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Effect of Para Grass and Mimosa Pigra Utilization with Basal Diets of Brewer's Grain and Rice Bran on Growth Performance of Goats under Semi-free Grazing System

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Abstract:- In Cambodia, farmers raise goats in a small scale, and they grow them in the traditional way under free ranging system during the day time and confinement at the night time. Due to the ease growing of para grass, natural growth of mimosa pigra and easily founded around the lakes, rivers, streams, and canals, these grasses are potential plants with high protein for raising goats. The three objectives of this study are to compare: (a) the feed intake of goats; (b) the growth performance of goats; and (c) the feed conversion ratio of goats. As the research methods, this experiment was carried out at Research Station of Svay Rieng University by using RCBD with 4 treatments and 3 replications. All treatments utilized the different levels of para grass and mimosa pigra with basal diets of brewer's grain and rice bran on the growth performance of goats under a semi-free grazing system. Results showed that the highest DM intake of goats from 0–60 days is T4=684 g/day, the highest growth performance of goats from 0–60 days is T2=110 g/day, and the best feed conversion ratio of goats from 0–60 days is T2=5.89 if compared to other treatments. In conclusion, the utilization of 85% para grass combined with 15% mimosa pigra are actually increased the feed intake of goats, increased live weight gain of goats, and well improved feed conversion ratio of goats under the semi-free grazing system.

Keywords:- *Para Grass, Mimosa Pigra, Brewer's Grain, Rice Bran and Growth Performance.*

I. INTRODUCTION

Goat production in Cambodia still remains restricted in comparison to other livestock production methods. Goat production is a customary source of meat for family gatherings and festivities for certain farmers in highland regions. Goat production is often carried out using the traditional management style, in which the goats are confined in an elevated pen at night and released for daytime grazing (Ho Bunyeth & Preston, 2006). The frequency of natural calamities, particularly drought and flooding, is a significant barrier to goat production in the vast system. The high rate of internal parasite infestation in grazing goats is another important constraint (Kochapakdee et al., 2001; Waller, 1999). According to Woodward & Reed (1989), browsing plants are more drought-tolerant than grasses, making them a more dependable and superior feed source for the development of sustainable feeding systems. Small ruminants benefit greatly from these plant resources since they are abundant in protein, permanent feed sources, and readily available in the area (Sokerya & Rodriguez, 2001).

In tropical and subtropical locations, para grass (Brachiaria mutica) is a creeping perennial grass that thrives in a variety of soil types, particularly in marshy and flooded situations. Para grass contains four times the calcium content of rice straw, is very pleasant, and is a good source of the important minerals sodium (Na) and phosphorus (P) (Sath et al., 2013). According to Heinritz et al. (2012), the water-soluble carbohydrate (WSC) contents of the majority of tropical grasses, including Brachiaria species, range from 32 to 77 g/kg DM, which is relatively low for creating well-fermented silages. Furthermore, a great energy supplement for the majority of agricultural animals, including cattle and goats, is sugar palm syrup or energy sources like rice bran or brewer's grain. According to Broderick & Radloff (2004), adding a source of easily digested energy to fresh or silage during feeding promotes the flow of microbial protein into the small intestine and increases the intake of DM linearly. Nevertheless, adverse consequences of supplementing energy, such lowered rumen pH and fiber digestibility, have also been documented (Petit & Veira, 1994).

According to Lonsdale (1992), mimosa pigra (Mimosaceae) originated in Central America. Mimosa pigra is known by its native names in Vietnam (Nguu Ma Vuong) and Cambodia (Preh Khlorm Yeak, or Banlar Youn). Its exceptional development makes it one of the harmful weed species found in tropical wetlands (Tran Triet et al., 2004). Studies have shown that these trees can be used to generate green manure, medications, livestock feed, and erosion prevention in addition to ways to stop harm from the species. In order to minimize the potential for regeneration and ultimately manage the tree's growth, we should chop them down consistently within a short period of time (30 to 45 days) in order to manufacture goat feed (Thu Hong et al., 2008). The two objectives of this measure's application are to restrict the spread of mimosa pigra in the natural environment and to

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supply feed for animals, particularly goats. As an additional invasive weed, mimosa pigra spreads via seeds throughout South East Asia, particularly along riverbanks and other damp places. Farmers now find it more difficult to control their land use because of this weed's quick spread. Miller (1988) suggested that mimosa pigra be controlled by cutting or grazing the plant before it flowers and seeds, or by harvesting the foliage for animals. Recent studies have demonstrated the high nutritional content of mimosa, which may support growth rates of over 100 g/day when grazed in situ (Thu Hong et al., 2008) and over 80 g/day when provided as the only feed while in confinement (Thu Hong et al., 2021).

The rice bran produced in Cambodia is not only dependent on the type of rice but also on how it is milled. According to Harris & Staples (2003), rice bran typically has 12.9% CP and 8.6% CF. Additionally, it was said that rice bran had 60% TDN (as fed), 10% CF, 12% fat, and 12% CP. In comparison to rice and wheat, rice bran has a higher lysine level and a lower glutamic acid concentration. It also has a better balance of essential amino acids, scoring 80% for lysine and 90% for threonine, according to Narasinga & Rao's research (2012). Essential fatty acids (EFA) and energy are abundant in rice bran, which is also a strong source of B-complex vitamins, including thiamine and nicotinic acid, as well as a few other minor B-vitamins.

A by-product of the beer-brewing industry is called wet brewers' grains (WBG). Depending on where the grains came from, some corn or rice may be included in the WBG, which are the discarded grains, which are typically scarcely present. Westendorf & Wohlt (2002) reviewed the nutrient composition of WBG and concluded that the protein, fiber, and energy concentration of WBG make them a good supplement for diets for both ruminants and nonruminants. To enhance rumen function and animal production, WBG may be more advantageous in a ruminant diet due to its high fiber and protein content. Furthermore, the degree of intake in cattle can be influenced by the moisture content of a WBG, especially when it is fed alongside fresh forages or silage. Studies reveal a 0.2 lb/100 lb reduction in dry matter intake for every 10% increase in dietary moisture content (Schingoethe et al., 1988).

Typically, farmers raise goats in a small scale, and they grow them in the same way as any other animals, according to their routines. However, the cost of selling goats in the market has increased, and more people are wishing to raise them. Due to the ease growing of para grass, mimosa pigra and easily founded around the lakes, rivers, streams, and canals, these grasses are potential plants with high protein for animal husbandry.

The objectives of this study are to compare: (a) the feed intake of goats; (b) the growth performance of goats; and (c) the feed conversion ratio of goats.

II. MATERIALS AND METHODS

A. Location and Climate

This research experiment was carried out at Research Station of Svay Rieng University, located in Chambak village, Sangkat Chek, Svay Rieng town, Svay Rieng province. The environmental temperature during the experiment ranged from 37 to 39 degrees centigrade.

B. Experimental Design and Treatments

A total of twelve goats with an average of 17 kg were selected and allocated by the Randomized Complete Block Design (RCBD) with 4 treatments and 3 replications. There were 12 pens totally and each of the experimental pen was two-meter-length, one-meter-width, and 1.6-meter-height. Those pens were constructed from square wood and saplings. Each pen was contained a single goat with waterer and feeder, vaccinated and de-wormed for 15 days before starting the experiment. The period of this experiment for sixty days of which from 01st April to 30th May 2022. 'The treatments (T) were indicated and the experimental layout as follows:

T1: Control (Para grass 100%)
T2: Para grass 85% + Mimosa pigra 15%
T3: Para grass 70% + Brewer's grain 15% + Rice bran 15%
T4: Para grass 55% + Brewers' grain 15% + Rice bran 15% + Mimosa pigra 15%

Table 1. Experimental Layout

Block	**I**		**II**		**III**	
Pens	T2	T1	T1	T4	T3	T2
	T4	T3	T2	T3	T4	T1

Table 2. Composition and Chemical Composition of the goat diets

Ingredients	**T1**	**T2**	**T3**	**T4**
Para grass	100	85	70	55
Mimosa pigra	-	15	-	15
Brewer's grain	-	-	15	15
Rice bran	-	-	15	15
Chemical composition of the feed (%)				
Dry matter (DM)	19.6	21.9	30.9	33.3
Crude protein (CP)	14.5	14.0	15.4	14.9
Organic matter (OM)	87.8	88.7	75.0	64.3
Crude fiber (CF)	31.4	31.5	25.6	25.7

C. Experimental Feeds and Feedings

The experimental materials include para grass purchased from home growers, rice bran from the provincial market, brewer's grain from animal feed vendors in Prasot commune, mimosa pigra found along lakes and streams.

The methods of feeding the goats were divided into two conditions: in the morning, all the goats were regularly mixed the feeds based on goat's body weight and fed to the goats twice a day, from 7 a.m. to 11 a.m., and in the afternoon, free grazing from 2 to 4 p.m. for 2 hours. The goats were weighed before the start of the experiment and every 10 days for up to 60 days during the experiment. The 2 kg scale was used for

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weighing the feed offer and feed refusals, and a 150 kg scale was used for weighing the goats.

D. Sample Collection

At the start of the trial, and then every ten days following that, the animals were weighed in the morning before feeding. Every day, feed offers and refusals were gathered, weighed, and samples were stored in plastic bags frozen at -20°C until analysis. Prior to examination, samples of feed that were accepted and rejected at the conclusion of each ten-day period were carefully combined by hand and homogenized in a coffee grinder.

E. Chemical Analysis

All experimental data were entered into Microsoft Excel and analyzed by the software program of General Linear Model (GLM) via the ANOVA option of Minitab Version 16. All mean values were compared by Turkey method in Minitab version 16 The sources of variation were treatments, replications and error.

III. RESULTS AND DISCUSSION

A. The feed intake of goats

➢ *Feed intake in dry matter of goats (g/day)*

A total of feed intake in dry matter (DM) in treatment 4 was higher. However, they were non-significant different if comparing to the treatment 1, treatment 2 and treatment 3 (P>0.05) (Table 3, Figure 1 and Figure 2).

These results are higher than the findings of Bui Phan Thu Hang et al. (2022) who reported that the maximum DM feed intake was 546 g/day as feeding the goats with Melia azedarach foliage 1.5% mixed with mimosa pigra and those goats were confine in the pens. However, these results are similar to the result of Thu Hong et al. (2008) who reported that the highest of intake was 632 g/day as the goats fed with the mixture of para grass plus mimosa pigra under free choice.

Table 3. Mean values of feed intake of goats

	T1	T2	T3	T4	SEM	P-value
DM intake, g/day						
Para grass (PG)	643	322	506	253	5.23	
Mimosa pigra (MP)	-	322	-	271	2.01	
Brewer's grain (BG)	-	-	63	63	0.64	
Rice bran (RB)	-	-	57	57	0.57	
Total	**643**	**644**	**626**	**645**	**7.29**	0.207
DM, g/kg LW	**30^{b}**	**29.7^{c}**	**29.7^{c}**	**30.7^{a}**	**0.07**	<0.001
Total CP, g/day	**92.5^{c}**	**122^{a}**	**84.0^{d}**	**112^{b}**	**1.16**	<0.001
Total CF, g/day	**40.4^{a}**	**40.9^{a}**	**34.7^{c}**	**36.2^{b}**	**0.42**	<0.001

abcd: Mean values within row without a common letter are different at P<0.05

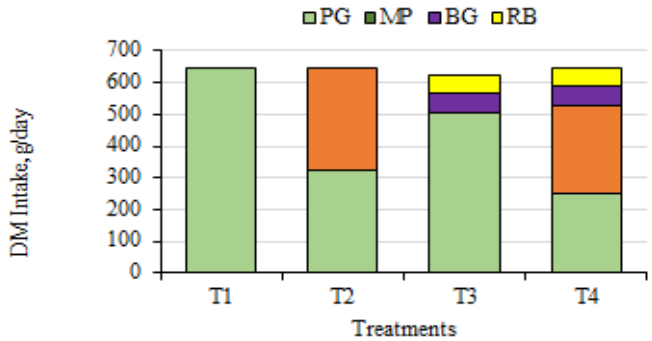

Fig 1 DM feed intake of goats in feed Composition (g/day)

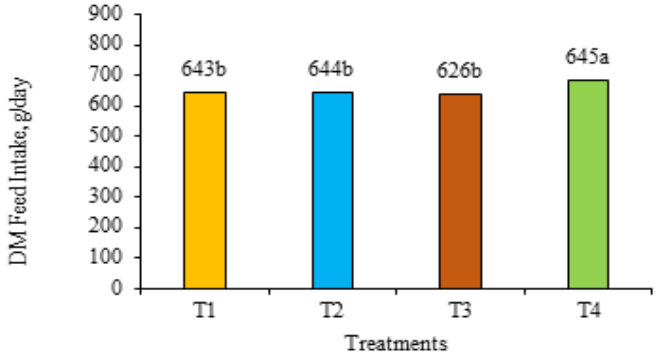

Fig 2. DM feed intake of goats from 0-60 days (g/day)

➢ *Protein intake of goats (g/day)*

A total of protein intake (CP) among all treatments were very significant different (P<0.05). However, the treatment 2 was highest once comparing to the treatment 1, treatment 3 and treatment 4 (Table 3 and Figure 3).

These results are higher than to the findings of the result of Thu Hong et al. (2008) who reported that the highest of protein intake was 64.3 g/day when the goats fed with the mixture of para grass plus mimosa pigra under free choice. However, the results are similar to the finding by Bui Phan Thu Hang et al. (2022) who reported that the maximum of crude protein intake was 124 g/day as feeding the goats with Melia azedarach foliage 0.5% mixed with mimosa pigra under the goats were kept by the confined condition. Moreover, these results are also similar to Thu Hong et al. (2021) who reported that the highest of crude protein intake was 96.5 g/day as the goats were fed with the combination of mimosa pigra, water spinach, concentrate feed and tannin during the experiment.

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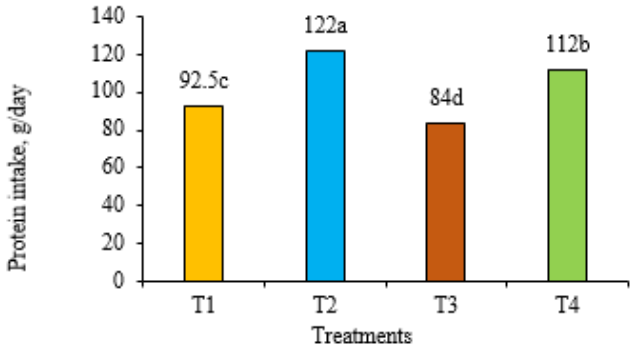

Fig 3: Protein intake of goats from 0-60 days (g/day)

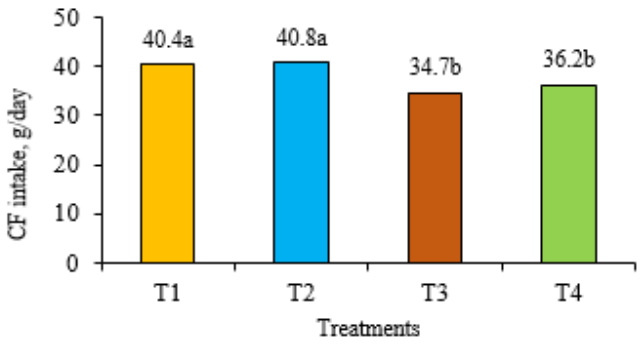

Fig 4: Crude fiber intake of goats from 0-60 days (g/day)

➢ *Crude fiber intake of goats (g/day)*

A total of crude fiber intake in dry matter of treatment 1 and treatment 2 were higher and very significant different as compared with the treatment 3 and treatment 4 (P<0.01). For the treatment 4 was higher and very significant different as compared with the treatment 3 (P<0.01) (Table 3 and Figure 4).

These findings are lower than to the findings of the result of Sath et al. (2013) who reported that the goats fed the ensiled para grass with 3% of sugar palm syrup but the recent findings fed the goats with the fresh para grass or para grass mixed with mimosa pigra or para grass plus brewer's grain. However, the current findings were similar to the result of Nguyen Thi Thu Hong et. al (2008) who reported that the highest of crude fiber was ranged from 35.4 to 66.6 g/day when the goats fed with the mixture of para grass plus mimosa pigra or only mimosa pigra.

B. The growth performance of goats

The growth rate of goats of the treatment 2 was higher than the treatment 1, treatment 3 and treatment 4, even thought the live weight gain of goats were weighted either during 0-30days or 30-60days or 0-60days. However, those treatments were non-significant (P>0.05) (Table 4 and Figure 5). Anyway, the relationship between DM feed intake and live weight gain showed that the live weight gain was slightly linear related to the DM intake (Figure 6).

According to these results are higher than to the findings of the result of Nguyen Thi Thu Hong et. al (2008) who reported that live weight gain was ranged from 67.9 to 82.5 g/day when the goats fed with the mixture of para grass plus mimosa pigra or mimosa pigra alone respectively under free choice and night time supplementation with grass under confinement. In addition, the results are also higher to the finding by Bui Phan Thu Hang et al. (2022) who reported that the maximum of crude protein intake was 40 g/day as feeding the goats with Melia azedarach foliage 0.5% mixed with mimosa pigra or feeding only mimosa pigra under the condition of confinement.

Table 4. Mean values for main effects on growth rate and feed conversion ratio of goats

	T1	T2	T3	T4	SEM	P-value
Live weight, kg						
Initial	17.5	18.2	17.5	17.5	1.50	0.98
30 days	19.5	20.3	19.3	19.8	1.69	0.97
60 days	21.3	22.7	20.8	21.5	1.89	0.92
Final	22.5	23.6	21.7	22.5	1.90	0.91
Live weight gain, g/day						
0 - 30 days	86.7	117	73.3	80.0	20.1	0.47
30 - 60 days	127	117	86.7	86.7	11.3	0.07
0-60 days	104	110	83.9	97.2	9.11	0.27
FCR, kg/kg of body weight						
0 - 30 days	6.6	5.53	8.57	7.82	0.72	0.07
30 - 60 days	6.07	5.76	8.06	7.72	0.94	0.28
0 -60 days	6.14^{b}	5.89^{b}	7.57^{a}	7.08^{a}	0.22	0.001

ab: Mean values within row without a common letter are different at P<0.05

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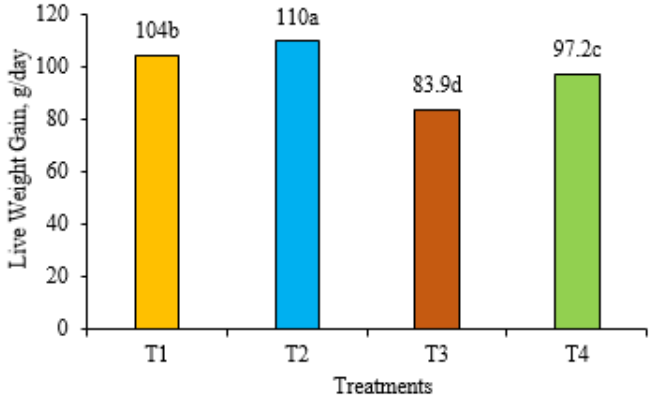

Fig 5. Growth performance of goats from 0-60 days (g/day)

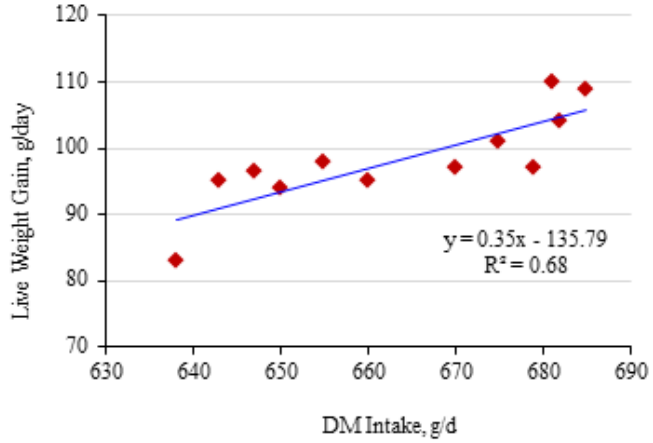

Fig 6. Relationship between live weight gain and DM intake of goats from 0-60 days (g/day)

C. The feed conversion ratio of goats

The feed conversion ratio of the treatment 2 in the period of 0-30 days and 30-60 days was better than other treatments but if compared among these treatments were non-significantly differences (P>0.05) (Table 4). Moreover, the overall of the feed conversion ratio of the treatment 2 was better improved than treatment 1, treatment 3 and treatment 4 (Table 4 and Figure 7).

In regard to this finding was agreed with Bui Phan Thu Hang et al. (2022) who fed the goats with mimosa pigra only or mimosa pigra with different levels of 0.5 to 1.5% mixed with Meia azedarach foliage. In addition, the results were slightly lower than to the finding of Mupenzi et al. (2021) who used brachiaia grass and napier grass mixed with or without leucaena leaf meal on the feed conversion ratio of goats. However, the feed conversion of the treatment 2 was better than the report of Aswanimiyuni et al. (2018) who fed the goats with guinea grass plus napier grass on the growth performance of goats.

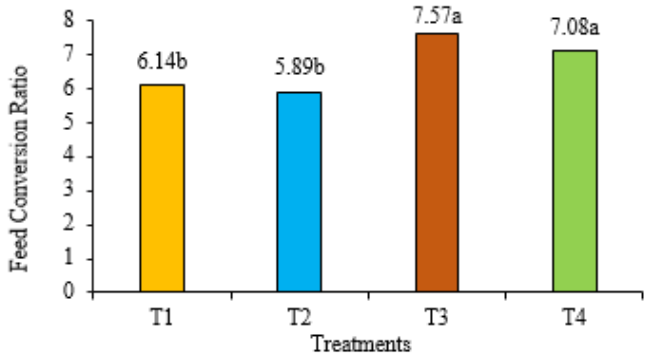

Fig 7. Feed conversion ratio of goats from 0-60 days

IV. CONCLUSION AND RECOMMENDATION

After 60 days of conducting experiments on the use of para grass and mimosa pigra with basal diets of brewer's grain and rice bran on the growth performance of goats under a semi-free grazing system, we can conclude that the highest DM intake of goats is the treatment 4 (T4=684 g/day), the highest growth performance of goats is the treatment 2 (T2=110 g/day), and the best feed conversion ratio of goats is the treatment 2 (T2=5.89) if compared with other treatments. In conclusion, the utilization of 85% para grass combined with 15% mimosa pigra is actually increased the feed intake of goats, increased live weigh gain of the goats, and well improved feed conversion ratio of goats under a semi-free grazing system.

The suggestion is to comprehend the importance of using local resources for animal husbandry in order to feed animals, based on the experimental results. This will guarantee farmers' ability to raise livestock sustainably and spur the growth of the domestic animal husbandry industry, both of which are important in reducing rural poverty.

FURTHER STUDY

We want the upcoming generation of students to study using the above feed for the reproduction of goats at SRU, given the advantages of para grass and mimosa pigra.

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