Effects of supplementation with *Gliricidia sepium* leaves on performance of Bali cattle fed elephant grass

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Abstract

The increasing price of concentrates make its supplementation to livestock fed low quality grasses is prohibitively expensive. This causes the need for less dependence on concentrates and more emphasis on quality forages like *Gliricidia sepium* for use in livestock production system. To evaluate the efficacy of *Gliricidia* as supplement, an experiment was carried out to determine the effect of incremental levels of *Giricidia* leaves on dry matter intake, digestibility and growth of Bali cattle fed elephant grass basal diets. The animals were randomly assigned to four experimental diets i.e: Elephant grass 100% (EG100), EG85, EG70 and EG55% (DM basis).The basal and supplement component of diets were mixed homogenously before offered to the cattle. Results indicate that dry matter intake, dry matter digestibility, gain and feed efficiency of Bali cattle increased linearly as the proportion of *Gliricidia* increased in the diets up to 45% level. It can be concluded that supplementation of *Gliricidia* u up to 45% level is very beneficial to increase performance of Bali cattle fed elephant grass basal diets.

Keywords: *animal performance, Bali cattle, mother of cocoa, napier grass, supplement*

Introduction

In many developing countries like Indonesia, demand for meats is far exceeding domestic supply. In 2017, due to low productivity of livestock reared by the farmers, the government of Indonesia had to import about 40% of her meat demand, mostly from Australia. While demand for meat is steadily increasing due to human population and income growth, the domestic population of livestock is hardly increasing. This mainly caused by low and seasonal productivity and quality of natural grass and shrinking grassland area as resulted from conversion much of grassland area into other purposes such as agricultural and plantation crops, housing and industrial estates. Consequently, most of the rest grasslands are undergoing overgrazing and this promotes invasion of alien pernicious weed like *Chromolaena odorata* and *Lantana camara*. Due to shrinking grassland areas, most of livestock reared by the farmers have to be grazed on non-conventional areas like abandoned plantation estates, river bank, under coconut plantation crops, marginal lands and forest margin. During the dry season, many livestock have to be fed with low quality feeds such as standing hay, crop residues and low quality agro-industrial by-products.

To cope with shortage of feed, the government of Indonesia has been encouraging the farmers to cultivate high yielding and dry season tolerant grass, mainly elephant grass (*Pennisetum purpureum*). Now, this grass has been the most widely cultivated fodder and it is mainly utilized in cut and carry system for beef and dairy feeding.

As animal feed, elephant grass has been subjected to many studies. In general, although it is harvested at proper intervals, this grass can only support low levels of animal production (Odhiambo 1974, Muinga et al 1992, Antari et al 2016). This is attributed to its high levels of NDF and ADF and low levels of crude protein and digestibility (Rusdy 2016). Improvement of livestock production fed on the low quality grass could be conducted through supplementation with concentrate or high quality forages like legume forages. In most tropical areas, the use of commercial concentrate is limited by high cost and unavailability. The use of quality forage like legume forage leaves as supplement is more promising, because besides cheaper, they also contain low levels of fiber and higher levels of protein, digestibility and some minerals. Many tree legumes are also more resistant to drought conditions, so availability of feeds can be more guaranteed throughout the year.

One of the promising forage legumes that can be used as supplement to ruminants is *Gliricidia sepium*. In Indonesia, this plant is considered as the most widely cultivated multi-purposes tree after *Leucaena leucocephala*. Glircidia leaves contain high levels of protein and low fiber (Man and Wiktorsson 2002) that make it suitable to be used as supplement for livestock fed on low quality forages such as elephant grass. There is a limited study concerning the use of *Gliricidia* leaves as supplement to Bali cattle, the indigenous cattle of Indonesia. The objective of this study was to evaluate the effect of *Gliricidia* leaves supplementation on performance of growing Bali cattle fed elephant grass basal diets.

Materials and methods

Site

The experiment was conducted at Maiwa Breeding Center, an experimental farm owned by Faculty of Animal Science Hasanuddin University. It locates at Maiwa, Enrekang district (latitude 3^{o} 27$^{'}$32'', longitude 110^{o} 52' 53''), with a distance about 180 km from Makassar, the capital of South Sulawesi province, Indonesia. Temperature of the site ranging from 21.4 to 31.9^{o} C and rainy season occurs from November to April with the peak of rainy season is in December and January. The total annual rainfall is about 2400 mm. The experiment lasted from September until December 2018.

Feeds, animals, treatment and management

Elephant grass with regrowth age of 1.5 to 2.5 months and *Gliricidia* ;leaves were harvested inside of Maiwa Breeding Centre area with sickle daily and chopped with motorized chopper into pieces (5 – 10 cm length). Both forages were harvested in the morning for feeding in the afternoon, some of them allowed to wilt overnight for feeding in the next morning. Big stems of both forages species were removed to ensure they can be consumed uniformly.

Twelve female Bali cattle with age between 1.5 to 2 years old and average initial body weight of 110 kg ranged from 101 to 127 kg were housed individually in partitioned pens measuring 2 x 1.25 m for each cow with concrete floor, metal sides and zinc roof. Each pen equipped with feeding and watering facilities.

The animals received four experimental diets in a randomized complete block design with three replicates. The experimental diets were: EG100 (elephant grass 100%), EG85, EG70 and EG55 (dry matter basis). A 21 day adaptation period was used to allow the animals to get used to the xperimental diets. Before commencement of study, all the animals were treated with internal and external parasites.

Feed collection period lasted for 10 weeks. During this period, experimental diets were offered daily at 8/00 AM and 17.00 PM. Feed offered and refusals were weighed every day to determine feed intake. The experimental diets were adjusted so that 10 - 20% remained of previous day intake. All the experimental diets were fed *ad libitum*. The experimental diets were sampled every two weeks, samples were bulked and later analyzed. Clean drinking water was provided at all times. Animals were weighed at the beginning of the study and subsequently every 7 days until day 70. Average daily gains were calculated as differences between final and initial body weights divided by number of feeding days. Feed conversion rate was calculated as weight of feed DM consumed divided by weight gain.

Digestion trial

A digestion trial was conducted during the 11 th week of study. About 20 g of fresh feces of each animal were collected daily. After weighing, the daily feces were kept in the refrigerator at temperature of 4^{o} C. At the end of the 7 days collection, the feces of each animal were bulked, mixed and sampled. The samples were oven dried at 60^{o} C for 72 hrs to determine fecal dry matter. The samples were then milled to pass a 1 mm screen and stored in plastic cups for determining dry matter digestibility, using acid insoluble ash (Van Soest 1994).

Chemical analysis

Dry matter content of the feed and feces was determined by oven drying the samples at 100^{o} C for 24 hours. Nitrogen content of the feeds and feces were determined by micro Kjeldahl method (AOAC 1980). Neutral detergent fiber (NDF) and acid detergent fiber (ADF) were determined using the procedure of Goering and Van Soest (1970). Calcium and phosphorus were determined with inductively coupled plasma optical emission spectrophotometry (SOP 2005).

Statistical analysis

Data on gain, dry matter intake, crude protein intake, dry matter digestibility and feed conversion rate were analyzed with ANOVA with individual cattle as replications.

Results and discussion

Nutritional composition of elephant grass and *Gliricidia*

As expected, elephant grass had lower protein and higher NDF and ADF content than *Gliricidia (*Table 1). Crude protein of elephant grass used in this study (8.65%) is not too different with reports in the literature. Njoka-Njiru et al (2006) and Antony and Thomas (2014) reported protein values of elephant grass were 8.10 and 9.60% when the grass harvested at 42 and 45 days, respectively. Crude protein content of elephant used in this study is slightly above the protein requirement for maintenance of ruminants (Milford and Minson 1966).

Gliricidia leaves had a high nutritive value, with crude protein of 22.6% of dry matter. This value is not too different with the report of Owamuka (2018) for crude protein content of *Gliicidia* of 20.7 in Nigeria while Alonso et al (2003) reported crude protein content of *Gliricidia* cv. Cuba of 24.3%.

NDF and ADF contents of *Gliricidia* were lower than those of elephant grass (Table 1). The higher NDF and ADF content

of grass than legumes is in agreement with reports in the literatures (Abdulrazak et al 1996, Tambara et al (2017).

Table 1. Nutritional composition of elephant grass and *Gliricidia sepium* (% DM except for dry matter which is on fresh basis)

Nutritional composition	Elephant grass	*Gliricidia*
Dry matter	17.4	19.0
Crude protein	8.65	22.6
NDF	66.5	44.3
ADF	43.3	6.80
ADL	6.27	5.67
Calcium	0.18	1.74
Phosphorus	0.13	0.17

Animal performance

The lowest dry matter intake was found for animals fed sole elephant grass and the highest with 45% level gliricidia.

With ncreasing gliricidia levels, total dry matter intake, dry matter digestibility and daily gain increased. Similar trend was also reported in cattle supplemented with *Gliricidia* and in an elephant grass basal diet (Abdulrazak et al 1996, Marsetyo et al 2012) and in Bunaji bulls supplemented with *Gliricidia* (Jokhtan 2013). In goats, improvemed performance by *Gliricidia* supplementation was reported by Ondiek et al (2000), Phimphachanhhyongsod and Ledin (2002) and Mpairwe et al (2003) and in sheep by Fasae et al (2014).

The positive effect of *Gliricidia* supplementation on dry matter intake and dry matter digestibility could be attributed to the high protein contents of protein and fermentable energy of *Gliricidia*. *In sacco* studies indicates the higher rumen dry matter degradability of *Gliricidia* leaves over elephant grass. Rumen degradability of *Gliricidia* leaves incubated for 48 h was 69.0% (Odeyinka et al 2003); higher than degradability of elephant grass incubated for the same time (42.1%) (Rambau et al 2016).

Table 2. Live weight, daily gain, dry matter and crude protein intake, dry matter digestibility and feed conversion ratio of cattle fed experimental diets

Parameter	EG100	EG85	EG70	EG55	SEM	*p*
Initial weight, kg	109	109	111	111	0.53	>0.05
Final weight, kg	121^{a}	127^{ab}	133^{b}	138^{c}	3.93	<0.01
Gain, kg	11.2^{a}	16.8^{b}	21.7^{c}	27.3^{d}	3.43	<0.01
Daily gain, kg	0.16^{a}	0.24^{b}	0.31^{c}	0.39^{d}	0.05	<0.01
DMI, kg/d	2.50^{a}	2.95^{ab}	3.26^{b}	3.50^{b}	0.25	<0.05
CPI, kg/d	0.22^{a}	0.32^{b}	0.42^{c}	0.55^{d}	0.22	<0.01
DM digestibility	0.57^{a}	$0.59a^{b}$	0.63^{b}.	0.64^{b}.	0.01	<0.05
Feed conversion ratio, DMI/kg gain	15.6^{c}	12.3^{b}	10.5^{ab}	8.97^{a}	1.34	<0.01

Values with the same superscript at the same row do not differ at p<0.05

Figure 1. Effect on daily weight gain of Bali cattle of replacing Elephant grass with *Gliricidia sepium leaves*

As increasing *Gliricidia* levels, daily gain increased (Fig.1) The positive effect of *Gliricidia* supplementation on daily gain of Bali cattle in the present study is in line with the work of Marsetyo et al (2012) who reported daily gain of 0.174 g when Bali cattle fed sole elephant grass ad libitum, but increased to 0.311 g/day when elephant grass supplemented with *Gliricidia* at 10 g DM/kg body weight/day. However, the daily gain in this study was lower compared with the work of Abdulrazak et al (1996). who reported that when beef cattle fed sole elephant grass diet, daily gain was 0.31 kg, but when elephant grass supplemented with 30 g DM/kg $MW^{0.75}$ *Gliricidia*, they gained to 0.48 kg/day.

In the present study, daily gain was the lowest when animals fed sole elephant grass and attained the highest when *Gliricidia* fed to animals at 45% inclusion level. It needs further study to determine the effects of feeding of *Gliricidia* at higher inclusion level. However, the optimum level of *Gliricidia* might be below 100%, because feeding of *Gliricidia* to Bali cattle at 100% level resulted in the lower daily gain compared to the feeding mixture of elephant grass - *Gliricidia* diet (Marsetyo et al 2012). Jokhtan (2013) reported that daily gain of cattle attained the highest level when the diets comprised of 50% *Gliricidia* and 50% cottonseed cake (dry matter basis), while in goats, Aregheore et al (2002) reported that inclusion of *Gliricidia* at 50% level resulted in the highest daily gain when *Ischaemum aristatum* was used as basal diet. However, Phimphachandhovangsod and Ledin (2002) reported that live weight gain was highest when the *Gliricidia* intake comprised 30% of total intake in goats fed *Panicum maximum* basal diet. This might be attributed to the higher nutrient contents of *Panicum maximum* than *Ishaemum aristatum*.

Conclusion

- Supplementation with *Gliricidia* leaves is very beneficial to improve intake, digestibility and gain of Bali cattle fed

elephant grass basal diets.

- Therefore, *Gliricidia* leaves can play a major role as economic supplement to improve performance of Bali cattle fed low quality feed and can be recommended to be cultivated in the farm to reduce feed cost in cattle enterprise.

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