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Research Article

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Proximate Composition and Metabolizable Energy Profiles of Banana Leaves of Different Growth Stages

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Abstract

This preliminary study was conducted to assess the proximate and Metabolizable energy compositions of Banana leaves of different growth stages as a prelude to using them to feed farm animals. The banana leaves were the fresh leaves (FBL), matured leaves (MBL) and yellow leaves (YBL) aged 7, 15 and 19 weeks respectively. Results of proximate analysis showed the dry matter, crude protein, crude fibre, ether extract, ash, nitrogen free extracts and Metabolizable energy to be 96.29, 96.78 and 96.96; 17.50, 13.13 and 8.75; 14.86, 14.94 and 15.91; 4.58, 10.05 and 10.91; 13.04, 12.35 and 13.82; 45.26, 46.31 and 48.32% and 2965.66, 3311.57 and 3303.44 Kcal/kg for the fresh, matured and yellow leaves. Significant ($P<0.05$) differences were observed in the crude protein, ether extract, nitrogen free extract and Metabolizable energy fractions while the dry matter, crude fibre and ash were not significantly ($P>0.05$) affected by differences in age of the banana leaves. It was concluded that the proximate composition and Metabolizable energy of the banana leaves present them as a potential feedstuff. It was recommended that both the mature and yellow banana leaves which abound after the plant has completed its life cycle (when all bunches carrying the fruits are harvested) could be used in feeding ruminant animals.

Keywords: *Proximate composition, Metabolizable energy; Banana leaves; Ruminant feeding*

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Introduction

Ruminant livestock, due to the nature of their digestive tracts, feed mainly on roughages which form their basal diets. Some of the roughages are crop residues which become available for ruminant feeding after the main product of interest has been harvested. Among the plants which produce food for human consumption and for other industrial uses which also generate substantial crop residues is banana. The banana plant is a tree-like herb and produces fruits which on ripening are used for human feeding all over the world. The leaves are large, flexible and water proof (Wayback machine, 2012), are also used for biogas production (Yaro, 2016). The leaves are also used for food packaging in some parts of the world and according to Frogmon (2012), the leaves import an aroma to food that is cooked or served on them. Besides adding flavour, the leaves keep juices in and protect food from burning, much as foil does (Hortpurdue, 2009). Inam-ul-Haq., *et al*. (2016) reported the crude protein composition of the leaves to be 8.96%. Aduku (2012) reported crude protein, crude fibre and ash contents of banana leaves as 14.22, 19.68 and 13.50% respectively. The aerial parts of the plant die down to the ground after the growing season and one of the shoots growing at the base of the plant, the sucker, then takes over (Promusa, 2017). This unique and interesting life cycle thus offers attraction for researching into the possibility of employing the leaves for ruminant feeding after the plant has completed its life cycle but is still standing with its leaves intact. Advantage of conversion of the leaves to livestock feed lies in addition of another feed resource for ruminant feeding. Additionally, there will be value addition to banana leaves, especially after the ripe fruits have been harvested as the leaves will then be channelled to ruminant feeding.

Materials and Methods

Study area

The study was conducted at the University of Agriculture, Makurdi. Makurdi, the capital of Benue State is located between latitude 6° and 8° north and longitude 6° and 10° east. The Federal University of Agriculture, Makurdi is located at latitude 7° 44 N and longitudes 8° 54 E in the southern guinea savannah region of Nigeria. The annual temperature ranges between 21°c in January to 35°c in March. It has annual rainfall of 1105 mm to 1600 mm and relative humidity which is highest between August and September (69%) and lowest between January and February (39%).

Collection of banana leaves

The banana leaves used in the study were harvested at a banana plantation at Ityo-Mu, a suburb of Makurdi. Due diligence was exercised in monitoring age of the plants to harvest the leaves at the determined ages.

Proximate analysis

Proximate analysis was done at the laboratory of the Department of Animal Nutrition, College of Animal Science, University of Agriculture, Makurdi, Nigeria using the procedure of AOAC (2005).

Metabolizable energy estimation

The Metabolizable energy of the banana leaves was calculated base on proximate constituents using the formula of Carpenter and Clegg (1956).

Data analysis

Collected data were analyzed using Analysis of Variance package of Minitab statistical Software. Significant differences were separated using the Fishers package of the software.

Results

Result of the proximate composition and Metabolizable energy of the banana leaves assessed in the study are shown in Table 1. Stage of the banana leaves exerted significant ($P < 0.05$) effect on the crude protein, ether extracts, nitrogen free extracts and Metabolizable energy while there were no significant ($P < 0.05$) differences in the dry matter, crude fibre and ash of the banana leaves. The dry matter ranged from 96.29 to 96.78% in the fresh (FBL) and yellow leaves (YBL) respectively. Crude protein was highest in the fresh leaves and also significantly higher than that of the mature and yellow leaves. Crude protein content of the mature leaves was also significantly higher than that of the yellow leaves which were the least. The crude fibre composition which did not show any significant effect was highest in the mature leaves, followed by that of the fresh leaves and lastly by that of the yellow leaves. Ether extracts of the banana leaves showed a significant difference pattern where values of the mature and yellow leaves were similar to each other but significantly higher than that of the fresh leaves which were the least and also significantly lower than those of the mature and yellow leaves. The ash fraction which did not manifest any significant difference was highest in the yellow leaves followed by the mature leaves and lastly the fresh leaves. The nitrogen free extracts fraction reacted significantly to stage and age of the banana leaves; highest value was recorded for the yellow leaves and was significantly higher than the values of the mature and fresh leaves which were statistically similar to each other. The Metabolizable energy profile also showed a significant effect of age and stage of growth on the banana leaves; highest values were obtained for the mature and yellow leaves which were statistically similar to each other but significantly higher than the value of the fresh leaves which was the least and also significantly lower than the others.

Parameters	FBL	MBL	YBL	SEM	LOS
Dry matter (%)	96.29	96.78	96.96	0.78	NS
Crude protein (%)	17.50[a]	13.13[b]	8.75[c]	0.39	*
Crude fibre (%)	14.86	15.91	14.94	0.45	NS
Ether extract (%)	4.58[b]	10.05[a]	10.91[a]	0.24	*
Ash (%)	13.04	12.35	13.82	0.36	NS
Nitrogen free extracts (%)	45.26[b]	46.31[b]	48.32[a]	0.48	*
Metabolizable energy (Kcal/kg)	2965.66[b]	3311.57[a]	3303.44[a]	103.95	*

Table 1: *Proximate composition and Metabolizable energy of banana leaves.*

FBL = Fresh banana leaves; MBL = Mature banana leaves; YBL = Yellow banana leaves; SEM = standard error of mean; LOS = Level of significance; NS = not significantly different (P > 0.05); * = significantly different (P < 0.05); Metabolizable Energy, ME (kcal/kg) was calculated using the formula of Carpenter and Clegg, (1956).

Discussion

The high and non-significant difference in the dry matter content of the leaves goes against normal expectation that as the plant ages the parts should contain more dry matter. Shayo (1997) reported that total dry matter content of leaves is linearly related to plant maturity. The dry matter content of the banana leaves is however attributed to presence of the waxes in the leaves which would have prevented much water content i.e. the waxes occupying the matrices of the leaves. The significantly higher crude protein content of the banana leaves harvested at different ages is not surprising but explained on the basis of the fact that at earlier ages, there is lower content of cell wall constituents which the plants progressively deposits in their parts as they age to enable them maintain an upright position necessary for accessing sunlight for photosynthetic activities to guarantee food production for the plant. This report is consistent with that of other authors who reported higher crude protein content for younger plant parts than the older parts (McDonald., *et al*. 1988; Shayo, 1997; Jimoh., *et al.* 2015).

Additionally the crude protein value range of the banana leaves (8.75 to 17.50%) meets the minimum dietary crude protein level of 6.50 to 8.00% recommended for optimum performance of ruminant tropical animals (Minson, 1981). The crude fibre level pattern of numerical increase from the fresh to the mature leaves is consonant with the expectation that as the plant matures and undergoes secondary thickening, the fibre level should naturally increase. The increment in the observed crude fibre level is consistent with the report of Vishu (2016) that crude fibre tends to increase with advancing ages of plants. The lower crude fibre of the yellow banana leaves is also explained by the assumption that due to the yellowing of the leaves, some metabolic reactions by the plant enzymes may have caused a general change in the proximate composition of the leaves as the leaves prepared to rot away and give way to another sucker to utilize resources in the environment for its development and growth (Promusa, 2017). Vishu (2016) reported that nutrients in plant leaves quickly disintegrate with advancing plant age and as the leaves and stems disintegrate. The increasing ether extracts of the banana leaves as they aged is explained on the basis of deposition of more waxy materials in the leaves, which probably dissolved in the reagent used for ether extract determination in the laboratory, thus raising the ether extract values. More so, Jimoh., *et al*. (2015) also reported lower fat content in forages harvested at eight weeks than those harvested at 12 weeks. The lower ash content in the mature leaves compared to the fresh and yellow leaves is attributed to the higher content of fibre in the mature leaves. Vishru (2016) reported an inverse relationship in the crude fibre and calcium composition. Calcium is one of the minerals contained in the ash fraction of proximate analysis system of feed evaluation. Thus lower calcium content would naturally translate to lower ash value. Jimoh., et al. (2016) also reported that ash content was higher in leaf fractions harvested at 12 than at eight weeks. The nitrogen free extracts increase as the banana leaves aged was explained as a direct response to the crude protein content. The crude protein content decreased with increasing age while the nitrogen free extracts increased because high protein (which has 16% nitrogen) content reduced the composition of the nitrogen free component. The Metabolizable energy content increasing with increasing age of the banana plants was noted to be caused by the higher ether extract and nitrogen free extracts fractions that were used in the Metabolizable energy calculations.

Conclusion

It was concluded that the proximate and Metabolizable energy content of the banana leaves of differing ages studied in this work presented them as a possible feed material for ruminant livestock.

Recommendation

It was recommended that the mature and yellow leaves of banana plants should be considered for more chemical evaluation (antinutritional factors) as a prelude for possibly adopting them as a ruminant feed resource.

References

1. Aduku AO. “Animal Nutrition in the Tropics: Feeds and Feeding Pasture Management Monogastric and Ruminant Nutrition”. *Davcon computer ans Business Bureau* 11 (2012): 17-18.
2. AOAC. “Association of Official Analytical Chemists. Official Methods of Analysis (Ed. W. Horowitz) 18th Edition”. (2005): 1,018.
3. Frogmom. “Black cod steamed in banana leaves with Thai Marinade”. (2012):
4. Hortpurdue. “Banana. Hortpurdue”. (2009):
5. Inuran – ul- Haq M., *et al*. “Proximate analysis of different agricultural wastes used for the cultivation of Volvariella volvacea”. National agricultural Research Centre (2011):
6. Jimoh OS., *et al*. “Proximate composition of the morphological fractions of Panicum maximum varieties affected by age in the Derived Savannah of Nigeria”. *Proceedings Conference Society for Grassland Research and Development in Nigeria* 1 (2015): 80-84.
7. McDonald P., *et al*. “Animal Nutrition, fifth edition published by Pearson Education Limited, Edinburgh Gate, Harlow”. (1995): 451-464.
8. Minson DJ. “Nutritional differences between tropical and temperate pastures. In: Grazing Animals. Disciplinary approach”. *World Animal Science* 3 (1981): 143-147.
9. Nassoro Z. “Evaluation of nutritive browse tree fodder species indigenous to Kiteto and Kongwa district. M.Sc. thesis”. University of Dodoma (2014):
10. Promusa. “Morphology of the Banana plant”. (2017):
11. Shayo CM. “Uses, yield and nutritional value of Mulbery (Morus alba) tree for ruminants in the semi-arid areas of Tanzania”. *Tropical Grassland* 31 (1997): 699-704.
12. Vishru VRP. “Factors affecting the nutritive value of commonly available forages”. (2016):
13. Way back machine. “Frozen banana leaves. Archived 2012-06-30. At the way back machine, Temple of Thai Food store”. (2012):
14. Yaro MN. “Proximate composition of banana leaves and estimation of fungal degradation products of the leaves at mesophilic temperature”. *Worldwide journal of multidisciplinary Research and Development* 2.2 (2016): 31-35.

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