The effect of gliricidia or mixture of rice bran and copra meal supplementation on feed intake, digestibility and live weight gain of early weaned Bali calves fed a Mulato grass[1]

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ABSTRACT: This study was done to examine the effect gliricidia or mixture of rice bran and copra meal supplementation on feed intake, digestion and growth of weaned Bali calves given Mulato grass. Eighteen male Bali calves approximately 115±5.5 (SE) kg in initial weight and 11 months of age were housed in pen and allocated to one of three dietary treatments. The treatments were Mulato grass (MG) *ad libitum*, MG *ad libitum* supplemented with gliricidia and MG *ad libitum* supplemented with a mixture of rice bran and copra meal (RBCM) in equal proportions (1% W/d, DM). The experimental design was a completely randomized block design, with 3 treatments and 6 replicates (animals) per treatment. The length of experiment was 10 weeks, consisting of a 2 week preliminary period for adaptation to diets and an 8 week experimental period for measurements. Parameters measured were feed intake, feed digestibility and daily liveweight gain. In all parameters measured, there was a significant differences ($P<0.05$) among three dietary treatments. Bali calves given MG *ad libitum* plus RBCM showed highest feed intake, digestibility and daily live weight gain, while calves receiving MG only showed the lowest feed intake, digestibility and daily liveweight gain. In conclusion, this study demonstrated that combination between energy and protein content of the diet dictated feed intake, digestibility and daily liveweight gain of weaned Bali calves.

Key words: Bali calves, mulato grass, rice bran, copra meal

INTRODUCTION

Bali cattle is one Indonesian native breed which has played a significant role in farming system in Indonesia. However, the growth rate of Bali cattle managed under smallholder farming system is generally low when cattle rely on native grass. Many studies (Abduh *et al*., 1992; Bahar and Rachmat, 2003 and Marsetyo *et al*., 2006) indicated that the growth performance of Bali cattle grazing on natural pasture or given native grass is about 200 g/d. Furthermore, report on station studies conducted at Grati, Lombok, Kupang and Palu indicated that the daily live weight gain of weaned Bali calves were 122, 25, 24 and 103 g/d, respectively (ACIAR Report, 2008). The poor performance of Bali cattle given solely native grass are mostly due to low protein content of native grass. Amar (2008) reported that crude protein (CP) content of natural pastures in Palu was 4-6%. In addition, ACIAR Report (2008) indicated that CP content of native grass in Grati, Lombok, Kupang and Palu ranged at 5-8% which suggested that additional CP is needed to increase cattle performance.

One strategy to increase growth performance young Bali cattle are through providing forage or feed with higher energy and CP content. The use of Mulato grass (*Brachiaria mulato*) and addition of high CP content supplement such as Gliricidia or RBCM have high possibility to improve the performance of Bali cattle under current system which is mostly rely on native grass. Mulato is tropical warm-season forage native grass to Africa which has been introduced to Indonesia since 2006 and Central Sulawesi 2008. CIAT (2002) reported that Mulato is highly palatable to ruminants which contained 11-13% of CP and 70% of digestibility. Damry *et al* (2009) reported that MG is well

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adapted in Palu Central Sulawesi, with CP content ranged from 9-13%. Marsetyo *et al*. (2009) suggested that growth rate of weaned Bali calves was higher when given MG than native grass. While addition of Gliricidia or RBCM to native grass has shown an increase in growth of weaned Bali calves in previous studies (Marsetyo *et al*., 2007; ACIAR Report, 2008). Gliricidia, rice bran and copra meal are available at farmer level in Central Sulawesi, therefore high adoption rate is expected from this experiment. However, the use of MG either as a single feed or in combination with Gliricidia or RBCM and their effect on intake, digestion and growth of weaned Bali calves have not been studied yet. This study is therefore aimed to examine the response of weaned Bali calves given MG and MG plus Gliricidia or RBCM. Some parameters such as feed intake, digestibility and daily liveweight gain were measured in order to study Bali calves response to those dietary treatments.

MATERIALS AND METHODS

Treatment and Feeding

The experiment was conducted in the pen located in the village of Malonas, District Donggala, Central Sulawesi (0°30'N to 2°20'S and 119°45'E to 121°45'E), from August to October 2009. The experiment lasted 10 weeks, consisting of a 2 week preliminary period for adaptation to diets and an 8 week experimental period for measurements of feed intake, digestibility and growth. The experimental design was a completely randomized block design, with 3 treatments and 6 replicates (animals) per treatment. Animals were ranked and blocked on the basis of an unfasted live weight. Within blocks animals were then randomly allocated to individual pens and treatments. All calves were treated with Ivomec (1 mL per 10 kg of live weight) for internal and external parasites at the beginning of this preliminary period.

Eighteen Bali calves approximately 115±5.6 (SE) kg in initial weight and 11 months of age were allocated to one of three dietary treatments. The three dietary treatments were MG *ad libitum*, MG *ad libitum* plus Gliricidia (1% W/d) and MG *ad libitum* supplemented with RBCM (1% W/d, DM). The supplements were given once daily at the basis of dry matter, at 07:00 h and fed separately to the MG. The amount of supplement offered was adjusted based on the most recent live weight measurement. The supplements were gradually introduced over the first 7 days of the preliminary period. Mulato grasses were cut locally (Malonas, Donggala district) each day and offered twice a day at 09:00 and 14:00 h. The grass was chopped to 5-10 cm in length before feeding. The amount of grass offered each day was set at 20% more than that consumed by calf on the previous day. Fresh drinking water was provided *ad libitum* to individual animals in a separate bucket.

Measurements

Feed intake was measured daily by recording the amount of feed offered and refused. Daily sub-samples of the grass and supplements offered during experimental period were collected and bulked for analysis of dry matter (DM), organic matter (OM), crude protein(CP), neutral detergent fibre (NDF) and ether extract (EE). Digestibility was measured by total faecal collection over 7 consecutive days during week 8 of collection period. Faeces were collected at 08:00 h each day, weighed and a 10% sub-sample was stored at -20°C and then bulked for each animal over 7 consecutive days. Dry matter content of feeds, refusals and faeces were determined by drying representative samples at 60°C. Live weight was measured each week.

Chemical Analysis

Samples of feeds, refusals and faeces were ground using a refrigerated blender before passing through a 1mm screen. Feed, refusals and faeces were analysed for DM, ash (AOAC, 1984) and ash-free NDF (Goering and Van Soest, 1970). In addition, feeds were also analysed for nitrogen (N) with the Kjeldahl method (AOAC, 1984), and EE (Woodman, 1941).

Parameters Measured

The parameters measured in this experiment were forage DM intake, total DM intake TDMI), dry matter digestibility (DMD) and live weight change.

Statistical Analysis

Data from intake, digestibility and growth studies were analysed as a randomized block design. Least significant difference was used to test for possible differences between treatment means (Steel and Torrie, 1991).

RESULTS AND DISCUSSION

The nutritive value of feed given to calves is presented in Table 1. The main difference between MG, Gliricidia and RBCM is the CP content. The CP content of Gliricidia is more than double of the CP content of MG (21.9 vs 10.4% DM). Glricidia contained the lowest NDF compared with MG and RBCM. RBCM showed the highest DM, and EE contents compared with MG and Gliricidia.

Table 1. Nutritive value of feed used in Experiment

Feedstuff	DM[1], %	OM[1], %DM)	CP[1], % DM	NDF[1], % DM	EE[1], % DM
Mulato grass	26.4	90.6	10.4	56.3	1.4
Gliricidia	28.8	89.6	21.9	39.2	2.4
Rice bran / copra meal[2]	89.6	94.3	17.8	51.5	9.4

[1]Dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fibre (NDF), ether extract (EE).
[2]Rice bran and copra meal were mixed in equal proportions prior to feeding.

The effect of supplement intake on feed intake is shown in Table 2. Forage DM intake was highest ($P<0.05$) for animals receiving MG only followed by animal receiving MG plus RBCM and Gliricidia supplements, respectively, but no difference ($P>0.05$) between the last two groups. All calves receiving Gliricidia or RBCM consumed 100% of their total allowance. Total DM intake expressed as percentage of liveweight was highest ($P<0.05$) for calves received MG supplemented with RBCM, followed by calves received MG plus Gliricidia and MG only, respectively. Although the addition of supplement increased total DM intake, in fact, supplement resulted in the decline of forage intake that often called as a substitution. In this study, the substitution rates with addition of Gliricidia and RBCM (1%W/d) were 22 and 16%, respectively. This is only small substitution rate. The reason of this substitution is not clear but probably because of limited gut fill and increasing intake of metabolisable energy (ME) due to supplemental feed. Animal received either Gliricidia or RBCM had higher total digestible DM intake suggest that their ME intakes were higher than animal received MG only. Marsetyo (2003) suggests that high ME content from supplemental feed can potentially result in the decrease in forage intake.

The effect of supplement intake on DMD, total digestible DM intake and daily liveweight gain are shown in Table 2. There were significant differences ($P<0.05$) in DMD, total digestible DM intake and daily live weight gain among three dietary treatments. These parameters follow the pattern of TDMI in which the greatest value was achieved by calves received MG *ad libitum* plus RBCM, followed by calves received MG *ad libitum* plus Gliricida and calves received MG only, respectively (Table 2). Total Digestible DM intake expressed as percentage of body weight of calves received MG plus RBCM was 11 and 49% higher than caves received MG plus Gliricidia and MG only, respectively. This study demonstrated that addition extra nitrogen (N) to calves given MG could stimulate feed intake and digestibility. The stimulation of total intake and digestibility of calves supplemented with Gliricidia or RBCM could be due to increased N intake and supported by earlier

studies (McLennan *et al*., 1981; Pearson and Archibald, 1990; Bowen *et al*., 1998). Assuming that N is one of the major limiting nutrients (along with minerals, particularly sulphur, and soluble carbohydrate) in forage, a significant increase in intake and digestibility could have been expected when supplementary nitrogen was provided. Carbohydrate supplementation in addition, supplies substrates for microbial activity in the rumen. The reason for the highest responses in total intake, digestibility for calves received RBCM could be due to addition of extra N and carbohydrate from feed component such as rice bran. These results suggest that combination between energy and protein content of the diet dictated feed intake and digestibility of weaned Bali calves.

Table 2. Feed intake, digestibility and growth of weaned Bali calves given Mulato grass, Mulato grass plus Gliricidia or a mixture of rice bran and copra meal

Parameter	Mulato grass (MG)	MG+ Gliricidia	MG+ (rice bran / copra meal)
Forage intake, kg DM/d	3.13± 0.41	2.32 ± 0.09	3.07 ± 0.09
Forage intake, %W/d	2.65± 0.21[a]	2.06± 0.09[b]	2.23 ± 0.09[b]
Supplement intake, kg DM/d	0.0	1.15± 0.06	1.39± 0.06
Supplement intake, %W/d	0.0	1.00	1.00
Total intake, kg DM/d	3.13± 0.41	3.47± 0.14	4.46 ± 0.20
Total intake, %W/d	2.65± 0.21 [a]	3.06± 0.10 [b]	3.23 ± 0.06[c]
Dry matter digestibility, %	56.2± 0.77[a]	61.1± 0.62[b]	64.1± 0.86[c]
Total digestible DM intake, kg DM/d	1.76± 0.14	2.12± 0,09	2.86± 0.13
Total digestible DM intake, %W/d	1.39± 0.05[a]	1.86± 0.08[b]	2.07± 0.06[c]
Daily live weight gain, g/h/d	311 ± 11.9[a]	420± 13.5[b]	521 ± 10.7[c]

[abc] Means with different superscripts in same row are different (P<0.05).

Bali calves receiving MG with no supplementation showed the lowest (P<0.05) growth rate followed by MG plus Gliricidia and RBCM supplementation, respectively. The main constrainsts leading to these lower cattle performances given MG only are probably from lower supply of protein or other nutrients for animal, which result in the low rate of productivity. Many previous studies (Marsetyo *et al*., 2007; ACIAR Report, 2008; Damry *et al*., 2008; Panjaitan *et al*., 2008) indicated that CP content of forages influence significantly feed intake and digestibility, and retention time of digesta in the rumen. The total feed intake and digestibility of calves received MG were significantly lower (P<0.05) than calves received MG plus Gliricidia or RBCM. This contention is supported by Panjaitan *et al*. (2008) who suggested that the lower of CP content of forages the longer retention time its digesta in the rumen. For example, cattle fed Speargrass (*Heteropogon contortus*) with a CP content of 2.57%, the digesta stay in the rumen for 72 hours. In contrast, cattle given Pangola grass (*Digitaria eriantha*) with a CP content of 7.55%, retained the digesta in the rumen for 28.6 hours.

The growth performance of Bali cattle fed MG only was higher than Bali catte received native grass. In a previous study, Bahar and Rachman (2003), for example, reported that the daily live weight gain of young Bali cattle, grazing on native grass in South Sulawesi ranged from 5 to 100 g/d during the dry season. Paat and Winugroho (1990) found that the growth of Bali cattle grazing native grass in South Sulawesi was 40 g/day, while Abduh *et al*. (1992) reported that the live weight gain of 115 kg Bali cattle grazing native grass in Gowa District of South Sulawesi was 321 g/day. Damry *et al*. (2008) noted that growth of weaned Bali calves grazed in Donggala, Central Sulawesi was 286 g/d. In the present study, Bali calves given native MG only exhibited a growth rate of 311 g/day.

It is evident from the current study, and others (Parwati *et al*., 1999; Marsetyo, *et al*., 2007; ACIAR Report, 2008; Damry *et al.*, 2008), that native grass alone will not provide sufficient nutrients required to maximize the growth potential of young growing Bali cattle. Higher growth rates of Bali cattle can be achieved through introduction improved pasture or the provision of simple supplements, such as Gliricidia or RBCM. The current study demonstrated that when Bali calves fed MG only, they grew faster than calves given native grass. However the addition of simple supplements, such as Gliricidia or RBCM to MG can result in higher daily live weight gain than calves given MG only. The main reason for difference in daily liveweight gain of calves offered with three dietary treatments was probably differences in total digestible DM intake. As can be seen from Table 2, that total

digestible DM intake of calves received MG plus Gliricidia and RBCM was 34 and 49% higher than calves received MG only, respectively.

It is difficult to compare the data of liveweight gain of cattle offered with MG as single feed with other studies. The only data available were in Lombok (ACIAR Report, 2008; Marsetyo et al. 2009). Marsetyo (2009) reported that Bali calves given MG only showed a daily growth rate of 366 g//d which is close to the current result (311 g/d). Both studies used similar materials with similar chemical contents so it is no surprising for the close growth rate data. However, study in Lombok suggested that daily liveweight gain of Bali calves based on MG was 169 g/d (ACIAR Report, 2008). This value is below the liveweight gain of the current study. The reason for the differences is probably CP content which associated with harvest time. In addition, the highest value of daily liveweight gain in this current study is approaching the genetic potential of Bali calves maximum growth. Study conducted at Grati East Java suggested that the highest growth rate of Bali calves received high protein content (18.8%) was 646 g/d.

CONCLUSIONS

It is concluded that addition protein from supplement feed can stimulate feed intake, feed digestibility and growth rates of young Bali calves given Mulato grass. However supplementation with protein and energy source resulted in highest daily liveweight gain of Bali calves received Mulato grass mainly through increased dry matter intake and digestibility.

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