Nutritional Evaluation of Some Browse Plants Incubated with *Panicum maximum* by *in-Vitro* Gas Production Technique.

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Abstract

In- vitro gas production technique for 24 hours was used to determine the nutritive values of some selected browse plants (*Gliricidia sepium , Leucaena leucocephala , Azardirachta indica , Gmelina arborea*) incubated with *Panicum maximum*. samples were formulated in their respective combination with *Panicum maximum* at ratio 50:50, the treatments were as follows: T1(100% *Panicum maximum),*T2 (50% *Panicum maximum+50% Leucaena leucocephala), T3 (50% Panicum maximum +50% Gmelina arborea), T4 (50%Panicum maximum+50% Gliricidia sepium), T5(50%Panicum maximum + 50%Azardirachta indica)* . The samples were subjected to proximate analysis and *in vitro* gas production. Results obtained from proximate composition showed that crude protein (CP) content varied from 10.70 to 25.50g/100g DM, crude fibre (CF) ranged from 4.13 to 38.00g/100g DM, ether extract (EE) ranged from 10.44 to 15.35g/100g DM and ash 9.09 to 14.72g/100g DM. Methane (ml/200mg DM) production was high in T4 and low in T3. The lowest and highest potential gas production, 'a+b' values of 5.33mL/200mgDM and 12.33mL/200mgDM was obtained for T1, T3 andT4 respectively. The results showed that there were significant differences ($p<0.05$) among the forages in metabolizable energy (ME), organic matter digestibility (OMD), and short chain fatty acid (SCFA), highest values of ME (4.85 MJ/Kg DM), OMD (40.98%) and SCFA (0.324µmol) were recorded for T4 when compared to other treatments; this indicate that T4 which has highest metabolizable energy (ME), organic matter digestibility (OMD), and short chain fatty acid (SCFA) has the potential benefit to meet nutrient requirement of ruminants during dry season.

Keywords : *In vitro*, gas production, *Panicum maximum*, browse plants, nutritive evaluation.

- **Introduction**
- Period of dry season is always a stressful period for livestock as the environment is characterized by insufficient feed due to the minimal amount of rainfall. Animals are fed predominantly on low quantity and quality feeds, which are deficient in nutrients essential for efficient microbial fermentation (1) resulting to low animal performance in terms of growth and reproduction. Studies have shown that the use of grasses such as *Panicum maximum* in the dry season alone is not adequate to allow optimum production in sheep and goat. Indigenous browse species are useful source of animal feeds, as these plants remain green during the dry season and provide vegetation with better nutritive value than other annual grass and herbaceous species that become withered (2). In spite of their abundance, many browse plant have been generally undervalued mainly because of insufficient knowledge about their potential feeding value.
- The in vitro gas production technique is a laboratory estimation of rate and extent of nutrient disappearance in livestock feed sample for the purpose of assessing the potential nutritive value of the feed. It is also a method that is reproducible and parameters obtained correlate

well with in vivo trials (3). In vitro gas production technique has the advantage of not only being less expensive and less time consuming but it allows for more precision in experimental conditions than the in vivo method (4). It is convenient, fast and allows a large number of samples to be handled at a time. Thus this study was design to evaluate the nutrient potential of some browse plant leaves (*Gliricidia sepium, Leucaena leucocephala, Azadirachta indica, Gmelina arborea* incubated with *Panicum maximum*) using the in vitro gas production technique.

- **Materials and methods**
- **Experimental sample preparation**
- The forage samples were harvested from the Federal College of Animal Health and Production Technology, Moor Plantation, Ibadan. The Treatments were as follows; T1(100% *Panicum maximum),* T2 (50% *Panicum maximum+50% Leucaena leucocephala), T3 (50% Panicum maximum +50% Gmelina arborea) T4 (50%Panicum maximum+50% Gliricidia sepium) T5(50%Panicum maximum + 50%Azardirachta indica).* Known weight of each sample was oven dried at 65^0C to a constant weight for dry matter determination (DM). The samples were milled in a hammer mill to pass through 1mm mesh sieve and stored in an air tight container at room temperature for subsequent laboratory analysis. Proximate analysis; crude protein, crude fibre, ether extract and ash were analysed according to the standard methods of (5).
- **In vitro gas production and statistical analysis**
- Rumen fluid was obtained from five West African dwarf goats using stomach tube. The animals were fed with concentrate diets (40% corn, 10% wheat offal, 10% palm kernel cake, 20% groundnut cake, 5% soya bean meal, 10% dried brewers grain, 1% common salt, 3.75% oyster shell and 0.25% fish meal). The use of rumen liquor and buffer (9.8g $NaHCO_3$+2.77g Na_2HPO4+0.57g KCl+0.47g NaCl+0.12g $MgSO4.7H_2O$+0.16g/litre $CaCl_2.H_2O$) (1:4, v/v) under continuous flushing with CO_2 for incubation was as reported by (6). The gas production was measured at 3, 6, 9, 12, 15, 18, 21 and 24 hour. After 24 hour post incubation 4ml of 10M NaOH solution was introduced as described (7) to estimate methane. Metabolizable energy (ME,MJ/KgDM) and organic matter digestibility (OMD %) were estimated as established by (6) and short chain fatty acids (SCFAμ/mol) was calculated as reported by (8) using 24 h post incubation. ME = 2.20 +0.136* Gv+ 0.057* CP +0.0029* CF, OMD = 14.88+ 0.889Gv +0.45CP + 0.651XA; SCFA = 0.0239*Gv – 0.0601, where Gv, CP, CF and XA are net gas production (ml/200mgDM), crude protein, crude fibre and ash of the incubated samples respectively. Data obtained were subjected to analysis of variance and means were compared where significant using Duncan multiple range F- test (9).
- **Results and discussion**.
- The crude protein content of the experimental samples ranged from 10.70 - 18.10%, of which the crude protein content of T1 (100% *Panicum maximum*) the least barely exceeds the minimum recommended range of 7.0 -8.0% for efficient functioning of rumen microorganisms (10). It however fell short of the range of 11.0 -13.0% known to be capable of supplying adequate protein for maintenance and moderate growth in goats (11). It was also observed that the addition of *Panicum maximum* reduces the protein contents of the browses. Browse plants have been reported to have high CP of high digestibility, and are also high in vitamins and minerals (12). Crude fiber ranged from 38.00 – 21.07 % T1 recorded the highest. High levels of fibre have been acknowledged (13) to be inversely related to feed digestibility and nutrient availability. Table 2 Show the in-vitro characteristics of *Panicum maximum* incubated with some browse plants. The intercept value ‘a’ at 24 hours ranged from (2.67) in T1 (*panicum maximum*) to 6.00 in T4. The value ‘a’ used ideally reflect the fermentation of immediate soluble fraction. The soluble fraction makes the attachment by rumen micro-organism to be done easily and lead to much gas production. The extent of gas production ‘b’ described the fermentation of insoluble but degradable fraction of the samples,

ranged from (3.00) in T1 to (6.33) in T4. (14) found that 'b' value could account for 88% for feed intake. The rate of gas production 'c' ranged from (0.04) in T1to (0.12) in T5.(15) reported that factors that determine the rate of gas production during fermentation depend on the nature and level of the fibre, the presence of secondary metabolite and the potency of rumen liqour for incubation. The extent of gas production 'a+b' ranged from 5.67 to 12.33 T4 and T5 recorded the highest.(7) also reported in vitro gas production to be synonymous with feed digestibility, so that the higher the gas production the higher the digestibility (15).. Methane production observed in this study ranged from 1.00 – 3.00. Methane production is said to be energy loss to ruminants and also contribute to global warming (16) result of destruction of ozone layer. In most cases, feedstuff that show high capacity for gas production are also observed to be synonymous for high methane production. and also most tropical feedstuffs have been implicated to increase methanogenesis (17). Highest value of metabolizable energy, organic matter digestibility and short chain fatty acid are consistently recorded for T4 (50% *Panicum maximum* and 50% *Gliricidia sepium*) in this study. This shows that the diet mixture could have the highest potential to make energy available to ruminant, this correlate with earlier report of (14) that higher short chain fatty acid (SCFA) or volatile fatty acid (VFA) such as butyrate and acetate suggest a potential to make energy available to ruminants.

Table 1: Proximate composition (%) of the browse plant and panicum maximum mixtures

Treaments	DM	CP	ASH	EE	CF
1	35.13^{b}	10.70^{b}	11.05^{a}	10.44^{b}	38.00a
2	34.78^{b}	15.74^{ab}	10.45^{ab}	15.90^{a}	26.17b
3	57.86^{a}	11.15^{b}	10.10^{ab}	10.86^{b}	24.75^{b}
4	31.08^{bc}	18.10^{a}	11.08^{a}	12.14^{ab}	33.04^{ab}
5	25.22^{c}	13.00^{ab}	12.90^{a}	13.63^{ab}	21.09^{c}

SEM= standard error of mean, a,b,c – Means in the same column with the same superscripts are not significantly different ($p<0.05$)

Table 2:*In-vitro* gas production (ml/200mg/DM) parameters of the browse plants and *Panicum maximum* mixtures

TREAMENTS	OMD	ME	SCFA	METHANE
1	31.93^{b}	3.62^{ab}	0.08^{c}	2.50^{ab}
2	37.07^{a}	4.33^{a}	0.16^{b}	2.00^{b}
3	32.97^{ab}	3.82^{ab}	0.12^{b}	1.00^{c}
4	40.98^{a}	4.85^{a}	0.24	3.00^{a}
5	35.05^{ab}	3.82^{ab}	0.09^{c}	2.50^{ab}
SEM	1.28	0.20	0.03	1.00

SEM= standard error of mean, a,b,c – Means in the same column with the same superscripts are not significantly different ($p<0.05$)

Table 3: *In-vitro* gas production (ml/200mg/DM) constant of browse plants and panicum maximum mixtures

TREATMENTS	A	B	A+b	C
1	2.67^{c}	3.00^{c}	5.67^{c}	0.04^{c}
2	4.66^{b}	4.67^{b}	9.33^{b}	0.08^{b}
3	3.00^{bc}	4.33^{bc}	12.33^{a}	0.09^{b}
4	6.00^{a}	6.33^{a}	12.33^{a}	0.09b
5	2.33^{c}	4.33^{bc}	6.67^{c}	0.12^{a}
SEM	0.87	0.79	1.44	0.03

SEM= standard error of mean, a,b,c – Means in the same column with the same superscripts are not significantly different ($p<0.05$)

- **Conclusion and recommendation**
- It was observed from this study that *Panicum maximum* incubated with *Gliricidia sepium* at ratio 50:50 resulted in significant increase in metabolizable energy (ME), organic matter

digestibility (OMD), short chain fatty acid (SCFA) with highest potential gas production. It is therefore recommended that *Panicum maximum* should be fed along with some of these browse plant which can benefit ruminant during dry season thus improving their growth performance.

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