Seasonal effect on productivity of Bali cows in oil palm plantation in Riau Province, Indonesia

H Maulana¹, Panjono¹, E Baliarti¹, D T Widayati² and I G S Budisatria¹

¹ Department of Animal Production, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta 55281, Indonesia
² Department of Animal Breeding and Reproduction, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta 55281, Indonesia

Corresponding author: bali_arti@ugm.ac.id

Abstract. This study was aimed to assess the effect of seasons on the productivity of Bali cows kept in oil palm plantation (OPP). The study used 20 Bali cows and 1 bull, which kept semi-intensively without supplementary feeding. Cow’s reproductive data, grouped according to birth time, dry season (DS) (May-October) and the rainy season (RS) (November-April) from August 2016 to September 2018, were used. These data were used to determine calving interval and calf mortality. Cows were weighed monthly to estimate dry matter consumption, which was calculated using the Minson equations. Calves were weighed at birth and weaning. Cow’s reproductive index (CRI) and cow’s productivity index (CPI) were calculated based on reproductive data and weaning weight. Data were analysed using One way ANOVA. The result showed that during the DS, the consumption was better (1.96% BW) compared to the RS (1.83% BW) (P<0.01). Calf mortality was higher in the RS (19.05%) than in the DS (17.65%), due to high rainfall and humidity. During the two seasons, calving interval, birth and weaning weights, CRI and CPI of Bali cattle in OPP were relatively similar. It is concluded that the seasons did not influence productivity of Bali cows kept in OPP.

1. Introduction
A major constraint to Bali cattle productivity in the tropical rangeland is seasonal fluctuation in forage availability and quality due to different rainfall patterns between rainy and dry seasons. Bali cows in the rangeland has lower consumption during DS, resulting nutrients deficiency and decreasing the productivity [1].

Area of oil palm plantations in Indonesia is very wide and potential as grazing area for cattle breeding system [2]. Oil palm plantation has potential fresh forage production 1.12-1.36 ton/ha with dry matter of 16.94-26.38% and crude protein of 16.63-17.80% [3]. Indonesia has 12.3 million hectare OPP [4] and can be accommodated for 10.5 million Bali cattle [5]. Potential calf production each year from integration cattle-OPP system are 4.68 million if 80% of the herd are the productive cows [6]. That calf production is equivalent to 27.45% of the total Indonesian beef cattle population [7]. Cattle-OPP integration system can be potential alternative for breeding industry to scaling up the population of Indonesian beef cattle.

Information regarding the productivity of Bali cows grazing in OPP in different seasons is not existing. Cow’s productivity is determined by the calving interval, birth weight, weaning weight, and calf mortality. These aforementioned variables determine the level of cows reproduction index (CRI)
and cows production index (CPI). This research was conducted to know the effect of the season on the productivity of Bali cows that kept in OPP. Another benefit of this research is to provide information that can be used to determine the reproductive management of cattle-OPP integrated system.

2. Materials and methods

2.1. Study site
This study was conducted in PT. Perkebunan Nusantara (PTPN) V Sei Rokan, a national oil palm plantation company, in Rokan Hulu, Riau from August 2016 until September 2018. Data of monthly average rainfall and number of rainy days were gathered from Indonesian Meteorology, Climatology, and Geophysical Agency (BMKG). Data for 5 years (2013-2017) were averaged and used to define the rainy seasons and dry seasons for the study site. The rainy season was between May and October (rainfall >250 mm/month) and the dry season from November to April (rainfall >250 mm/month) (Figure 1). Cows were grouped based on birth time (rainy season n=22 and dry season n=31).

![Figure 1. Monthly average rainfall and number of rainy days (in year 2013-2017) in Riau Province](image)

2.2. Data collection
Total 20 Bali cows (bodyweight 258±25.17) were kept in a colony with a Bali bull (366.8 kg). The cows were kept semi-intensively (grazed from 8 a.m. to 5 p.m. and returned to the barn) without supplementary feeding. The cows were routinely weighed every month which their body weight were used to estimate the dry matter (DM) consumption, calculated using Minson equation [8]. Data of cow’s reproductive parameters (birth and mortality of the calves) were recorded to determine the calving interval (CI) and calf mortality. Calves were weighed at birth and weaning (205 days). To calculate CRI and CPI, these equations were used:

\[
CRI = \frac{\sum \text{calves birth} - \sum \text{calves mortality}}{\sum \text{cows}} \times \frac{365 \text{ days}}{\text{calving interval (days)}}
\]

\[
CPI = \text{Cows reproduction index (CRI)} \times \text{calf weaning weight (kg)}
\]

Data were analysed using One way ANOVA, operated by SPSS 20.0 program.
3. Results and discussion

3.1. Feed consumption
Table 1 presents the DM consumption and productivity of Bali cows kept in OPP. The results indicated that DM consumption was not significantly different in both seasons (P>0.05), but DM consumption per BW in DS (P<0.05) was higher compared to those in RS, that might be due to low water content of the forages. This result was consistent with the other studies which reported that DM consumption of livestock influenced by season and altitude [9]. The quality of forages strongly influences DM consumption in different seasons. In the dry season, cows have higher DM consumption [10,11].

Table 1. The DM consumption and productivity of Bali cows kept in oil palm plantation

| Parameters                      | Rainy        | Dry         | Sig.  |
|--------------------------------|--------------|-------------|-------|
| Consumption:                   |              |             |       |
| Dry Matter intake (g/day)      | 4624.70±573.35 | 4709.50±497.95 | NS    |
| Dry Matter intake (%BW)        | 1.83±0.21    | 1.96±0.19   | **    |
| Productivity:                  |              |             |       |
| Calving interval (day)         | 425.77±94.78 | 386.36±84.67 | NS    |
| Mortality (%)                  | 19.05%       | 17.65%      | -     |
| Birth weight (kg)              | 13.12±2.16   | 12.74±2.24  | NS    |
| Weaning weight (kg)            | 76.23±9.63   | 78.34±14.65 | NS    |
| Cows reproduction index        | 0.69±0.36    | 0.76±0.46   | NS    |
| Cows production index          | 69.15±18.84  | 75.02±27.04 | NS    |

**=P<0.01, NS=non significant

In contrast with other result [1], reported that Bali cows kept in natural rangeland had better DM consumption during the RS. It might be caused that Bali cows kept in OPP had a different feeding behaviour, as the cows had alternative sources of feeds during the DS. Bali cows might consume oil palm leaves (from the punning process) during the DS [12]. The availability of palm oil leaves in both seasons is an alternative for Bali cattle, as palm leaves have high biomass (1,430 kg/ha) which contains 14% crude protein (CP) and 56% total digestible nutrient (TDN) [13]. This condition makes OPP has more advantages than natural rangeland. However, the DM consumption of Bali cows under OPP was below the standard (2.2 % BW); study on intensive system reported that Bali cattle are able to consume native grass up to 2.6% BW [14].

3.2. Cows productivity
Bali cows gave relatively similar results on CI, birth and weaning weight, CRI, and CPI in both seasons, as presented in Table 1. The calf mortalities were high (17-19%) in both seasons due to low quality of forages, disease, and parasite. Birth and weaning weights were quite low in both seasons (12-13 kg), when compared with other study that revealed birth weight of Bali cattle in a breeding centre in Bali was 18 kg [15]. Another result by [16] found that Bali cows fed by OPP by-product, can produced calves with birth weight of 15-18 kg. As birth and weaning weight have a high correlation [17], it was understandable that weaning weights in both seasons were also low. The other study by [6] found that weaning weight of Bali cattle under OPP was around 130 kg. The low weaning weights resulted low CPI. Low of DM consumption might affect the reproductive performance of livestock. The other result from [16] reported that the reproductive performance of Bali cows in OPP areas was influenced by the consumption of DM and crude protein. Supplementary feeding from palm oil by-product can improve the reproduction performances. However, calving interval of the cows in both seasons were quite low, resulting high CRI (Table 1). One of advantages of Bali cattle is good reproductivity, even in harsh condition and poor quality of feed Bali [1]. Joining with a bull in a
colony may be also a good factor of mating success, as bull could minimize silent heat or abnormal estrous behaviour of the cows [18].

4. Conclusion
As a conclusion, this study revealed that the season does not have a significant effect on cow’s productivity kept in OPP. However, good feeding management should be improved to achieve higher productivity of Bali cattle under OPP systems.

Acknowledgments
The authors would like to thank to Rekognisi Tugas Akhir (RTA) programme of Universitas Gadjah Mada for financial support.

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