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Evaluation of Some Kenyan and Nigerian Livestock Feedstuffs

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Abstract- This experiment was carried out to respectively evaluate the nutritive and anti-nutritive constituents of some feedstuffs and forages that are abundantly found in Kenya and Industrial rice milling wastes and Umucass 36 cassava plant meal abundantly found in Nigeria with the aim of producing them in commercial quantity for the enhancement of livestock development and feeding in Kenya and Nigeria and the entire African continent. The forages obtained in Kenya are Napier grass, Guatemala giant panicum, Boma Rhodes, Giant setaria, Mulatto and Green leaf desmodium. Rose coco, Green grams pea and Sorghum are livestock grains obtained from Kakamega County market. Rice milling waste and Umucass 36 cassava root meal (gari) were obtained from Abia State, Nigeria. They were all evaluated for their nutritive content using internationally acceptable stands. The results showed that these feedstuffs are rich in dietary nutrients and the digestibility coefficients of the forages and the feedstuffs are encouraging. Processing or non-processing of Rose coco, Green gram peas and Sorghum showed no definite pattern of response that can be traced to the processing methods used in this trial. In conclusion, the richness of these feedstuff has the potential of enhancing livestock feeding and production in these two countries if properly applied.

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I. Introduction

Animal agriculture, poverty, food security, people's health and nation's economy are inextricably linked. According to Kosgey *et al*. (2011), Adams (2016) and Alarcon *et al*. (2017), beef industry made the largest contribution (35 percent) to agricultural gross domestic product (GDP) in the Kenyan's economy, while about 61.1 percent of the people are employed in agriculture related business. According to Nigerian Bureau of Statistics (2017), the livestock sector contributed 28.68 and 22.93 percent respectively in the third quarter of 2016 and second quarter of 2017 while 29.15% was contributed to overall GPP in real terms in Nigeria. It was further stated that cattle sector is the highest component of the total livestock cash income which contributes an average of 12 percent of the total Nigerian livestock cash income (NBS, 2010). Despite animal agriculture's contribution to the national economy and people's livelihood as a major source of food (protein) and employment in virtually all nations of Africa; its activities are dominated by small producers and their primitive subsistence-inclined practices. Kenya and Nigeria are two of a kind and are blessed with good climatic environment that can encourage expansive production of livestock. For instance, Kakamega County has a tropical, high rainfall climate due to its proximity to the equator, temperatures are constant throughout the year. Average afternoon temperature are around 28°C/82°F, but night time is cool at around 11°C/52°F. It often rains throughout the year, but peaks in April and May (Kenyan National Bureau of Statistics, 2019). Nigeria, on the other hand has tropical climate with variable rainy and dry seasons, depending on location. It is hot and wet most of the year in the Southeast but dry in the Southwest and farther inland. Rainfall decreases progressively away from the coast, the far north receives no more than 2 inches (500mm) a year. Abia state lies on 52m above sea level. The climate here is tropical with average annual temperature of 26.9°C/78.78°F and precipitation averages2193mm. In view of the convivial climatic environment and the contributions of animal agriculture to the economy of these two countries, there is the need to consciously harness the environment to further enhance the country's livestock development through efficient commercial and large scale production of forages and other feed resources which would bring about efficient livestock feeding. It is on this premise that selected forages, feedstuffs and agricultural byproducts obtained from these two countries were evaluated for their nutritive content so as to know which of these feed resources could be cultivated on a large scale.

II. Materials and Methods

Eight (8) matured forages were harvested from the Masinde Muliro University of Science and Technology Teaching and Research Farms, Kakamega County, Kenya, while feedstuffs such as rose coco beans, raw green grains pea and Sorghum were purchased from the open market within the Kakamega County. These feedstuffs were processed by using either toasting, roasting and or soaking in water. The dry

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sampleswere milled and respectively analyzed for their proximate, crude fibre fractions and anti-nutrients according to the procedures described by AOAC (1980; 1984 and 2006).

Umucass 36 cassava plant, a new species of cassava and earlier introduced by IITA (2011) being cultivated on a large scale in Nigeria was also obtained from Umuahia, Abia State, while rice milling waste was obtained from Bendel (also Abia state). They were all respectively analyzed for their proximate, fibre fractions, minerals, amino acids and anti-nutrients using the procedures described by AOAC (1984; 1980 and 2006)

Rice milling waste is a round-the-year highly available mixture of all the by-products obtained in the rice milling process in Nigeria.

III. Results and Dicussion

The results of the nutrient content and digestibility coefficients of some forages obtained at the Masinde Muliro University of Science and Technology Research Farm, Kakamega County is resented in Table 1.

Table 1: The nutrient content and digestibility coefficients of some forages obtained in Kakamega County

Forages	Proximate (%)			Digestibility Coefficients		
	DM	Ash	CP	OMD (%)	OMg/KgDM	DMD (%)
Napier grass (South Africa)	91.21	9.59	12.62	25.76	232.99	30.25
Guatemala	92.70	11.08	13.03	26.17	232.69	29.25
Giant Panicum	92.69	9.75	13.18	25.11	226.64	29.78
Napier grass (Ouma)	85.52	13.73	11.56	26.45	230.92	33.67
Boma Rhodes	91.83	8.24	17.44	35.33	324.14	36.21
Giant Setaria	91.45	7.47	9.91	45.67	422.56	48.54
Mulatto	92.30	10.49	10.43	59.48	532.47	61.92
Green leaf Desmodium	92.36	6.08	18.20	25.73	241.66	30.06

OMD- Organic matter digestibility; DMD- Dry matter digestibility.

The result shows that the DM values for the 8 types of forages ranged from 85.52 to 92.69 percent. Napier grass (Ouma) has the highest (13.73%), which is closely followed by Guatemala (11.08%) and Mulatto (10.49%), while Giant Setaria gave the least value (7.47%) of ash. The percent crude protein value ranged between 9.91 (Giant Setaria) and 18.20 (Green leaf Desmodium). The highest organic matter digestibility was obtained from Mulatto and this was closely and respectively followed by Giant Setaria (45.67) and Boma Rhodes (35.33) while the value of others ranged between 25.11 and 26.45. The organic matter/dry matter digestibility ranged from 226.64 (OMg/kgDM) to 532.47 (OMg/kgDM). The percent dry matter digestible value was highest for Mulatto (61.92) and closely followed by the Giant Setaria (48.54), while the others ranged from 29.45 to 36.21. From the foregoing, the DM values of these forages showed that they can easily be baled and or ensiled. The CP values also showed these forages as having higher protein values than most of the grains (maize, sorghum and millet) often used as feed supplements inanimal nutrition while the ash value of these forages are higher than that obtained by Zafar (2008). The nutritive value of these forages could have been influenced by one or all of these factors which include stage of maturity, edaphic influences, plant species, climate, range condition and animal class. According to Schroeder (2018), the stage of growth seems to be the most important factor affecting the chemical composition and digestibility of forages.

Table 2: The percent Neutral detergent fibre of the forages obtained from Kakamega County, Kenya

Forages	NDF (%)
Napier grass (South Africa)	79.00
Guatemala	80.50
Giant panicum	66.10
Napier grass (Ouma)	58.90
Boma Rhodes	61.40
Giant setaria	65.50
Mulatto	68.20
Green leaf desmodium	61.10

NDF: Neutral detergent fibre

The percent NDF ranged from 58.90 (Napier grass – Ouma) to 80.50 (Guatemala). The neutral detergent fibre, commonly referred to as cell wall fraction is the insoluble portion of the forage which contains the cellulose, hemicellulose, lignin and silica. According to Schroeder (2018), NDF is negatively correlated with dry matter intake. In other words, as the NDF in forages increases, animal would consume less of such forage. This agrees with the less than 50% digestibility coefficient values obtained in most of the forage considered in this trial, only with the exception of Mulatto forage which respectively has 59.48 OMD and 61.92 DMD percent digestibility values. It is pertinent to know that NDF increases with the advancement in maturity of forages and a better prediction of forage intake can therefore be made using NDF.

Table 3: The nutrient content and digestibility coefficients of some selected but differently processed and unprocessed feedstuffs (grains) obtained from Kakamega County market

Feedstuffs	Proximate (%)			Digestibility Coefficients		
	DM	Ash	CP	OMD (%)	DoMD	DMD (%)
Rose coco (raw)	87.55	3.60	17.19	89.56	863.35	90.83
Rose coco (toasted)	93.51	5.38	22.61	81.96	775.56	83.39
Rose coco (roasted)	92.80	3.75	17.40	75.06	722.46	76.55
Raw green grams (specie I)	92.51	3.41	24.13	90.59	874.94	91.30
Raw green grams (specie II)	91.79	2.34	23.88	92.08	899.27	93.07
Sorghum (raw/unsprouted)	9.89	1.07	11.33	80.64	797.78	80.53
Sprouted sorghum	91.84	1.16	10.91	71.24	704.12	71.90

OMD- Organic matter digestibility; DoMD- Digestibility organic matter in dry matter; DMD- Dry matter digestibility.

The dry matter content values ranged from 87.55 (Raw rose coco) to 93.51 percent (Toasted rose coco), while the percent ash and crude protein content ranged from 1.07 (unsprouted sorghum) to 5.38 (toasted rose coco) and 10.91 (sprouted sorghum) to 24.13 (raw green grams pea). The OMD, DoMD and DMD digestible coefficient of all the test material were comparable and commendable. Processed or unprocessed, they are feedstuffs that hold great promise for livestock production in our clime.

Table 4: The nutritive content and gross energy of Rice Milling Waste obtained from Bendel, Abia State, Nigeria

Parameter	Percent Nutritive Content
Dry matter	89.84
Crude protein	10.80
Crude fibre	24.09
Ether extract	4.15
Ash	15.08
Nitrogen free extract (NFE)	35.72
Neutral detergent fibre (NDF)	65.73
Acid detergent fibre (ADF)	49.68
Acid detergent lignin (ADL)	17.57
Hemicellulose	16.05
Cellulose	32.16
Gross energy (Kcal/kg)	37.89

The result showed that rice milling waste is rich in nutrients. The percent crude protein (10.80), crude fibre (24.09), ash (15.08) and NFE (35.72) makes it a feedstuff of choice in livestock nutrition. With the exception of neutral detergent fibre (65.73) and all the other fibre fractions are within the range that could be tolerated by both ruminants and non-ruminants.

Table 5: The nutritive content and gross energy of the various parts of Umucass 36 cassava plant

Parameter (%)	CRM	CFM	CTSM	CCM	S.E.M
Dry matter	91.7^{ab}	90.00^{b}	90.00^{b}	92.80^{a}	0.02
Crude protein	2.29^{d}	21.79^{a}	5.93^{c}	19.83^{b}	0.04
Ether extract	4.10^{b}	2.36^{d}	2.71^{c}	7.67^{a}	0.00
Crude fibre	6.45^{b}	19.77^{a}	19.74^{a}	5.87^{c}	0.00
Ash	7.56b	8.70^{a}	6.33^{c}	4.74^{d}	0.02
Nitrogen free extract	70.67^{a}	37.80^{d}	56.13^{b}	54.71^{c}	0.05
Gross energy (Kcal/kg)	3.66^{b}	3.42^{c}	2.89^{d}	3.77^{a}	0.00

Means within the same row with different superscript (a-d) are significantly (P<0.05) different. CRM- cassava root meal; CFM- cassava foliage meal; CTSM- cassava tender stem meal; CCM- cassava composite meal; SEM- standard error of mean.

From the above table, cassava foliage meal and cassava composite meal respectively have 21.79 and 19.83% crude protein which can be exploited as a protein meal in both ruminant and non-ruminant nutrition. The ash content which ranges from 4.74 and 8.70% were also significantly (P<0.05) higher for cassava foliage meal (19.77%) and cassava tender stem meal (19.74%). From the foregoing, the fibre provided by the inclusion of these dietary resources in animal diets has the propensity to enhance proper digestion in the animals (Kurai *et al*. 2004). The implication of this is that utilizing cassava plants which hitherto are often regarded as wastes in our climecould become a link in the food chain (Shroider, 2018) just like the forages.

Table 6: The macro and micro mineral constituents of the various parts of the Umucass 35 cassava plant.

Parameter	CRM	CFM	CTSM	CCM	S.E.M
Macro minerals (%)					
Sodium	0.24^{b}	0.27^{a}	0.23^{a}	0.21^{d}	0.00
Potassium	0.70^{c}	0.88^{a}	0.88^{a}	0.73^{b}	0.00
Calcium	0.29^{a}	0.28^{b}	0.25^{c}	0.23^{d}	0.00
Phosphorous	0.36	0.38	0.32	0.34	0.00
Magnesium	0.28	0.29	0.25	0.34	0.00
Micro mineral (mg/kg)					
Iron	93.55^{d}	221.65^{a}	189.40^{b}	178.50^{c}	0.37
Copper	6.95^{b}	5.55^{b}	22.25^{a}	3.95^{bc}	0.10
Zinc	36.00^{b}	41.55^{a}	5.35^{c}	4.05^{c}	0.35
Manganese	15.00^{d}	17.70^{c}	28.50^{a}	22.15^{b}	0.00

Means within the same row with different superscript (a-d) are significantly (P<0.05) different. CRM- cassava root meal; CFM- cassava foliage meal; CTSM- cassava tender stem meal; CCM- cassava composite meal; SEM- standard error of mean.

Table 7: The amino acid profile of Umucass 36 cassava foliage meal

Parameters (%)	Value
Alanine	2.19
Arginine	6.46
Aspartic acid	2.16
Cysteine	3.09
Glutamic acid	8.67
Glycine	3.07
Histidine	1.34
Isoleucine	1.75
Leucine	3.44
Lysine	1.94
Methionine	0.54
Phenylalanine	3.14
Proline	2.64
Threonine	1.53
Tryptophan	1.26
Tyrosine	3.27
Ornithine	0.24
Serine	0.90
Valine	8.27

Table 8: The anti-nutritional constituents that are present in the various parts of the Umucass 36 cassava plant

Parameter	CRM	CFM	CTSM	CCM	S.E.M
HCN (mg/kg)	4.6^{b}	1.26^{d}	1.74^{c}	6.57^{a}	0.00
Trypsin inhibitor (TIUmg)	9.62^{a}	2.25^{c}	2.37^{c}	8.74^{b}	0.00
Tannin (%)	0.014^{b}	0.086^{a}	0.005^{c}	0.00^{d}	0.00

Means within the same row with different superscript (a-d) are significantly (P<0.05) different; SEM- standard error of mean.

Tables 6 and 7 show the macro and micro minerals and amino acid constituents of the various meals produced from the various parts of Umucass 36 cassava plant.

The macro and micro minerals are significantly (P<0.05) available in virtually all the components parts of Umucass 36 cassava plant and can therefore be included in animal feed. Table 7 also show a rich amino acid profile of Umucass 36 cassava plant, thus making it a rich source of dietary plant protein in livestock nutrition.

Table 8 shows the anti-nutritional constituents that are present in the various parts of Umucass 35 cassava plant. The HCN, Trypsin inhibitor and tannin were significantly (P<0.05) influenced. The HCN level ranged from 1.26 (cassava foliage meal) to 6.57 (cassava composite meal) which is within an accepted tolerable level.

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IV. Conclusion

The results of the resent study indicate that these forages, rice milling waste and Umucass 36 cassava plants components are rich in dietary nutrients and have the potentiality of being used as major feedstuffs in livestock nutrition. It can also be used to further enhance livestock feeding, first in Kenya and Nigeria and the entire continent of Africa. Lastly, it is pertinent to begin to think about the business of cultivating these forages on a commercial/large scale and thereafter harvested and sold to farmers who are involved in animal production.

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