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Full Length Research Paper

Evaluation of nutritive value of sugar cane bagasse fermented with poultry litter as animal feed

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An experiment was carried out to study the effect of fermentation and poultry litter level of nutritive value of bagasse as animal feed. Four rations were made contained zero poultry litter (T1), 10% (T2), 20% (T3) and 30% (T4), the rations were ensiled for two months. An analysis of variance was performed for the treatments and significant differences was identified by means of Tukey`s T-test. The approximate analysis of chemical composition of dry crude protein (CP), ether extract (E.E), Ash, crude fiber (CF), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL) and in vitro DM and OM digestibility of the four experimental rations before and after fermentation were carried out. PH increased with increased poultry litter level, CP increased significantly due to fermentation and with increasing level of chicken manure 3.8% to 5.4%, 6.4% to 13.2%, 8.5% to 14.8% and 15.4% to 16.3% in T1, T2, T3 and T4 respectively. CF, NDF and ADF were decreased significantly (P<0.05) due to increased level of poultry litter and due to fermentation. The *in vitro* DM and OM digestibility increased significantly due to fermentation and with increased poultry litter up to 80.2% and 79.79% in T4 after fermentation respectively. The Addition of poultry litter to bagasse and fermentation were largely improved CP content and DM and OM digestibility, this might contributed positively in animal nutrition.

Keywords: Poultry litter, fermentation, Bagasse, DM digestibility.

INTRODUCTION

Bagasse is a highly fibrous by product after sugar cane is crushed to remove sucrose. Many sugar milling factories around the world release large quantities of bagasse as a part of their byproducts, some even dispose it as a waste. Traditionally, past research has more or less focused on utilization of bagasse for production of energy, fabrication boards and paper manufacture as well as for the production of insulation materials. In addition the one major potential use of bagasse is as a feed stuff for cattle (Rivers, 1988). However its low digestibility limits its use in the row state (Anakalo and Anakalo, 2009).

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Bagasse is used as a basal diet, it's important to give the correct supplementation in order to obtain satisfactory physical and economic responses. The supplementation must take account of the productivity of the animals (e.g. Growing fattening, lactating, and etc.), (Mahala *et al*., 2007). poultry litter in particular considered as a better source of non- protein nitrogen (NPN) than urea (Mahala *et al*., 2007), can replace most expensive protein feed such as soybean meal, groundnut meal, cotton seed cakes, and etc.

Poultry litter Intensive chicken farming leads to solids disposal problems worldwide it is known to be more valuable as feed nutrient due to high fiber and non protein nitrogen content of the waste. Poultry manure has a potential use as a ruminant feed in addition to its

Table 1. Composition of four rations (n = 6) on DM basis

	T1	T2	T3	T4	SEM
CP	4.59 ^{d}	9.82 ^{c}	11.62 ^{b}	15.83^{a}	0.15
CF	50.86^{a}	39.98^{b}	36.89^{c}	27.57^{d}	8.66
Ash	6.17^{c}	6.06^{d}	7. 93 ^{b}	10.5^{a}	6.37
E.E	1.33^{c}	0.7d^{5}	1.66^{b}	2.41^{a}	8.66
NDF	63.17^{a}	61.53^{b}	58.32^{c}	54.35^{d}	0.02
ADF	25.86^{a}	18.90^{b}	19.32^{c}	6.40^{d}	0.01
ADL	15.40^{a}	12.55^{b}	11.20^{c}	7.73^{d}	0.02

$^{abcd..}$ Mean in the same row with no common superscript were significantly differ (P<0.05)
T1= 0% poultry litter ,T2= 10% poultry litter , T3= 20% poultry litter and T4= 30% poultry litter

traditional use as fertilizer. It has been shown that poultry litter is more valuable as a feed ingredient than as a fertilizer. (Anakalo and Anakalo, 2009).

In fact, the economic value of poultry manure litter as a feed ingredient in balanced diets for several classes of ruminants is up to four times greater than its value of fertilizer. In addition to offering an economic advantage, using poultry litter as animal feed is environmentally friendly. Many of the nutrients in the broiler litter are redistributed on pasture land as cattle manure. The utilization of the waste through ruminant animals could thus become a convenient option of disposing the waste.

Fermentation of bagasse with chicken manure improve the protein and mineral content, increased the dry matter digestibility and increase the dry matter and the protein degradability (Mahala *et al.*, 2007).

In general sense fermentation is the conversion of carbohydrates such as sugar into an acid or an alcohol. Crude fiber fermentability has been identified as one of the limiting factors in utilization of high fiber content feeds such as bagasse. One of the ways of using sugar cane as animal feeds is as ensilage. The ensilage process is a technique that consists in preserving foddering plant through acid fermentation adequacy, in which lactic acid bacteria convent soluble sugar into lactic acid, Anakalo and Anakalo,2009).

The objective of this study was to improve the nutritive value of sugar cane bagasse by fermentation with poultry litter as animal feed.

MATERIALS AND METHODS

Basal diet containg 85% bagasse, 10% molasses and 5% sorghum grain was formulated. Graded level of poultry litter (0%, 10%, 20% and 30%) were added to the basal diets as percentage of diet weight to made four dietary treatment T1,T2, T3 and T4 respectively. Molasses was mixed with water to the ratio of 1:2 before being added to each dietary treatment each diet was thoroughly mixed and put into plastic bags which was carefully consolidated and compressed to remove the air before being closed, the bags were stored for two months away from the sunlight to ferment, the initial and final PH were measured, at the end of fermentation approximate composition analysis for CP,CF, ash and E.E were determined using(A.O.A.C, 1980) and NDF, ADF and ADL were determined according to (Van Sost and Robertson,1980) and *in vitro* DM and OM digestibility conducted using methods of Tilly and Terry, 1963).

Statistical analysis

The data was arranged before and after fermentation to be examined by a one way ANOVA with treatment (2X4) factorial design were used. Treatments factors were fermentation (before vs after fermentation) and the level of poultry litter (0%, 10%, 20% and 30%).means of main effects and interactions were separated by LSD

RESULTS AND DISCUSSION

CP increased significantly (P < 0.05) due to fermentation and with increasing level of poultry litter 3.8% to 5.40%, 6.4% to 13.2%, 8.5% to 14.8% and 15.4% to 16.3% in T1, T2, T3 and T4 respectively (Table 1) and (Table2). The Highest CP content (15.4%) was reported in 30% poultry litter before fermentation, this is expected due to higher content of nitrogen in chicken manure. This results agreed with (Mahala *et al.*, 2007; Goering and Smith,1977).

Ash content increased significantly (P<0.05) after fermentation with increase level of poultry litter (table 2). In this study ash content was increased from 3.4% to 9.2%, from 3.7% to 4.4%, from 6.3% to 9.6% and from 6.7% to 13.4% due to fermentation in T1, T2, T3 and T4 respectively. This result was higher than that reported by (Ngyen and Ngyen, 2001; Mahala, *et al.,* 2007) who found

Table 2. Effect of fermentation and poultry litter levels on the nutritive value of bagasse fermented with poultry litter as animal feed

	Dietary treatments			
Proximal composition	**T1**	**T2**	**T3**	**T4**
Ash % BF	3.4 ± 0.01^{h}	3.8 ± 0.01^{f}	6.3 ± 0.01^{g}	6.8 ± 01^{c}
Ash% AF	9.2 ± 0.01^{c}	$8.4\pm.01^{d}$	9.6 ± 0.01^{b}	$13.4\pm.01^{a}$
C.P % BF	3.8 ± 0.11^{h}	$6.4\pm.03^{f}$	$8.5\pm.O4^{e}$	$15.4\pm.04^{b}$
C.P % AF	$5.4\pm0.0.2^{g}$	$13.2\pm.08^{d}$	$14.8\pm.19^{c}$	$16.3\pm.49^{a}$
FAT% BF	1.9 ± 0.014^{b}	$0.7+0.01^{f}$	1.5 ± 0.01^{d}	1.8 ± 0.01^{b}
FAT% AF	$0.8+0.00^{f}$	0.8 ± 0.00^{f}	1.8 ± 0.01^{c}	3.0 ± 0.02^{a}
NDF % BF	75.6 ± 0.02^{a}	73.1 ± 0.01^{b}	71.1 ± 0.01^{c}	67.7 ± 0.0^{d}
NDF% AF	50.7 ± 0.21^{e}	50.1 ± 0.01^{f}	45.5 ± 0.01^{g}	41.0 ± 0.01^{h}
CF% BF	54.3 ± 0.0^{a}	40.8 ± 0.01^{c}	36.3 ± 0.01^{b}	33.9 ± 0.02^{g}
CF% AF	47.4 ± 0.01^{b}	39.1 ± 0.01^{d}	37.5 ± 0.01^{e}	21.4 ± 0.01^{h}
ADF% BF	31.5 ± 0.02^{a}	23.5 ± 0.01^{b}	23.3 ± 0.01^{c}	20.3 ± 0.01^{d}
ADF% AF	20.2 ± 0.02^{e}	16.2 ± 0.01^{f}	15.4 ± 0.02^{g}	12.4 ± 0.14^{h}
ADL% BF	13.9 ± 0.02^{b}	13.0 ± 0.02^{b}	9.5 ± 0.01^{d}	9.4 ± 0.02^{g}
ADL% AF	16.9 ± 0.02^{a}	12.1 ± 0.01^{e}	10.1 ± 0.02^{f}	6.4 ± 0.01^{h}

Error are + standard deviation of triplicate determination
abc.. Mean in the same column within the same fermentation trait with no common superscript were significantly differ (P<0.05)
T1= 0% poultry litter , T2= 10% poultry litter , T3= 20% poultry litter, T4= 30% poultry litter
BF = before fermentation
AF =after fermentation

Table 3.pH before and after fermentation in four dietary treatments

Dietary treatment	T1	T2	T3	T4	SEM
pH before fermentation	4.57e	5.6abc	5.65ab	5.94a	0.18
pH after fermentation	4.69e	5.23cd	5.21d	5.34bcd	0.18

[Abcd] Mean in the same column and/or row with no common superscript were significantly differ (P<0.05)
T1= 0% poultry litter, T2= 10% poultry litter, T3= 20% poultry litter , T4= 30% poultry litter
SEM= standard error of means

Table 4. Effects of poultry litter levels on DM and OM digestibility % for the dietary treatment

Dietary treatment	T1	T2	T3	T4	SEM
DM *dig%*	56.36d	67.29c	70.63b	80.20a	0.42
OM *gid%*	33.54c	67.35b	67.71b	79.79a	1.5

[Ab] Mean in the same column with no common superscript were significantly differ (P<0.05)
T1= 0% poultry litter, T2= 10% poultry litter, T3= 20% poultry litter, T4= 30% poultry litter
SEM= standard error of means

2.77 % and 5.89% respectively. This might be due to high level of poultry litter in this study 10%. 20% and 30% compared with the highest level 10% in (Mahala, *et al.,* 2007).

CF, NDF and ADF were decreased significantly (P<0.05) due to increased level of poultry litter (Table1) and due to fermentation (Table 2). The crude fiber of bagasse silage was higher than that reported by (Ngyen And Ngyen, 2001) who found the crude fiber 23.08% which may be attributed to the varieties used or processing methods. In this study more addition of poultry litter decrease NDF contents this agreed with (Mahala, *et al.*, 2007; Meng,1988; Wukegian, 1996; Coa *et al.*, 2000).

There was increase level in fat content before and after fermentation with the increase level of poultry litter percentage. Whereas T1 after fermentation showed the lowest value 0.80% compared with 1.92% before fermentation (Table 1).

T4 (30%) poultry litter showed highest value (5.34) of pH, while T3 (20%) showed lowest value of PH (5.21) after fermentation, whereas T1 (0%) poultry litter revealed no change in pH 4.57 and 4.69 before and after fermentation respectively (Table 3). This is similar to that reported by (Mahala *et al.*, 2007) who found no change in the pH in diet having 0% poultry litter, in this study the pH tended to be high before and after fermentation due

Table 5 . Effect of fermentation on DM and OM digestibility %.

	DM dig%	OM dig%
Before fermentation	55.7b	44.12b
After fermentation	81.5a	80.07a
SEM	0.3	1.06

[Abcd] Mean in the same column and/or row with no common superscript were significantly differ (P<0.05)
SEM= standard error of means

to high level of poultry litter which is liberate more ammonia.

In vitro DM and OM digestibility revealed progressive increasing ($P < 0.05$) with the increase of chicken manure level (Table 4) and due to fermentation (Table 5) in both fermented and unfermented dietary treatments. The values of OM digestibility were higher than that reported by (Mahala *et al.,* 2007) who found the organic matter digestibility (46.13%)after fermentation, because of high levels of poultry litter used in this study, which is contributes to the desirable acidity (Rogers and Poore, 1994;Yang, 2002).

CONCLUSION

This study indicates that the additions of poultry litter improved protein, mineral contents and DM and OM digestibility.

The use of such low cost by products and residues resulting in an animal feed seems to present a great nutritional potential to livestock farmers.

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