Role of seasons on the production and reproduction performance of kacang goats (*Kambing kacang*) in North Middle Timor Regency

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ABSTRACT
The primary concern of this study is to explore the effects of season change on the production and reproduction performance of *Kambing Kacang* in North Middle Timor regency. Survey method, including observation and direct measurement of the livestock, and interview method was used for the purpose of collecting primary data. Interview method was applied to 120 farmers who have approximately 96 goat sires. The statistical analysis indicated that birth weight, male birth weight, weaning weight, and male weaning weight were significantly affected by reproductive season. While female birth weight and female weaning weight were not affected. Pre-weaning mortality was high in dry season 8.06% compared with rainy season 3.45%. Litter size during the dry season was 1.55 offspring per reproductive season. The highest percentage of birth in the dry season occurred in October and November. While the rainy season occurred on January and February.

Key words: *Kambing kacang*, Production Performance, Reproduction performance, Season.

INTRODUCTION
Kacang goats is a native goat from Indonesia that widely distributed throughout Indonesia. It has a variety of production and reproduction aspects for each region. Kacang goats has a lighter weight compared with the other type of goats, easy to adapt, and has a good reproduction rate (Setiadi et al. 2011). The goats have an important role in the integrated farming system, and they contribute to the income of farmer in the North Middle Timor regency. The potential development of Kacang goat in this region is supported by the goat population that amounts to 44.655 and wide pasture of 86.339 ha (Dinas Peternakan, 2015).

Generally, North Middle Timor regency has a semi-arid climate due to its short rainy season (3–4 months) and longer dry season (8–9 months). The climate affected the production and reproduction performance of goats directly and indirectly. The high temperature during the dry season directly affected goat performance by the increasing temperature, the decreasing of food consumption, redistribution of blood flow, and changes in the endocrine’s function. Moreover, it affects negatively to the production and reproduction performance of the livestock (Alam et al. 2011).

Lack of information about the effect of seasons on livestock production and reproduction performance is adversely influencing the development of livestock. Therefore, an effort to provide information through scientific research is strongly needed in order to compose policies for livestock development that are in accordance with the carrying capacity of North Middle Timor regency.

MATERIALS AND METHODS
A survey method was applied in this study, including observation and direct measurement in the research location. Materials used in this study were Kacang Goats (*Kambing kacang*) owned by 120 farmers from Biboki Anleu, North Insana, South Biboki and East Miornaffo subdistrict. The respondents were determined by the criterion of having at least 6 goats and at least 10 years of breeding experience. Variables measured in this study were: 1) Birth weight (kg) of the offspring (a maximum of 48 hours after birth) that were born during the rainy and dry season; (2) Weaning weight (kg) was taken of the offspring that were weaned (age ± 3 months) during the rainy and dry season; (3) Pre-weaning mortality (%): the total number of deaths of offspring pre-weaning divided by the total number of offspring born during the rainy and dry season; (4) Litter size: the number of kids born to each doe at each birth (single or twin) during the rainy and dry season; (5) Reproductive season: total number of reproductive seasons during the rainy and dry season.

Data Analysis
Data collected was analyzed using independent samples t-tests by SPSS software version 20.

RESULTS AND DISCUSSION
Effect of seasons on birth and weaning weight of Kacang goats: Effect of the season on Kacang birth weight and
weaning weight in North Middle Timor is presented in Table 1. The average Kacang birth weight was 1.60 ± 0.19 kg. This is higher than that reported by Hoda (2008) in North Maluku (approx. 1.36 kg), and is lower than the mean reported by, Nasution et al. (2010) (1.71 kg), and Nasich (2011) (3.56 kg). The average birth weight presented by Nasich (2011) was obtained from newborn goats produced by crossing Boer bucks with local does (PE). The different reported birth weights were probably affected by many factors, such as genetic and environmental factors (including age, weight, and management system).

The kids’ mean birth weight in the dry season (1.55 ± 0.18 kg) was lower compared to the average in the rainy season (1.64 ± 0.21 kg), and this difference was statistically significant (P < 0.05). This result was consistent with that of Harikrishna et al. (2013) study of the effect of climate in India on Osmanabadi goat birth weight. In that study, the birth weight of the goats during the winter, dry season, and rainy season were 2.42 ± 0.02 kg, 2.46 ± 0.02 kg and 2.64 ± 0.02 kg, respectively, which are all higher compared with the weights in this study. The different birth weights were probably due to differences in the habitat and external factors, such as climate, feed resources, and also internal factors (genetic).

Kids born during the dry season had a lower birth weight compared with those born in the rainy season, it may cause of the does experienced a lack of feed during the dry season, which affected fetal development and resulted in a lighter weight. Generally, the dry season significantly affects the quality and quantity of vegetation (as forage) and the availability of water for irrigation (Sejian et al., 2016). During the rainy season, the vegetation is more varied and nutritious compared with the dry season. The decrease in the quantity and quality of vegetation during the dry season resulted in declining dietary consumption further contributed to by the increase in temperature and livestock endocrine function. Madibela et al. (2002) studied Tswana goats in South Africa and reported a different result compared to this study. Tswana goats are given supplemental food and they could reach a birth weight of 2.8 ± 0.1 and 3.1 ± 0.1 kg during the dry season and rainy season, respectively. This proves that birth weight can be increased by providing supplemental feed.

The season tends to affect the quality and quantity of the available vegetation; therefore, the use of additional supplemental feed becomes an important factor. Manu et al. (2007) found that the addition of supplemental feed significantly affected the birth weight of Bligon goats. The birth weight of Bligons with no supplement during the dry season was 1.73 kg, higher than the birth weight of Kacangs in this study. This is possibly related to genetic differences between Bligon and Kacang.

A an analysis of birth weight based on sex found a heavier birth weight of male kids in the rainy season compared with the dry season. The statistical analysis revealed that both male and female kid birth weight was significantly (P < 0.05) affected by season. The heavier weight of male kids in the rainy season is predicted to be related to the availability of nutrition for the fetus at the end of pregnancy. In contrast, female kids had no difference in birth weight between the rainy and the dry season. This was probably caused by a similar effect on the fetal development of female kids during the rainy and dry season. Priyanto (1994) and Sulaksana (2008) mentioned that a good quality and quantity of feed at the end of pregnancy significantly affects birth weight because of the high rate of fetal growth 1–2 months before birth.

The average weaning weight of Kacangs was 8.73 ± 0.57 kg (Table 1). The mean reported in this lower than Anggara et al. (2014) at 10.58 ± 1.18 kg and Elieser et al. (2012) at 10.02 ± 0.79 kg. This may be caused by differences in the management system in each area, especially feeding management. Maylinda (2010) stated that the weaning weight is mostly influenced by environmental factors, such as livestock management and milk production.

Table 1: Average of birth weight and weaning weight affected by season on North Middle Timor.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>N</th>
<th>Weight (kg) Dry season</th>
<th>N</th>
<th>Rainy season</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight</td>
<td>57</td>
<td>1.55 ± 0.18</td>
<td>84</td>
<td>1.64 ± 0.21</td>
<td>1.60 ± 0.19</td>
</tr>
<tr>
<td>Male</td>
<td>31</td>
<td>1.61 ± 0.16</td>
<td>44</td>
<td>1.74 ± 0.16</td>
<td>1.68 ± 0.15</td>
</tr>
<tr>
<td>Doe</td>
<td>26</td>
<td>1.48 ± 0.18</td>
<td>40</td>
<td>1.53 ± 0.21</td>
<td>1.51 ± 0.19</td>
</tr>
<tr>
<td>Weaning weight</td>
<td>57</td>
<td>8.50 ± 0.59</td>
<td>84</td>
<td>8.96 ± 0.54</td>
<td>8.73 ± 0.57</td>
</tr>
<tr>
<td>Male</td>
<td>31</td>
<td>8.62 ± 0.58</td>
<td>40</td>
<td>9.17 ± 0.51</td>
<td>8.90 ± 0.55</td>
</tr>
<tr>
<td>Doe</td>
<td>26</td>
<td>8.36 ± 0.58</td>
<td>40</td>
<td>8.72 ± 0.48</td>
<td>8.54 ± 0.53</td>
</tr>
</tbody>
</table>

Information: The different superscript in the row indicated a difference (P<0.05).
Average weaning weights during the dry and rainy season were 8.50 ± 0.59 kg and 8.96 ± 0.54 kg, respectively. The statistical analysis revealed that weaning weight was significantly (P < 0.05) influenced by the season. During the rainy season, the vegetation growth reaches its highest quality and quantity. This will influence the formation of prolactin hormone and increased milk production. Increased milk production was correlated with the growth and development of the goat. A high developmental rate will determine the weaning weight later.

The statistical analysis showed that season significantly (P < 0.05) influenced the male kid weaning weight, but insignificantly influenced the female kid weaning weight. This was probably because the pre-weaning growth rate of male kids was faster during the rainy season compared with the dry season. The male growth rate was relatively faster than the doe, especially if it was supported by external factors, such as feed. A good quality diet given during the lactation period had a different impact on male and female kids, and this results in different weaning weights.

**Mortality:** The mortality rates of Kacang newborn goats during the dry and rainy season were 8.06% and 2.30%, respectively (Table 2). The high rate of pre-weaning mortality is probably related to weak immune systems and low birth weight during the dry season. During the pregnancy, the doe gets less nutrition from the pasture during the dry season compared with the rainy season. This results in low colostrum and milk. Basman et al. (2015) and Setiadi et al. (2001) found that the mortality rate depends on the litter size, milk production, and heat stress experienced by the does and kids. The heat stress experienced by does affects milk production due to restrictions in oxytocin hormone production by the hypothalamus (Husveth et al., 2011). The decrease in oxytocin release was followed by a decrease in milk production, which significantly increased the mortality rate. Devendra and Burns (1994) explained that the main causes of newborn mortality were cold, inadequate nutrition, disease, and heat stress.

Average mortality of the pre-weaning goat occurred during the first 2 weeks after birth. Muthalib et al. (1989) reported that the highest mortality rate of pre-weaning goats took place between the ages of 1 to 2 weeks after birth.

**Litter Size:** Average litter size, the number of offspring, and mortality occurred during the dry and rainy season in North Middle Timor are presented in Table 2. The litter size in the dry season was similar to that in the rainy season (1.55 offspring/birth). The livestock in the North Middle Timor regency are genetically similar. In regards to litter size, genetics plays a major role in the number of ovulated eggs and the breeding system. In fact, the breeding system in North Middle Timor is a natural breeding system during both the dry and rainy season. Because there are a sufficient number of male goats, the litter size during the dry and rainy season is similar. These results on litter size agree with the results published by Reksohadiprojo (1984) who mentioned that season indirectly affects the productivity of livestock. The season is strongly related to the quality and quantity of vegetation for livestock diets. Williamson and Payne (1990) reported that foodstuff forage is more nutritious in the rainy season than in the dry season.

The average litter size in this study was higher than that reported by Bushara et al. (2016) for Taggar goats (the mountain goat from South Africa), who had a different litter size in the rainy and dry seasons (1.45 ± 0.09 and 1.18 ± 0.09 respectively). This demonstrated that litter size was affected by differences in the genetics and environment of livestock. Generally, climate changes negatively affect the quality of forage on the pasture, and this affects livestock productivity (Porter et al. 2014).

The number of offspring during the rainy season (62 offspring) was less than in the dry season (87 offspring). This was related to the number of does that give birth. Forty does gave birth in the dry season as compared with 56 in the rainy season. This indicated that forage availability was significantly affecting breeding activity. Nevertheless, further research in using an intensive system was needed in order to reveal the correlation between productivity and climate.

**Reproductive season:** Kacang goat (Kambing kacang) reproductive season activities based on month is demonstrated the reproductive season during dry and rainy season. Reproductive season in North Middle Timor regency is presented in Table 3.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dry</th>
<th>Rainy</th>
<th>Total</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter Size (offsprings/reproductive season)</td>
<td>1.55</td>
<td>1.55</td>
<td>3.1</td>
<td>1.55</td>
</tr>
<tr>
<td>Number of births</td>
<td>62</td>
<td>87</td>
<td>149</td>
<td></td>
</tr>
<tr>
<td>Number of deaths (goat)</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>8.06</td>
<td>3.45</td>
<td>11.51</td>
<td></td>
</tr>
<tr>
<td>Number of sires (doe)</td>
<td>40</td>
<td>56</td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Litter size, the number of offspring, and mortality occurred during the dry and rainy season.
The table shows that there is no significant difference between a reproductive season of Kacang Goat (Kambing Kacang) during the dry season and rainy season. This revealed that reproductive season happened almost every month. The results of this study is supported by Mahmilia (2010) who reported that reproductive season of Kacang goat is throughout the year based on her research at Loka Penelitian Sei Putih in North Sumatra.

Amoah et al. (1996) mentioned that Kacang Goat is tropical goat that has sexual desire almost throughout the year.

Based on the birth percentage, the highest number of birth happened in October-November (the dry season), and in January-February (in rainy season).

The results demonstrated that breeding at pasture area usually happened in May-June and August-September. This is strongly affected by the ratio between male and doe.

A total number of male obtained during the study was 120, while doe was 629. The ratio is predicted to be strongly supported the natural breeding in the pasture.

**CONCLUSION**

Birth weight, male birth weight, and male weaning weight was significantly influenced by season. While doe birth weight and doe weaning weight showed the inverse correlation. Pre-weaning mortality during the dry season was higher than during the rainy season. Litter size in the dry and rainy season has no differences. The reproductive season was not affect by season, but based on the birth percentage showed that the highest number of birth occurred during October-November (in the dry season) and January-February (in rainy season).

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