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Potential Utilization of Tree Legume Leaves and Straw as Local Feed Resources of Large Ruminant in the Tropic

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ABSTRACT

The objectives of this study were to determine the ability of ongole grade cattle (OGC) and Buffaloes (B) in intake and digestibility of Calliandra calothyrsus (CC), Gliricidia sp. (G) Corn stover (CS). The study used 5 females (OGC) and 5 females (B). This research was carried out in two periods, namely the adaptation period 14 days and the collection period 15 days. The variables observed were voluntary intake of neutral detergent fiber (VINDF), digestibility of neutral detergent fiber (DNDF), digestibility of acid detergent fiber (DADF), digestibility of crude protein (DCP). Treatment is designed in 2 x 3 factorial. The results showed that (OGC) and (B) had different abilities to intake NDF (g/kg BW 0.75day) (1.72 vs 1.86). (B) have the ability to intake NDF (CS) higher than OGC (4.13 vs 3.80) while (CC) and G are the same (0.80 vs 1.27 and (0.57 vs 0.57). (B) have the ability to intake NDF (CS) higher than OGC (4.13 vs 3.80) while (CC) and (G) are the same (0.8 vs 1.27 and 0.57 vs 0.57). (OGC) and (B) are the same in (DCP), NDF and ADF (%). (DNDF) and (DADF) was highest at (CS) (68.53; 63.57) then (G) (43.87; 42.50) and lowest at (CC) (40.48; 33.19). The highest (DCP) was at (G) (66.04) followed by (CC) (47.47) and (CS) (944.10). In conclusion, intake NDF (CS) was higher than (CC) and (G). (DNDF) and (DADF) (CS) was higher than (G) and (CC). Intake of NDF (CS) in (B) is higher than (OGC).

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1. INTRODUCTION

Cattle and buffalo in Indonesia have a dual role, namely as labor and a source of animal protein. To increase the productivity of cattle and buffalo, it is necessary to review the methods of maintenance, especially those related to nutrient needs, the ability to intake dry matter and the digestibility value of feed. The ability to intake a feed ingredient when given as a single feed can provide an overview of its palatability, or the extent to which the feed is liked by livestock. Productivity of ruminants in Indonesia, especially large ruminants, depends on fiber feed, therefore the prediction of feed intake and digestibility is an important aspect. Corn stover is a source of fibrous feed from agricultural plant waste that can be utilized. In addition, Calliandra calothyrsus, Gliricidia sp. can be used as a source of fibrous feed and has a high protein content as ruminant animal feed in the tropics. Feed intake is the most important determining factor that determines the amount

of nutrients that can be obtained by livestock and subsequently affects the level of production [1]. where production efficiency is mainly determined by the intake of digested organic matter [17]. The speed at which livestock intake fiber feed is limited by the capacity of the digestive tract, volume of the rumen, and the rate of passage feed out of the rumen which is based on the relationship between intake and digestibility, fiber content and other indicators that affect the length of stay of feed in the rumen [6]. This study aims to obtain information about the differences in the ability of ongole grade cattle and Buffalo in terms of intake and digesting Corn stover or Calliandra calothyrsus, Gliricidia sp. as the sole feed. It is hoped that this research can be used as basic information on the value of feed Gliricidia, Corn stover and Calliandra, as feed for cattle and buffalo in Indonesia so that suitable supplementation for each feed can be given.

2. Materials and Methods

Materials

Five females ongole grade cattle with a body weight of 150 – 200 kg, aged 2.0 – 2.5 years were used in this study. As well as five females buffaloes with a body weight of 200 – 250 kg aged 2.0 – 2.5 years. 10 individual cages measuring 1.25 x 2 meters equipped with places to eat and drink, scales for weighing livestock and feed . The feed used in this study was Calliandra calothyrsus, Gliricidia sp. and corn stover

Methods

The study consisting of three stages. The first stage of the cattle and buffalo were fed Gliricidia sp, stage II was fed Corn stover and stage III was fed Calliandra calothyrsus. This research was carried out in two periods, namely the adaptation period for 14 days and the collection period for 15 days. The adaptation period is carried out by adapting livestock to the environment and research feed. The provision of research feed is carried out in stages so that the livestock can intake all the research feed. At this period, deworming medication is also given so that the livestock are not attacked by worm parasites. The preliminary stage is a continuation stage after the adaptation stage. The preliminary stage lasts for 14 days and aims to remove food residue in the digestive tract from the previous time. At this stage, observations are made on the ability of livestock to intake feed. At the end of the preliminary stage, the livestock's weight is weighed. During the collection period, samples of feed, feed residue and feces were taken. Every day, the feces are collected in a mixer evenly and weighed, then 10% of the sample is taken, dried, ground and analyzed in the laboratory. Feeding of 80 percent of the livestock's intake capacity during the adaptation stage is done twice a day (08.00 AM and 3.00 PM) while drinking water is provided ad libitum. Due to the facilities are limited and the number of livestock is limited, the treatment is not carried out at the same time. The first treatment uses Ongole grade cattle and Buffalo with Gliricidia sp feed, then Corn stover and lastly Calliandra calothyrsus with the assumption that intake and digestibility are not affected by time and the physiological status of livestock [11], [28]. Parameter calculations are carried out as follows [24]: Feed Intake (Kg) = Feed given (Kg/day) – Remaining Feed (Kg/day)

$$\text{Nutrient digestibility (\%)} = \frac{\text{Nutrient intake } \left({}^{\text{kg}}/_{\text{day}}\right) - \text{Nutrient of feces } \left({}^{\text{kg}}/_{\text{day}}\right)}{\text{Nutrient intake } \left({}^{\text{kg}}/_{\text{day}}\right)} \times 100\ \%$$

Statistical Analysis

The collected data were analyzed by analysis of variance, using the general linear models (GLM) sub-program of the Statistical Analysis System program [22]. Treatment is designed in 2 x 3 factorial randomized block design followed by the Duncan multiple range test [23].

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3. Results and Discussion

Analysis composition of treatment feeds is presented in Tabel 1.

Table 1. Results of the analysis of the chemical composition of feed Glisidia, Corn stover and Calliandra (% DM)

Feed chemical composition	Type of feed		
	Glirisidia sp.	Corn stover	Calliandra
Dry matter	41.02	54.59	31.78
Organic Matter	90.84	96.97	96.13
Crude protein	23.53	5.78	22.29
NDF	35.00	68.60	29.10
ADF	21.80	42.10	18.20

Intake of neutral detergent fiber (NDF) is presented in table 2. The average NDF intake of buffalo (1.86 g/kgBW 0.75day) while the average NDF intake of ongole grade cattle (1.72 g/kgBW 0.75day).

Table 2. Voluntary intake of neutral detergent fiber in ongole grade cattle and buffalo receiving different forages (g/kg BW0.75 day)

Intake NDF	Type of feed			Average
	G	CS	CC	
Cattle	0,57^{c}	3,80^{b}	0,80^{c}	1,72*
Buffalo	0,57^{c}	4,13^{a}	1,27^{c}	1,86*
Average	0,57	3,97	1,04	

Note: The numbers in the same column followed by the same letter are not significantly different (P >0.05), *significant (P<0.05).

Feed intake regulation in ruminants is very complex and many factors are involved [10], [3]. Intake of forage in ruminants has an association effect on digestibility [18]. Intake of NDF in this treatment has a significant effect on cattle and buffalo. There is an interaction between feed and livestock, this means that both feed and livestock simultaneously affect intake of NDF. In this study, buffalo had a significantly higher ability to intake corn stover (CS) than cattle, while Calliandra calothyrsus (CC) and Gliricidia sp.(G) had the same ability. Intake of NDF is related to intake of dry matter. The high intake of CS in buffaloes compared to cattle is due to the intake of dry matter in buffaloes which is higher than cattle [23]. Buffalo cattle are more efficient in utilizing low quality forage than cattle [19]. The low intake of NDF in CC and G is due to the low NDF content of the feed. In addition, it is suspected to be caused by anti-nutritional substances. The presence of tannins at calliandra in the second cell wall resulted in reduced total NDF intake. Furthermore, with increasing age of the plant, the tannin content increases. In other words, the higher the tannin content in a plant, the lower the ability of livestock to intake NDF. The effects of condensed tannins on N metabolism in ruminants vary depending on the plant source and the concentration used [2]. Feed intake in ruminants depends on the taste and degree of digestibility of the feed [5]. If livestock intake feed that contains tannin, the tannin will form compounds with glycoproteins found in saliva, thereby limiting the amount of feed intake. High tannins will reduce the taste and amount of feed intake. The preference level of gliricidia as a single feed in sheep gave unfavorable results, but when added to other feeds it increased intake and digestibility [12]. The use of Calliandra calothyrsus at 30% of grass straw basal feed (Chloris gayana) significantly increased intake and weight gain in crossbred dairy goats (Toggenburg x Small East Africa goat) [15]. Providing 30% calliandra supplements to sheep has great

potential as green feed for ruminants in dry and semi-dry lands because it can increase crude protein content, increase dry matter intake [13]. Calliandra calothyrsus wafer supplement of 12.37% in basal feed significantly increased feed intake, digestibility, weight gain and feed efficiency in Ettawa grade goats [8]. Substitution of concentrate with 15% Gliricidia sp at dairy cattle did not affect ration intake, digestibility and total milk production in the first 3 months of lactation [27]. Supplementation of concentrate feed containing 54.57% Gliricidia sepium leaf flour, 55.59% Leucaena leucocephala, 40.85% Moringa oleifera in Beef Bali Cattle significantly increased feed intake, daily weight gain, feed conversion ratio and digestibility [3]. The low digestibility of crude protein (CP) in CS (Table 3.) is due to the low CP content in CS [25]. Crude protein content of less than 7 percent has a negative effect on digestibility. If the nitrogen precursor is reduced then the microbial activity will be low as a result it will reduce digestibility. In addition, in old plants, protein is bound to the fiber fraction, causing it to be unusable by microbes and by host livestock and is only excreted in feces.

Table 3. Digestibility of crude protein, neutral detergent fiber and Acid detergent fiber in ongole grade cattle and buffalo receiving different forages

Intake (%)	Type of feed			Average
	G	CS	CC	
CP				
Cattle	70,77^{a}	46,21^{c}	48,52^{b}	55,17^{ns}
Buffalo	61,30^{a}	41,10^{c}	46,42^{b}	49,61^{ns}
Average	66,04	44,10	47,47	
NDF				
Cattle	44,27^{b}	69,04^{a}	39,15^{c}	50,82^{ns}
Buffalo	43,47^{b}	68,03^{a}	42,56^{c}	51,35^{ns}
Average	43,87	68,53	40,84	
ADF				
Cattle	43,67^{b}	63,05^{a}	32,94^{c}	46,55^{ns}
Buffalo	41,33^{b}	64,10^{a}	33,45^{c}	46,29^{ns}
Average	42,50	63,57	33,19	

Note: $^{a, b, c}$ The numbers in the same column followed by the same letter are not significantly different (P >0.05), ns = non significant (P>0.05).

The high digestibility of CP in G compared to CC and CS is due to the higher CP content compared to CC and CS [25]. In addition, the utilization of G is more optimal when compared to CC which contains quite high crude protein. This is because the G feed given has experienced withering, the anti-nutritional content such as coumarins is reduced so that its utilization is better than CC which is given in fresh form [20]. The low digestibility of protein in CC is due to the occurrence of covalent bonds between tannins and proteins so that the bonds become irreversible. Tannin condensation binds to cell-coated polymers and inhibits proteolytic activity in Butyrivibrio fibrisolvens and Streptococcus bovis as a result of which protein utilization is reduced [21]. Tannins can prevent rumen nitrogen metabolism by reducing proteolytic bacteria [4]. The low digestibility of NDF and ADF in CC in this study was caused by the binding of tannin compounds to the fiber. Phenolic acid is related to the digestibility of the cell wall [26]. Furthermore, the presence of tannins which are insoluble in NDF and ADF shows that tannins are strongly bound to fiber. Fiber bound to tannins can be resistant to degradation by rumen microbes and also free tannins will inactivate microbes and enzymes as a result of which fermentation in the rumen will be inhibited. There is another possibility that condensed tannins suppress forage digestibility through inhibition of microbial enzymes in the rumen, namely having the ability to suppress bacteriostatic growth as in Fibrobacter

succinogenes and kill bacteriocides [14]. Furthermore, it is suspected that the impact of tannins in the rumen environment is mainly due to its interaction not only fiber but also with enzymes, proteins. This interaction can cause a longer retention time of NDF and ADF components in the feed resulting in delayed rumen emptying and potentially affecting feed intake control [7]. The high digestibility of NDF and ADF CS in this study was due to CS not containing anti-nutrients. Corn stover has no anti-nutritional compounds such as phenolics so that the utilization of this feed can be better [9]. It is recommended that giving 100 grams of corn stover per kilogram of body weight fed with concentrate can increase the growth of Awassi sheep [16].

4. Conclusions

Based on the results of this study, it can be concluded that intake of NDF CS was higher than CC and G. Digestibility of NDF and ADF CS was higher than G and CC. Intake of NDF CS in buffalo is higher than in ongole grade cattle.

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