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The Effect of Different Seasons and Land Types Towards the Performance of Bali Cattle Production in Southeast Sulawesi

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ABSTRACT

The Bali Cattle in Southeast Sulawesi its productivity is influenced by the seasonal environmental conditions. The objective of this study was to analyze the performance production of cows Bali Cattle and its calves that were born on different season (rainy season and dry season) as well as on different types of land. The research methods applied were survey and observation method. The variables being observed follows: body weight (BWT), daily body weight gain (PBBH), body condition score (BCS) and birth weight (BW). Data were analyzed by using the Analysis of Variance (ANOVA) of nested design. The result of the research indicated that the average of body weight, daily body weight gain, BCS and birth weight was higher during the rainy season compared to the dry season. The average of body weight, daily body weight gain, and BCS was higher on paddy field. On the contrary, the birth weight on dry area was higher than it was on wetlands. The average of male cattle birth weight was higher than the average of female cattle. It could be concluded that the cow's working performance production was affected by the feed consumption and environments (season and the type of land). On the other hand, calf birth weight was affected by sexes, in addition it was also related to cow's feed intake on late pregnancy phase.

Keywords: Bali Cattle; Seasons; Land Types; Production.

INTRODUCTION

The Balinese cattle (*Bos sondaicus; Bos javanicus*) are native Indonesian beef cattle and domesticated species of wild bull (Bos-bull's banteng) at 3500 BC. The domestication was occurred in Bali, so the cow is called as Bali or Balinese Cattle (Rollinson, 1984). The example of Bali cattle superiority among others are the adaptation ability if the environment is not good, feed conversion and disease resistance (Toelihere, 2003). Bali Cattle farms in Southeast Sulawesi are still applying herding pattern so that environmental factors such as seasons are greatly affected livestock productivity. Seasons can directly influence the animal's body temperature, the activity of certain organs, grazing, thus it is affecting production process (Sulaksana and Farizal, 2014).

The change of the season is followed by differences in climatic elements. The different temperatures of the changing seasons affect the body's physiological processes of livestock. The heat pressure can cause a declining rate of livestock's metabolism due to the decreasing amount of feed intake (McDowell et al., 1970). The difference level of rainfall also influences food supplies in the prairie. During rainy season, there are many kinds of green forages that grow with the good quality of nutrients while on the dry season the number of green forages is reduced and the quality is also declining. Maintenance system relies on food sources taken from

natural grass in the pasture, livestock productivity fluctuates in accordance to seasonal changes.

The conservation of Bali cattle on different types of land is related to the use of land for agricultural commodities. There are two dominant types of land. The first is rice field which is also considered as wetland. The second is field area which is deemed as dry land type. Breeders use both types of land agricultural commodities waste land for feeding Bali cattle especially after harvest period. Wetland and dry land are providing different kind of feeding waste (Hadi and Ilham, 2002).

RESEARCH METHOD

Location.

The location of the study in two different places was purposively determined based on the criteria of Bali Cattle preservation on the area of paddy fields and dry land in Southeast Sulawesi. The first location was in the Lapangisi Village, Mowewe District, East Kolaka Regency which was the area of rice fields. The second location was in Waworaha Village, Palangga District, South Konawe Regency which was used as the example of dry land area.

Research Materials.

The materials of the study were Bali Cattle found in location that had been previously mentioned. It consisted of 123 cows and 160 calves. There were 53 cows of Bali Cattle found on dry land. On the other hand, in paddy field area there were 70 cows of Bali Cattle. The selected respondents had the criteria of raising Bali Cattle cows that had already giving birth and adopted a semi-intensive maintenance system.

Methods.

The method used was a survey and direct observation method on cows and calves of Bali cattle performance production in paddy fields and dry land. Productive's Bali Cattle cows were observed. It meant they had an experience of having calves. The effect of seasons and the different types of land on the performance of Bali cattle production were including as follows: body weight (BWT), daily body weight gain (PBBH), Body Condition Score (BCS) and the birth weight (BW). The weight of the cow's entity (BWT) was obtained by direct weighing in the morning before the cattle was grazed. PBBH was derived from the calculation of body weight (Amien et al., 2012), using the following formula:

$$PBBH = \frac{W_2 - W_1}{t_2 - t_1}$$

Note: PBBH = Daily Body Weight Gain (kg), W_2 = Final Body Weight (kg), W_1 = Initial Body Weight, t_2 = End Time Observation (day) and t_1 = Initial Time Observation.

BCS was qualitatively measured by using a scoring system of the body 1-5, according to the instructions of Awaluddin and Panjaitan (2010), namely: Score 1 = very thin; Score 2 = thin; Score 3 = medium; Score 4 = fat, and score 5 = very fat.

The weight of a newly born calf was weighed directly just after the calf was born. The classifications of the dry and rainy season were based on the concept of Badan Meteorologi dan Geofisika or Meteorology and Geophysics (BMKG, 2014), with the reference of the closest climate station's rainfall data.

Data Analysis.

The data were analyzed by using analysis of variance (ANOVA) nested design and the differences between the treatment factors were calculated with the employment of Tukey test (HSD) using the help of Minitab 17.

RESULTS AND DISCUSSION

The results of the respondent survey taken from breeders group and the rearing management of Bali Cattle from both locations are shown in Table 1.

Table 1. The Characteristics of Cattle Breeders and Rearing Management of Balinese Cattle on the Research Location

Breeders Characteristics	Waworaha Village (Field area)	Lapangisi Village (Rice Field Area)
Breeders' age (year)	56.3	51.0
• 15-55 (%)	46.2	75.0
• > 55 (%)	53.8	25.0
Breeding experience (year)	22.0	18.2
Herding Patterns		
• Free (%)	7.7	16.7
• Bind (%)	30.8	25.0
• Mixed / free + bind (%)	61.5	58.3
Herding period (hours)	8.7	12.3

The survey results presented in Table 1 showed that the breeders aged 15-55 in the village of Lapangisi were 75% higher compared to the number of breeders in Waworaha Village, which was only reaching 46.2%. Suratiyah (2006), stated that aged 15-55 this range of age was considered to be productive age category, while the >55-year of age category was assumed to be less productive age. The experiences of breeding based on two locations were 22.0 and 18.2 years. Saleh et al. (2006) alsoe noted that the extensive period of breeding would help more on mastering good livestock management such as feeding, health care and the management of cattle reproduction. And Gazali et al. (2015) also stated that the semi-intensive system maintenance of both locations was still applying grazing patterns, because the affordable maintenance cost.

The grazing patterns that was made by combining free and bind herding proved that Bali Cattle received enough guard from breeders; moving the cattle from one place to another place while at the same time was also providing drinking water. Grazing period showed that the longer the time of herding period, the shorter attention period would be given by the breeders to the cattle.

Seasons.

Based on rainfall data, the seasons of both locations were at the same time (BPTP Sultra, 2016). The rainy season was in December to July and the dry season was in August to November. The means of temperature, humidity and rainfall rate of both research locations is shown in Table 2.

Table 2. The Conditions of Air Temperature, Humidity and Rainfall Rate of Rainy Season and Dry Season in Different Locations

Climate Elements	Rainy Season		Dry Season	
	Palangga	Mowewe	Palangga	Mowewe
Air Temperature (°C)	26.0±0.7^{a}	25.6±0.6^{a}	25.7±1.3^{a}	24.9±0.8^{a}
Air Humidity (%)	85.0±2.1^{a}	88.0±1.8^{a}	81.3±3.7^{b}	84.4±2.6^{ab}
Rainfall Rate (mm)	67.0±21.4^{a}	61.6±15.6^{a}	21.6±12.1^{b}	26.8±15.4^{b}

Source: Climate Station of Institute for Agricultural Technology Assessment Southeast Sulawesi (processed)
Description: a, b different superscripts in the same row indicated significantly different (P<0.05).

Table 2 showed that the time of rainy season and dry season arrival was followed by the difference on the average of rainfall, humidity and temperature on both research locations. The average air temperature on both sites during rainy season and dry season was in the same range. Humidity level of the same season was higher in rice field than it was in dry land. The state of rainfall on both locations showed the similar average. Graphically, the state of the rainfall rate of research sites is shown in Figure 1.

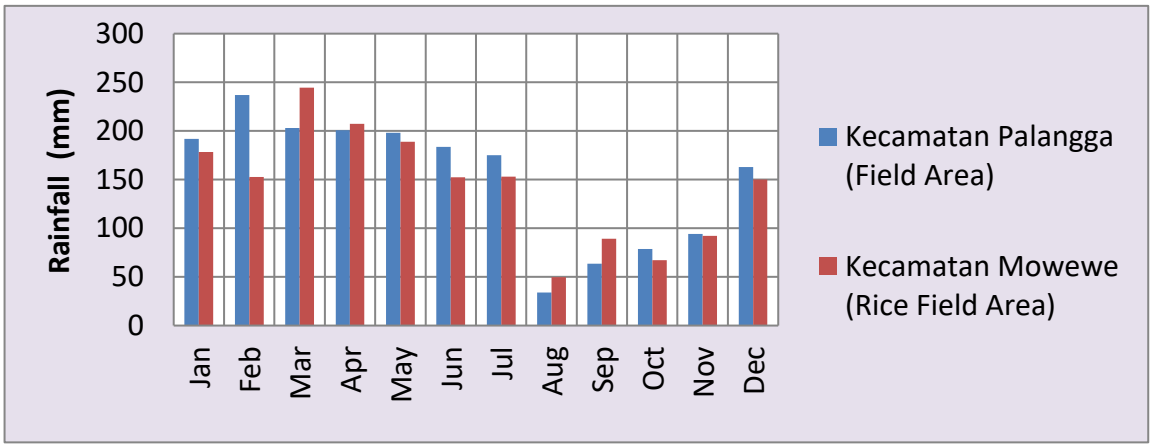


Figure 1. The state of Rainfall on Research Location.

Figure 1 showed the distribution of rainfall variations during the observation month (January to December) at the study site. The state of rainfall rate on both locations showed the same variation; the rainy season (December to July) rainfall rate was (>150 mm/month), whereas during the dry season (August to November) the rate range was around (<150mm/month).

Feed management.

The observation of management and feed consumption variety on both types of Balinese cattle raising farms are shown in Table 3.

Table 3. The Management and Feed Consumption Variety on Both Types of Bali Cattle Raising Farms.

Feed variety	Feeding Management	Field Area	Rice Field
		Consumption Rate (kg/cow/day)	
Grazing Feed (natural grass)	(morning - afternoon)	*Ad libitum*	*Ad libitum*
Additional Feed	(afternoon- evening)		
• Gliricidia		1-1.5	2.7
• Elephant Grass		2.3	5.2
• Setaria Grass		3.3	2.6
• Grass mowing (natural grass)		4.7	-
Rice Bran	(seasonal)	1.5	1.6
Agricultural Waste Feed	(seasonal)		
• Rice Straw		1-1.5	*Ad libitum*
• Corn Straw		4.0	3.2
• Skin of Soybean Pods		1.4	-
• Groundnut Straw		3.5	-
• Cocoa Skin		-	5.6

Table 3 showed that both type of lands provided the same basal feed which was field grass found on the grazing land. The cattle ate it during grazing period started from morning until late afternoon. Some types of grass were commonly found in the field, such as Bermuda grass (*Crynodon dactilon*), needle grass (*Crisopogon ariculatus*), and reeds (*Inperata cylinrica*), in addition, there was also a type of legume (*Calopogonium*). During the afternoon or evening grazing period, cows would be feed at home or in the garden next to the breeders' house. The feed variety for example were Elephant Grass (*Penisetum purpureum*), Setaria Grass (Setaria sphacelata), Mullato Grass (*Mullato hybrid*), and also Gliricidia legume (*Gliricidia sepium*) depending on the type of forage planted by farmers.

Rice bran feed and other agricultural wastes were seasonal (temporary). It was depending on the harvest of agricultural commodities. The intensity of the provision and the availability of rice bran was more in number in paddy fields than in dry land. Rice bran was given in the afternoon by mix it up with cow's drinking water. On the agricultural waste feed of dry land, it could be contained corn straw, peanut straw, soybean pod shell and a little rice straw. In paddy field, rice straw was given ad libitum, cacao skin and also a little bit of corn straw. The supply of water was given twice a day with and addition of salt.

The results of the analysis of the nutrient content of meadow and cutting grass planted by farmers is shown in Table 4.

Table 4. Nutrient content of meadow and cutting grass on researchlocation

Description	Waworaha Village (Field Area)		Lapangisi Village (Rice Field)	
	Meadow Grass	Cutting Grass*	Meadow Grass	Cutting Grass*
	- - - - - - - - - - - - - - - - Nutrition Score (%) - - - - - - - - - - - - - - -			
- Water Substance	67.73	78.94	75.55	84.38
- Dry ingredients	32.27	21.06	24.45	15.62
- Organic Materials	87.18	87.40	85.29	83.24
- Dust	8.30	7.60	9.67	12.70
- Crude Protein	5.00	5.70	10.34	8.69
- Raw Fiber	26.69	26.59	23.36	26.30

Source: Result Analysis from Laboratory of Animal Husbandry, Haluoleo University

Description: * Elephant Grass + Setaria Grass + Odot Elephant Grass (*Penisetum purpureum cv. mott*.) in the village of Lapangisi and Elephant Grass + Setaria Grass + Mullato Grass in Waworaha Village.

Table 4 showed that the results of the analysis of forage nutrients on both sites were during the end of the dry season or the beginning of the rainy season (December). The result that highlighted the differences was the crude protein. The crude proteint content of field grass of paddy fields (10.34%) was higher compared to dry land (5.00%). Similarly, the crude protein of wetland grass pieces was (8.69%). It was higher than dry land (5.70%). Crude protein was very important because it was closely related to the digestibility of feed. Mc.Donald (2002), stated that if the crude protein the lower caused the digestibility of a feed material was low because it decreased the performance of rumen microbes, on the contrary if the crude protein was high, the feed nitrogen was also high, the feed nitrogen was converted into microbial protein, thereby it could increase the microbial digestion of the organic material of feed.

Performance Production of Bali Cattle on the Different Seasons and Land Types.

The observation of Bali Cattle cows production performance and the birth weight (BW) on the different seasons and land types are shown in Table 5 and Table 6.

Table 5. The Bali Cattle Performance Production Performance on The Different Seasons and Land Types.

Indicator	Land Type and Season			
	Rice Field		Field Area	
	Rainy Season	Dry Season	Rainy Season	Dry Season
N	68	65	53	53
Birth Weight (kg)	238.4±21.1 [a]	230.0±22.7 [a]	231.2±21.2 [a]	212.8±18.3 [b]
N	65	53	53	53
Daily Weight Gain (kg)	0.11±0.08 [a]	-0.04±0.08 [b]	0.08±0.07 [a]	-0.04±0.06 [b]
N	70	70	53	53
BCS (score 1 - 5)	3.4±0.4 [a]	3.1±0.4 [b]	3.1±0.3 [b]	2.8±0.3 [c]

Description: a, b different superscripts in the same row indicated significantly different (P <0.05)

Table 6. Birth Weight of Bali Cattle on The Different Seasons and Land Types.

Land Type	Sexes	n	Rainy Season	n	Dry Season
Rice Field	- Male	37	15.1±1.9 [ab]	20	15.9±1.7 [a]
	- Female	38	13.8±1.4 [b]	23	13.5±1.8 [b]
Field Area	- Male	14	16.1±1.4 [a]	5	15.4±1.1 [ab]
	- Female	18	15.7±2.1 [a]	6	14.0±1.7 [ab]

Description: a, b different superscripts in the same row indicated significantly different (P <0.05)

Cow Body Weight.

The results showed that cows' body weight (BWT) during rainy season was higher (P<0.05) than it was on dry season. The average weight of Balinese cattle during the rainy season in paddy fields was (238.4±21.1 kg) and on the field area was (231.2±21.2 kg), it weighed more than in the dry season of dry land (212.8±18.3 kg) which was similar (P>0.05) to the same weigh of cows on dry season in paddy fields (230.0±22.7 kg). This showed that the season and the type of land affected the weight of the parent body.

During the rainy season, heavy rains resulted in the growth of excellent forage better than on the dry season since low rainfall rate caused the delayed growth of green feed. The results showed that the production of grass during the rainy season in grazing land was as much as 7, 3 times more than the grass production number on the dry season (Dominggus, 2010). The availability of forage allowed the cows to consume feed in sufficient quantity during the rainy season, while on the dry season the number of forage was reduced resulting on insufficient feed intake. Performance production of body weight was influenced by cows' consumption and the environment (Kurniasari et al., 2016).

Cows' body weight performance in this study was indicating that body weight of Bali cattle which was raised in grazing land was low. The results of Baso et al. (2014) study in South Sulawesi, Barru regency, the basis weight of Bali Cattle cows was 174.1±27.7 kg to 217.9±46.7 kg. Based on Talib et al. (2003), in West Nusa Tenggara was 241.9 kg, and in East Nusa Tenggara was 221.5 kg. Bali Cattle in the breeding center in Bali had a higher body weight based on Romjali and Rasyid

results (2007), in Tabanan, it was 266.8 kg and previously Talib's result (2003) showed 302.3 kg. The low weight of Bali cattle was affected by cow feed consumption, environment, and the fluctuations of feed availability in the meadow (Kurniasari et al., 2016 and Wirdahayati et al., 1998) and also the decrease of genetic quality due to selection ineffectiveness (Hartati et al., 2007).

Daily Body Weight Gain.

The results showed that during rainy season, Daily Body Weight Gain was higher ($P<0.01$) than it was on dry season, while type of land in the same season was similar ($P>0.05$). The average of cows' Daily Body Weight Gain on rainy season in paddy fields was (0.11±0.08 kg) and on dry land, it was (0.08±0.07 kg). The average showed higher result than the result on dry season in both fields respectively (-0.04±0.08 kg and -0.04±0.06 kg). This implied that seasons affected cows' Daily Body Weight Gain compared to the types of land.

Cows' daily body weight gain increased during rainy season, but it would be decreased during dry season. The rate of growth of muscle tissue affecting Daily Body Weight Gain was related to feed consumption. It was not only related to the sufficient amount of feed consumption but also it should contain good nutrition quality. During rainy season, the growth rate of muscle tissue was increased because grazing land had enough production and good nutritional content of forage (Dominggus, 2010), whereas during dry season, the growth rate of muscle tissue was decreased due to insufficient feed consumption caused by the declining forage production and decreased nutrition content of forage in grazing land. Anindita (2009), stated that crude protein of field grass during rainy season was 16.5% which was higher than the dry season 8.9%. Warwick et al (1983) stated that the consumption and nutritional value of feed affected Daily Body Weight Gain.

Both types of land still applied the herding pattern, so the provision and adequacy of feed was still dependent on grazing land availability. Meadow area provided low nutrition quality (Table 4). Results of previous studies had also shown that grazing land only providing natural grass of green forages (90%) and a small number of legumes' forage, the crude protein content was high during rainy season and low during the dry season (Arnold, 2013). Moreover, the difference of the temperature of both seasons affected the metabolism and feed intake. Williamson and Payne (1978), stated that temperatures could reduce the consumption of feed intake and digestibility. Livestock that suffered from feed shortage would face energy deficiency, decreased growth, or even body weight loss.

Body Condition Score (BCS).

The results showed that the BCS number on rainy season was higher ($P<0.01$) than it was on dry season, and the wetland result was also higher ($P<0.01$) compared to the field area's result. The BCS average of Bali cattle on rainy season in paddy fields (3.4±0.4) was higher than it was on dry season (3.1±0.4). The BCS average during rainy season on dry land was (3.1±0.3), it was higher than the average on dry season (2.8±0.3). This was implied that the season and the type of land had significant roles on affecting Bali cattle's BCS.

The BCS of cows in paddy fields was significantly higher compared to dry land. This was due to the consumption of feed and nutrient content of different grass on both land (Table 4). The consumption of cutting forage (cut-and-carry) provided the farmers such as elephant grass and Gliricidia legume

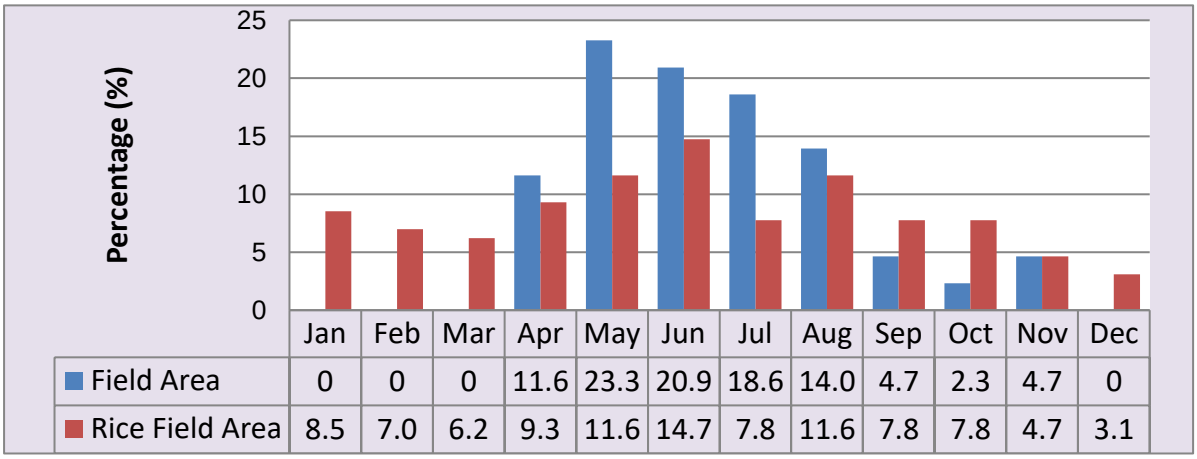
in paddy fields was higher than dry land. In paddy fields, the availability of added feed, such as rice bran was better. Moreover, cacao skin and rice straw was also easily available throughout the year. The cutting forage itself also contained higher crude protein of nutrient content. Production performance was not only influenced by the maintenance of the system but also by the feeding consumption and environment (Kurniasari et al., 2016).

Birth Weight (BW).

The results showed that birth weights (BW) on dry land was higher ($P<0.01$) compared with to the wetland's result. The birth weight during rainy season was higher ($P>0.05$) compared to the dry season, and bull calf BW was higher ($P<0.01$) than heifer BW. The highest bull calf BW took place on dry land during rainy season (16.1±1.4 kg) which was higher than on dry season (15.4±1.1 kg). On the other hand, it was similar ($P>0.05$) with the heifer BW during rainy season (15.7±2.1 kg) and higher than heifer BW during dry season (14.0±1.7). Birth weight bull calf of dry land was similar ($P>0.05$) with bull calf BW of wetland on dry season (15.9±1.7) but it was certainly higher than during rainy season (15.1 ± 1.9 kg), and heifer BW on both season (13.8 ± 1.4 kg) and (13.5 ± 1.8 kg).

The bull calf birth weight was higher than heifer weight. The difference of newly born calves between bull calf and heifer in this study were 0.90 kg on dry land and 1.84 kg in paddy fields. This was because genetically bull calf were more superior to heifer because bull calf had an androgen hormone that caused nitrogen retention more than on heifer (Purwantho, 2012). Toelihere (1997), stated that the size of the bull calf placenta was larger than heifer placenta. During prenatal growth, one factor that can affect birth weight was the size of the placenta.

Birth weight was strongly related to birth time and nutritional status of the cows at the time of pregnancy. In wetland area, the birth time occurred throughout the year while the highest birth moment of dry area took place at the end of the rainy season (May-July). The birth weight of rainy season was higher than dry season (Muzani et al., 2004). Calf's birth weight on dry land was higher than the calf's birth weight on wetland. The differences in birth weight of both types of land were associated with the feed intake of final phase pregnancy (6-9 months). Graphically, the monthly distribution percentage of new born cattle of paddy fields and dry land in Bali was shown in Figure 2.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field Area	0	0	0	11.6	23.3	20.9	18.6	14.0	4.7	2.3	4.7	0
Rice Field Area	8.5	7.0	6.2	9.3	11.6	14.7	7.8	11.6	7.8	7.8	4.7	3.1

Figure 2. The Percentage Distribution of Bali Cattle Birth per Month at Research Location

Figure 2 showed that in paddy fields, the birth took place almost throughout the year therefore the final phase of pregnancy distribution was also spread throughout the year. On the contrary, the highest birth rate occurred in dry land only at the end of rainy season to early dry season (April to August), so that the last three months of late pregnancy age phase (6-9 months) was occurred during the peak of the rainy season (January to April).

The late pregnancy of cows at dry land's which occurred during the peak of the rainy season could guarantee the nutritional status of the cowdue to the consumption of green feed that was good, both for the quantity and quality whereas the nutritional status of pregnant cows at varies period in the paddy fields could not be guaranteed. The nutrition of fetal growth in the third trimester of pregnancy 6-9 months affected calves' birth weight (Karnaen and Arifin, 2007). When cows were given nutritious feed during pregnancy, from every 1 kg increase of cows' body weight could increase the birth weight of calves until 0.021 kg (Hartati and Dicky, 2008). These results suggested that in addition to the influence of sexes and environment (season and the type of land), birth time and cows' period of late pregnancy also affected the Bali cattle calves' calf birth weight.

CONCLUSION

The performance production of cows (body weight, daily body weight gain and body condition score) was affected by the consumption of feed and environment (seasons and the types of land), whereas the birth weight (BW) was influenced by sexes and also the feed intake during pregnancy when the cows were at the end of pregnancy phase.

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