Reproductive Rate Performance of Boer Goat and Its F1 Cross in Indonesia

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Abstract. Aim of crossbreeding practice is to increase local or indigenous breeds productivity by introducing exotic breeds. It expected that crossbreed result better performance. For that, this study aims to evaluate the reproductive rate (RR) performance of Boer goat compared to its F1 cross. Kidding record were collected in CV. Kambing Burja, East Java, Indonesia from January 2012 to December 2015. In this study, Boer bucks (purebred) were mated with two doe breeds that are female Boer (100% Boer) and female F1 Cross (50% Boer). For evaluation purposes, litter size, kidding interval and annual pre-weaning mortality were used as components for reproductive rate calculation in both mating system. Result shows Boer does significantly (P<0.05) perform better in litter size at year 2012, 2014 and 2015 when compared to F1 cross. In term of kidding interval, Boer and F1 cross shows different value in each observation year, moreover Boer goat show lower preweaning mortality percentage than F1 cross. According to RR value, we can see that Boer has better performance compared to F1 cross, however its value was varied in every year observation. Based on this result we can concluded that Boer reproductive performance is relatively better than its F1 cross.

1. Introduction
Crossbreeding is a way to increase local or indigenous breeds productivity by introducing exotic breeds that have superior quality [1]. The effect of crossbreeding will bring up the hybrid vigor (HV) or heterosis and it is expected that crossbreed resulted better performance compared to the both parents such as production or reproductive traits [2]. However, it cannot be denied that crossbreeding also have negative effects, such as mating with an unmeasured breed composition which can cause a decreasing of genetic diversity [3].

Indonesia has various local or indigenous goat breeds such as Gembrong, Kacang, Jawarandu, Kosta, Samosir, Etawa Grade and many others [4]. Indonesian local goats are well-known for their robustness towards environment and feed sources, however it has small body size and low production performance [5]. To solve this problem, crossbreeding commonly practiced by introducing new genetic sources with high productivity performance. For example, to improve local goat meat production Boer goat was introduced. Boer goat is a meat type goat originated from South Africa equipped with excellent body conformations, good carcass quality, fast growing and high adaptability to any environmental challenges [6]. Introducing Boer to local goat is able to increase carcass percentage of crossbred goat [7]. Based on that characteristic, Boer become a potential genetic resources in crossbreeding programs for improving Indonesian local goat productivity.

Crossbreeding between Boer and Kacang which aims to produce Boerka goat has been found in Indonesia. Boerka has better capacity to grow, larger body weights than Kacang and relatively adaptive to tropical condition. Compared to other breed, in average, Boerka yielded extra birth and weaning weight of 32% and 35% respectively [8]. Another report shows that crossbred between Boer buck and Etawah does could increase birth weight by 15.6% and weaning weight by 10.07% [9]. The
success of a crossbreeding program, could not only measured by the production traits of the crossbreds, however, their reproduction also matters as it relates to the sustainability.

Both fertility and reproductive rate (RR) are the key factors to increase population as well as rearing profit. Reproduction rate is defined as the number of offspring weaned from every doe per year [10,11]. Reproduction rate is estimated by incorporating the elements of litter size, pre-weaning mortality and kidding interval [10]. This parameter measures the productivity of a given population in annual base. The term productivity in this context referred to the ability of a population to survive and produce offspring based on the number of breeding females.

Studies on Boer crosses have been conducted, however none of them concerned in discussing reproduction traits as a unity. Therefore, this study aims to evaluate the RR performance within Boer goat compared to its F1 cross. The term of F1 cross goat is the result of crossbreeding between Boer buck with Jawarandu doe which commonly called Boerja. For the additional information, Jawarandu is an Indonesian local goat which is also a product of crossbreeding between Etawah buck and Kacang does that have been establish many years ago and spread along the archipelago.

2. Materials and Methods

Pedigree and birth records at CV. Kambing Burja, Malang, East Java, Indonesia were used in this study. Data were obtained since the first kidding occur started from January 2012 until March 2016, followed with data classification which based on doe breed and years of kidding. In total, data were retrieved from 18 Boer bucks which mated to 174 Boer does (100% Boer) and 642 F1 cross (50% Boer).

Boer goats were obtained from Australia or which born in Indonesia. Meanwhile, the F1 cross is the result from crossbred between Boer buck and Jawarandu doe. Jawarandu goats were obtained from local market near the farm without parity and age information. Female goats were reared in colony, 20-25 head per flock and didn’t separated between breed composition, therefore no different in farm management. Mating process was performed by joining Boer buck in the flock for 45 days.

To evaluate reproductive performance, RR value which consist of litter size (L), pre-weaned mortality percentage (M) and kidding interval in year (I) were calculated using the following formula [10] for every year of observation:

\[ RR = \frac{L(1 - M)}{I} \]  

(1)

Litter size was calculated based on the number of kid from each doe that giving birth. Kidding interval is the distance between two kidding time, calculated in term of year. Moreover, pre-weaned mortality was calculated in % from the number of weaned kid at 77 days divided with number of kids which are born. Data of litter size and kidding interval between breed were compared using t-test \((\alpha=0.05)\), while mortality percentage and RR value were analyzed by descriptive.

3. Results and Discussion

3.1. Reproductive Performance of Boer goat and F1 Cross

The yearly reproductive performance of does were shown in Table 1. Boer does significantly \((P<0.05)\) shows better performance in litter size at year 2012, 2014 and 2015 when compared to F1 cross. In term of kidding interval, there were no significance \((P>0.05)\) differences between breeds in each observation year, moreover Boer goats also shows lower preweaning mortality compared to F1 cross.

Litter size is generally influenced by doe than buck [12]. Boer goat known as prolific bread and has fecundity rates until 210% or litter size for about 2.1 kids born/doe kidded [7]. Boer goat is assumed to be able to ovulate more fertile ova than F1 cross. Moreover, kidding interval in this study shows better compared to the previous study at 0.82 year [8]. In this regards, kidding interval is highly influenced by farm management, where good management practice would decrease kidding interval significantly.
[13] because related to reproductive efficiency in mating management. A strict mating schedule was applied in CV. Kambing Burja, therefore all the breeds are reared under the same condition resulted in relatively uniform of kidding interval. Pre weaning mortality was influenced by management, litter size and mothering ability [8]. It is reported that Boer has better mothering ability than other crossbred [14], Boers are able to produce sufficient milk to raise the kids [7,15] resulted less number of preweaning mortality.

Table 1. Reproductive traits of Boer goat and F1 cross does

| Trait                  | Dam     | 2012   | 2013   | 2014   | 2015   |
|------------------------|---------|--------|--------|--------|--------|
| Litter Size            | Boer    | 1.765  | 1.578  | 1.557  | 1.535  |
|                        | F1      | 1.275  | 1.461  | 1.419  | 1.511  |
|                        | P Value | <0.001 | 0.046  | <0.003 | 0.631  |
| Kidding Interval (year)| Boer    | 0.806  | 0.743  | 0.745  | 0.768  |
|                        | F1      | 0.736  | 0.766  | 0.753  | 0.776  |
|                        | P Value | 0.124  | 0.209  | 0.471  | 0.590  |
| Preweaning Mortality (%)| Boer   | 3.333  | 28.324 | 14.286 | 32.653 |
|                        | F1      | 8.163  | 25.959 | 18.530 | 43.004 |
| Reproductive Rate      | Boer    | 2.117  | 1.522  | 1.791  | 1.345  |
|                        | F1      | 1.591  | 1.412  | 1.536  | 1.109  |

3.2. Reproductive rate of Boer goat and F1 Cross

According to RR calculation, we can see that Boer has better performance compared to F1 cross in every year of observation (Table 1 and Figure 1). It can be said that Boer has higher number of offspring weaned from every doe per year, thus more efficient in reproductive performance. Moreover, we also see the variation of RR value in all the year observation. Despite breed genetic differences, rearing management or environmental factor seems to be the factor which vary year by year that may influencing the RR variation [12]. In addition to that, the level of reproductive efficiency is also affected by litter size, weaned kid, kidding interval and the length of the reproductive cycle [15]. At this point, we can assume that reproductive efficiency differences between Boer and its F1 cross is related to the genetic potential. This assumption is in line with the finding in the number of litter size as well as preweaning mortality value which represent mothering ability (Table 1). A better genetic value due to long term selection in Boer could be one of plausible explanation. The more number of survived kids per doe per year would be a sign of good farm management practice that leads to higher efficiency. The last but not the least, a good plan along with continues evaluation is a must to achieve better genetic gain in crossbreeding program as well as to maintain the local breed genetic diversity.

Figure 1. Reproductive rate variation of Boer and F1 cross during observation
4. Conclusion
It is concluded that reproductive performance of Boer goat is better than its F1 cross. A better breeding strategy and the improvement of farm management should be done in parallel to gain success of breeding goal.

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