

Effects of Drying Condition and Storage Length on the Physical Characteristics and In Vitro Gas Production of *Megathyrsus maximus* (Ntchisi) Hay

Foluke E. Enwete, M.Agric. (in-view)^{*1}; Peter A. Dele, Ph.D.¹;
Chika C. Anotawere, M.Agric. (in-view)¹; Bolanle T. Akinyemi, Ph.D.¹;
Yunusa M. Ishiaku, Ph.D.²; Adetayo B. Adekeye, Ph.D. (in-view)³;
and Olufemi S. Onifade, Ph.D.¹.

¹Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria.

²Feeds and Nutrition Research Programme, National Animal Production Research Institute, Shika, Ahmadu Bello University, Zaria, Nigeria.

³Crop and Pasture Production and Sustainable Environment Programme, World Bank for Africa Centre for Excellence in Agricultural Development and Sustainable Environment, Federal University of Agriculture, Abeokuta, Nigeria.

E-mail: salawufoluke@gmail.com*

ABSTRACT

The study was carried out to evaluate the physical and sensory characteristics and *in vitro* gas production of hay produced from *Megathyrsus maximus* (Ntchisi) under six drying conditions and five storage length. Agronomic study was carried out in the dry season and hay was produced during this period. The experiment was a 6x5 factorial in a split plot design which comprises of two factors; 6 drying condition (Translucent, Green, Zinc, Black, Canopy and Traditional) as the main plot, and 5 storage length (0, 2, 4, 6, and 8 weeks) as the subplot.

Hay produced under green color roofing sheet had the highest score of 15.13 in color profile. Storage length was significantly ($p < 0.05$) affected by physical and sensory characteristics of hay. Highest gas production was recorded from the eight week storage length hay and also in hay produced under the translucent roofing sheet. At zero and two week of storage length the *In vitro* dry matter digestibility was 67% and 66.5%, respectively. It was concluded that, the green color controlled drying chamber hay was best in color odor profile and in *In vitro* dry matter digestibility and translucent controlled drying chamber was recommended as the medium to obtain the best volume of gas production. Also at zero and two week storage length the *In vitro* dry matter digestibility was considered the best because the hay quality was still retained.

(Keywords: *digestibility, drying conditions, hay, in vitro, storage, livestock food, ruminant forage*).

INTRODUCTION

One of the major problems facing developing countries in the tropics is the production of sufficient food. Protein derived from ruminant animals is one of the major classes of food which is very essential for the well-being of the body (Anthony *et al.*, 1986).

Forage is important to livestock production since it is the major source of ruminant feed and nutrition for sustainable animal protein. Forage provides more than 90 % of energy and protein requirement of ruminants particularly in rural and sub-urban areas and the role of green feed in filling the bulk and supplying nutrients to ruminant animals have been extensively reported (Akinsoyinu and Onwuka, 1988).

Adequate animal nutrition is essential for high rates of gain, ample milk production, efficient reproduction, and adequate profits. *Megathyrsus maximus* is being found to be highly productive native pastures in south west Nigeria and produces high yields of palatable fodder. It is one of the most common grasses in the derived savanna region of Nigeria (Ajayi and Babayemi, 2008). Therefore, because of the high dry matter contents in guinea grass and animal production potentials and for this its potential to be sustained, the low soil fertility that is a common to the tropics need to be addressed.

Maintaining high soil fertility can be achieved through fertilizer (organic and inorganic) application. Hay making has been traditionally

considered to be suitable in the dry season, but most forages in the dry season are usually fibrous and low in quality, so the need to preserve the excess in the rainy season is paramount, to be able to have better quality forage for livestock in the dry season. Hence, the reason for this study whereby hay drying structures are made with different colored roofing sheets which is to represent the drying conditions.

MATERIALS AND METHODS

The field experiment was established in October 2015, at the organic section of the Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta (FUNAAB) Ogun State, Nigeria. The material for hay making was sourced from the established experimental plot. Laboratory analysis was carried out at the Department of Pasture and Range Management Analytical Laboratory, College of Animal Science and

Livestock Production, Federal University of Agriculture Abeokuta, Ogun State, Nigeria.

Experimental Design and Management

The *Megathyrus maximus* Ntchisi was cut back to give room for uniform regrowth and the experiment was laid in 6x5 factorial arranged in a split plot design comprising of two factors which are: 6 drying condition; black, green, translucent roofing sheets, canopy, zinc roofing sheet and conventional drying condition. 5 hay storage length; 0, 2, 4, 6, and 8 weeks, making a total of 30 treatments. The physical characteristics (leafiness, odor, color, and foreign materials) were estimated using the modified procedure of Vough (2000) for each sampling time and the *in vitro* gas production was determined using Menke and Steingas procedure (1988).

RESULTS AND DISCUSSION

Table 1: Effect of Drying Condition and Storage Length on the Physical Characteristics of *Megathyrus maximus* Ntchisi Hay.

Factors	Leafiness	Color	Odor	Foreign Materials	TOTAL
Drying Condition					
Translucent	13.20a	14.33ab	15.20a	9.40b	74.47b
Green	12.98a	15.13a	15.40a	9.52a	75.76a
Zinc	12.55b	14.50ab	15.00ab	9.60a	73.79c
Conventional	12.50b	14.45ab	14.65b	9.53a	73.04d
Black	12.45b	13.70b	14.20b	9.50a	71.21f
Canopy	12.30b	13.70b	14.68b	9.50a	71.69e
SEM	0.35	0.42	0.39	0.10	0.31
Storage Length (weeks after storage)					
Zero	12.77b	13.52c	15.08a	9.69a	72.94c
Two	11.46c	13.94bc	13.63b	9.35c	69.11e
Four	13.40ab	14.77ab	15.31a	9.65ab	75.90b
Six	11.53c	13.98bc	15.23a	9.42bc	71.66d
Eight	14.10a	15.27a	15.02a	9.44abc	76.90a
SEM	0.25	0.38	0.35	0.09	0.28

a,b,c,d,e,f: Means in the column with different alphabets are significantly ($p < 0.05$) different. SEM = Standard Error of Mean.

Table 2: Effects of Drying Condition and Storage Length on the *in vitro* Gas Production (ml/200mg DM) of *Megathyrus maximus* Ntchisi Hay.

Factors	Time (hr)					
	3	6	12	24	36	48
Drying Condition						
Translucent	3.60a	9.30a	21.40a	25.00a	26.40a	28.60a
Green	3.40ab	8.90ab	21.40a	24.20ab	26.20a	27.80ab
Zinc	3.20abc	8.60ab	21.40a	23.80b	25.80ab	27.20ab
Conventional	2.70bc	8.40ab	20.80a	24.20ab	25.40ab	26.80ab
Black	2.70bc	8.20b	21.40a	23.80b	25.20ab	26.40b
Canopy	2.50c	8.10b	20.20b	22.40c	24.40b	26.20b
SEM	0.35	0.46	0.28	0.55	0.70	0.922
	Storage Length (weeks after storage)					
Zero	3.58ab	9.50a	20.67b	23.50bc	26.67ab	29.00a
Two	3.08b	8.92a	20.83b	23.67bc	25.67b	27.83a
Four	2.17c	7.50b	20.83b	22.67c	23.83c	25.00b
Six	2.25c	7.50b	21.17b	23.83b	24.33c	25.00b
Eight	4.00a	9.50a	22.00a	25.83a	27.33a	29.00a
SEM	0.28	0.37	0.25	0.49	0.57	0.75

a,b,c,d: Means in the column with different alphabets are significantly ($p < 0.05$) different. SEM = Standard Error of Mean.

The leafiness, odor, and foreign materials profile of the hay are not significantly ($p > 0.05$) affected by the drying condition on like the color profile of the hay that was significantly ($p < 0.05$) affected by the drying condition, this is in line with Vough (2000).

Storage length effects on the physical characteristics of the hay was significantly ($p < 0.05$) affected. The color profile of the hay scored ranged from 13.52 at zero week of storage length to 15.27 at eight week of storage length. The highest scored color profile was in hay covered with green color this might be as result of green color absorption of all colors except green.

Hay with zero, four and, six week of storage length, falls within Vough (2000) range, which indicates the good odor condition of the hay. Foreign materials profile of the scored hay was higher at zero week of storage length, which indicated that the hay was subjected to some weed by Dele (2012).

The gas production was significantly ($p < 0.05$) higher from 3-48 hr for hay produced from translucent material drying condition. In green, zinc, and black color drying condition at 12hr of incubation, the same volume of gas was statistically the same in translucent material drying condition. At 48hr of incubation, the least gas

production volume was detected in canopy material drying condition.

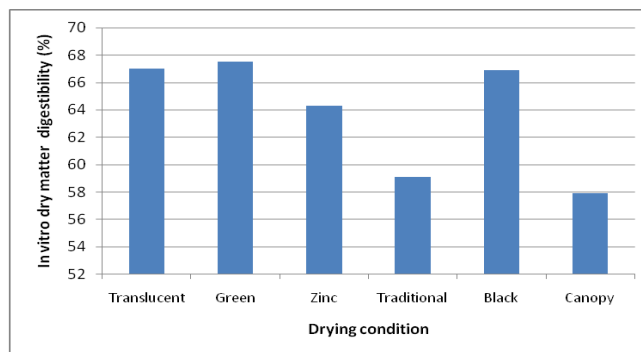


Figure 1: Effect of Drying Conditions on the *In vitro* Dry Matter Digestibility of *Megathyrus maximus*.

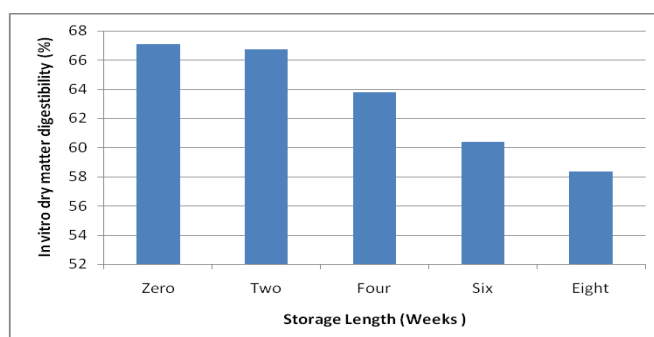


Figure 2: Effect of Storage Length on the *In vitro* Dry Matter Digestibility of *Megathyrus maximus*.

The gas production was significantly ($p < 0.05$) higher from 3-48 hr for hay produced from translucent material drying condition. In green, zinc, and black color drying condition at 12hr of incubation, the same volume of gas was statistically the same in translucent material drying condition. At 48hr of incubation, the least gas production volume was detected in canopy material drying condition.

It was recorded that, the hay produced at eight weeks of storage length has the highest gas volume at 3, 12, 24, 36, and 48 hr. Also, at 48 hr of incubation, zero week of storage length has the highest gas volume. It was reported by Coelho et al. (1998) that, the gas production is as a result of substantial changes in carbohydrate fractions.

Figure 1 shows the effect of drying conditions on the *in vitro* dry matter digestibility of *Megathyrus maximus*. The *In vitro* dry matter digestibility of hay dried under the green drying condition had the highest score of 67.5% this score was higher than what Dele (2012) reported. This could be as a result of the green color drying condition the hay was subjected to. Hay dried under the traditional drying condition had 59% *In vitro* dry matter digestibility, this was in line with Dele 2012 report.

Figure 2, *In vitro* dry matter digestibility was affected by the storage length. At zero week and two week of storage length highest score for the *in vitro* dry matter digestibility was recorded. This was lower than the value reported by Silanikove (1988) this could be because of the urea treatment used.

CONCLUSION

It can be concluded from this study that, hay produced from green drying condition had the highest score in color and odor profiles and also in *In vitro* dry matter digestibility. Translucent drying condition hay had the highest volume of gas production and at zero and two week of storage length the *In vitro* dry matter digestibility had the highest score.

REFERENCES

1. Ajayi, F.T. and O.J. Babayemi. 2008. "Comparative *in vitro* Evaluation of Mixtures of *Megathyrus maximus* cv Ntchisi with stylo (*Stylosanthes guianensis*), lablab (*Lablab*

purpureus), centro (*Centrosema pubescens*) and histry (*Aeschynomene histry*)". *Livestock Research for Rural Development*. 18-20.

2. Akinsoyinu, A.O. and C.F.I. Onwuka. 1988. "Mineral Constituents of some Browse Plants used in Ruminant Feeding in Southern Nigeria". *Nigerian Journal of Animal Production*. 15:57-62.
3. Anthony, Y., F.O.C. Ezedinma, and C.O. Ochapa. 1986. *Introduction to Tropics Agriculture*, 5th Edition. Pearson Education Limited, Edinburgh Gate, UK.
4. Coelho, M., F.G. Hembry, F.E. Barton, and A.M. Saxton. 1998. "A Comparison of Microbial, Enzymatic, Chemical and Near Infrared Reflectance Spectroscopy Method in Forage Evaluation". *Animal Feed Science and Technology*. 20:219.
5. Dele, P.A. 2012. "Evaluation of Dry Matter Yield and Nutritive Quality of Forage, Hay and Silage from Three Grasses Fertilized with Animal Manures". Ph.D. Thesis, Federal University of Agriculture: Abeokuta, Nigeria. 138pp.
6. Menke, K.H. and H. Steingas. 1988. "Estimation of the Energetic Feed Value from Chemical Analysis and *in vitro* Gas Production using Rumen Fluid". *Animal Research and Development*. 28:7-85.
7. Silanikove, N., O. Cohen, D. Levanon, T. Kipnis, and Y. Kugenheim. 1988. "Preservation and Storage of Green Panic (*Megathyrus maximus*) as Moist Hay with Urea". *Anim. Feed Sci. Technol.* 20: 87-96.
8. Vough, L.R. 2000. "Evaluating Hay Quality". Online fact sheet, FS-644. University of Maryland: College Park, MD. Available online at <http://www.agur.umd.edu/MGE/Publication.cfm?ID=110>

ABOUT THE AUTHORS

Foluke E. Enwete is a postgraduate student in the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria and is currently being supervised by Dr. Peter A. Dele.

Dr. Peter A. Dele, is a registered Animal Scientist and is a member of the Nigerian Institute of Animal Science. He is a Lecturer in the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria. He holds a Ph.D. in Pasture Production and Utilization.

Chika C. Anotawere is a postgraduate student in the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria and is currently being co-supervised by Dr. Peter A. Dele.

Dr. Bolanle T. Akinyemi, is a Lecturer in the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria. Her research interests are in the areas of Pasture Agronomy and Utilization

Dr. Yunusa. M. Ishiaku is a Research Scientist with the Feeds and Nutrition Research Programme, National Animal Production Research Institute, Shika, Ahmadu Bello University, Zaria, Nigeria

Adetayo B. Adekeye is a Ph.D. student with Crop and Pasture Production and Sustainable Environment Program, World Bank for Africa Centre for Excellence in Agricultural Development and Sustainable Environment, Federal University of Agriculture, Abeokuta, Nigeria. He is currently being supervised by Professor O.S. Onifade

Dr. Olufemi S. Onifade is a Professor in the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta, Nigeria and a Council Member, Nigerian Institute of Animal Science. His research interests are in the areas of Pasture Agronomy and Utilization

SUGGESTED CITATION

Enwete, F.E., P.A. Dele, C.C. Anotawere, B.T. Akinyemi, Y.M. Ishiaku, A.B. Adekeye, and O.S. Onifade. 2020. "Effects of Drying Condition and Storage Length on the Physical Characteristics and *In Vitro* Gas Production of *Megathyrus maximus* (Ntchisi) Hay". *Pacific Journal of Science and Technology*. 21(2):327-331.

 [Pacific Journal of Science and Technology](http://www.akamaiuniversity.us/PJST.htm)