



# APPLYING IN VITRO GAS PRODUCTION TECHNIQUE TO ASSESS THE NUTRITIVE VALUE OF GMELINA ARBOREA LEAVES AS RUMINANT FEED



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## Abstract

In vitro gas fermentation method was used to evaluate the nutritive value of different forms of *Gmelina arborea* leaves. Two experiments were conducted. Experiment 1 involved the determination of chemical composition of green, yellow and brown leaves. In experiment 2, the nutritive value of green, yellow and brown leaves of *Gmelina arborea* was assessed by in vitro gas production technique for total gas production over a period of 24 hr and to predict organic matter digestibility (OMD), metabolizable energy (ME) and short chain fatty acid (SCFA). Methane volume (CH<sub>4</sub>) was measured after incubation at 24 hr. The in vitro gas production characteristics soluble degradable fraction (a), (insoluble degradable fraction (b), potential degradability (a+b) and rate of degradation (c) were also predicted.

Results revealed that the chemical composition of green, yellow and brown leaf varied significantly (p<0.05). Dry matter ranged from 80.15 to 91.24 % in green and brown leaf respectively. Same trend was observed for neutral detergent fibre, it ranged from 60.92 to 63.77%. The crude protein ranged from 24.84 to 26.44% in brown and green leaves respectively. The IVGP, ME, SCFA and methane production were not significant (p>0.05), except OMD. Same trend was observed for all the in vitro characteristics with the green leaf recording the highest value, while the lowest values were obtained in the brown leaf. They ranged between 3.75 and 5.25 ml/200mg DM; 3.27 and 3.49 MJ/Kg DM; 0.10 and 0.94 µmol; 1.5 and 3.0 ml/200mg DM in yellow and green leaf respectively. OMD ranged significantly from 41.57 to 45.05 % in yellow and green leaf respectively. The b, a+b and c also did not vary significantly.

## Introduction

The attainment of sustainable livestock production largely depends on the availability, quality and quantity of feed.

Seasonal fluctuations and scarcity of forage in Nigeria is the major factor limiting the productivity of ruminants as animals rapidly lose weight gained during the lush season which may lead to death, thus resulting in a great economic loss to farmers (Babayemi *et al.*, 2003).

Various efforts are being made by researchers in resolving these adverse effects.

This has called for identifying feed resources that are non conventional and is under-utilized as fodder for ruminants. *Gmelina arborea* is a cheap non-conventional feed resource for ruminants in Nigeria (Amata, 2014).

The leaves are very high in protein and it a suitable source of energy (Amata and Lebari, 2011). The leaves are available all year round ensuring availability of feed to animals during the dry season (Amata, 2014).

The in vitro gas production technique has over the years proven to be the most reliable simple efficient way of evaluating fodder trees and shrubs for their potential in the animal industry (Theodorou *et al.*, 1994).

Therefore the objective of this study is to evaluate the nutritive potential in three different forms of *Gmelina arborea* leaf as feed supplements for ruminants using in vitro gas production technique to predict gas production parameters: (Metabolizable energy (ME), Short chain fatty acid (SCFA), Organic matter digestibility (OMD))

## Materials and Methods

Twenty *Gmelina arborea* trees within the environment of Lead City University, Ibadan. Oyo State, Nigeria were marked randomly for collection of samples. Green and yellow leaves are plucked from each *Persea americana* tree. The brown leaves were picked from the floor around the root of each plant. Reasonable numbers of each leaf type were collected and taken to the laboratory for analysis.

Incubation was as reported (Menke and Steingass 1988)



*Gmelina arborea* leaves



Pix 1: Collection of rumen liquor through from an animal



Pix 2: Flushing of the rumen liquor with carbon dioxide to make prevent the micro organisms from dying.



Pix 3: filling the syringe with inoculums and samples



Pix 4: syringes with inoculums and samples set in the incubator

Data obtained were analyzed and subjected to analysis of variance procedure (ANOVA) of SAS (2012). Significant treatment means were separated by Duncan's multiple range test of the same package.

## Results and Discussion

In vitro gas production parameters of different forms of *Gmelina arborea* leaf is shown in Table 1. Highest in vitro gas production parameters was obtained in the green leaf, (3.49 k; 0.94; 45.05 % and 5.25 ml) for ME, SCFA, OMD and TIVGP while the least value was obtained in the brown leaf. Values obtained for SCFA in this study compared well with the values reported for some dry season forages (Mako *et al.*, 2012). The rate and extent of gas production can be considered a good indicator of the digestibility and fermentability of feeds and microbial protein synthesis (Elghandour *et al.* 2015). Although gas production is a nutritionally wasteful product (Mauricco *et al.*, 1999) but provides a useful basis from which Metabolizable Energy (ME), Organic Matter Digestibility (OMD) and SCFA may be predicted. Gas production is an indication of degradability of samples (Arifuddin *et al.*, 2017). The degradation observed in the samples is an indication that GA leaf can be used as feed supplement for ruminants

L eaves	In vitro gas production parameters			
	ME	SCFA	OMD	TIV GP
Green	3.49	0.94	45.05 <sup>a</sup>	5.25 <sup>a</sup>
Yellow	3.28	0.13	42.18 <sup>b</sup>	4.33 <sup>b</sup>
Brown	3.27	0.10	41.57 <sup>b</sup>	3.75 <sup>c</sup>
SEM	0.11	0.04	0.53	0.17

ab=means on the same column with different superscript differ significantly (p<0.05)

ME= Metabolizable energy (MJ/Kg DM); SCFA (µmol)= Short chain fatty acid; OMD (%) = Organic matter digestibility; TIVGP (ml/200 mg DM)= total in vitro gas production; CH<sub>4</sub> (ml/200 mg DM)= Methane; SEM = standard error of mean

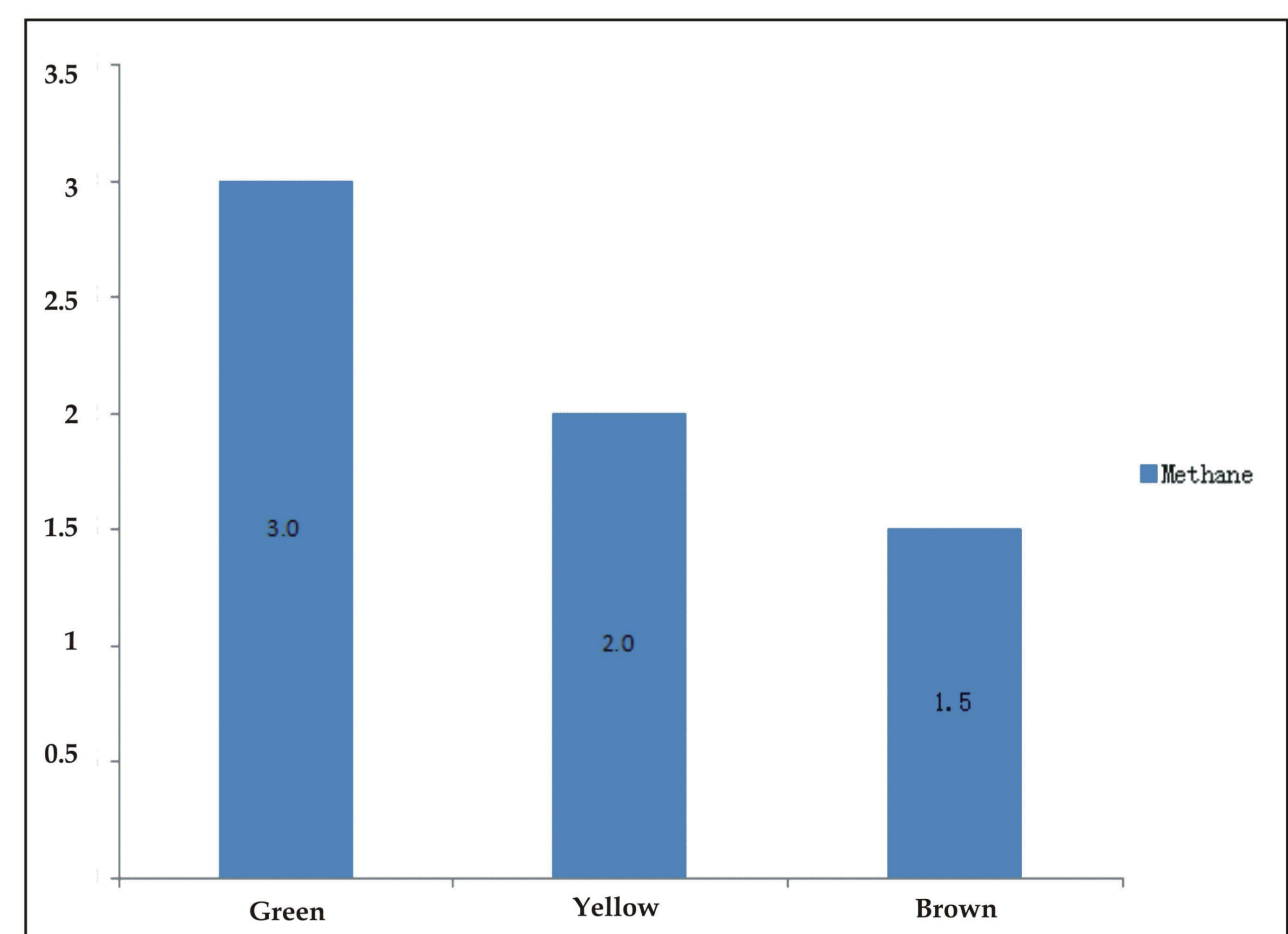


Fig 1: Methane production (ml/200 mg DM) of *Gmelina arborea* leaf

Presented in Fig 1 is the methane production from the different leaf form of GA. Significant variation was observed among the leaf forms. It ranged from 1.5 to 3ml/200 mg DM in brown and green leaf respectively. In most cases feedstuffs that show high capacity for gas production are also observed to be synonymous for high methane production, this could be attributed to the high methane production obtained for green leaf. Methane production indicates an energy loss to the ruminant and many tropical feedstuffs have been implicated to increase methanogenesis (Babayemi and Bamikole, 2006b) as an integrated part of carbohydrate metabolism (Demeyer and Van Nevel 1975).

## Conclusion

In vitro gas production an indication of feedstuff degradability. Gas production parameters revealed that *Gmelina arborea* leaf has potential as feed supplement in the tropics.

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