

EFFECT OF UREA TREATMENT ON CHEMICAL COMPOSITION AND IN VITRO DIGESTIBILITY OF MAIZE COBS

* Akinfemi, A. and Adebayo, B.J.

Department of Agricultural Technology, Yaba College of Technology, Epe Campus, Odoragunshin, Lagos State.

Corresponding author: babsade2@yahoo.com, +2348030559306

Abstract

An experiment was conducted to evaluate the changes in the chemical composition and in vitro digestibility of maize cob treated with a guided levels of urea, such that Treatments 1, (untreated), T2, (0.5%), T3, (1%), T4 (1.5%) and T5 (2.0%). The result obtained showed a wide variation in the proximate composition (%) with crude protein ranging from 2.50 to 12.81, crude fiber 7.85 to 10.75, and Ether extract, 5.38 to 6.19. The contents of NDF, ADF and ADL also differed significantly ($P < 0.05$). The estimated organic matter digestibility (OMD, %) ranged from 43.66 to 56.94 and metabolizable energy (MJ/KgDM) ranged from 7.60 to 14.47. The potential extent of degradation ($a + b$) ml was enhanced with the highest value (39.00) obtained in T4. The urea treated maize cob enhanced OMD, ME and b . The results obtained suggest that urea treatment of maize cob is an effective method of treatment of feed for consumption of ruminants.

Keywords: Agricultural wastes, Metabolizable energy, Ruminants.

Introduction

In Nigeria, large quantities of agricultural wastes (Akinfemi et.al 2010) especially maize cob (*Zea mays*) is generated annually. This is perhaps a reflection of maize production. The estimated total grain yield amounts to 1.37million tonnes per year with an annual growth of 10.2 percent (FMAWR, 1988) while maize residues were estimated to be about 4.11 million tonnes, consisting mainly of straw, skins and trimmings, cobs and bran (Adebowale, 1985). These residues or wastes are often burned, fed to livestock or left on the farm to rot. However, the high lignocellulosic content of the residues required a source of readily available carbohydrates and nitrogen to optimize their utilization (Kategile 1981) particularly when treated. In the present study, maize cob is treated with urea and the changes in the chemical composition and in vitro digestibility is thus examined.

Materials and Methods

Samples of milled maize cobs 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 inocula 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, %) = $14.88 + 0.88Gv + 0.45CP + 0.651XA$ (Menke and Steingass, 1998). Short chain fatty Acids (SCFA) as $0.0239Gv - 0.0601$ (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 corn cobs

parameters	T1	T2	T3	T4	T5	SEM
Crude protein	2.5 ^e	10.75 ^c	9.96 ^d	11.67 ^b	12.81 ^a	0.02
Crude fibre	10.75 ^a	10.15 ^b	9.40 ^c	8.45 ^d	7.85 ^e	0.03
Ether extract	5.79 ^d	6.19 ^b	6.45 ^a	5.38 ^e	5.94 ^c	0.004
Ash	2.88 ^d	2.75 ^e	2.98 ^c	3.29 ^b	3.67 ^a	0.004
Carbohydrate	68.70 ^d	70.16 ^b	71.21 ^a	71.21 ^a	69.73 ^c	0.03
NDF	70.25 ^a	57.75 ^b	44.75 ^c	35.50 ^d	26.50 ^e	15.65
ADF	35.13 ^a	28.88 ^b	22.38 ^c	17.75 ^d	13.25 ^e	7.82
ADL	14.05 ^a	11.55 ^b	8.95 ^c	7.10 ^d	5.30 ^e	3.13
Cellulose	21.08 ^a	17.33 ^b	13.43 ^c	10.65 ^d	7.95 ^e	0.12
Hemicellulose	35.13 ^a	28.88 ^b	22.38 ^c	17.75 ^d	13.25 ^e	0.20

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	27.00 ^{ab}	22.00 ^b	32.00 ^{ab}	36.00 ^a	33.35 ^{ab}	2.08
(a+b) ml	29.00 ^{ab}	25.00 ^b	35.00 ^b	39.00 ^a	36.32 ^{ab}	2.08
C h ⁻¹	0.188 ^c	0.216 ^b	0.238 ^{ab}	0.246 ^a	0.241 ^a	0.004
OMD (%)	43.66 ^b	43.73 ^b	52.42 ^{ab}	56.94 ^a	55.30 ^a	1.85
ME(MJ/KgDM)	7.60 ^d	11.76 ^c	12.66 ^{bc}	14.18 ^{ab}	14.47 ^a	0.28
SCFA (umol)	0.753 ^{ab}	0.657 ^b	0.897 ^{ab}	0.992 ^a	0.929 ^{ab}	0.05

a,b,c, mean 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, OMD= Organic matter digestibility, ME= Metabolizable energy, SCFA= Short chain fatty acid, SEM= Standard error of mean

After treatment with urea and molasses, the chemical composition of the resulting substrate was altered. (Table 1) In the present study, as urea-molasses treatment increased, NDF, ADF, ADL, Hemicellulose and cellulose decreased. The NDF content of the treated cobs might have decreased as a result of hemicellulose solubilization (Sunstol and Coxworth, 1984). Previous studies have also reported reduction of NDF in urea treated crop residues and grass hays (Ramirez, 2003). Increments in CP content may be due to non-protein nitrogen addition to the treated cobs. The results of the *in vitro* gas production characteristics (Table 2) showed a higher value recorded for treated samples. The improved values recorded for fermentation of the insoluble, but degradable fractions (b), organic matter digestibility, (OMD) and potential extent of degradation (a+b) ml and could be due to improvement in nutrient uptake by rumen microbes SCFA was better in the urea-molasses

treated cobs, this implies that more energy is available to the animal.

Conclusion

The study showed that urea treated maize cob had high crude protein contents. High values of OMD predicted in all the treatments showed an inherent potential that can improved the performance of ruminants if properly utilized in feeding.

References

- Akinfemi A., Ladipo, M.K. and Yakubu .A. (2010). Evaluation of Fungal treated beniseed as feed for Goats. Proc. 35th Conf. Nig. Soc. For Amim. 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. Technol.* 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 Rumiantes: Sistemas Extensivos. Ed. Trillas, Mexico, pp: 159 – 175.