LONG TERM EVALUATION OF SOME SPECIES OF TROPICAL PASTURE UNDER DIFFERENT GRAZING REGIME IN COCONUT BASED FARMING

David Arnold Kaligis[1*], Selvie Diana Anis[1]

[1] Department of Animal Nutrition and Forages Science,
Faculty of Animal Husbandry, Sam Ratulangi University, Indonesia

Abstract

Improving the productivity and quality of forage resources for ruminants in shaded environment underneath coconuts plantations needs to study the yield and persistence of the species. Under controlled and free grazing regime grasses species of Stenotaphrum secundatum and Brachiaria humidicola cv. Tully showed a good performance in terms of herbage yield and persistence in heavy grazing, and combined well with legumes, especially Arachis pintoi cv. Amarillo. Rotational grazing regime and ideal stocking rate is needed to ensure the productivity of Brachiaria humidicola cv. Tully pasture and daily gain of cattle in coconut based farming.

Keywords: evaluation, tropical pasture, grazing regime, coconut, farming.

INTRODUCTION

The province of North Sulawesi, Indonesia has a high potential of beef cattle grazing under coconut plantation because of its wide area of coconut plantations not intercropped with other grain crops.

Free grazing in coconut based farming system is common in this province and other places in Eastern part of Indonesia. However, existing forage resources under coconut plantations consist primarily of naturalized grasses and legumes as well as weed species of low productivity [1].

In previous research programs, some excellent species of grasses and legumes and their yield have been identified [1]. Furthermore, performance evaluation of those promising species under mixed pasture with very light stocking rate has also been reported by [2]. This article as a report of a series of several studies to evaluated the performance of those species under a long term grazing regime. The first series of this report is the results of controlled grazing system reported by [2] and compared with the results of free grazing reported by [3]. The second series of this report is the results of good rotational grazing management in coconut plantation on the performance of *Brachiaria humidicola* cv. Tully as one of the among promoting species, and the average daily gain of cattle.

MATERIAL AND METHODS

The experiment was located at the Coconut Research Institution, Kayuwatu Manado (latitude 1°30'S, longitude 125°30'E and 67 m above sea level). The initial trial of the first series of experiment was started in 1992 until 1994 for controlled grazing regime as experiment 1 [2]. In January 1995 the plots were opened to animals for free grazing regime either freely or tethered until medio 1998. After free grazing periods of 2.5 years, as experiment 2, those plots of the experiment were fenced, and grasses and legumes were cut. The pasture were allowed to re-grow for six weeks, after which samples were taken randomly from 1.5 m^2 quadrant following the procedure of [2], and the second cutting was done six weeks later. The data collected were dry weight yield and botanical composition.

After the first series of experiment, in year of 2003 in the same location, 2.5 ha of pasture of B. *humidicola* were established, as the second series of experiment or as experiment 3. The aim of this experiment was to find out the effects of stocking rate on the performance of pasture (ground tiller, dry weigh of root and

*Corresponding author: kaligis.david@yahoo.co.id
The manuscript was received: 19.05.2012
Accepted for publication: 29.05.2012

crown, botanical composition), and the average of daily gain of cattle. After the pasture was well established, the trial was started in 2005 and finish in 2008. There were 18 young male Onggole crossed breed cattle with the average body weight of 210 kg were used in this experiment. The treatments being evaluated were three level of stocking rate (SR) namely SR1 was 0.6 AU, SR2 was 1.2 AU and SR3 was 1.8 AU per ha, with three replication in rotational grazing system. The layout of experiment was arranged in Randomized Block Design (RBD).

RESULTS AND DISCUSSIONS

Experiment 1 and 2

Dry weight and legume contribution

Dry weight yields and the percent contribution of legumes in a mix pasture under two grazing systems. Controlled grazing as experiment 1, with a very light stocking rate [2] and experiment 2, of free grazing [3] are shown in Table 1. In controlled grazing no significant difference in yield was noted among the mixed pastures with the exception of the *B. humidicolla* cv. Tully + legumes mixture LM. It is interesting to note that the native pasture gave almost the same yield (83.0 g/m^2) with that of the other mixtures namely *Axonopus compressus* + LM (95 g/m^2), *Paspalum notatum* cv. Competidor + LM (95 g/m^2), *Stenotaphrum secundatum* cv. Vanuatu + LM (95 g/m^2) and *Brachiaria decumbens* cv. Basilisk + LM (100 g/m^2).

Table 1 Dry weight (g/m^2) and contribution of legumes (%) under two grazing system

Grazing System	Mixed Pasture (MP)					
	NF	MP1	MP2	MP3	MP4	MP5
Controlled (Expt.1)	83^b	95^b	80^b	95^b	100^b	140^a
Mean of 4 harvest at 8 weeks old	(19.0)	(23.5)	(40.5)	(24.0)	(18.5)	(17.0)
Free (Expt.2)	47^b	47^b	53^b	59^b	10^c	65^a
Mean of 2 harvest at 6 weeks old	(8.7)	(47.3)	(26.90)	(31.4)	(33.4)	(22.1)

Treatment means with common letters are not significantly different (P>0.05).
Figures in the bracket are percentages of legume contribution.
NF = native forage.
MP1 = *Axonopus compressus* + legume mixture (LM).
MP2 = *Paspalum notatum* cv. Competidor + LM.
MP3 = *Stenotaphrum secumdatum* cv. Vanuatu + LM.
MP4 = *Brachiaria decumbens* cv. Basilisk + LM.
MP5 = *Brachiaria humidicola* cv. Tully + LM.
LM = *Arachis pintoi* cv. Amarillo + *Arachis repens* + centro CPI 58575.

However, the legume was relatively low in MP5 (17.0%) compared with the other treatments. High legume contribution was found in MP2 (40.5%), but decreased sharply at free grazing (27.0%). Furthermore, dry weight yields under free grazing system were lower than those under controlled grazing system. These low dry weight yields may be due to uncontrolled frequencies and intensities of the animal grazing. Consequently, the forage plants were stunted to reach a normal re-growth. The highest dry weight yields (65.0 g/m^2) were found at the treatment of MP5 using *B. humidicola*, while the lowest dry weight yields (10.0 g/m^2) were found at the treatment of MP4 using *B. decumbens*. It was observed that the botanical composition of mixed pasture changed extremely compared with those of controlled grazing system with low stocking rate. Generally, the proportion of the legumes on mixed pasture increased significantly, except those of NF and MP2.

Species Distribution

Species distribution of the forages studied is presented in Table 2. The component of weeds dominated the plot of NF treatment (70%), while the other components were native forages (30%) consisting of local grasses and legumes. This native forage was naturally used as the ruminant edible feed.

Table 2 Botanical composition of pasture under free grazing system (Expt. 2)

Component (%)	Mixed Pasture (MP)					
	NF	MP1	MP2	MP3	MP4	MP5
1.Grasses						
Axonopus compressus	-	35.10	-	-	-	-
Paspalum notatum	-	-	57.34	-	-	-
Stenotaphrum secundatum	-	-	-	51.94	-	-
Brachiaria decumbens	-	-	-	-	5.66	-
Brachiaria humidicola	-	-	-	-	-	55.21
2.Mixed legume	-	47.85	26.95	31.39	33.45	22.13
3.Native forages*	30.07	11.15	14.10	12.00	20.51	15.58
4.Weeds**	69.93	5.90	1.61	4.67	40.38	7.08

*Consisted of local grasses and local legumes for ruminant edible feed.
** Un-edible feed for ruminant.

The proportion of legumes at MP1 treatment was about 48% while those of *A. compressus* were about 35%. In MP2, the proportion of *P. notatum* was high (67%) while the proportion of legume was about 27%. *P. notatum* had high ability to dominate plot of the trials due to its strong and compact root system, such that the components of weeds remaining on the plot of the trial decreased to about 2%. MP3 using *S. secundatum* was able to dominate the weeds. This mixed pasture was ideal as indicate by high proportion of legume (31%), grass 52% and native forages 12%. MP4 using *B. decumbens* contained high proportion of weeds (40%) and the proportion of grass was about 6%, but high in mixed legumes and native forages were about 33 and 20% respectively. MP5 using *B. humidicola* showed that the proportion of grass, mixed legumes, native forages and weeds were 55, 22, 16 and 7% respectively.

Experiment 3

The performance of pasture in term of number of ground tiller, dry weigh of root and crown, botanical composition and the average daily gain of cattle were shown in Table 3.

Table 3 The performance of pasture and the average daily gain of cattle

Variable	Stocking Rate (SR)		
	SR1	SR2	SR3
Pasture performance			
-Ground tiller number.	3.67^{c}	14.00^{b}	27.89^{a}
-Root dry weight	4.07^{b}	5.80^{b}	11.09^{a}
-Crown dry weight	3.48^{c}	9.01^{b}	14.34^{a}
Botanical composition (%)			
-*Brachiaria humidicola*	78.89^{b}	83.46^{b}	90.42^{a}
-Legumes	0.78^{b}	0.95^{b}	1.33^{a}
-Weeds	0.33^{c}	1.77^{b}	2.97^{a}
-Dead material	19.61^{a}	12.40^{b}	4.61^{c}
Average daily gain (g/h/d)	465.70^{a}	387.60^{b}	338.90^{c}

Note: Number in rows followed by different letter is significantly different by HSD at 0.05.

Table 3 showed that the performance of pasture were getting better as stocking rate increased up to SR3 or 1.8 AU, where the number of ground tiller, dry weight of root and crown as indicator of persistency [4] were significantly higher than SR1 and

SR2. Furthermore, the component of dead material was significantly lower at SR3 but the percentage of *B. humidicola* was higher. Those data means that with 1.8 AU could ensure the sustainability of pasture production. The ADG per animal was significantly higher about 466 g/h/d at SR1 compared to the others SR which were decreased when the stocking rate increased. This finding was slightly higher than those as

reported by [5]. Even though the ADG was lowest per animal in SR3 but it was greater when calculate per ha [6].

CONCLUSIONS

1. Tropical species of *S. sucundatum and B. humidicola* showed good performance of dry weight yield and persistence both under controlled and free grazing system.

2. Good management in term of stocking rate for grass species of *Brachiaria humidicola* is needed to ensure the sustainability of pasture and animal production in coconut based farming.

ACKNOWLEDGMENTS

We wish to thank to the Australian Center for International Agriculture Research (ACIAR) for financial support and to Dr. Max Shelton as head of cord group of researcher from the University of Queensland for their valuable contribution and assistance throughout the implementation of the first cycle of field experiment. Thanks to the Minister of National Education and Culture of the Republic of Indonesia for financial support of second cycle of the research.

REFERENCES

[1] Kaligis, D.A and C. Sumolang, Forage species for coconut plantation in Nor Sulawesi.In: Forage for Plantation Crops. Ed.: H.M. Shelton and W.W. Stur. Procceding of a workshop, Sanur Beach, Bali Indonesia 27-29 June, 1990. ACIAR Proc. No. 32, 1990.

[2] Kaligis, D.A., C. Sumolang., B.F. Mullen and W.W. Stur, Preliminary evaluation of Grass-Legume pastures under coconuts in North Sulawesi. In: Integration of ruminants into plantation systems in Southeast Asia. Ed.: B.F. Mullen and H.M. Shelton. Proc. Of a workshop at Lake Toba, North Sumatra, Indonesia. 9-13 September 1994. ACIAR Proceedings no. 64, 1994.

[3] Kaligis, D.A., Performance of pasture species under free grazing in Coconut plantation. In: Integrated Crop-Livestock Production System and Fodder Trees. Ed: Abella C. de la Vina and Frank A. Moog. Proc. 6th Meeting of regional working group on grazing and feed resources for Southeast Asia, October 5-9, 1998, Mayon International Hotel, Legaspi City, Philippines, 1998.

[4] Mullen, B.F., Rika, I.K., Kaligis,D.A and W.W Stur, Performans of grass Legumes pastures under coconut in Indonesia. Expl. 1997, Agric. 33, 1997, p 409-423.

[5] Pereira, J.M., Tarre, R.M., Macedo, R and R.M. Boddey, Productivity of B.humidicola pastures in Atlantic forest region of Brazil as affected by stocking rate and the presence of a forage legume. 2009, Nutr. Cycl. Agroecosyst 83, 2009, p 179-196.

[6] Shelton, H.M., Productivity of cattle under coconuts. In: Forage for Plantation Crops. Ed.:H.M. Shelton and W.W. Stur. Procceding of a workshop, Sanur Beach, Bali Indonesia 27-29 June, 1990. ACIAR Proc. No. 32, 1990.