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Grazing Behavior of Bali Cattle and Plant Species in Relation to Cattle-Oil Palm Integration System

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The aim of this study was to evaluate grazing behaviour of Bali cattle kept in oil palm plantation in Bengkulu, Indonesia. The experimental design was a randomized block with three treatments of different level of stocking rate namely 1 AUE/ha, 1 AUE/1.5 ha, and 1 AUE/2 ha and four replications. Twelve Bali cows with an average weight of 93 kg, aged 1-1.5 years, with similar BCS were used in this experiment. All animals were grazed in rotational grazing (7 days grazing and 21 days resting time) in 4 paddocks for 12 weeks. All animals were grazed during day time (08.00 – 16.00), and kept in animal barns during the night. Grazing behaviour (grazing, ruminating, walking, drinking, and idling) were manually recorded when they were in their allocated paddock. Plant species were identified through cutting 0.5 m^2 sampling square, weighed, and identified for each species. The results obtained were analysed using ANOVA followed by DMRT to test the difference between the means.
Result indicated there were no significant difference between all treatments on both grazing behaviour and plant species grazed. Most of the time animals spent their time for grazing (76.4%), followed by ruminating (18.3%), and others activities (walking, drinking, and others) (5.26%). There were at least 30 plant species identified in the grazing area, while there were four species dominated the grazing area, namely *Axonopus compresus, Paspalum conjugatum, Cyrtococcum trigonum,* and *Ischaemum indicum.*

Keywords: Rotational grazing, Bali cattle, Oil Palm, different AUE, plants

Introduction

Indonesia is the biggest Crude Palm Oil (CPO) producer in the world, producing more than 30.9 million ton/year in 11.4 million hectares of land (Directorate General of Estate Crops, 2014). Indonesia's palm oil production will grow by 7.5% this year, compared with the 9.4% annual average growth recorded over the past five years (BMI Research, 2015). The Indonesia oil palm business has been able to employ more than 2.2 million households and 5.5 million employees (Directorate General of Estate Crops, 2014). At present time, Indonesia has been dependent upon beef production from overseas, as this year Indonesia had to import around 700.000 heads of cattle (BMI Research, 2015). The unexploited area of oil palm area can be

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potentially used for keeping cattle (Wan Mohamad, 1978; Chee dan Faiz, 1990; Tajuddin *et al*., 1990), especially for grazing the Indonesian native Bali cattle (Dwatmadji *et al.*, 2004, Dwatmadji *et al*., 2015) which can be fed under poor nutritional forage (Andrews, 1972; Copland, 1974).
Several factors influence grass consumption by cattle, such as plant characteristics including cultivar and chemical composition and management practices including grazing intensity and herbage allowance (Chilibroste, 2005; Rearte, 2005; Wales *et al*., 2005). Cattle will perform different grazing behaviour and performance depending on botanical composition or forage species, forage mass, and other sward canopy characteristics (Sollenberger, 2005).

Objectives: This study aimed to evaluate the grazing behaviour (grazing, ruminating, walking, drinking, and idling) of Bali cattle and botanical composition on native pasture under cattle-oil palm managed at three levels of Animal Unit Equivalent (AUE).

Materials and methods

The study was conducted in oil palm plantations area (average age of 7-8 years) in Central Bengkulu Regency, Bengkulu Province, Indonesia. Twelve (12) Bali cows with an average weight of 93 kg, aged 1-1.5 years, with similar BCS were used in this experiment. The research used a randomized block with three treatments of different level of stocking rate namely 1 AUE/1 ha, 1 AUE/1.5 ha, and 1 AUE/2 ha with four replications in each treatment. All animals were grazed in rotational grazing in 4 paddocks for 12 weeks. Three (3) paddock for each treatment (1 AUE/ha, 1 AUE/1.5 ha, and 1 AUE/2 ha) was built based on the initial cows weight. Each paddocks consisted of 4 (four) sub-paddock to accommodate targeted grazing rotation plan, which consisted of 7-days grazing period and 21-days of resting period for each sub-paddock. Using this schedule, every sub-paddock was re-grazed by the same cows every three weeks period.

All 12 Bali cows were grazed during day time (08.00 – 16.00), and were kept in animal barns during the night for security reason. Grazing behaviour (grazing, ruminating, walking, drinking, and idling) were manually recorded by trained personnel when they were in their allocated paddock. Plant species were identified through cutting 0.5 m^2 sampling square, weighed, and identified for each species. The results obtained were analysed using ANOVA followed by DMRT to test the difference between the means (Steel and Torrie, 1980).

Results and Discussions

Table 1. Mean ± SEM (%) of grazing, ruminating, walking, drinking, and others/idle time measured during day time based on 3 treatments (1 AUE/1 ha, 1 AUE/1.5 ha, and 1 AUE/2 ha).

Treatments	Grazing	Ruminating	Walking	Drinking	Idling
1 AUE/1 ha	76.7 ± 1.33	18.4 ± 1.27	0.73 ± 0.13	0.31 ± 0.06	3.75 ± 0.44
1 AUE/1.5 ha	75.0 ± 1.70	19.1 ± 1.59	1.20 ± 0.36	0.59 ± 0.28	4.04 ± 0.47
1 AUE/2 ha	77.4 ± 1.61	17.4 ± 1.60	1.24 ± 0.29	0.18 ± 0.02	3.74 ± 0.52
P=	0.53	0.71	0.36	0.24	0.88

Table 1 indicated that there was no significantly different of grazing, ruminating, walking, drinking, and idling among all treatments. Most of the time Bali cattle spent their time for grazing (>74%) and ruminating (>18%), while other activities (walking, drinking, and idling) used less percentage of time. Although the grazing behaviour of cows was shown to be more influenced by the pasture management (such as different stocking rate, like in this research) (Campana *et al*., 2015), it seemed that this did not occur in this research. Crowder and Chheda (1982) showed that grazing time reflects the ease of grasping and taking the forage, and the sward structure and its chemical characteristics showed greater influence on the grazing activities (Campana *et al*., 2015). To satisfy its nutritional needs under the circumstances imposed by the sward, management, and the environment, the grazing cattle generally manoeuvres by adjusting its eating behaviour in terms of eating time, bite rate, chewing rate, and intake rate (Taweel *et al*., 2004)

There were three origins which shown to influence total eating time, bite rate, and herbage intake, known as plant (sward) (Penning *et al*., 1991; Gibb *et al*., 1997), animal (Gibb *et al*., 1999), and environmental origin (Pulido and Leaver, 1995). It seemed that as animal and environment were in similar origins in this research, any different of grazing behaviour would be due to plant origin reflected in their botanical composition. Table 2 showed the botanical composition and plant species rank under different treatments.

Table 2. Botanical composition (%) under oil palm tree based on 3 different treatments (1 AUE/1 ha, 1 AUE/1.5 ha, and 1 AUE/2 ha).

No	Nama Species	1 AUE/1 ha		1 AUE/1.5 ha		1 AUE/2 ha	
		%	Rank	%	Rank	%	Rank
1	*Axonopus compresus*	19.77	1	47.57	1	32.68	1
2	*Paspalum conjugatum*	17.52	2	7.89	3	8.41	3
3	*Cyrtococcum trigonum*	14.61	3	6.88	4	9.78	2
4	*Ischaemum indicum*	10.64	4	3.58	7	5.10	7
5	*Melastoma malabatricum*	9.74	5	10.15	2	6.41	6
6	*Croton hircus*	6.14	6	5.36	5	8.06	4
7	*Desmodium trifolium*	4.95	8	0.86	13	4.56	8
8	*Borreria sp.*	4.37	9	4.34	6	3.71	11
9	*Calopogonium muconoides*	1.95	10	1.84	11	0.59	16
10	*Paspalum sp.*	1.14	11	1.93	10	3.87	10
11	*Erigeron bellioides*	1.04	12	0.59	14	0.07	24
12	*Ageratum conyzoides*	0.55	13	-	-	4.44	9
13	*Pueraria phaseolides*	0.47	14	3.31	9	1.01	14
14	*Mikania*	0.28	15	-	-	0.13	22
15	*Imperata cylindrical*	0.21	16	0.87	12	0.06	25
16	*Mimosa*	0.21	17	-	-	-	-
17	*Hydrocotyl asiatica*	0.18	18	-	-	0.08	23
18	*Blumea lacera*	0.08	19	-	-	-	-
19	*Ludwigia hyssopifolia*	0.06	20	0.13	18	0.14	21
20	*Spigelia anthelmia*	0.04	21	0.06	19	-	-
21	*Acalypta indica*	0.02	22	0.36	16	1.33	12
22	*Digitaria*	-	-	0.04	20	1.24	13
23	*Paspalum disticum*	-	-	-	-	0.87	15
24	*Cleome*	-	-	0.26	17	0.32	17
25	*Fimbristylis miliacea*	-	-	0.02	22	0.19	18
26	*Desmodium sp.*	-	-	0.58	15	0.15	19
27	*Centrosema pubescens*	-	-	-	-	0.15	20
28	*Ferns*	-	-	0.04	21	-	-
29	*Pteridium*	-	-	0.01	23	-	-
30	*Others*	*6.02*	*7*	*3.32*	*8*	*6.65*	*5*
TOTAL		100.00	--	100.00	--	100.00	--

Table 2 indicated that overall there were more than 29 plant species in oil palm area, and 4 plant species was dominant under all treatment, namely *Axonopus compresus*, *Paspalum conjugatum*, *Cyrtococcum trigonum*, and *Ischaemum indicum*, in which the total value were 62.5% (1AUE/1 ha), 66.9% (1 AUE/1.5 ha), and 55.9% (1 AUE/2 ha). Although grazing animals could change botanical composition in grass lands (Rook and Tallowin, 2003) and forage production in oil palm pasture (Dwatmadji *et al.*, 2015), it seemed that all three treatments did not affect the botanical compositions in this research. The only botanical composition changes occurred in this research was only the rank sequence of plant species (Table 2), except for *Axonopus*

compresus grasses in which they always in the top rank for all treatments. Having no difference in grazing behaviour among all treatments (see Table 1), has resulted in no significantly differences in botanical composition. This was adajcent to several researcher (Seman *et al*., 1999; Da Trindade, 2016; Briske, 1996; Gibb, 2006) who mentioned that grazing behaviour would affect dry matter yield by reducing plant regrowth, altering pasture botanical composition, and influencing plant utilization.
Most of the plant species found in this research were low to medium quality forage (Stur and Shelton, 1991).

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