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EXAMINING THE EFFECT OF UREA AND POULTRY LITTER IN ENHANCING THE NUTRITIONAL QUALITY OF ENSILED RICE MILLING WASTE FOR DRY SEASON RUMINANTS FEEDING

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ABSTRACT

An experiment was conducted to examine the effects of Urea and Poultry litter (PL) in enhancing the physiochemical qualities of ensiled rice milling waste (RMW) in a completely randomized design. RMW was treated with four different proportions of Urea and PL, which were ensiled in in-vitro laboratory silo (946ml). The treatments were; A (100%RMW), B (100%RMW+ Urea), C (80%RMW + 20%PL) and D (60%RMW + 40%PL). The treatments were ensiled for 21 days and analysed for physical properties, proximate and fibre compositions.Results showed that,higher ($P<0.05$) values of temperature and pH were reported in treatment D while lower values were obtained in treatment A. Treatment C has good temperature, pH, dark brown colour and sweet aroma. Treatment B and C has higher ($P<0.05$) values of Nitrogen Detergent Fibre compared to other treatments. It is concluded that, treatment C (80%RMW + 20%PL) should be used to enhance the nutritional quality of ensiled rice milling waste. Hence, it is recommended for dry season ruminant feeding.

Keywords; Additives, Ensilage,In-vitro, Poultry litter, Rice milling waste.

INTRODUCTION

Rice milling waste is one of the commonest agro-industrial wastes generated in large quantities in most parts of Nigeria. Rice processing by-products are obtained from rice milling industries, and these are abundant in the rice producing regions of Nigeria (Omotola and Ikechukwu, 2006).Rice milling waste is one of the by-products of rice processing making up to about 60% of the total by-products (Foulkes, 1998). Although one can hardly classify rice milling waste among hazardous wastes, its treatment is very important in view of the great volume of waste materials involved. In Nigeria and many other developing countries, where the bulk of rice produced is for consumption, the most common waste treatment technique employed is combustion which has several disadvantages including environmental pollution (Thipwimon *et al*., 2004). The quantity of rice milling by-products generated in Nigeria annually was estimated at 1,032,993.6 metric tons (NAERLS and PCU, 2004). The effective utilization of rice milling waste as animal feed will greatly reduce its disposal problems and contributes towards value addition in the rice sector. This research is therefore designed to study the effects of Urea and Poultry litter in enhancing the physiochemical qualities of ensiled rice milling waste.

MATERIALS AND METHODS

This research was conducted at the Animal Nutrition Laboratory of Binyaminu Usman Polytechnic, Hadejia, Jigawa State (coordinates of 12º28'N /10º01'E).Samples were obtained from Three Brothers Rice Processing Industry waste dump which is 5km away from Hadejia town along Nguru-Hadejia road. Random sampling technique was employed to collect samples at 15cm depths from different points using a clean plastic container and shovel. All foreign materials (stones, glass, iron, polythene, etc.) were removed. The samples were pooled together, mixed thoroughly and packed into a labeled empty polythene bags which were immediately transported to the laboratory for analysis. Inorganic granulated urea was obtained from Hadejia market while poultry litter (PL) was obtained from a deep litter poultry production system of the polytechnic. The collected rice milling waste (RMW) and PL were sundried for 3 days during dry season by thinly spreading on a concrete floor.

The dried RMW was ensiled with urea and PL in different proportions as; A (100%RMW), B (100%RMW+ Urea), C (80%RMW + 20%PL), and D (60%RMW + 40%PL). Twelve (12) bottles of (946ml) were used as laboratory silos. The procedure of Roy and Rangnekar (2006) was followed in which 1kg urea was dissolved in 15 litres of water and sprinkled on 25kg of RMW, for samples without urea 15 litres of water was used for every 25kg RMW. Greese and Masking tape were used to further seal the bottles after filling with weighed materials and compressed. The silos were kept at an average room temperature of 27^{o} C for 21 days incubation period in the laboratory. At the expiration of the ensiling period, the silos were opened and the top most 5cm materials were scooped off to avoid contamination with partially ensiled materials. The samples were then taken using forceps from each ensiled bottle for physical observations. The contents were scored for aroma and colour by three independent panelists on a subjective score of 1-4. A portion of the RMW was left untreated and used for the control experiment.

The temperature of the ensiled materials was determined through insertion of thermometer into the silage for 2- 3 minutes and the readings were recorded while a digital pH meter was used to measure the pH of the ensiled materials. Proximate analysis was done to determine nitrogen (N) for crude protein determination (N×6.25), crude fibre (CF), ether extract (EE), nitrogen free extract (NFE) and ash according to the procedure of AOAC (2005).Energy contents were estimated using adiabatic bomb-calorimetry in which gross energy was determined by measuring heat of combustion.

The data generated were subjected to analysis of variance (ANOVA) in completely randomized design (CRD) of GENSTAT (2014), where significant differences between means were separated using Duncan Multiple Range Test (DMRT) at 5% probability level.

RESULTS AND DISCUSSIONS

Temperature, pH, colour, aroma and texture of the resultant silages were shown in Table 1. Results showed that higher ($P<0.05$) values of temperature and pH were reported in treatment D while lower ($P<0.05$) values were obtained in treatment A. The temperature ranges of 28.9 – 31.0^{o}C obtained in this study were slightly higher than the temperature ranges of 25.0 - 27.5^{o}C (Akinwande *et al*., 2013), 28.3 - 29.1^{o}C (Babayemi *et al.*, 2010) and 28.4 – 33.4^{o}C (Abdullahi *et al.*,2019). However,temperature range of 29.40 – 45.00^{o}C was reported as satisfactory silo temperature (Amodu and Abubakar, 2004). Temperature is an essential factor that affects silage quality and colour. McDonald *et al.* (1998) stated that temperature above 30^{o}C makes silage to become dark, due to caramelization of sugars in the forage.

A good silage must be cooled at opening or be at room temperature. pH is one of the quickest and simplest ways of evaluating silage quality. Kung and Shaver, (2002) reported that silage with pH values range between 4.3 - 4.7 has a good quality and aroma. Treatments A and C have pH values within the recommended rate. This is in line with the report of Leterme *et al.* (1992), who recorded an increase in silage pH when pressed sugar-beet pulp was ensiled with molasses and urea, laying hen excreta or soybean meal. Silage quality can be evaluated physically through smell, colour and texture and by chemical analysis (Wattiaux, 2000). The colours obtained in this study were close to the original colour of the materials used for the silages. This observation coincides with the findings of Abdullahi *et al.* (2019) and Babayemi *et al.* (2010) using similar procedure though with different feed materials. The aroma was generally sweet for silages except in treatment B that had urea produces putrid or rancid odour. All the silages were firm in texture and not slimy which is also an indication of good silage, slimy texture indicate spoilage or mould growth (Abdullahi *et al.*,2019).

Table 1: Temperature, pH and Physical Properties of the Ensiled Rice Milling Waste Enhanced with Urea and Poultry Litter

Treatment	Temperature(^{0}C)	pH	Colour	Aroma	Texture
A	29.00^{c}	4.34^{c}	3	3	Firm
B	30.00^{b}	7.96^{a}	4	1	Firm

C	28.90^{c}	4.86^{b}	4	3	Firm
D	31.00^{a}	7.91^{a}	3	2	Firm
LSD	**0.57**	**0.08**			

$^{a, b, c, d}$ Means with different superscripts along columns differ significantly at (P < 0.05).
Colour: 1 = Yellowish green, 2 = Pale yellow, 3 = Light brown, 4 = Dark brown.
Aroma: 1 = Putrid, 2 = Pleasant, 3 = Sweet, 4 = Very sweet.

Proximate composition of ensiled rice milling waste enhanced with urea andpoultry litter

Proximate composition of the resultant silages was shown in Table 2, Treatment B has higher (P<0.05) values of moisture content while treatment A has lower(P<0.05) values of moisture content. The higher percentage of Dry Matter was obtained from Treatment A (100% Rice Milling Waste) compared to other treatments.Enhancement of the ensiling quality of Rice Milling Waste with both Urea and Poultry Litter resulted in silages with moderate (P>0.05) Crude Protein content, Nitrogen Free Extract and Either Extract across all the treatments. The result of this study regarding the proximate contents were within ranges reported by Abdullahi *et al*., (2019) and Mciteka, (2008).

Table 2: Proximate Composition of Ensiled Rice Milling Waste Enhanced with Urea and Poultry Litter

Treatment	MC (%)	DM (%)	CP (%)	CF (%)	EE (%)	ASH (%)	NFE (%)
A	2.81^{c}	97.19^{a}	5.80	24.04^{a}	2.10	15.03^{a}	50.22
B	3.70^{a}	96.30^{c}	6.04	23.25^{b}	2.20	14.54^{b}	50.27
C	3.29^{b}	96.71^{b}	6.01	23.99^{a}	1.96	14.16^{c}	50.59
D	3.32^{b}	96.68^{b}	6.13	23.67^{a}	2.12	14.75^{ab}	50.01
LSD	**0.33**	**0.33**	**0.38**	**0.38**	**0.38**	**0.38**	**1.27**

$^{a, b, c, d}$ Means with different superscripts along columns differ significantly at (P < 0.05).
MC = Moisture Content, DM = Dry Matter, CP = Crude Protein, CF = Crude Fibre, EE = Ether Extract, ASH = Ash and NFE= Nitrogen free extract

Fibre composition and energy content of ensiled RMW enhanced with urea and poultry litter.

Fibre fractions and energy content of the resultant silage were shown in Table 3.Treatment B and C has higher (P<0.05) values of Nitrogen Detergent Fibre (NDF) compared to other treatments.This result is in concord with the findings of Liu and Guo (2010) who reported that, the use of steam treatment in a high pressure vessel at different pressures and for a range of different treatment times increased the degradation` in in-vitro rumen fluid after 24 hours and the rate of degradation, but could not enhance the potential degradability of the fibrous fractions (NDF, Acid Detergent Fibre and hemicellulose). This makes these treatments in many cases economically unprofitable for farmers as the benefits may be too low or even negative (Sarnklong *et al.,* 2010). Moreover, similar energy contents were recorded across all the treatments.

Table 3: Fibre Composition and Energy Content of Ensiled Rice Milling Waste Enhanced with Urea and Poultry Litter

Treatment	NDF (%)	ADF (%)	ADL (%)	CEL (%)	HEM (%)	ENERGY (Kcal/Kg)
A	47.40^{b}	40.93^{b}	0.25	40.68^{c}	6.47^{b}	1031.02
B	48.17^{a}	42.55^{a}	0.21	42.34^{a}	5.62^{c}	1048.10
C	48.10^{a}	41.30^{b}	0.23	41.07^{b}	6.80^{ab}	1027.04
D	45.30^{c}	38.40^{c}	0.21	38.19^{d}	6.90^{a}	1044.73
LSD	**0.38**	**0.38**	**0.38**	**0.38**	**0.38**	**0.38**

$^{a, b, c, d}$ Means with different superscripts along columns differ significantly at (P < 0.05). NDF = Nitrogen Detergent Fibre, ADF = Acid Detergent Fibre, ADL = Acid Detergent Lignin, CEL = Cellulose and HEM= Hemicellulose.

CONCLUSION AND RECOMMENDATION

It is concluded that, treatment C (80%Rice Milling Waste + 20%Poultry Litter) should be used to enhance the nutritional quality of ensiled rice milling waste. Hence, it is recommended for for dry season ruminant feeding.

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