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Reproductive Performance of Peranakan Ongole (PO)- and Limousin x PO Crossbred (Limpo) Cattle at Different Altitude Areas in East Java, Indonesia

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ABSTRACT

Background: Peranakan Ongole (PO) cattle is one of local cattle in Indonesia. These cattle is originated from genetically uncontrolled crosses between Sumba Ongole cattle introduced from India with local cattle in East Java since 1930s during Holland colonization. PO cattle are a tropical breed which has well adapted in Indonesia especially in East Java. However since 1990s PO cattle are crossed with temperate cattle, Limousin breed without consideration the final genetic constitution of breeding goal. The offspring of this crosses spread overall in East Java area including lowland and highland areas. **Objective:** To evaluate the reproductive performances of PO cattle and its crosses with Limousin (Limousin x PO = Limpo) reared at lowland low- and highland areas (5 m vs. 700 m above sea level) in farmer condition of East Java. A total of 361 cows including 218 PO cattle (low area = 174 and high area=44) and 143 Limpo cattle (low area = 35 and high area = 108) were included in this study. **Results:** The age at first mating of PO cows was higher ($P<0.01$) than Limpo cows (PO: 2.17±0.82 vs. 1.74±0.33 yrs, Limpo: 2.06±0.29 vs. 1.67±0.30 yrs, for low- and highland, respectively). Service per conception (S/C) was higher ($P<0.05$) for Limpo in highland than others (PO: 1.64±0.77 vs. 1.94±0.87, Limpo: 1.65±0.68 vs. 2.00±1.14, for the respective areas), whereas no significant differences were observed for days open (DO) period (PO: 4.28±0.87 vs. 4.89±0.83 months, Limpo: 4.49±0.26 vs. 4.85±0.77 months, for the respective areas) and for calving interval (CI) period (PO: 14.11±1.23 months vs. 14.51±0.89 months, Limpo: 14.14±1.55monts vs. 14.34 vs. 1.72months, for lowland and highland areas, respectively). **Conclusion:** The reproductive performance of both PO and Limpo cattle was more efficient when the cattle reared in lowland area than those in highland area according to the DO and CI periods.

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INTRODUCTION

Reproduction performance evaluation in cattle production is an important step in the management system to determine whether an herd in the farming system shows an efficiency in the biological cycle or give an economic benefit or not. It was reported that environment condition and breed of cattle influenced the growth rate, calf production and reproduction of local cattle in Indonesia (Nugroho, 2012). In the semiarid climate, *Bos indicus* cattle showed superior reproductive performance than *Bos taurus* cows (Meirelles *et al*. 1991). The similar study was conducted in tropical climate with different environment of relative humidity for different crossbred dual-purpose cows. This study suggested that during dry season resulted higher pregnancy rate of cattle than during rainy season, and the Crossed Brown Swiss x Zebu and Holstein x Zebu cows had a higher pregnancy rate than the pure Brown Swiss or Holstein cattle in the same condition (Osorio-Arce and Segura-Correa, 2002). It means that reproductive performances of cattle is affected by environment conditions, since the other study reported that normally *Bos indicus* or Zebu type cattle or some tropical cattle breeds have inferior reproductive performance compared with *Bos taurus* breeds that normally originated from temperate regions (Barbosa and Duarte, 1989), indicating that the breed of cattle gives contribution to the effect of the productive and reproductive performances. To clarify this information, we observed the reproductive performance of local cattle in Indonesia, namely Peranakan Ongole (PO) cattle (*Bos indicus* type) and crossbred between *Bos taurus* x *Bos indicus* (Limousin x PO) cattle in two different environment condition i.e. lowland (5 m above sea level) and highland (700 m above sea level) with different daily temperature and relative humidity. Some literature reviews and studies reported close interrelationship and effect between genotype and environment factors on the productive and reproductive performances in beef and dairy cattle (Mulder and Bijma, 2005; Hammack, 2009;

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Hammami *et al*. 2009) . The reproductive traits included in this study were the age of first mating and calving, service per conception, interval between calving and first mating after calving, days open and calving interval. These traits are believed as important indicators that can expressed the efficiency of the biological reproduction of cows and the economic benefit rate of cattle farming.

2. Methodology:

This study was conducted in the farmer conditions which spread at two different altitude areas, i.e. lowland (about 5 m above sea level= a.s.l) and highland area (≥700 m a.s.l) of East Java Province, Indonesia. Those two different altitude areas showed average daily environment temperature of 32.55 ± 2.14 oC vs. 27.84 ± 1.72 oC and relative humidity of 59.92 ± 6.22% vs. 76.79 ± 4.39%, for lowland and highland, respectively. The animal was fed with local grass and rice straw with un-regular additional rice bran.

A Total of 361 multipara cows were used in this study consisting of two breeds, Peranakan Ongole (PO) cattle (N = 209: 174 were taken in lowland and 35 in highland) and Limousin x PO crossed bred (Limpo) (N = 152 consisting of 44 in lowland and 108 in highland). Those sample number was taken by purposive sampling with consideration that the animals should be healthy and have calved at least two times with normal partus. All cows were mated artificially using frozen semen.

Survey study was conducted to observe directly the animals and to interview the farmers and inseminator, while secondary data were obtained from available data at District Livestock Services. Variables measured were the age of first mating (AFM), age of first calving (AFC), service per conception (S/C), days open (DO), first mating after calving (FMAC) and calving interval (CI). Data obtained were analyzed with ANOVA.

3. Results:

The reproductive performances including the age of first mating (AFM), age of first calving (AFC), service per conception (S/C), days open (DO), first mating after calving (FMAC) and calving interval (CI) of Peranakan Ongole (PO) cattle in lowland (N = 174) and highland (N – 35), and PO x Limousin crossbred or Limpo in lowland (N = 44) and highland (N = 108) were shown in Table 1.

Table 1: Reproductive performances of PO and Limpo cattle at different altitudes of farmer condition.

Altitude of Location (above sea level)	Breed of cattle	Age of first mating (years)	Age of first calving (years)	Mating after calving (months)	Service per conception	Days Open (months)	Calving Interval (month)
Lowland (5 m)	PO	2.17±0.82a	2.85±0.49 a	3.30±0.58 a	1.64±0.77 a	4.28±0.88	14.11±1.23
	Limpo	2.06±0.29 a	2.82±0.34 a	4.56±1.68 b	1.66±0.68 a	4.49±0.29	14.15±1.73
Highland (700 m)	PO	1.74±0.38 b	2.68±0.34 b	4.28±1.35 b	1.94±0.87 a	4.89±0.83	14.57±1.54
	Limpo	1.67±0.31 b	2.56±0.30 b	4.22±1.03 b	2.01±1.10 b	4.85±0.77	14.34±0.30

Age of first mating:

The age of first mating of PO cattle was not different with those of Limpo cattle both in lowland and highland areas. However, for both cattle breeds PO and Limpo showed that the age of first mating of cows reared in lowland was significantly higher (P<0.01) than those in highland area (Figure 1-a).

Age of first calving:

The similar effect pattern of age of first mating was observed for the age at first calving (Figure 1-b). The age of first calving was more influenced by altitude environment (P<0.01) than those by breeds. Figure 1-b and Table 1 showed that the both cattle breeds PO and Limpo in Lowland area were observed as higher age of first calving than those reared in highland one.

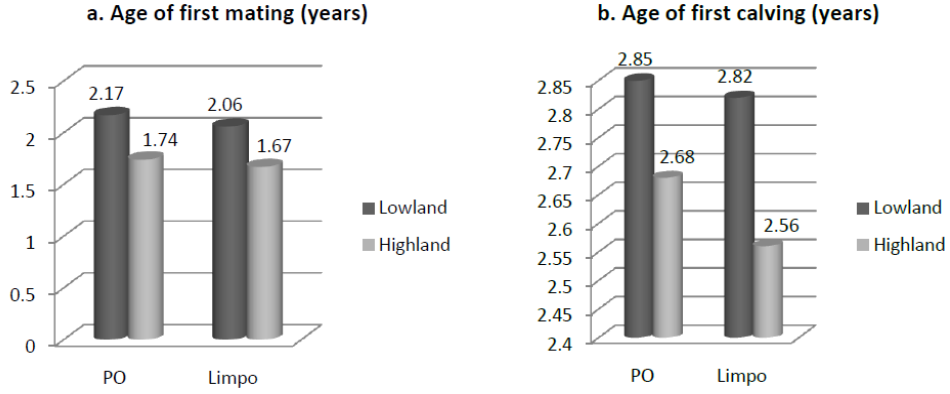

Fig. 1: Effect of breed and altitude on the age of first mating (a) and age of first calving (b) of PO and Limpo cattle at lowland and highland areas.

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First mating after calving:

The time period between calving and first mating after calving was influenced by breeds and altitude areas where the cattle were cared. Table 1 and Figure 2-a showed the shortest time period between calving and first mating after calving was in the PO cattle in lowland area than the other groups. Limpo in lowland area showed to delay the first mating after calving (4.56±1.68 months) than this breed in highland area (4.22±1.03 months), while the longer period for PO cattle was recorded when this breed reared in highland than those in lowland (4.28±1.35 vs. 3.30±0.58 months, for high- and lowland, respectively).

Service per conception:

Service per conception is the number of insemination per cow to produce pregnant cow. In this study, service per conception was influenced by breed and altitude environment, although the breed influence was more dominant (Table 1 and Figure 2-c). Service per conception of Limpo cows in highland was significant higher ($P<0.05$) than the other groups (2.01±1.01 vs. 1.66±0.68 for S/C of Limpo cattle in highland and lowland, respectively), while the altitude environment did not influence the service per conception in the PO cows (1.94±0.87 vs. 1.64±0.77 for highland and lowland, respectively).

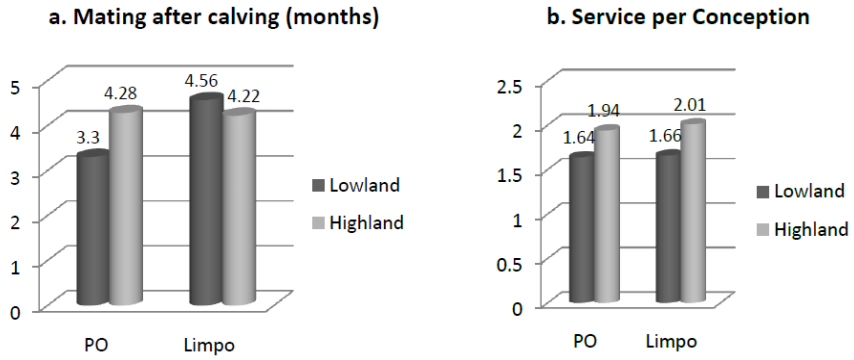

Fig. 2: Interval period between calving and first mating (a) and service per conception (b) of PO and Limpo cattle at lowland and highland areas.

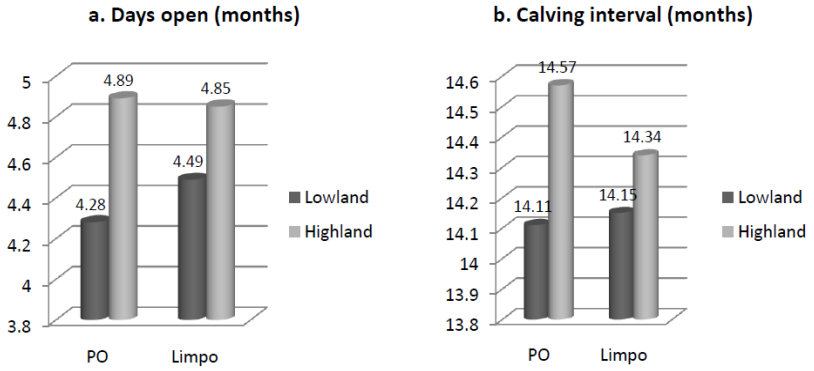

Fig. 3: Time period of days open (a) and Calving interval (b) of PO and Limpo cattle reared in lowland and highland of East Java, Indonesia.

Days open:

Days open expressed the effect of management and fertility efficiency of cows during insemination period and pregnancy diagnosis. Table 1 and Figure 3-a showed that there was no significant difference for days open between group of cows. However, the cows in highland showed the longer period of days open (PO: 4.89±0.83 months, Limpo: 4.85±0.77 months) than those in lowland for the both cattle breeds (PO: 4.28±0.88 months, Limpo: 4.49±0.29).

Calving interval:

Calving interval is time period between calving to the consecutive calving and known as an important indicator to measure the efficiency of reproduction in a farm or herd of cows. In this study, the calving interval period was not influenced by the effect of altitude and breed of animals ($P>0.05$). However, the animals reared in lowland showed shorter calving interval period ($P>0.05$) (PO: 14.11±1.23 months, Limpo: 14.15±1.73 months) than those for the cows reared in highland (PO: 14.57±1.54 months, Limpo: 14.34±0.30 months).

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4. Discussions:

Reproductive performances are most important indicator to determine the fertility of animal, efficiency of management and so far the economic benefit of the farm. The practice reproductive performance measurements in the field are generally consist the age of first mating, the age when the cow reach the ability to produce calve at the first time, service per conception, the time period between calving and first mating after calving, service per conception, days open and calving interval (Tavirimirwa *et al*. 2013).

Age of first mating and calving is important indicator for evaluating indirectly the growth rate of animal in relation to reach a normal reproductive activity. The age of first mating and the age reached to have first calve in this study are significantly affected by altitude environment, whereas the animals farmed in lowland delayed the age for first mating and calving. In contrary with this study, Geneyehu *et al*. (2005) reported that the environment climate affected significantly on the age at first calving for local cattle and its crosses with temperate cattle. In our study, the age of first mating ranged between 1.67 to 2.17 years (20.3 to 26.4 months) was shorter than local cattle and its crosses in temperate cattle in Ethiopia that was about 40.6 months (Gebeyehu *et al*. 2005). It was observed that there was interaction between breed and environment climate, especially for age of first calving. This effect was also reported by Sahin *et al*. (2012) that genotype x environment interaction was observed for the first calving and milk yield traits in dairy cows. Nugroho (2013) reported that PO cattle showed lower feed consumption, lower growth rate and lower body condition score (BCS) than Limpo cattle, indicating that the breed of cattle in tropical rural condition affected the growth rate of cattle. In dairy cows, age at first lactation affected the total milk yield during consecutive second and third lactations. The earlier age at first calving and lactation decreased the milk production in the consecutive production (Madani, *et al*. 2008). The breed factor did not effect on this variable, although the local PO cattle observed in lowland area showed later age at the first mating and calving. This was due to the different genetic response rate to the critical environment condition resulting lower feed consumption and BCS. Bridges and Lemenager (2008) stated that lower BCS in beef cattle caused the lower reproductive performance including the age at first mating and calving

The interval between calving and first mating in this study ranged from 3.30 to 4.56 months or 99 – 137 days. The environment condition and breeds affected the interval between calving and first mating. This was according to report of Kebede *et al*. (2011) that breed of beef cattle and the mean of daily temperature during dry season and wet season resulted different interval between calving and first estrus and mating. They reported that this interval was longer during dry season (69.6 days) than wet season (74.2 days), might be due to the low quantity and quality feed consumption during dry season resulting lower BCS (Kebede *et al*. 2011). Service per conception ranged between 1.64 and 2.01 was more affected by environment climate than breed of cows was according to the results reported by Kebede *et al*. (2011). They reported that beef cattle in tropical climate showed higher service per conception (1.94 – 20.03) than our study. The crossbred cattle containing temperate genetic (Limpo) and its crosses with tropic breed showed highest service per conception as in our study.

Among the reproductive characteristics, age at first mating, number of services per conception, days open and calving interval are the bases for determining a profitable beef farming (Enyew *et al* 1999). The heritabilities of these traits are normally low, so that environmental factors, including management conditions and feeding for the animals, play an important role in the variability of the traits (Olori *et al* 2002). Days open period (range: 4.29 – 4.89 months or 128.7 – 146.7 days) and calving interval (range: 11.1 – 14.57 months or 423.3 – 437.1 days) was not significantly affected by breed and environment condition. This was similar to finding of Kebede *et al*. (2011) in local cattle in Ethiopia with days open period ranged between 109 – 134 days, but was shorter calving interval period as reported by Madibela *et al*. (2001) for *Bos taurus* cattle and local beef cattle reared under hot stress condition in that it ranged between 576-584 days.

5. Conclusion:

According to our data it was concluded that the reproductive performances base on the reproductive cycle (first mating after calving, service per conception, days open and calving interval) of PO cattle was more efficient than its crosses with Limousin cattle. Altitude environment and breed of cattle influenced on the age at first mating and calving, first mating after calving and number of service per conception, but no on days open and calving interval. The reproductive performance of both PO and Limpo cattle was more efficient when the cattle reared in lowland area than those in highland area according to the DO and CI periods.

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