed in days.

The data used in the study were 1821 production records from 699 dairy cows that had completed lactation between one and six. Lactation period of 1, 2, 3, 4, 5 and 6 consisted of 678, 519, 318, 186, 72 and 48 production records, respectively. To determine the effect of non-genetic factors, the selected data were then analyzed using multiple regression methods.

3. Result and Discussion

The National Breeding Centre for Dairy Cows and Forage (BPTU HPT) of Baturraden the so commonly called BBPTU-HPT Baturraden is one of the largest dairy cattle breeding centers in Indonesia. BBPTU-HPT Baturraden was established on July 22, 1953 under the name of *Induk Tanaman Ternak Baturraden*. Changes in function and name lasted several times until on May 24, 2013 it changed to the The National Breeding Centre for Dairy Cows and Forage (BPTU HPT) of Baturraden.

The task of Baturraden BBPTU-HPT is to carry out breeding, maintenance of dairy cows, milk and forage production, marketing of dairy cows and forage, under the supervision of the Directorate General of Animal Husbandry. BBPTU-HPT Baturraden is located at the slopes of Mount Slamet with an altitude of 600 - 650 m asl, and has a total land area of 250 ha. BBPTU consists of 4 areas, namely Limpakuwus, Tegalsari, Manggala, and Munggangsari; each area has different function. Tegalsari is used as the head office and nursery for dairy cows. Limpakuwus is used as a place for raising cows and dairy cows. Manggala has the most extensive area that is used as a place for raising dairy cows with a rearing farm system. Munggangsari is used as a place for training farmers and official housing.

BBPTU-HPT Baturraden has an average temperature of around 24˚C with humidity ranging from 70 - 80% and rainfall ranges from 7000 - 8000 mm per year. Temperature and air humidity is one of the important factors that can be used as a basis in maintaining dairy cattle because it greatly affects livestock production [5]. Other factors other than temperature and humidity that affect livestock production are feed. Forage feed needed by livestock can be fulfilled because BBPTU-HPT Baturraden is also engaged in the development of forage fodder so that it can be used as a place for raising dairy cows and cows as well as providing extensive land for grazing livestock.

Effect of Non Genetic Factors on Milk Production

The results of the regression analysis showed that milk production was influenced by the variable number of days milked (P <0.01) and age at calving (P <0.05). While the season and lactation period variables did not show a significant effect (P> 0.05) on the variation in milk production of dairy cows. The mean and standard deviation of the number of days milked, age at calving and milk production are listed in **Table 1.**

Table 1. Average and standard deviation of the number of days milked, age at calving and milk production based on lactation period

Lactation Number	Number of days milked		Age of calving (days)		Production (kg)	
	Average	Standard Deviation	Average	Standard Deviation	Average	Standard Deviation
L1	321.54	63.67	925.99	166.54	2896.35	867.86
L2	319.86	65.32	1357.97	218.38	3083.40	942.78
L3	306.86	68.71	1760.29	252.63	3101.61	1085.07
L4	297.89	73.32	2119.76	279.47	2729.53	922.14
L5	308.08	76.25	2570.00	325.11	2867.50	923.63
L6	313.56	64.61	2949.50	252.61	2801.94	947.86

Based on the data in **Table 1**it can be observed that the trend of milk production increased until third lactation or at an average age of 1760.29 ± 252.63 days, with production of 3101.61 ± 1085.07 kg, then production began to decline at the fourth lactation (2729.53 ± 922.14 kg). The average number of days milked from the cows studied was 315.34 ± 66.82 days. This condition shows that the length of dairy cows in one production cycle has met good management, so that in one year the cow can give birth once. This condition is not much different from the number of milking days at West Java, reported the average daily milk production of FH dairy cows was 13.93 ± 3.23 kg/ head / day with a range between 8.17-25.25 kg [6]. The results of this study (13.93 kg) turned out to have shown an increase in the average daily milk production per head when compared to what was reported by researchers in West Java in the last 10 years. In Ujung Berung District of 13.62 ± 3.96 kg / head / day [7], in KPSBU Lembang [8] and Banyumas, Central Java 12.62 ± 3.17 kg / head / day [9]. Milk production was 13.3 ± 3.64 kg / head / day.The number of milking days is still within the range mentioned by [10], namely 270 - 400 days, and explained that the number of milking days is shorter if the dairy cows are mated too soon after calving or dried due to an illness. In contrast, the number of milking days is long if the cow is difficult to mate again after giving brith. The normal lactation period in lactating dairy cows is 305 days or 10 months [10]. Calving intervals that are problematic and can harm farmers are more than 14 months [12]. Age, number of milking days, lactation year, number of dry days and breeding interval have a significant effect on milk production [13]. The effect of these five factors together on the total variance of milk production is 48 % and the most influential is the number of lactation days which is 42.4 %.

Most of the cows studied (52 percent) gave birth in the dry season. But the season does not affect milk dairy production. This is presumably because the provided management has been carried out well so that the detrimental effect in the dry season does not affect milk cow milk production. It could also be due to that rainfall is quite high in the area so that forage is available throughout the year. Based on the records at the Perhutani Baturraden Service, the average rainfall per month was always above 250 mm. The lowest average rainfall in July is 278.8 mm and the highest in November is 976 mm. This condition is perfect for the growth of forage so that feed is always available for livestock.

The lactation period does not affect milk production. This is presumably due to the large variation in age in each lactation period. There is overlap between ages and lactation periods. This is evidenced by a fairly high positive correlation between the lactation period and age at calving (P <0.01), which is equal to 0.922. This means that an increase in lactation period will be followed by an increase in age. In contrary, the age effect on milk production is relatively small (P <0.05).

As shown in **Table 1**, we find that the milk production trend increases until the third lactation or at the average age of 1760.29 ± 252.63 days, with production of 3101.61 ± 1085.07 kg, then production begins to decline at the fourth lactation (2729.53 ± 922.14 kg). Although still below the first lactation, the milk production increased again at fifth lactation (2867.50 ± 923.63 kg), and decreased again at sixth lactation (2801.94 ± 947.86 kg). This condition illustrates that cows in BBPTU Baturraden Dairy Cattle reach peak production in the third lactation period or at an average age of 1760.29 ± 252.63 days (4 years 10 months ± 9 months). The decrease and increase in production after the third lactation is suggested to be due to the low level of genetic progress due to a decrease in culling activities. Milk production in most dairy cows is produced in the third and fourth lactation period with a range of age of 5-6 years, and after that milk production will continue to decline with the aging of cows [14]. This is in line with research by Hadisusanto [15] which revealed that the peak of lactation was reached in the third lactation period, where the lactation period I had the ability to produce a lower average milk production than the lactation periods II and III. According to Schneeberger et al. [16] the decline in production is made possible by an increase in farm size which is not accompanied by the addition of adequate amounts of feed.

The variable number of milking days has a coefficient of determination (r^2) of 0.391 for milk production. This coefficient of determination (r^2) of 0.391 shows that only 39.1 percent of the variation in milk production can be explained by the equation, which illustrates the relationship between the number of milking days and milk production. Or in other words, 39.2 percent of the variation in milk production is affected by the number of milking days. The variable number of milking days had highly significant effect on milk production (P <0.01). The correlation between the number of milking days and milk production is also quite high (P <0.01), which is equal to 0.626, which means that changes in the number of milking days will also affect milk production.

The variable number of milking days together with the age when giving birth variable has a determination coefficient of 0.394. This determination coefficient of 0.394 shows that 39.4 percent of the variation in milk production of dairy cows is influenced together by the variable number of milking days and age at calving. The results of the F test show that the variable age at calving has a significant effect on milk production.

The age at calving from the cows studied ranged from 518 to 3393 days (1 year 6 months to 9 years 4 months), and the average was 1435.07 35 569.84 days (4 years ± 1 year 7 months). This fact shows that the cows studied were still in the productive phase. This is also reflected in the average lactation period of 2.23 ± 1.30. Information was also obtained that the age of the first calving was 925.99 ± 166.54 days (2 years 7 months ± 6 months), Basically, Awan et al. [17] state that milk production can be improved through improving genetic quality and environmental manipulation, as well as improving maintenance management.Furthermore, according to Moran [18]) the age of the first mating dairy cow, should be done after the young dairy cow has reached mature body weight, which is 15 months old with a body weight of 300-350 kg and will experience the first calf at the age of 24 months. Cozler [19] stated that FH virgin cattle experience the age of first puberty, so it should be artificial insemination or mated for the first time at the age of 15-18 months, so that it is beneficial for livestock by having maximum milk production and optimal breeding interval.

Season has no effect on milk production of dairy cows. This is presumably because maintenance management has been carried out well so that the adverse effects in the dry season do not affect the milk production of dairy cows. Another allegation is that the rainfall is quite high in the area so that forage is available throughout the year

The lactation period has no effect on the milk production of dairy cows. This is suggested to be due to large age variations in each lactation period. There is an overlap between age and lactation period. This is evidenced by the relatively high positive correlation between the lactation period and the age of calving (P <0.01), which is equal to 0.922. This means that an increase in the lactation period will be followed by an increase in age. While the age effect on milk production was relatively small (P <0.05).

The results of the regression analysis showed that milk production was influenced by the variable number of milking days (P <0.01) and age at calving (P <0.05), while season and lactation periods showed no significant effect (P> 0.05) to variations in milk production for dairy cows.

4. Conclusion

For the purposes of genetic evaluation of dairy cows, it is necessary to make correction to the effect of milking days and age at calving in order to increase the accuracy of estimated genetic potential of milk production.

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