RUMINAL DEGRADABILITY OF WOOD ASH EXTRACT (WAE) TREATED *Pennicetum pedicellatum* AND ITS POTENTIAL USE IN RUMINANT DIETS

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ABSTRACT

The objective of this study was to determine the ruminal degradability of dry matter in situ, for urea treated Maize stover. The dry matter disappearance in M1ranged from 34.61-48.43 in 3 - 96 hours respectively, M2 ranged from 34.47-77.67 within 3-9 6hours, M3 ranged from 34.23-76.54 within the incubation period of 3-96 hours and M4 from 37.24-78.86 between 3-96 hours incubation periods respectively. Ruminal DM disappearances increased with rumen incubation time for all the treatments (3 to 96h). Treatment M4 had the highest value at all times and the lowest DM disappearances were found in treatment M1. The values recorded for treatment M2, M3 and M4 had no significant difference between each other, but had significant ($P<0.05$) difference when compared to treatment M1. The fitted values, values was significantly ($P<0.05$) higher than the measured values in all the treatments with M1 recorded the lowest values and M4 with the significantly ($P<0.05$) higher values. There is an indication that incubation period had significant ($P<0.05$) influence on the feed materials, as there was a positive relationship between incubation period and dry matter disappearance. There was also similar positive correlation between the amount urea inclusion and dry matter disappearance.

Keywords: WAE, Nylon Bag, Rumen degradability, *pennicetum pedicellatum* hay.

INTRODUCTION

Wood ash has been used to treat straws to improve their digestibility and mineral contents (Nolte *et al.*, 1987; Ramirez *et al.*, 1992; Ndlovu, 2007). Such treatments could improve goat and sheep production in developing countries (Ramirez *et al.*, 1992; Wanapat, 2000). Alkaline treatments of high fibre roughages have been investigated extensively, and there are numerous reviews of their effect in incrementing the feeding value for ruminants (Jackson, 1978; Wanapat *et al.*, 1985; 2000; Chanjula, *et al.*, 2002). The most common alkalis used are NaOH, Ca(OH)2 and urea-ammonia. Nolte *et al.*, (1987) found that treatment of wheat straw with 30% solution of wood ash for six hours increased digestibility of DM, organic matter (OM), neutral detergent fibre (NDF) and acid detergent fibre (ADF) in goats. Ramirez *et al.* (1992) confirmed these results and showed that the DMD of diets containing maize stover treated with a 20% wood ash increased by up to 20% in sheep, compared to a control group. Wood ash and animal urine are readily available low-cost products that can be used to improve fibre digestibility of straw in a manner comparable to NaOH treatment. Therefore, crop residue treated with 20% solution of wood ash, 20% wood ash plus urea or with urine could economically supply a major portion of the energy and protein needs in ruminants during winter seasons (Ramirez *et al.*, 1991). Sorghum straw is a lignocellulostic crop residue produced in considerable amounts in some sorghum grain-producing regions. However, in areas where feed for animal production is limited, most producers use sorghum straw as animal feed. The low digestibility and nutritive value of sorghum straw limits animal intake and cannot support growth of adult ruminants without adequate supplementation (Males, 1987; Sommart *et al.*, 2000). Wood ash is also considered economical as an alkaline source. Kyarisiima *et al.* (2004) conducted a study to investigate the effects of

wood ash treatment on the nutritional value of high tannin sorghum. High tannin sorghum was either soaked in wood ash slurry and then germinated for four days or soaked in wood ash extract and germinated for 28 hours or germinated after soaking in water. Treatment of high tannin sorghum with wood ash extract was effective in reducing the tannin level and did not lower the nutritive content of the grain. There was no significant difference in feed intake between the maize based diet and the diet that contained wood ash extract treated sorghum. There was a significant improvement in growth rate of chicks that were fed on a diet that contained treated sorghum. This was also reflected in the improvement of the digestibility of diets that contained treated grain. Limited information has been available on characteristics of DM and OM degradation in the rumen of feed sources locally used for livestock in the tropics with special reference North Eastern Nigeria. The degradability characters of these feed sources may assist in nitrogen supplementation that will optimize the synchronization of carbohydrate degradation and nitrogen availability. The objective of this study was to determine the rumen degradability of dry matter for urea treated Maize Stover.

MATERIALS AND METHODS

The research was conducted at the Livestock Teaching and Research Farm, Department of Animal Science, Adamawa State University to determine the rumen degradability characters of WAE treated *Pennicetum pedicellatum* Hay (H). The chopped feeds materials weight 100kg were soaked in a solution of 4, 5 and 6kg of Wood Ash Extract (WAE) crystal, in 50liters of water each over night and were sundried. The description of the study area is as in Adebayo and Tukur (1999). Three (3) grams of each sample were put into six different nylon bags and inserted via permanent Ruminal cannula and left in the rumen for each incubation time: 3, 6, 12, 24, 48, 72 and 96 hours. The bags containing undigested residues were removed from the rumen after each incubation time and thoroughly washed in running tap water until the washing water was clear. The difference in weight of dry matter in nylon bags before and after rumen incubation represented materials degraded in the rumen. Washing losses were determined in triplicate by weighing about 3g of each feed sample into nylon bags, soaking them in warm water (40°C) for an hour and subsequently washing the bags as those incubated in the rumen and finally drying the samples in an oven (60°C).

Chemical Treatment of Hay

i. 100kg of Hay + 0 Wood Ash Extract (H1)
ii. 100kg of Hay + 4kg Wood Ash Extract (H2)
iii. 100kg of Hay + 5kg Wood Ash Extract (H3)
iv. 100kg of Hay + 6kg Wood Ash Extract (H4)

RESULTS AND DISCUSSION

The result for ruminal dry matter (DM) disappearance values for wood ash extract treated *Pennicetum pedicellatum* Hay was shown in Table 1 and graphically presented in Figure 1. The dry matter disappearances were in the ranges of 21.68-46.57%, 27.42-67.91%, 28.09-67.00% and 31.39-71.55% for H1, H2, H3 and H4 respectively. Ruminal DM disappearances increased with rumen incubation time for all the treatments (3 to 96hours). Treatment H4 had the highest value at all periods and the lowest DM disappearances were found in control treatment (H1). There was a significant ($P<0.05$) difference in H4 as compared to the other treatment groups. The values were plotted, the degradation curves were presented in figure 4, and the graph characterizes the measured and the statistically fitted values. The fitted values, values were significantly ($P<0.05$) higher when compared to the measured values in all the treatments with H1 recorded the lowest values and H4 with the significantly ($P<0.05$) higher values. The result indicates that incubation period had significant ($P<0.05$) influence on the feed materials, as there was a positive relationship between incubation period and dry matter disappearance (degradability). There was also similar positive correlation between the amount wood ash extract added and dry matter disappearance. At incubation period of 48hours H2, H3 and H4 were observed to be sufficient, since the degraded values were more than 50%, while treatment H1 was below 50% at 48 hours an indication of poor degradability in H1, the differences may be attributed to the incubation time and the different treatment given to the diets.

These also suggest that at 48hours, most of the dry matter in this diet were available to ruminal

microbes. The degradability characteristics of *Pennicetum pedicellatum* hay diets are presented in Table 51. The amount of DM disappearance characteristics as washing lost were observed to increase across all the parameters, with the significant (P<0.05) increase in H2, H3 and H4 when compared to H1. The variation in the value may be attributed to the fact that, the treatments of diets H2, H3, and H4 had positively increased the degradability of the *Pennicetum pedicellatum* Hay. The differences could also be attributed sources, chemical composition and extent of processing of the feed materials as earlier refered by Nocek and Tamminga (1991) in straws. In addition, the structural differences between the feed materials also might also be other basis for the reported differences in degradability among the feed sources. The trends observed in degradability had reflected in the performance of the animals when fed diets to the animals and their performance rated. Significant (P<0.05) difference in weight gain was observed in the urea treated diets as compared to the non treated diets, so also weight gain observed to be significantly (P<0.05) higher in urea treated maize Stover, followed by urea treated rice straw and lastly by those obtained for wood ash extract treated *Pennicetum pedicellatum* Hay.

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Table 1 Actual Dry Matter Disappearance (DMD%) of WAE treated *Pennicetum pedicellatum* Hay (H)

Incubation Time/h	H1	H2)	H3	H4	SEM
3	21.68^{c}	27.42^{b}	28.09^{b}	31.39^{a}	0.554
6	27.22^{d}	30.89^{c}	33.13^{b}	36.68^{a}	0.372
12	35.33^{b}	36.00^{b}	35.96^{b}	42.76^{a}	0.331
24	38.75^{c}	42.01^{b}	42.50^{b}	45.71^{a}	0.552
48	43.60^{c}	49.96^{b}	52.36^{a}	53.22^{a}	0.670
72	46.37^{c}	58.00^{b}	58.04^{b}	63.10^{a}	0.336
96	46.57^{c}	67.91^{b}	67.00^{b}	71.55a	0.670

a,b,c,- Row means with different superscripts are either significant at P<0.05 or highly significant at P < 0.01; SEM (Standard Error of Mean)

Table 2 Degradability Characteristics of Experimental diets

Treatments Diets	A	B	C	A+B
H1(0% WAE)	41.33^{c}	26.92^{b}	0.036^{c}	68.25^{b}
H2(4% WAE)	69.33^{a}	26.00^{bc}	0.046^{b}	95.33^{a}
H3(5% WAE)	70.55^{a}	24.54^{c}	0.048^{b}	95.09^{a}
H4(6% WAE)	57.33^{b}	39.67^{a}	0.054^{a}	97.00^{a}
SEM	0.562	0.665	0.001	0.676

A=Washing loss; B= Rumen degradable fraction; C= Degradation rate constant; A+B= Potential degradation; a,b,c,- Row means with different superscripts are either significant at P<0.05 or highly significant at P < 0.01; SEM (Standard Error of Mean)

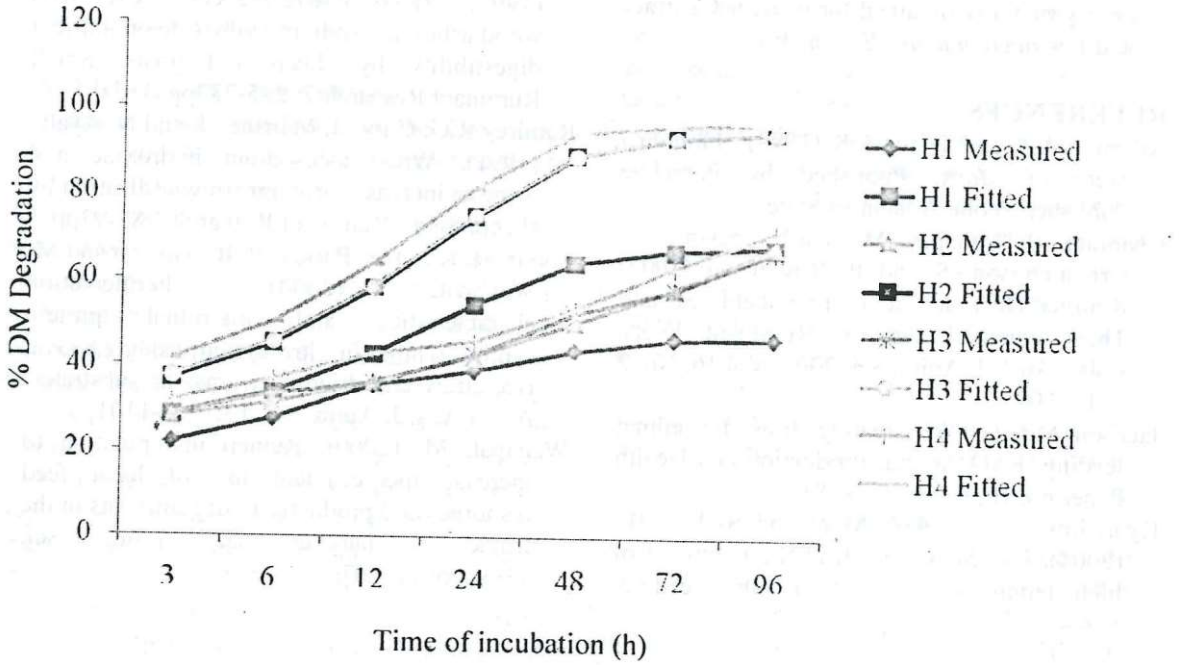

Figure 1 degradation Curve for *Pennicetum pedicellatum* Hay (H) Diets (H1, H2, H3 and H4)