

## The Effect of Breeds, Parity and Age Variation on Reproductive Performance of Beef Cattle in Special Region of Yogyakarta

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### Abstract

Beef cattle are one of the main livestock commodities. Therefore, an analysis of the factors that can influence the optimization of beef cattle farms needs to be done. Some of these factors are breeds, parity, and age. This study was conducted to determine the relationship between breeds, parity, and age on reproductive performance of beef cattle in Special Region of Yogyakarta. The cows were chosen with the criteria of female PO, Simpo, and Limpo cows, aged 2 to over than 8 years old, and had given birth at least 1 time. This study used 90 PO cows, 45 Simpo cows, and 10 Limpo cows. The data of Service per Conception (S/C), Conception Rate (CR), Pregnancy Rate (PR), Calving Interval (CI) and Estrus Post Partum (EPP) were obtained from livestock artificial insemination card and interview with the farmers in the livestock groups around the Special Region of Yogyakarta. The data were grouping based on the breeds, parity, and age of cattle, then analyzed descriptively and statistically. There were no significant differences in CI, EPP, and PR among three breeds groups, PO, Limpo, and Simpo, but there was significant difference in S/C. The S/C of Simpo group was higher than PO and Limpo groups. Based on the parity, less parity had the highest S/C and lowest PR, while the EPP relatively similar in all the groups. Age was not effects the S/C but influence in the PR. Older group had highest PR. Based on these results, we conclude that Limpo and PO cattle in livestock group around Special Region of Yogyakarta have better reproductive performance than Simpo cattle. More parity and older age have reproductive performance relative good than less parity and young age.

**Key words:** age; breeds; cows; parity; reproductive performance

### Introduction

Beef cattle is still an economic commodity in the village. The economic benefit value of beef cattle has a relationship with reproductive efficiency. Reproductive management is a very important part of a livestock business because the reproductive power of high livestock groups accompanied by good reproductive management will produce high efficiency with high livestock productivity as well. Farmers in Yogyakarta Province rely on local cows and imported cows for farming. Types of cattle that are usually imported include Limousin

and Simmental. Limousin and Simmental cows are crossed with local Indonesian cattle such as Peranakan Ongole (PO) cattle. This is one form of improving good reproductive performance for females (Purbowati, 2005). One aspect that needs to be considered in an effort to improve the genetic quality of local cattle is the reproductive status of cattle. According to Przysucha et. al., (2013) Limousin cattle are less able adapt to tropical conditions and lack of feed. According to Hadi and Ilham (2002) explained that subtropical cows such as Limousin, Simmental, and Brahman will tend to

have problems when in tropical climates because of climatic conditions that are very different from the original habitat. Environmental factors that affect reproductive efficiency including temperature, sunlight intensity, air humidity, wind speed and rainfall contribute greatly to heat stress levels in cows. Continued heat stress will cause a decrease in productivity and reproductive performance of cows (Jaenudin et. al., 2018). The cattle farm in Yogyakarta has a temperature of 28-29° and a humidity of 79-81% (Hudaya et. al., 2020).

Cattle farms in Indonesia recognize the results of crossing or crossbreed from beef cattle as PO, LimPO, and SimPO. These crossbred cows can produce good offspring because as a male characteristic of Simmental and Limousin is dominant and is passed down to their children with large body yields and rapid growth which causes high selling prices compared to local cows namely PO cattle. Controlling uncontrolled crossbreed can cause reproductive performance to change. The efficiency of cow reproduction can be said to be good if a mother cow can produce one calf in one year (The main aspects to be considered in cow reproductive performance are seen from Service per Conception (S / C), Conception Rate (CR), Pregnancy Rate (PR), Calving Interval (CI) and Estrus Post Partum (EPP). This can be used as information and material for evaluation for farmers to improve the reproductive performance of female cattle. Reproductive appearance can be used to calculate the time of the existing breeding cycle and can be used to estimate future livestock populations (Yulyanto, 2014).

Data on reproductive performance in cattle have been widely reported, but there is not much about the description of beef cattle breed variation, parity, and age on CI, EPP, S/C and PR in beef cattle at Special Region of Yogyakarta Province. Comprehensive research on reproductive performance is important in an effort to improve the efficiency and maintenance strategy of cattle.

### Material and Method

The research was conducted in May-November 2018. The research region was in Special Region of Yogyakarta included Kradenan Livestock Group, Nggirli Livestock Group,

Handini Mukti Livestock Group, Mergo Andini Makmur Livestock Group, Andini Mulyo Livestock Group, Mardi Mulyo Livestock Group, Ngudi Rejeki Animal Group, Andini Animal Group Makmur, Sedyo Mulyo Livestock Group, and Ngudi Raharjo Livestock Group. The data were collected from the livestock identity card that contained information about owner's name, owner's address, type of cow, age of cow, cattle card, Artificial Insemination card (AI), AI frequency, and animal status. The cows were chosen with the criteria of female PO, Simpo, and Limpo cows, aged 2 to more than 8 years old, and had given birth at least 1 time. This study used 90 PO cows, 45 Simpo cows, and 10 Limpo cows. Cows are given forage feed in the morning and afternoon, while additional feed is given in the morning. Drinking water was given *ad libitum*.

The method used in this study was a field survey with interviews with farmers and examination artificial insemination card to get further information including pregnancy status, frequency of delivery, Service/Conception (S/C), Calving Interval (CI), Pregnancy Rate (PR) and Estrus Post Partum (Priyo Jr et. al., 2020). The data were analyzed descriptively and statistically with One-Way ANOVA tests used the SPSS program.

### Result and Discussion

The results of our research on reproductive performance included Calving Interval (CI) and Estrus Post Partum (EPP) from different breeds groups of beef cattle in the Special Region of Yogyakarta were presented in Table 1.

Table 1. Performance of reproducing the influence of breed variations on CI and EPP.

Breed	Number of cows	CI (month)	EPP (month)
PO	42	14,92 ± 3,15 <sup>a</sup>	3,52 ± 1,62 <sup>a</sup>
LimPO	20	15,10 ± 3,30 <sup>a</sup>	4,27 ± 1,39 <sup>a</sup>
SimPO	3	14,66 ± 3,05 <sup>a</sup>	4,00 ± 1,00 <sup>a</sup>

Note: The same superscript in the same column shows no significant difference (P <0.05).

The results of the research about CI based on the breeds (PO, LimPO and SimPO) were 14.92 ± 3.15 months; 15.10 ± 3.30 months; 14.66 ± 3.05 months, while the EPP were 3.52 ± 1.62 months; 4.27 ± 1.39 months; 4.00 ± 1.00 months. Based on

the One-Way ANOVA statistical test, there were not significantly different ( $P > 0.05$ ) of CI and EPP from the three breeds groups.

Based on the results of research on reproductive performance affecting Service per Conception (S/C) and Pregnancy Rate (PR) carried out in different groups of beef cattle in the Special Region of Yogyakarta are presented in Table 2.

Table 2. Performance of S/C and P/R of the various cattle breeds in Yogyakarta

Breed	Number of cows	S/C (times)	PR (%)
PO	48	1,67 ± 1,19 <sup>a</sup>	3,52 ± 0,00 <sup>a</sup>
LimPO	25	1,83 ± 0,80 <sup>a</sup>	4,27 ± 0,00 <sup>a</sup>
SimPO	7	3,19 ± 4,50 <sup>b</sup>	4,00 ± 0,00 <sup>a</sup>

Description: Different superscripts in the same column show significant differences ( $P < 0.05$ ).

The results of research on S/C sequentially based on PO, LimPO and SimPO breeds were 1.67±1.19 times; 1.83±0.80 times; 3.19±4.50 times, while PR in the sequence is 3.52±0.00 percent; 4.27±0.00 percent; 4.00±0.00 percent. Based on the One-Way ANOVA statistical test the calculation of S/C in PO cattle with LimPO has no difference and there are differences in PO and LimPO cattle with SimPO. The calculation of PR in cattle PO, LimPO and SimPO did not differences significantly ( $P > 0.05$ ).

Based on the results of research on the description of parent parity on reproductive performance of beef cattle carried out in various groups of beef cattle in the Special Region of Yogyakarta are presented in Table 3.

Table 3. Overview of parent parity on the performance of beef cattle reproduction in the Yogyakarta farmer group

No	Number of cows	Parity (times)	Performance Reproduction		
			S/C	PR (%)	EPP (Month)
1	67	PI (1-3)	1,98 <sup>a</sup>	32,8% <sup>a</sup>	3,11 <sup>a</sup>
2	21	PII (4-6)	1,20 <sup>b</sup>	42,8% <sup>a</sup>	3,47 <sup>a</sup>
3	5	PIII (>6)	1,01 <sup>b</sup>	60,0% <sup>b</sup>	3,00 <sup>a</sup>

Description: Different superscripts in the same column show significant differences ( $P < 0.05$ ).

The results of the average S / C of the PI, PII, and PIII groups respectively; 1.98 times; 1.20 times and 1.01 times. The average PR in the PI, PII, PIII groups was 32.8%, 42.8%, and 60% respectively. The average EPP of the PI, PII and

PIII groups was 3.11 months respectively; 3.47 months and 3.00 months. Based on the One-Way ANOVA statistical test the calculation of S/C in PI group with PII and PIII group has difference significantly. The calculation of PR in PI and PII group with PIII group has difference significantly. The calculation of EPP in cattle PI, PII, and PIII did not differences significantly ( $P > 0.05$ ).

Based on the results of research on the influence of age on S/C and PR in different groups of beef cattle in the Special Region of Yogyakarta are presented in Table 4.

Table 4. Effect of age on cows on S/C and PR in Yogyakarta beef farmer group

Age (year)	Number of cows	S/C	PR %
2 – 5	30	2,06a± 2,28 <sup>a</sup>	56,17 <sup>a</sup>
5,1 – 8	9	1,43a± 0,74 <sup>a</sup>	75,60 <sup>b</sup>
>8,1	6	1,24a± 0,71 <sup>a</sup>	88,63 <sup>c</sup>

Description: Different superscripts in the same column show significant differences ( $P < 0.05$ ).

The results of S/C studies in the 2-5 year age group, 5.1-8 years and more than 8.1 years respectively are 2.06; 1.43 Results of PR studies in the 2-5 year age group, 5.1-8 years and more than 8.1 years and 1.24. 56.17%, 75.60% and 88.63%. Based on the One-Way ANOVA statistical test the S/C calculation in the age group 2-5 years, 5,1-8 years and more than 8.1 years there were no differences and there were differences. The calculation of PR in cattle in the 2-5 year age group, 5.1-8 years and more than 8.1 years showed significant differences ( $P > 0.05$ ).

The productivity of Cattle is influenced by some factor like genetic and environmental; cattle can reach their genetic potential conditions when supported by an optimal environment (Talib et. al., 2002). Livestock breeds and environmental conditions affect the reproduction ability, calving production and rate of growth (Nugroho 2012). In the tropical climates, zebu cattle show more superior reproductive performance than taurine cattle, but in highland taurine cattle have better reproductive performance (Barbosa and Duarte, 1989). There is a close relationship between genotype and environmental factors on the productive performance and reproduction of beef cattle (Mulder and Bijma 2005; Hammack 2009). The characteristics of reproduction, first mating

age, number of service per conception, open days and calving interval are the basis for determining the profitable cattle ranch (Enyew *et. al.*, 1999; Tavirimirwa *et. al.*, 2013).

Peranakan Ongole (PO) derived from the uncontrolled crossing between Sumba Ongole cattle with local cattle in Java since the 1930s. PO cattle are a tropical species that have adapted in Indonesia, especially in East Java. Since the 1990s, many PO cattle crossed with taurine cattle, mainly Simmental and Limousin, through artificial insemination without considering the genetic composition of descendant, so it is feared that it will affect their adaptation, reproduction, and growth. PO cattle are known as beef cattle and draught cattle. They are suitable as draught animals due to a big and strong body, docile and quiet, tolerant to heat, have high adaptability over different environmental conditions, able to grow in limited forage conditions, and high reproductive activity. The female quickly returned to a normal condition after giving birth. However, the percentage of a carcass is generally lower than other Indonesian local cattle (Sutarno and Setyawan, 2015).

Limpo (Limousin x PO) and Simpo (Simmental x PO) cattle are widespread across Java, in the lowlands and highlands. Simpo and Limpo cattle containing genetic of *Bos taurus* and *Bos indicus* cattle (Suyadi *et. al.*, 2014; Priyo Jr *et. al.*, 2020). PO cattle's first mating age is higher than Limpo cattle's. In the highlands, service per conception (S/C) is higher for Limpo and there was no significant difference for open days period (DO) and calving interval period (CI), making it both more efficient to be maintained in the lowlands. Environmental conditions and the breeds of cattle affect calving interval period and first mating (Suyadi *et. al.*, 2014). Cattle species and the average daily temperature resulted in a different interval between calving and mating. This interval is longer in the dry season than the wet season, probably because of the low quantity and quality of feed during the dry season which result of low BCS (body condition score) (Kebede *et. al.*, 2011). Service per conception ranged from 1.64 to 2.01 is affected more by climate than by species of cattle that in a tropical climate it shows higher service per conception (Kebede

*et. al.*, 2011). Limpo and cattle containing genetic of *Bos taurus* and *Bos indicus* cattle show high service per conception (Suyadi *et. al.*, 2014). The period of open days and calving interval was not significantly influenced by the breeds of cattle and environmental conditions (Suyadi *et. al.*, 2014). Performance of reproduction based on the reproduction cycle (first mating after calving, service per conception, open days and calving interval) of PO cattle is more efficient than Limpo. Altitude and breeds of cattle affect the age of first mating and first calving, the first mating after calving and the number of services per conception, but not on open days and calving interval. Based on the reproduction performance, PO cattle and Limpo cattle are more efficient to be raised in the lowlands than highlands (Suyadi *et. al.* 2014).

The results of the research in Table 1, according to Yulyanto (2014), the value of EPP and CI between PO and LimPO cattle differ significantly, where the reproductive performance of PO cattle is better than LimPO and SimPO. Environmental conditions and livestock breeds affect the period of the first birth and mating interval (Suyadi *et. al.*, 2014). The results of this study are the reproductive performance of each breed in CI and EPP known to exceed the ideal number because the same maintenance management is carried out by breeders between PO, SimPO, and LimPO breeds where farmers maintain with traditional systems. Traditional breeders tend to provide animal feed with low energy and protein content because the reproductive performance of livestock can be influenced by maintenance management conditions. In terms of quantity and quality, forage is one of the important keys for the condition of cattle crossing to remain good and productive (Diwyanto and Inounu 2009).

The results of the research in Table 2 show that there are no differences in the S/C values of PO and LimPO cattle, whereas SimPO cattle with PO and LimPO have differences. According to Akriyono (2017) states that S/C PO cattle tend to be better than LimPO cattle. According to Affandhy *et. al.*, (2003), if the S/C is low, the value of the comfort of the female cow is higher and if the S/C value is high, the lower the fertility rate of the female cows. According to Suprayitno (2016) said that the reproductive performance of cattle

with Limousin crosses with the effect of Ongole is characteristic with cattle PO. High service per conception in cattle SimPO can be caused by adaptation and nutrition factors. According to Hadi and Ilham (2002) that subtropical cows such as Simmental will tend to experience problems when in the tropical climate region because of the climate and different nutrients from the habitat. All results of the pregnancy rate show that they are not in the normal range. A low PR value can be caused by the occurrence of calm lust in cattle after childbirth, lack of knowledge of farmers in detecting lust, breeders marrying their mothers after giving birth for a long period of time so that the length of the blank becomes long and the IB failure is high.

The results of the study in Table 3, according to Ihsan and Wahjuningsih (2011) the average number of PO S/C cattle is 1.4 times and Limousin 1.36 times, whereas according to Nuryadi and Wahjuningsih (2011) states that the value of S/C cattle PO and Limousin cattle are 1.28 times and 1.34 times, respectively. The high and low S/C values can also be due to old cattle age, low body condition score and nutritional factors from the food provided and inseminator skills in implementing IB (Sari et al., 2016). The average S/C PI group is 1.98 times. This is because in the range of 1 to 3 times parity, female cows have not experienced reproduction, so that when artificially inseminated it may not work. According to Ismail (2009) that livestock that has just given birth once will be difficult to detect lust because estrogen levels are still low. The pregnancy rate was obtained in PI, PII, PIII groups respectively 32.8%, 42.8%, and 60%. According to Fanani et. al., (2013), a good PR value is 60-70%, while conditions in Indonesia consider the changing natural conditions, management and distribution of scattered livestock, so that PR 45-50% can be considered good. The percentage of pregnancy in Yogyakarta livestock groups can be said to be quite good because in the parity range of 4 to 6 times it can produce nearly 50% of pregnancy upwards. According to Apriem et. al., (2012), it was explained that the high and low percentage of pregnancy was influenced by livestock conditions, lust detection, estrus detection and reproductive management which would affect livestock fertility

and conception values. According to Leksanawati et. al., (2010) the average postpartum estrus is (70.65 ± 1248) days at intervals of 60-75 days. The number of factors ranging from housing, nutritional status, livestock status, livestock recording, inseminator techniques and the accuracy of farmers looking at estrus cattle or not should also be considered. The difference in the average height of the EPP is suspected because the cows have different body conditions for each cow in the cattle group. This is also supported by Hastono's (2000) opinion which states that estrus is influenced by individual livestock conditions. Another factor that affects the percentage of estrus can reach 100% is age. This is confirmed by the statement of Salisbury and Vandemark (1985), which states that virgin cows up to the age of 6 years are in a productive period. Data taken from Yogyakarta livestock groups are on average 1 to 8 years old so that cows are no longer productive.

The results of the study in Table 4, obtained S/C sequentially 2.06; 1.43 and 1.24. According to Astuti (2004), the lower the S/C value, the higher the fertility rate, the higher the S/C value, the lower the fertility rate. These results indicate that cows 2-5 years and > 8.1 years or older cows have high fertility rates. According to Zainuddin et. al., (2014), this is caused by several factors, one of which is the parentage which is directly related to the physiological status of the animal. Cows that are too young at the time of the first marriage will find it difficult to experience pregnancy because the development of the physiology of the cow has not yet reached a perfect level. In addition, the performance and function of hormones are still not perfect, so that estrus detection is usually unclear and livestock will experience difficulties when giving birth and have a high risk of reproductive disorders. According to Wahyudi et. al., (2013), livestock fertility rates are also influenced by the age of livestock. The older the parent, the better reproduction compared to the young parent. The first ovulation process after childbirth signifies the complete development of follicles in the ovary that determine subsequent fertility and the need for a physiological repair process so that the parent can re-start the postpartum estrous cycle (Pryce et. al., 2004). Pregnancy Rate results were obtained sequentially 56.17%, 75.60% and 88.63%.

According to Dirgahayu, et. al., (2015), whose cows have aged, their hypothalamic-pituitary-ovarian axis has undergone changes and increased function, which has led to increased gonadotropin hormone secretion accompanied by an increase in ovarian response to the gonadotropin hormone. These results indicate that cattle aged 2-5 years and > 8.1 years or groups of older cows have increased reproductive and hormonal functions which causes PR to be high. This might be due to the good quality of the oocytes and ovaries so that they are fertile when the Artificial Insemination is done.

### Conclusion

Based on these results, we conclude that Limpo and PO cows in livestock group around Special Region of Yogyakarta have better reproductive performance than Simpo cows. More parity and older age have reproductive performance relative good than less parity and young age.

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