RUN -02

Treatment of Rice Straw with Urea-Molasses and the Effect on Proximate Composition and *In Vitro* Digestibility

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Abstract
Experiment was conducted to assess the impact of urea–molasses treatment of rice straw on the proximate composition and *in vitro* gas production. Samples of milled rice were treated with 0.5% urea (T_2), 7.0% urea (T_3), 1.5% urea (T_4) and 2.0% urea (T_5) (w/v) to which was added constant quantity of molasses. T_1 is untreated and serves as the control. The result obtained showed a significant ($P > 0.05$) increased in crude protein from 11.71(T_1) to 13.11 (T_5). The NDF decreased significantly ($P < 0.05$) with the increased addition of urea molasses from 75.12 (T_1) to 48.78 (T_5). Ether extract range from 4.99(T_5) to 5.57(T_4), CF from 4.67(T_5), to 5.65(T_1). The fermentation of the insoluble but degradable fraction (bml) increased proportionately with gas volume with values ranging from 6ml (T_1) to 26ml (T_5) and 14ml (T_1) and 30ml (T_5) respectively. The result observed in this study shows that urea-molasses treated could be used to improve the nutrient content of rice straw for ruminant.

Keywords: Urea-molasses, in vitro gas, rice straw, ruminant, metabolizable energy

Introduction

Rice straw is the byproduct of rice crop which is composed primarily of the stalk, after the grain and chaff have been removed. The straw is usually considered and treated as valueless waste; they are often burnt, added to the soil as soil conditioner and sometimes left on the farm to rot. Rice (*Oryza sativa*) is the second most popular cereal after maize (Van Soest, 2006). The straw constitutes up to half of the yield of rice. It has also been used as biofuel, livestock bedding, thatching and basket making; in few places, it has been used as source of erosion control such as mulching and fodder despite their low nutritive value. However, rice straw can be enriched by the use of urea-molasses treatment leading to improvement in their nutrient composition. In the present study, fertilizer guide urea and molasses were used to treat rice straw. This method of treatment will achieve improvement in the nutrient composition of the treated straw therefore converting the waste to value added product.

The aim of this study was to evaluate the impact of urea-molasses treated rice straw on the nutrient composition.

Materials and Methods

Samples of rice straw obtained from a commercial rice farm in Agbowa, Lagos. Samples were chopped (approximately 1cm). Feed grade urea dissolved in water containing molasses equivalent to 0.5% (T_2), 1.0% (T_3), 1.5% (T_4) and 2% T_5 (w/v) were sprayed on 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^{0}C for hours, to constant weight. Chemical composition of the treated (T_2 to T_5) and untreated sample T_1, were determined using standard methods (AOAC, 1995; Van Soest *et al.,* 1995).

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 24 h 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 0.0239Gv – 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).

Result and Discussion

The result of chemical composition of treated and untreated rice straw is shown in Table 1. Urea-molasses treated increased significantly ($P < 0.05$) the crude protein (%) from 11.72 (T_1) to 13.11 (T_5). This increase could be due to the addition of urea (non-protein nitrogen to the straw). The NDF, ADF and Hemicellulose consistently reduced with the increases inclusion of urea. However, the value of cellulose was not significantly different ($P > 0.05$). This observation is consistent with earlier report (Sundstol and Coxworth 1984) who reported Hemicellulose solubilization. Elsewhere, NDF reduction was observed in urea treated hays. Table 2 shows gas production characteristics, gas volume, estimated organic matter digestibility, Metabolizable energy and short chain fatty acid.

Table 1: Chemical composition (g/100gDM) of urea-molasses treated rice straw

Parameter	T_1	T_2	T_3	T_4	T_5	SEM
Crude protein	11.71^{d}	12.06^{c}	12.61^{b}	12.81^{b}	13.11^{a}	0.04
Crude fibre	5.65^{a}	5.42^{ab}	5.19^{bc}	4.89^{dc}	4.67^{d}	0.07
Ether extract	4.58^{c}	4.53^{c}	4.69^{c}	5.57^{a}	4.99^{b}	0.03
Ash	2.28^{c}	1.74^{d}	2.72^{b}	2.68^{b}	2.83^{a}	0.02
Carbohydrate	75.78^{a}	76.25^{a}	74.58^{b}	74.25^{b}	74.39^{b}	0.09
NDF	75.12^{a}	64.78^{b}	58.96^{c}	54.77^{d}	48.78^{e}	0.71
ADF	42.34^{a}	39.58^{ab}	37.23^{b}	37.12^{b}	34.96^{b}	0.86
ADL	16.42^{a}	13.54^{b}	11.11^{c}	11.06^{c}	10.25^{c}	0.40
Cellulose	25.92	26.05	26.17	26.01	24.71	0.88
Hemicellulose	32.78^{a}	25019^{b}	21.72^{bc}	17.66^{cd}	13.82^{d}	01.18

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.

Parameter	T_1	T_2	T_3	T_4	T_5	SEM
Bml	6.00^{c}	12.67^{bc}	20.67^{ab}	21.33^{ab}	26.00^{a}	1.39
Gv24	14.00^{a}	20.67^{bc}	28.67^{ab}	28.00^{ab}	30.00^{a}	1.48
OMD	33.96^{b}	39.63^{b}	47.64^{a}	46.94^{a}	49.02^{a}	1.31
ME	17.02^{c}	23.71^{bc}	31.75^{ab}	31.07^{ab}	33.09^{a}	1.48
SCFA	0.274^{c}	0.433^{bc}	0.625^{ab}	0.609^{ab}	0.656^{a}	0.04

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, Gv24= Gas volume produced at 24hour, OMD= Organic matter digestibility, ME= Metabolizable energy, SCFA= Short chain fatty acid.

Conclusion

From the result obtained in this study, urea-molasses treatment of rice straw improved the crude protein content and also the digestibility. Therefore, the product could be applied in the ruminant diet in combination with other feedstuff. However, further research is required with use of live animals to ascertain the level of inclusion in the diets of ruminants.

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