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The Content Of Nutrients, Gas Production And In Vitro Digestibility Of Some Potential Tree Foliages Of Ruminant Feed In Malang, East Java, Indonesia

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Abstract:
Background*: Manipulation of fermentation in the rumen was an effort to produce ruminant livestock production efficiency, by reducing methane gas production per unit of product. Various local tree folliages have the potential as a source of quality nutrients. Secondary metabolite compounds in plants have the potential as antimethanogenic. This experiment aimed at evaluating the potential of 17 tree foliages for ruminant supplements to increase animal production*.
Materials and Methods*: This experiment aimed at evaluating the potential of 17 tree foliages for ruminant supplements to increase animal production and supressing enteric methane production in the rumen. Nutritional evaluation were determined on the basis of proximate and fibre analysis while the fermentability of leaves were measured by in vitro gas production method. Samples of gas were withdrawn from the syringes to analysis gas production.*
Results*: The results showed that among 17 tree foliages, only three species, namely Swieteria mahagony; Felicium decipiens,Thw; Coffee arabica had crude protein content below 18 % , while the others varied between 18.5 and 36.5 %. In addition to that, not all species with high crude protein content can be considered as a source of protein supplements due to relatively lower digestibilty values (DM and OM digestibility < 30 %), total gas production and microbial biomass such as Samanea saman; Calliandra calothyrsus; Flemingia congesta. The leaves of Hibiscus rosa-sinensis Linn, Gliricidia sepium Jacq, Sauropus androgynus L.Merr, Moringa oleifera Lamm Manihot utilissima, and Sesbania grandiflora Linn show the value of digestibility and total gas production are high, and potential to be used as feed material source of protein and energy source. On the leaves of Eritrina lithosperma, Flemingia congesta, Calliandra calothyrsus Meissn, Leucaena leucocephala, Artrocarpus heterophyllus, Ceiba pentranda, Albazia falcataria, and Samanea saman show the decreasing value of fermentation process in the rumen by in vitro, but it has potential which can be used as protein source feed material. The crop leaves of Coffie arabica, mahogany, aid Felicium decipiens Swieteria Thw have nutrient value and low nutrient so that it is not recommended to use them as a feed supplement.*
Conclusion: *In conclusion, among 17 tree foliages only four species, namely Calliandra calothyrsus, Sauropus androgenus,L,Merr;Moringa oleifera,Lamm; and Samenea saman may be recommended as ruminant supplements to enhance ruminant production.*
Key Word*: nutritional evaluation, in vitro gas production, supplementation, tree foliage leaves, Indonesia*

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I. Introduction

Ruminant production in the tropics such as Indonesia seldom to achieve the genetic potential due to inadequate supply of essential nutrients for growth, and to combatintestinal parsites as well as hot and humid environmental stress. Traditional forages given to ruminant animals in the tropics are generally composed of native grass, cultivated grasses such as Elephant or King grass, and agricultural by-products. These are generally low in protein content and high in fibre constituents.In spite of ubiquitous distribution across the altitude and soil conditions tree foliages utilization by ruminant animals in Indonesia are scarce, because most farmers prefer to supplement their ruminant animals by agricultural by-products such as rice bran or tofu waste.

The report of [1] showed that in Lombok island of Indonesia, the use of tree foliages for goats were only four species, namely *Ceiba pentandra, Sesbania grandiflora, Leucaena leucocephala*, and jack fruit leaves indicating the limited information available to the farmers on the potential of tree foliages. Reviewed[2] the potential of tree foliage as strategic supplements for ruminants in developing countries with particular emphasis was given on the catalytic potential of foliage through its protein and mineral contents to alleviate feed intake.

Various efforts have been made by many workers to improve livestock production efficiency by manipulation of feed through fermentation to produce volatile fatty acids[3]. To obtain high production efficiency,

the basic living energy has to be converted into high large production by suppressing the production of methane gas per unit of product[4]. Some efforts have been made by many researchers to improve production efficiency, e.g. by supplementing concentrate[5], organic acids[6], essential oils[7], as well as probiotics and prebiotics[8], both in vitro and in vivo. The production of methane can be controlled by giving antibiotics, growth hormones, and chemicals. However, since these can lead to residues in products as well as toxic effects on livestock, these techniques are not recommended in Europe since 2006[4]. These conditions made the scientists began to intensify researches on natural compounds found in plants as feed additives to improve the productivity of livestock[9], and to reduce methane production[10]. Although the potential of the leaves of trees to improve livestock production has been widely reported, the use of information on native tree foliages that can increase the production and supressing enteric methane production in the rumen however, is still limited

The study aims to determine the effectiveness of some tree foliages of as ruminant feed in terms of chemical composition, gas production, digestibility, and microbial biomass by in vitro. The result of the study is the election of some tree foliages that have effective nutrient content as a feed supplement.

II. Material And Methods

Seventeen leaves of tree foliage collected from Malang areas were air forced dried in the oven at 60^0C until the weight was constant. They were then ground to pass 1 mm screen for further proximate[11] and fibre analysis[12].

Experimental design and variables observed

Seventeen treatments (seventeen tree foliage leaves) were arranged in a randomized block design with three replicates. The variables measured were (1) nutrient compositions (2) gas production, (3) organic matter digestibility (OMD), (4) microbial biomass (measured after 48 hours incubation).

In vitro gas production measurement

A source of innoculum was aspirated prior to morning feeding time from a rumen fistulated dairy cow weighing approximately 350 kg that received Elephant grass (9 % CP) and commercial concentrate (18 % CP) at 20-25 kg $head^{-1}day^{-1}$ and 5 kg $head^{-1}day^{-1}$, respectively. Drinking water was always available *ad libitum*. After collection, the rumen fluid was filtered through nylon sieve with a size of 100 μm was added by reduced buffer.

The incubation medium used to buffer rumen fluid consisted of 630 ml bicarbonate buffer solution, 315 ml macro minerals, 0.16 ml micro minerals, 1.6 ml 0.4% resazurin, 945 ml distilled water, 60 ml fluid reducer, and 660 ml rumen fluid[13]. Buffer rumen was saturated by CO_2 gas for 10 minutes before inserting into a syringe tube to ensure the anaerobic conditions in the reaction. Approximately 500 mg OM samples were incubated in a liquid medium buffered rumen. The sample was inserted into the tube and closed with a piston that had been lubricated with vaseline. A total of 40 ml of a mixture of buffer and rumen fluid was inserted to a syringe by using dispenser through the tip of the syringe that had been fitted by a *beklip* hose, in which the volume was readable (Vo) and then incubated in a water bath at temperature of 39ºC. A blank sample without the addition of the substrate into the syringe was also prepared. Gas production was recorded before incubation at 0 and 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, and 48 hours after incubation. Total gas values were corrected for blank and hay standards with known gas production.

Kinetics of gas production was estimated by the exponential equation described by[14] as follows: $\mathbf{p = a + b\ (1\text{-}e^{-ct})}$; Where : **p**-value is the cumulative gas production at time of t hours, while a, b and c is a constant of the exponential equation. The constant can be interpreted as gas production from soluble fraction (**a**), gas production from the insoluble fraction but can be fermented (**b**) and the reaction rate of gas formation (**c**). The calculation of exponential equation constant is performed with curve fitting program in MS Excel by neway method.

After incubation for 48 hours, the residual feed in the tube was removed, filtered, and transferred to the cup, dried, and ashed. The organic matter digestibility value (OMD) was obtained from the difference in organic matter content (OM) before incubation and initial content after incubation, proportional to the content of the OM before incubation[15].

Determination of microbial biomass

Determination of microbial biomass was performed according to the method of[15]. Microbial biomass = *Apparent undegradable* - *True undegradable*. *Apparent undegradable* was obtained as follows. After incubation time of 48 hours, 3 pieces of syringe were immersed in ice water to stop fermentation process, for 4 hours or until ready to do centrifuging. The fill of syringe was removed entirely and messed around 10,000 rpm for 16 minutes. The residue was obtained in 105ºC oven overnight. Then it was put in exicator for 1 hour and then it was weighed. The weight gained was *apparent undegradable*.

True undegradable was obtained by: after incubation period of 48 hours, 3 pieces syringe were immersed in ice water to stop the fermentation process, for 4 hours or until ready to have boiling with a solution of NDS. The fill of syringe was entirely removed and boiled with 100 ml of NDS solution to boiling for 1 hour. Then it was filtered through crucible which had weighed first, then washed with hot water 5 times and 3 times with acetone. After the smell of acetone had lost, it was put in 105^{o}C oven overnight. Then it was cooled in exicator for 1 hour and then weighed. The weight gained was *true undegradable.*

Statistical analysis

The data were statistically analyzed by PASW STATISTICA 18 according to a randomized block design followed with a honesty significant difference test[16]. Standart errors of means were calculated from the residual mean square in the analysis of varians.

III. Result

The chemical composition

The results of analysis showed that among 17 tree foliages, only three species, namely *Coffie arabica* , *Swieteria mahagoni*, and *Felicium decipiens* Thw had crude protein conten below 18%, while the others varied between 18.5 and 36.5%.

Table no 1 : Chemical composition DM, OM, CP, CF, EE, NFE, NDF and ADF from 17 species tree foliages

Species tree foliages	DM	OM	CP	CF	EE	NFE	NDF	ADF
	%	%	%	%	%	%	%	%
Hibiscus rosa-sinensis. Linn	17.6	85.8	24.2	15.9	5.85	39.8	50.7	40.7
Eritrina lithosperma	22.8	88.9	29.0	25.4	3.25	31.2	50.7	33.4
Flemingia congesta	27.8	93.5	22.8	30.0	3.01	37.7	42.9	33.4
Gliricidia sepium. Jacq	21.1	90.7	26.9	21.0	3.97	38.9	38.3	25.8
Calliandra calothyrsus. Meissn	35.7	93.7	23.7	19.5	4.13	46.6	34.5	31.7
Sauropus androgynus L.Merr	18.4	87.1	31.8	17.1	6.12	32.0	16.4	12.1
Moringa oleifera. Lamm	18.4	87.1	36.6	10.8	5.79	24.1	16.1	12.7
Manihot utilissima	21.4	92.2	24.2	14.7	6.56	21.1	53.6	38.5
Coffie arabica	28.9	93.2	24.0	23.1	3.02	53.4	38.9	30.3
Leucaena leucocephala	24.2	91.4	13.7	21.5	4.22	37.8	40.6	27.4
Swieteria mahagoni	37.1	88.8	27.9	22.9	2.97	52.0	32.6	32.4
Artrocarpus heterophyllus	25.0	90.4	10.9	26.0	2.03	43.2	46.4	46.1
Felicium decipiens. Thw.	42.7	94.7	19.2	20.3	5.39	13.8	33.8	24.1
Ceiba petandra	35.0	89.5	11.8	19.9	5.69	45.4	54.4	28.9
Albazia falcataria	31.8	93.7	18.5	22.4	3.66	45.6	43.0	39.8
Samanea saman	41.3	96.2	22.0	37.9	5.41	29.6	52.3	43.1
Sesbania grandiflora. Linn	18.3	90.8	23.3	23.5	4.45	36.8	39.7	25.9

DM = dry matter. OM = organic matter, CP = crude protein. CF = crude fiber. EE = extract etter. NFE= nitrogen free extract. NDF = neutral detergent fibre. ADF= acid detergent fibre . cutting plant samples in July 2022
**) 100% DM. analysis in the Laboratory of Animal Nutrition, Faculty of Animal Husbandry, Brawijaya University.*

Based on the protein content it can be expected that the supplementation using tree foliages does not only aim to reduce the methane content in the fermentation process in rumen, but also can improve the productivity of ruminants through the provision of supply of nitrogen and amino acids, either in rumen microbes or on ruminants directly through absorbs process post rumen in the small intestine[17]. This condition is especially more likely if the basic feed used has very low-quality feed like straw.

Gas production

The gas production has a positive relationship with the amount of substrate degraded and substrates are degraded largely determined by the number and types of rumen microbes. Gas production is a reflection of the amount of substrate fermented. The results of statistical analysis showed that 17 of gas production from the tree foliages differed significantly P <0.01. The highest gas production during 48 hours of incubation time was generated produced by *H. rosa sinensis* leaves (91.5 ± 2.57 ml), and the lowest was generated by *S. saman* (11.2±0.29 ml).

Table no 2: Production of gas, constant b and c by in vitro incubation at 48 hours of 17 tree foliages

Species of tree foliages	**Gas 48 hours**	**Value b**	**Value c**
	(ml)	(ml)	(ml/hours)
Hibiscus rosa-sinensis. Linn	91.5±2.57^{i}	142±5.1^{i}	0.029^{b}
Eritrina lithosperma	52.8±0.76^{e}	60.3±1.0^{e}	0.048^{d}
Flemingia congesta	24.7±0.76^{b}	24.9±0.6^{ab}	0.086^{f}
Gliricidia sepium. Jacq	75.2±2.93^{h}	93.8±2.7^{fg}	0.050^{d}
Calliandra calothyrsus. Meissn	37.3±0.76^{cd}	55.9±0.9^{de}	0.024^{b}
Sauropus androgynus L.Merr	59.2±0.76^{f}	107±6.4^{gh}	0.022^{b}
Moringa oleifera, Lamm	76.5±3.77^{h}	93.7±3.0^{fg}	0.066^{c}
Manihot utilissima	69.0±0.00^{g}	89.6±0.5^{fg}	0.047^{cd}
Coffie Arabica	35.5±0.87^{c}	48.3±1.7^{cde}	0.039^{c}
Leucaena leucocephala	59.8±3.21^{f}	82.1±4.1^{f}	0.028^{b}
Swieteria mahagoni	28.2±0.76^{b}	31.4±0.8^{bc}	0.079^{f}
Artrocarpus heterophyllus	72.5±2.29^{gh}	114±3.4^{h}	0.028^{b}
Felicium decipiens. Thw.	11.3±1.44^{a}	39.4±27.5^{bcd}	0.009^{a}
Ceiba petandra	43.2±2.08^{d}	151.5±3.0^{i}	0.006^{a}
Albazia falcataria	36.7±2.08^{c}	58.4±3.6^{de}	0.024^{b}
Samanea saman	11.2±0.29^{a}	12.03±0.2^{a}	0.065^{e}
Sesbania grandiflora. Linn	72.2±5.48^{h}	92.4±6.3^{fg}	0.060^{e}

b= gas production from the insoluble fraction but can be fermented and c= the reaction rate of gas formation, $^{a-k}$: means in the same column for each parameter with different superscripts are very significantly different P<0.01

The measurement of gas production for 48 hours periodically was conducted to determine how much gas is generated at certain times. In-vitro gas production (ml/0.5g DM) incubation at 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, and 48 hours of each plant is presented in Figure 1.

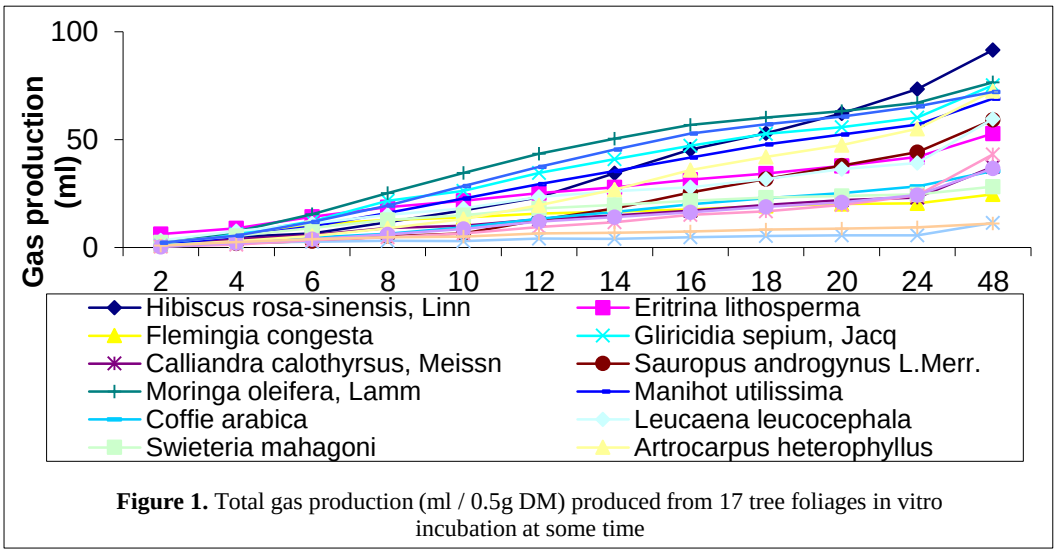

Figure 1. Total gas production (ml / 0.5g DM) produced from 17 tree foliages in vitro incubation at some time

Organic matter digestibility and production of microbial biomass

Organic matter digestibility and production of microbial biomass, apparent degradable, and true degradable by in vitro of 17 types of tree foliages are presented in Table no 3.

Table no 3: Organic matter digestibility (%), microbial biomass (mg), apparent degradable (mg) and true degradable (mg) by in vitro incubation at 48 hours of 17 tree foliages

Species of tree foliages	**OMD**	**Microbial biomass**	**Apparent degradable**	**True degradable**
	(%)	(mg)	(mg)	(mg)
Hibiscus rosa-sinensis. Linn	75.3 ±5.74^{i}	78.7±2.80^{bcd}	275±4.96^{j}	353±4.67^{j}
Eritrina lithosperma	51.5 ±3.52^{ef}	74.9±2.29^{abcd}	198±4.04^{fg}	273±4.38^{g}
Flemingia congesta	18.6 ±5.08^{a}	59.7±7.80^{ab}	69.1±3.56^{b}	125±1.23^{b}
Gliricidia sepium. Jacq	62.0 ±3.21^{gh}	91.4±8.51^{d}	243±4.44^{hi}	335±5.67^{i}
Calliandra calothyrsus. Meissn	30.3 ±2.25^{bc}	57.9±13.6^{ab}	129±9.97^{d}	185±3.36^{c}

Sauropus androgynus L.Merr	77.1 ±3.87^{i}	77.4±0.95^{bcd}	247±1.72^{hi}	323±0.68^{hi}
Moringa oleifera, Lamm	76.9 ±2.30^{i}	114±8.75^{e}	275±4.99^{j}	389±6.12^{k}
Manihot utilissima	53.2 ±4.96^{efg}	77.1±4.83^{bcd}	231±3.56^{h}	309±5.72^{h}
Coffie Arabica	46.8 ±1.84^{de}	56.7±3.32^{ab}	189±5.32^{f}	247±3.27^{f}
Leucaena leucocephala	40.8 ±0.34^{d}	88.3±10.9^{abc}	110±3.54^{c}	203±5.39^{d}
Swieteria mahagoni	38.9 ±5.20^{cd}	63.9±4.52^{ab}	111±2.54^{c}	177±1.06^{c}
Artrocarpus heterophyllus	56.5 ±7.39^{fgh}	67.4±9.61^{abc}	209±9.25^{g}	276±7.36^{g}
Felicium decipiens. Thw.	23.8 ±5.66^{ab}	53.8±8.85^{a}	47.5±4.07^{a}	100±6.11^{a}
Ceiba petandra	39.6 ±1.82^{cd}	76.0±7.41^{bcd}	161±1.51^{e}	237±5.85^{f}
Albazia falcataria	38.7 ±5.73^{cd}	66.2±4.27^{abc}	151±3.22^{e}	222±3.90^{e}
Samanea saman	28.3 ±4.29^{b}	62.1±15.9^{ab}	119±6.27^{cd}	180±9.30^{c}
Sesbania grandiflora. Linn	63.8 ±2.81^{h}	94.0±10.7^{de}	255±15.7^{i}	350±9.32^{j}

OMD= organic matter digestibility ; $^{a-k}$: means in the same column for each parameter with different superscripts are very significantly different P<0.01

The results of the analysis of the average microbial biomass, apparent degradable, and true degradable at 48-hour incubation time showed a very significant difference P<0.01 (Table no 3). Production of microbial biomass (mg) produced from 17 tree foliages by in-vitro incubation of 48 hours presented in Figure 2

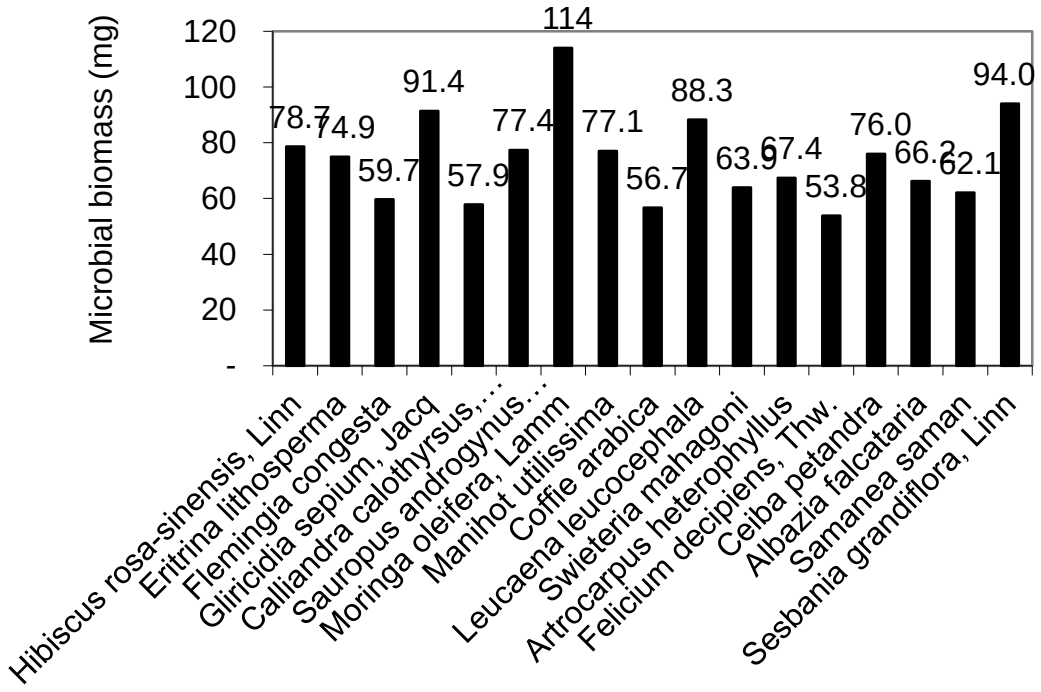

Figure 2. Production of microbial biomass (mg) produced from 17 tree foliages by in vitro incubation of 48 hours

The high production of microbial biomass and high degradable true value indicate that the feed has incubated is potential to be soluble and easily degraded in the rumen (*G. sepium, M. oleifera, L. leucocephala* and *S. grandiflora* leaves). *H. rosa-sinensis, S. androgynus* and *M. utilissima* leaves that had high true degradable value but low microbial biomass indicated that the feed are potentially soluble in the rumen.

IV. Discussion

The results of the chemical composition obtained indicated that tree foliages analyzed had the potential as protein supplement feeds, except for Coffie arabica, Swieteria mahagoni and Felicium decipiens Thw. *M. oleifera* has the highest protein (36,6%) among other plants, likewise the *S. androgynus L.Merr* (31.8%), it have relatively low crude fiber and ADF content (12%). This was advantageous because the high CP content followed by the low content of crude fiber and ADF which will produce a high digestibility values. Based on the

protein content it can be expected that the supplementation using tree foliages does not only aim to reduce the methane content in the fermentation process in rumen, but also can improve the productivity of ruminants. High protein content was expected to increase the supply of nitrogen and amino acids both for rumen microbes or through post-rumen absorption processes in the small intestine of ruminants[17]. This condition is especially more likely if the basic feed used has very low-quality feed like straw.

The high gas production shows the forage having insoluble fraction in rumen but it was potential to be degradable in the rumen. The gas produced was the result of the fermentation process that occurs in the rumen and can describe the amount of OM that can be digested by rumen microbes. Thus, the resulting gas production was basically a reflection of the amount of energy produced from the fermentation process. The highest gas production during 48 hours of incubation time was generated produced by *H. rosa sinensis* leaves (91.5 ± 2.57 ml), and the lowest was generated by *S. saman* (11.2±0.29 ml) (Table no 2). This was in line with the resulting OM digestability value (Table no 3). *H. rosa sinensis, Gliricidia sepium*. Jacq., *Moringa oleifera* Lamm and *Sesbania grandiflora*. Linn resulting in high gas production with relatively high OM digestibility

The maximum gas production (b) on the incubation time of 48 hours. Gas production at 48 hours of incubation produced gas more than 70% maximum gas production in almost all treatments except for *F. decipiens*. This suggests that the rate of in vitro gas production decreases with increasing the incubation time, due to fermentable substrates also diminishing in number[18, 19]. The maximum gas production cannot be estimated due to the incubation period of 48 hours is still not obtained slowing gas production so the curve looks linear as a result of the low rate of gas production (constant c). Based on some other studies that have evaluated the kinetics of gas production on a high-fiber feedstuffs observe up to 72 hours, even up to 96 hours after incubation to obtain a more accurate kinetic coefficient[20,21,22].

Moringa oleifera Lamm leaves is very quickly fermented, as evidenced by the high c value. Although fermented rapidly, the maximum gas production is not high. This is in contrast with *H. rosa-sinensis* leaves fermented not so fast, but produces maximum gas production which is very high.

In addition to that, not all species with high crude protein content can be considered as a source of protein supplements due to relatively lower disgetibility value (OM digestibility < 30%), total gas production and microbial biomass such as *Samanea saman; Calliandra calothyrsus; Flemingia congesta*. Leaves of *H.rosa-sinensis, G. sepium, S. androgynus, M. oleifera* and *S. grandiflora* have high digestibility values (more than 55%[3]. The high digestibility value indicated that this plant contains high CP followed by crude fiber content and ADF which tend to be low[23,24]. The high OM degradation process of 48-hour incubation was possible to hold because the plants leaves containing materials that are easily degraded by rumen microbes. Early incubation of rumen microbes degrade the material that is easily degraded so that the high degradation rate. After the easily degraded materials depleted, microbes degrade the tough material having the digestibility value of less than 55%.

OMD value (%) can be used as an indicator to determine the quality of the feed. The digestibility value shows how much nutrients in the feed material can be utilized by rumen microbes and benefits of feed given to the cattle. This research was conducted by in vitro using tube syringe with a substrate that was only for the tree crop leaves of the (without any other feed materials). This condition causes less rumen energy needs which are met so that the performance is less than optimal. The lowest OMD Value (%) of *Felicium decipiens* Thw. leaves compared to the other leaves is suspected of anti-nutritional compounds of high saponin. It is increasingly clear reason why animals do not eat *Felicium decipiens* Thw. leaves.

On the leaves of the plant *Calliandra calothyrsus* Meissn. *Coffie Arabica*, *Swieteria mahagoni*, *Felicium decipiens* Thw. and *Samanea saman* tend to have low OMD and gas production. This is due to the indirect effect of condensed tannins as reported by[25] and hydrolysable tannins[26, 27] found in the leaves of these plants which can cause decreased feed degradation in the rumen. High OMD results occurred in the leaves of *Sauropus androgynus* L. Merr and Moringa oleifera Lamm. Taking into account the results of this study, plant leaves with protein > 18% can be used as a protein source supplement. In vivo research[28], that goats that only rely on field grass feed with an average fresh feed of 7.06 kg/head/day produce ADG of 65.9 g/head/day, so they have not optimal according to the growth potential of goat livestock. Research on plant leaves as a source of protein as reported[29] using the leaves of *Gliricidia sepium*. Jacq., *Leucaena leucocephala*, *Samanea saman* as much as 10% in concentrate feed resulted in ADG of 105.9 g/head/day; feed conversion 6.56. Research on plant leaves to increase ruminant livestock production has also been reported[30, 31, 32]. To support the availability of quality ruminant feed, it is necessary to develop plants as a source of protein and is expected to reduce environmental pollution.

Microbial biomass was obtained from the difference in the apparent non-degradable and true undegradable values (Microbial biomass = apparent undegradable - true undegradable). The high production indicates that the number of rumen microbes (protozoa bakteri, Fungi) that play a role in degrading the feed in the rumen. The high production of microbial biomass and high degradable true value indicate that the feed has incubated is potential to be soluble and easily degraded in the rumen (*Gliricidia sepium*, Jacq. *Moringa oleifera*.

Lamm, *Leucaena leucocephala* and *Sesbania grandiflora*, Linn leaves). In *Hibiscus rosa-sinensis*, Linn. *Sauropus androgynus* L.Merr. and *Manihot utilissima* leaves have high true degradable value but low microbial biomass indicating that feed which is incubated potentially soluble in the rumen. In the crop leaves incubated have low microbial biomass production and low degradable true value are suspected have secondary compounds that inhibit the activity of rumen microbes so that the feed degradation decrease in the rumen.

V. Conclusion

In conclusion, among 17 tree foliages only four species, namely *Calliandra calothyrsus, Sauropus androgenus,L,Merr;Moringa oleifera,Lamm;* and *Samenea saman* may be recommended as ruminant supplements to enhance ruminant production. *Coffie arabica*, *Swieteria mahagoni* leaves contain nutrient and low nutrient so it is not recommended to use them as a feed supplement. *Felicium decipiens* Thw leaves has nutrients and nutrients which are not good for the manipulation of fermentation in the rumen.

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