CHEMICAL COMPOSITION AND *IN VITRO* FERMENTATION CHARACTERISTICS OF UREA TREATED MAIZE HUSK

Adebayo, B.J. and Akinfemi, A.
Department of Agricultural Technology, Yaba College of Technology,
Epe Campus, Odoragunshin, Lagos State.
Corresponding author: babsade2@yahoo.com, +2348030559306

Abstract
Studies were conducted to assess changes in the nutritive value of maize husk and the in vitro digestibility for the purpose of improving its contents for ruminant use. Samples of dried and milled maize husk were treated with 0.5% Urea (T2), 7.0% urea (T3), 1.5% urea (T4) and 2.0% urea (T5), while the control T1was untreated. The resultant substrates were sun dried and preserved for further use. The result obtained showed variations (P< .05) in the proximate composition and potential extent of degradation (a + b, ml). The crude protein ranged from 6.62 to 10.84%, crude fibre 8.15 to 11.45% and ether extract 4.52 to 6.59%, Hemicellulose 8.00 to 18.55% and Cellulose 16.00 to 37.10%. Fastest rate of degradation (C, h^{-1}) was observed in T5. The estimated organic matter (OMD) and short chain fatty acid (SCFA) were not significantly different (P>0.05). The result obtained in the present study showed that urea treated maize husk could be used as part of the feed for ruminant, especially during the period of scarcity.

Key words: Maize husk, Metabolizable energy, Ruminants

Introduction

Huge tonnage of maize husk abound in Nigeria, as a result of high maize (*Zea mays*) production. The husks are sometimes used as ruminant feed, burnt or left on the farm to rot. The major constraints in its use as feed for ruminant is the low available nutrient content. Other (Ramirez, 2003) observed that maize husk feed to ruminant will result in low voluntary intake, digestibility, nitrogen and energy content, and high cell wall concentration.

Feed-grade urea is widely available and has been used as source of ammoniation to improve the feeding value of various grass hays and crop residues by increasing non-protein preservative or fungicide (Sundstol and Coxworth, 1984). In the present study, Fertilizer grade urea was used to treat maize husk. This method is particularly important to cater for shortages of ruminant feeds during the dry season. Besides, the urea is readily available and its application in the treatment of crop residues is not difficult. The aim of this study was to determine changes in the nutrient content of maize husk after treatment with Urea molasses.

Materials and Methods

Samples of milled maize husk were used for the experiment. Fertilizer grade urea dissolved in water equivalent to 0.5 (T2) 1.0% (T3), 1.5% (T4) 2% T5 (W/v) to which was added molasses, were sprayed in 100g quadruplicate samples on DM bases. The thoroughly mixed samples were sun dried while the samples required for proximate composition and in vitro digestibility were oven dried at 105°c for hrs, to constant weight chemical composition of the treated (T2 to T5) and untreated sample T1 were determined using standard methods (AOAC, 1995 and Van Soest *et al.*, 1995).

In vitro gas production

Rumen liquor was obtained from three WAD female goats through suction tube before morning feed. The preparation is buffer solutions and rumen innocula was as described by Menke and Steingass (1988). Gas production was measured three hourly and at 24h gas production, 4ml sodium hydroxide (10ml) was introduced after 24h post incubation to estimate methane production. The average of the volume of gas produced from the blank was deducted from the volume of gas produced per sample.

Metabolizable Energy (ME) was calculated as ME = 2.20 + 0.136GV + 0.057CP + 0.0029CF (Menke and Steingass), organic matter digestibility (OMD, %) = 14.88 + 0.88Gv + 0.45CP + 0.651 XA (Menke and Steingass, 1998). Short chain fatty Acids (SCFA) as 0.0239 Gv – 0.0601 (Getachew *et al*, 1991) was obtained where Gv, CP, CF and XA are total gas volume, crude protein crude fiber and ash respectively. Data obtained were subjected to analysis of variance, where significant differences occurred, the means were separated using Duncan multiple range F-test of the SAS (Statistical Analysis System Institute Inc, 1988 options).

Results and Discussion

Table 1: Chemical composition (g/100gDM) of Urea-molasses treated maize husk

parameters	T1	T2	T3	T4	T5	SEM
Crude protein	6.62[e]	6.76[d]	8.25[c]	9.97[b]	10.84[a]	0.008
Crude fibre	11.45[a]	10.25[b]	10.03[b]	8.80[c]	8.15[d]	0.74
Ether extract	4.52[e]	4.97[d]	5.43[c]	6.14[b]	6.59[a]	0.006
Ash	1.91[a]	2.59[b]	2.77[c]	2.95[d]	2.22[e]	0.006
Carbohydrate	75.50[a]	75.43[a]	73.52[b]	72.14[c]	71.20[d]	0.032
NDF	74.20[a]	52.67[b]	44.40[c]	41.20[d]	32.00[e]	0.36
ADF	55.65[a]	39.50[b]	33.30[c]	30.90[d]	24.00[e]	0.27
ADL	18.55[a]	13.17[b]	11.10[c]	10.30[d]	8.00[e]	0.09
Cellulose	37.10[a]	26.33[b]	22.20[c]	20.60[d]	16.00[e]	0.18
Hemicellulose	18.55[a]	13.67[b]	11.10[c]	10.30[d]	8.00[e]	0.09

a,b,c,d,e, means on the same row with different superscripts are significantly varied ($p<0.05$)
NDF=Neutral detergent fibre, ADF= Acid detergent fibre, ADL= Acid detergent lignin, SEM= Standard error of mean

Table 2: Gas production characteristics, gas volume, estimated organic matter digestibility, metabolizable energy and short chain fatty acid.

Parameters	T1	T2	T3	T4	T5	SEM
b ml	26.33	26.33	23.67	22.00	20.00	2.87
C h^{-1}	0.189[a]	0.189[a]	0.182[a]	0.179[a]	0.148[b]	0.005
Gv24	23.00	25.00	26.67	29.33	29.33	2.87
OMD (%)	103.41	105.25	107.39	110.54	110.95	2.55
ME(MJ/KgDM)	9.14[b]	9.48[b]	10.56[ab]	11.90[a]	12.39[a]	0.39
SCFA (umol)	0.489	0.537	0.577	0.641	0.641	0.07

a,b,c, means on the same row with different superscripts are significantly varied ($p<0.05$), b= Fermentation of the insoluble but degradable fraction, c = Gas production rate constant,Gv24= Gas volume produced at 24hour, OMD = Organic matter digestibility, ME= Metabolizable energy, SCFA = Short chain fatty acid.

The result of chemical composition of the treated, and untreated maize husk is shown in Table 1. Urea molasses treatment increased the crude protein (%) content from 6.62 to 10.84. This could be due to the addition of non-protein nitrogen to the treated husk. The NDF, ADF, Hemicellulose and cellulose consistently reduced with increased inclusion of urea. This observation is consistent with earlier report (Sundstol and Coxworth, 1984 which reported Hemicellulose solubilization.

Previous studies have also reported reduction of NDF in Urea treated crop residues and grass hays. Table 2 shows gas production characteristics, gas volume, estimated organic matter digestibility, metabolizable energy and short chain fatty acid. There were no significant ($P>0.05$) in the value obtained in the fermentation of the insoluble but degradable fraction (b,ml). Estimated ME differed significantly ($P<0.05$) with the highest value predicted for T5. Use of *in vitro* gas production result could be use to predict ME and the values obtained have been reported to be consistent with those obtained by *in vitro* method.

Conclusion

The urea treated maize husk investigated in this study has appreciable crude protein contents. It has the potential to boost inadequate feed supply and improve low level of nutrients encountered by ruminants especially in the dry season.

References

Akinfemi A., Ladipo, M.K. and Yakubu .A. (2010). Evaluation of Fungal treated beniseed as feed for Goats. Proc. 35[th] Conf. Nig. Soc. For Anim. Prod. 14 – 17 March, 2010 University of Ibadan.

FMAWR (1988). Agricultural policy for Nigeria: Strategies for implementation. Lagos, Federal Ministry of Agriculture, Water Resources and Rural Development.

Adebowale, E.A. (1985). Response of sheep and goats fed maize straw treated with Local alkali. *Nigeri. J. Anim. Prod.* 12 : 137 – 140.

Katigile, J.A. (1981). Digestibility of low quality roughages supplemented with concentrate. In J.A. Katigile A.N. Said and F. Sundstol, eds.The utilization of low quality roughages in Africa. Proc. of Workshop held in Arusha, Tanzania. AUN Agricultural Development Report No. 1, Norway, Aas NLH.

AOAC (1995). Official Methods of Analysis. 16th edu. (Association of Official Analytical Chemist Arlington, VA).

Van Soest, P.J., Robertson, J.B., and Lewis, B.A. (1995). Methods for Dietary Fiber Natural Detergent Fiber and Non-Starch Polysaccharides in relation to animal nutrition. *J. Dairy Sci.* 74: 3583-357.

Menke, K.H. and Steingass, H. (1988). Estimation of the Energetic Fed. Value from Chemical Analysis and *in vitro* Gas Production using Rumen Fluid. *Anim. Res. Dev.* 28:7-55.

Getachew, G, Peter, E.J. Robinson, P.H., Taylor, S.J. (2001). *In vitro* Rumen Fermentation and Gas Production: Influence of Yellow Grease, tallow, corn oil and their Potassium soaps. *Anim. Feed Sci. Technl.* 93:1-15

Sundstol, F. and Coxworth, E.M. (1984). Ammonia Treatment. In: F. Sundstol and E. Owens (Eds), Straw and other Fibrous By-products as feed. Elsevier Publishing, New York, USA pp196

Ramirez –Luzano, R.G. (2003). Nutricion de Rummantes: Sistemas Extensivos. Ed. Trillas, Mexico, pp: 159 – 175.