



University of Kentucky  
UKnowledge

---

International Grassland Congress Proceedings

XXIV International Grassland Congress /  
XI International Rangeland Congress

---

## Feed Intake and Liveweight Gain of Goats Fed *Urochloa* Grass

P. M. Ngila

*South Eastern Kenya University, Kenya*

Donald M. G. Njarui

*Kenya Agricultural and Livestock Research Organisation, Kenya*

Michael N. Njunie

*Kenya Agricultural and Livestock Research Organisation, Kenya*

Follow this and additional works at: <https://uknowledge.uky.edu/igc>



Part of the [Plant Sciences Commons](#), and the [Soil Science Commons](#)

This document is available at <https://uknowledge.uky.edu/igc/24/2/12>

The XXIV International Grassland Congress / XI International Rangeland Congress (Sustainable Use of Grassland and Rangeland Resources for Improved Livelihoods) takes place virtually from October 25 through October 29, 2021.

Proceedings edited by the National Organizing Committee of 2021 IGC/IRC Congress

Published by the Kenya Agricultural and Livestock Research Organization

---

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact [UKnowledge@lsv.uky.edu](mailto:UKnowledge@lsv.uky.edu).

## Feed Intake and liveweight gain of goats fed *Urochloa* grass

Ngila, P. M\*, Njarui, D.M.G †, Njunie, M†

\*South Eastern Kenya University, Department of Agricultural Sciences, P.O. Box 170-90200, Kitui, Kenya; †Kenya Agricultural and Research Organization Katumani, P.O. 340-90100, Machakos, Kenya

**Keywords:** Coastal lowlands; crude protein; feed intake; Regression analysis; galla goats

### Abstract

Crude protein and digestible dry matter are the most important components of a feed and determine animal performance. The natural pastures in Kenya are prone to great seasonal and spatial fluctuation in both quality and quantity. Consequently, there was need to explore other nutritious alternative feeds. Sixteen growing male Galla goats weighing 10 - 24 kg were used in a twelve weeks feeding trial in the coastal lowlands of Kenya. They were randomly allocated four grass diets consisting of *Urochloa brizantha* cvs. Piata and MG4, *U. hybrid* cv. Mulato II and *Chloris gayana* (Rhodes grass), which was used as the control. Regression analysis was conducted using daily weight gains as dependent variable against nutrient intake (dry matter, crude protein, acid detergent fiber, acid detergent lignin, neutral detergent fiber and ash). Crude protein intake gave a better prediction of daily gain ( $R^2 = 0.89$ ,  $P < 0.001$ ). Grass diet with high CP and digestibility values are most suitable for high ADG of Galla goats.

### Introduction

Over many parts of Africa, rural communities depend heavily for their survival on agriculture and livestock that are amongst the most climate-sensitive economic sectors (Djikeng et al., 2013). Livestock plays a key role in our country Kenya; with the subsector contributing approximately 12% to the national Gross Domestic Product (Njarui et al, 2020). The effects of climate change however, have challenged the sustainability of the livestock sector. It is projected that the Kenyan population will reach 96 million with over 50% of the population living in urban areas by 2050 (FAO, 2017). Intensification of livestock production systems need to be a crucial strategy in meeting the increased demand for meat and milk that will be prompted by changes in population growth, urbanization and diminishing land sizes (Maina et al., 2019). This intensification of livestock production requires sustainable fodder production systems which are currently threatened by increased feed prices and prolonged drought (Fallis, 2015).

Forage grasses commonly found growing in the semi-arid regions of Kenya include Rhodes grass (*Chloris gayana*), Buffel grass (*Cenchrus ciliaris*), Maasai love grass (*Eragrostis superba*), Panicum maximum, *Enteropogon macrostachyus* and Horse tail (*Chloris roxburgiana*) (Nguku et al., 2016). These grasses' nutritional and yield status decline with changing climatic conditions in the year making them not capable of meeting the needs of livestock (Gitunu et al., 2003; Nguku et al., 2016). *Brachiaria* syn. *Urochloa* species are native to eastern and Central Africa and are extensively grown as livestock forage in South America and East Asia (FAO, 2015). The annual dry matter yields ranges from 8-20 t/ha depending on moisture and nutrients (FAO,2015). *Brachiaria* grasses are among the most nutritious forages in the humid tropics; e.g. *B. brizantha* contains about 10% (range:5-16%) crude protein (CP) in dry matter, 66% neutral detergent fibre (NDF) and 58% in vivo organic matter digestibility (Heuze et al., 2016). Therefore, production of improved planted forages is a solution that can be pursued to alleviate the current situation.

*Brachiaria* syn *Urochloa* grass being climate smart fodder is being promoted by stakeholders in the livestock sector as an alternative fodder source. Literature provides little information on relationship among feed intake, daily gain and nutrient intake in goats/ruminants fed *Urochloa* grasses. This study therefore, was an attempt to provide more information feed intake and weight gains of goats fed these grasses.

## Materials and Methods

The experimental design and data collection is the same as that used during this experiment; [https://www.researchgate.net/publication/309242553\\_Change\\_in\\_growth\\_of\\_Galla\\_goats\\_fed\\_different\\_cultivars\\_of\\_Brachiaria\\_in\\_the\\_coastal\\_lowlands\\_of\\_Kenya](https://www.researchgate.net/publication/309242553_Change_in_growth_of_Galla_goats_fed_different_cultivars_of_Brachiaria_in_the_coastal_lowlands_of_Kenya)

### Chemical composition of feeds used

Mixed samples of the experimental diets were analyzed using the procedures outlined in this study; [https://www.researchgate.net/publication/309242553\\_Change\\_in\\_growth\\_of\\_Galla\\_goats\\_fed\\_different\\_cultivars\\_of\\_Brachiaria\\_in\\_the\\_coastal\\_lowlands\\_of\\_Kenya](https://www.researchgate.net/publication/309242553_Change_in_growth_of_Galla_goats_fed_different_cultivars_of_Brachiaria_in_the_coastal_lowlands_of_Kenya)

### Statistical Analysis

The nutritive quality composition (DM, CP, OM, Ash, NDF, ADF, ADL, Ca, P) and digestibility of feeds were analyzed using the general linear model (GLM) procedures of the Statistical Analysis System (SAS, 2010). Values for feed intake and live weight gain were subjected to analysis of variance (ANOVA) in a completely randomized design using GLM procedures of the Statistical Analysis System (SAS, 2010) based on the following model:  $Y_{ij} = \mu + T_i + e_{ij}$ . Where;  $Y_{ij}$  = the  $j$ th observation of the  $i$ th treatment,  $\mu$  = overall mean,  $T_i$  = the effect of the feed of the  $i$ th grass treatment (1-4),  $e_{ij}$  = the residual error. Means were separated by least significance difference (LSD) (Steel and Torrie, 1981).

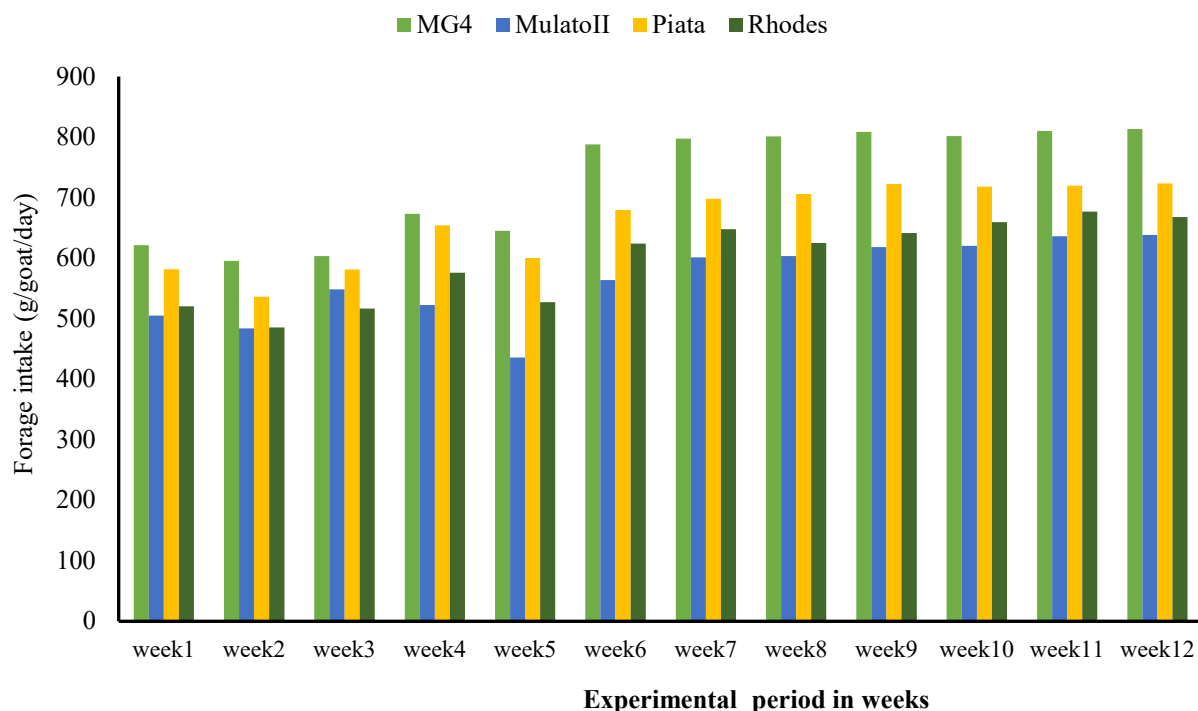
Multiple regression analysis followed the formula ( $Y = b_0 + b_1X + b_2X + b_nX$ ) daily gain as dependent variables against nutrient intake (dry matter, crude protein, Ash, NDF, ADL, DMD) (Rstudio).

## Results

**Table 1. Chemical composition (%) and digestibility (%) of feeds used in the feeding trial**

Feeds	CP	NDF	ADF	ADL	Ash	DoMD	DMD	Ca	P
Maize germ	13.9	27.5	7.7	0.4	3.6	84.7	87.4	0.03	0.73
Piata	12.6	57.9	35.4	3.6	10.8	49.0	55.0	0.27	0.20
MG4	12.1	57.1	36.9	4.3	10.7	48.7	55.5	0.27	0.22
Rhodes	6.7	68.6	44.3	5.5	7.7	39.8	44.6	0.39	0.08
Mulato II	3.0	70.7	46.9	6.3	5.0	38.2	41.4	0.27	0.19
LSD (P<0.05)	0.8	2.6	1.5	2.9	0.7	32.8	4.1	0.03	0.15
CV (%)	3.0	1.6	1.6	25.6	3.5	2.3	2.6	4.1	18.9

Significance differences at (P<0.05) in CP content were highest in the variety Piata (12.6% DM) with Mulato II having the lowest CP (3.0% DM). This was also the case with digestibility with Piata and MG4 having high digestibilities compared with Mulato II and Rhodes.



**Fig.1. Average feed intake of goats on Experimental feed weekly**

Experimental animals were given 100g of maize germ daily as supplements. Average feed intake ranged from 513-661g/day.

**Table 2. Total and average weights gains and feed conversion ratios of the goats under the experiment**

Feeds	IBW (kg)	FBW (kg)	ADWG (g/day)	AWC (kg)	FCR DM	FCR OM	FCR CP
MG4	16.00	19.47	41.3	3.47	16.0	9.6	2.1
Mulato II	15.63	15.80	2.0	0.17	259.5	113.8	8.5
Piata	15.25	19.05	45.2	3.80	13.4	7.6	1.8
Rhodes	15.87	16.68	9.6	0.81	56.2	26.6	4.1
LSD (P<0.05)		0.4	17.2	1.45	6.2	2.7	0.2
CV (%)		0.06	43.9	43.9	0.5	0.5	0.4

IBW=Initial body weight; FBW =Final body weight, ADWG =Average daily weight gain; AWC=Average weight change; FCR=Feed conversion ratio

Average daily gain (ADG) were highest in goats fed Piata (45.2g/day) and MG4 (41.3g/day) while goats fed Mulato II had the lowest ADG (2.0g/day)

**Table 3: Results of multiple linear regression for Dry matter, Crude protein, ADF and NDF in predicting Average daily gain (n=16). [R<sup>2</sup> = .8491, R<sup>2</sup>adj = .7943, F(4,11) = 15.48, p< .001]**

Variable	Estimate	Std. Error	t-value	Pr (> t )
----------	----------	------------	---------	-----------

Constant	43.37922	9.78009	4.435	0.001*
CP	0.04728	0.50474	0.094	0.927
DM	0.25631	0.22855	1.121	0.286
ADF	-0.028896	0.73739	-0.392	0.703
NDF	-0.24179	0.44543	-0.543	0.598

Predictors: (Constant), CP, DM, ADF, NDF

Dependent variable: ADG

$$\text{ADG} = 43.37922 + 0.04728\text{CP} + 0.25631\text{DM} - 0.028896\text{ADF} - 0.24179\text{NDF} \dots\dots\dots(\text{i})$$

$$\text{ADG} = 44.0337 + 1.4687\text{NDF} - 2.3560\text{ADF} \dots\dots\dots(\text{ii})$$

$$\text{ADG} = 43.71597 + 0.79252\text{CP} - 0.11066\text{DM} \dots\dots\dots(\text{iii})$$

### Discussion

Crude protein (CP;N x 6.25) in feeds serves two main functions in ruminants. The first is to supply N for the rumen microorganisms, and the second is to supply amino acids to the small intestines for absorption and use by the host ruminant animal. Amino acid supply comes from two sources, feed protein escaping microbial degradation and microbial protein (MP), derived from assimilating ruminal NH<sub>3</sub> (Broderick, 1994). Both amino sources are subsequently hydrolyzed and absorbed from the small intestine. It is the quantity of amino nitrogen, as well as the relative ratio of amino acids reaching the small intestine, that is important for optimum utilization. Until the minimum requirement for N is met in the rumen to satisfy microbial needs, ruminal fiber digestion is depressed, undigested residues accumulate in the rumen, and intake is depressed. For this reason, when dietary CP is below about 8% of the diet, CP content has a strong relationship with intake.

*Brachiaria* (*Urochloa*) hybrids Piata and MG4 were found to be better sources of protein when compared to Mulato II and Rhodes grass and this translated to higher weight gain (P<0.05). Average daily live weight gain was higher for goats fed on Piata (45.2g/day) and MG4 (41.3g/day) compared to those fed Mulato II (2.0g.day) and Rhodes grass (9.6 g/day)

Dry matter intake and crude protein intake positively and significantly contributed to daily gain, while crude fiber did not improve daily gain (R<sup>2</sup> = 0.7827). This shows that dry matter intake and crude protein are very important in determining feed intake. Animals eat to meet their energy and dry matter requirements and level of feed intake is determined by the dry matter content of the diet.

The equations developed from the study will enable nutritionists and ruminant farmers who may be interested in the inclusion of *Urochloa* grass spp in the diets of their animals to know the relationship between feed intake and weight gain of goats.

### Acknowledgments

### References

Broderick, G. A. (1994). Quantifying forage protein quality. *Forage quality, evaluation, and utilization*, 200-228.

Djikeng, A. (2013). Biosciences Eastern and Central Africa (BeCA) ILRI-hub annual letter 2012.

Fallis, A. . (2015). *Dairy Value Chain Analysis. USAID-KAVES Dairy Value Chain Analysis* (Vol. 53). <https://doi.org/10.1017/CBO9781107415324.004>

- FAO, 2015. Grassland Index. A searchable catalogue of grass and forage legumes. FAO, Rome, Italy.  
<http://www.feedipedia.org/node/20073>
- Food and Agriculture Organization. (2017). Africa Sustainable Livestock 2050: Country Brief Kenya.
- Gitunu, A.M., Mnene W.N., Muthiani, E.N., Mwacharo, J.M., Ireri R., Ogillo, B.P and Karimi S.K. 2003. Increasing the productivity of livestock and natural resources in semi-arid areas of Kenya. A case study from the southern Kenya rangelands. Proceedings for end of programme conference, agriculture/livestock research support programme, phase II held from 11-12 November 2003 at KARI headquarters. Nairobi, Kenya: Kenya Agriculture Research Institute.
- Hennessy, D. W., Williamson, P. J., Nolan, J. V., Kempton, T. J., & Leng, R. A. (1983). The roles of energy-or protein-rich supplements in the subtropics for young cattle consuming basal diets that are low in digestible energy and protein. *The Journal of Agricultural Science*, 100(3), 657-666.
- Heuzé, V. G. Tran, Sauvante, D., and Lebas, F. 2016. Bread grass (*Brachiaria brizantha*). Feedipedia, a programme by INRA, CIRAD, AFZ and FAO. <http://www.feedipedia.org/node/490> accessed on August 21, 2016.
- Leng, R. A. (1990). Factors affecting the utilization of 'poor-quality' forages by ruminants particularly under tropical conditions. *Nutrition research reviews*, 3(1), 277-303.
- Maina, K., Ritho, C., Lukuyu, B. A., & Rao, E. J. O. (2019). Determinants and impact of adopting climate-smart brachiaria grass among dairy farmers in Kenya.
- Martin, R., Linstädter, A., Frank, K., & Müller, B. (2016). Livelihood security in face of drought—assessing the vulnerability of pastoral households. *Environmental Modelling & Software*, 75, 414-423.
- Ngila, P. M., Njarui, D. M., Musimba, N. K., & Njunie, M. (2016). Performance of Galla goats fed different cultivars of *Brachiaria* in the coastal lowlands of Kenya. *J Fish Livest Prod*, 5, 210.  
<https://doi.org/10.4172/2332-2608.1000210>
- Nguku, S. A., Donald, M. G., Musimba, N. K., Amwata, D., & Kaindi, E. M. (2016). PRIMARY PRODUCTION VARIABLES OF BRACHIARIA GRASS CULTIVARS IN KENYA DRY LANDS. *Tropical and Subtropical Agroecosystems*, 19(1).
- Njarui, D. M. G., Gatheru, M., & Ghimire, S. R. (2020). Brachiaria Grass for Climate Resilient and Sustainable Livestock Production in Kenya. *African Handbook of Climate Change Adaptation*, 1-21.
- Paulino, mf, detmann, E., Valente, EEL, & Barros, LD (2008). Grazing cattle nutrition. *Symposium on strategic pasture management* , 4 (2008), 131-169.