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The Effect of Multistage Ammoniation on Fiber Fraction and Digestibility of Maize Stover *in vitro*

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ABSTRACT

The main objective of this experiment was to assess the effect of multistage ammoniation on fiber fraction and digestibility of maize stover *in vitro*. Maize stover were treated by multistage technique of different urea connect ration (8%, 4%, and 2%) and incubation for 14 days in room temperature. Digestibility of NDF, ADF, ADL, hemicellulose and cellulose, *in vitro* dry matter digestibility (DMD), organic matter digestibility (OMD), NH_3-N, total volatile fatty acid (VFA) and pH concentration were observed. However treatment maize stover and multistage ammoniation maize stover were composed by using T-test student as statistic. There were not significant different on fiber fraction and digestibility of maize stover. However, multistage ammoniation decreased ADF fraction by 56.67% to 45.39%. The DM digestibility of multistage ammoniation on fiber fraction and digestibility of maize stover also increased by 35.18 to 45.91. The total VFA and N-ammonia of multistage ammoniation on fiber fraction and digestibility of maize stover also higher than control.

Keywords: Ammoniation, Digestibility, *in vitro*, Maize stover

INTRODUCTION

Maize (*Zea mays*), like the other cereal grain, has certain limitations as a food for farm animals. Though and excellent source of digestible energy it is low in protein, and the proteins present are of poor quality. Maize contains about 730 g starch/kg DM, is very low in fibre and has a high metabolizable energy value (McDonald *et al*., 1995).

Maize stover consists of the leaves, husks, stalks and cobs of maize plants left in a field after harvest of cereal grain. It makes up about half of the yield of a crop. Maize stover is a very common agricultural product in areas having large acreage under maize cultivation. However, the nutritional quality of maize stover is poor. It is made up of cellulose, hemicelluloses, lignin *etc*. (Sekhonyana & Fulpagare, 2015). The nutritional quality of maize stover is low. Maize stover has very low digestibility for feeds of animal. The effect of ammonia on the cell walls on the forage. Several factor such as urea doses, moisture, temperature, affect the effectiveness of urea treatment. The nutritional quality of urea treated maize stover is drastically enhanced compared to normal stover. The increased microbial biomass in the treated stover may contribute significantly towards higher crude protein content. In countries where dairy industry is

well developed, a voluminous work has been done and is being done on maize to increase the protein content of the crop. The addition of protein rich concentrates or chemicals when feeding maize crop or its silage are being worked out. Thus efforts were directed to increase the contents of protein in maize silage by incorporating non-protein nitrogenous compounds (Sekhonyana and Fulpagare, 2015). The experimental was to study the effect of multistage ammoniation on fiber fraction and digestibility of maize stover *in vitro*. To using by-produce from agricultural for animal feeds.

MATERIALS AND METHOD

Sample preparation and chemicals analysis

The maize stovers were chopped into the size of 2-3 cm and weight 1 kg put in 10 plastic bags 5 bags for control maize stover non-urea and 5 bags for maize stover treated (1 bag/ 1 kg) maize stover treat urea 8%, 4%, and 2% incubation in room temperature 3, 7, and 2 day. After incubation 14 days control and treatment the sample of experimental feeds and fodders were dried in an oven at 105˚ C for the determination of dry matter. At the end samples of experimental feeds were subjected to detergent analysis and *in vitro* technique.

Detergent Analysis

Fermentation in the rumen modifies the actual diet received by the ruminant animal, and the balancing of diets for ruminants must also consider fiber quality and the rumen microbial requirements. In addition, fiber is not a nutritionally, chemically, or physically uniform material, which adds another dimension of complexity (Van Soet *et al*., 1991).

The nutritional rationale of the detergent system was based on assaying for the feed fractions defined as NDS, NDF and lignin. In this system, NDS constitutes the completely digestible fractions of carbohydrate and protein, as well as lipid and some ash, whereas NDF represents the structural fibre, which is only partially digestible, and lignin is the fraction of NDF that is totally indigestible (Animal Feed Science and Technology, 2015).

The method for acid detergent fibre (ADF), published in 1963 (Van Soest *et al*., 1963), was actually the first publication in the series that completely described the detergent analysis system, although the system continues to change as new challenges and methodologies become available.

In vitro procedures

Maize stover was incubated *in vitro* with rumen fluid and McDougall's buffer mixture by following the procedure of Tilley and Terry (1963**).** Rumen fluid from cattle was diluted with McDougal buffer (1:2) and dispensed into 1 g substrate-prepared incubation tube while also purged by CO_2 to maintain anaerobic condition. Incubation was applied in 39°C water bath for 24 h. The experimental to study Dry matter digestibility, Organic matter digestibility, NH_3-N, total VFA and pH of maize stover treated urea *in vitro* (Fariani *et al*., 2015).

Statistical analysis

The experimental the effect of multistage ammoniation on fiber fraction and digestibility of maize stover *in vitro*. All data were subjected to using t-Test Two-Sample Assuming Equal Variance (two-tail).

RESULTS

Chemical composition and *in vitro* evaluation

There were no differences in chemical composition between treatments (P>0.05). Untreated maize stover contained NDF, ADF and ADL at 61.03 ± 7.51, 56.67 ± 7.12 and 16.80 ± 9.73% while 56.37 ± 7.6, 45.39 ± 14.1 and 16.52 ± 2.3% were found in urea treated maize stover respectively. Cellulose and hemicelluloses were not deferent between treatments but trend to be higher when treated with urea.

The chemical composition of maize stove was 61.03% NDF ,56.67% ADF and 39.87% Cellulose into 56.37% NDF, 45.39% ADF and 28.87% Cellulose for treatment in detergent analysis of the present study are show in table 1 supplementation were not significant (p > 0.05) this result show about digestibility of ammonia on maize stover .

$$\textbf{\%NDF} = \frac{61.03-56.37}{61.03} \times 100 = 7.64\%$$

$$\textbf{\%ADF} = \frac{56.67-45.39}{56.67} \times 100 = 19.90\%$$

Table 1. Effect of multistage on fiber fraction of maize stover control (non-urea) and urea treated maize stover

Parameter	Control	Treatment	P-value
% NDF	61.03±7.51	56.37±7.6	ns
% ADF	56.67±7.12	45.39±14.1	ns
% ADL	16.80±9.73	16.52±2.3	ns
% Hemicellulose	4.36±0.67	11.16±10.9	ns
% Cellulose	39.87±9.11	28.87±13.0	ns

Note : Values are mean ± standard deviation, n = 5, ns = non-significantly (p>0.05). NDF = Neutral detergent fiber, ADF = Acid detergent fiber, ADL = Acid detergent lignin

In vitro digestibility

The Table 2 shown the effect of ureatreated maize stover on dry matter digestibility (% DMD) and organic matter digestibility (% OMD). Ureatreated maize stover was increased DMO (35.18 to 45.91 % DMO) and (33.72 into 45.16%).

$$\textbf{\% DMD} = \frac{45.91-35.18}{45.91} \times 100 = 23.37\%$$

NH_3-N, pH and Total VFA

The result of NH_3-N and pH were not significant in Table 2 ($p>0.05$) .Mean value of pH was very stable throughout from 6.84 into 6.90 and the data of NH_3-N was 11.0 to 11.0 not difference in this experiment.

The total VFA (volatile fatty acid) *in vitro* technique of the present study are show in Table 2. The mean of total VFA were not significantly different ($p>0.05$) which were 48.4% to 58.0% also higher than control.

Table 2. Effect of multistage ammoniation digestibility of maize stover *in vitro*.

Parameter	Control	Treatment	P-value
Dry Matter Digestibility	35.18±11.4	45.91±11.6	ns
Organic Matter Digestibility	33.72±11.4	45.16±11.2	ns
NH_3-N	11.0±0.009	11.0±0.006	ns
Total VFA	48.4±0.6	58.0±0.5	ns
pH	6.84±0.6	6.90±0.4	ns

Note : Values are mean ± standard deviation, n = 5, ns = non- significant ($p>0.05$)

DISCUSSION

The data also showed that urea treatment of maize stover observed in this study was in agreement with Saowaluck (2012) who revealed that the increasing levels of urea could increased parentage of dry matter digestibility, while ADL content of silage was decreased (87.5 to 89.8 and 3.6 to 4.2; $p<0.01$) This probably due to urea may decomposes into ammonia made cell wall weaken and small break the esters bonds with in cellulose and hemicellulose. Zain (2009) observed that treating cocoa pod with 6% urea and kept for 21 day decreased ADF. However, the experiment show digestibility of urea treated maize stover increased IVDMO from 35.18 to 45.91 and IVOMD from 33.72 to 45.16 according to Erika and Jayanegara (2015). As a consequence of this, the digestibility of urea treated cocoa pod increased as shown by higher IVDMD and IVOMD values compared to the control. It is further confirmed by the PCA loading plot that there was a positive correlation between digestibility.

CONCLUSION

Based on this study, it could be concluded that urea treated maize stover could enhanced nutrient composition, digestibility and ruminal fermentation. However, further research in *in vitro* need to be elucidated.

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