EFFECTS OF ADDITION OF NITROGEN ADDITIVES AND VARYING FERMENTATION DAYS ON ORGANOLEPTIC CHARACTERISTICS OF ENSILED RICE MILLING WASTE

***[1]Kabir, A. U., [1]Abdurrahaman, S. L., [1,2]Dahiru, M., [1]Suleiman, B. M., [1]Salisu, I. B., [1,2]Muhammad, A.S and [2]Musa B.S.**

[1]Department of Animal Science, Federal University Dutse, PMB 7156 Dutse, Jigawa State-Nigeria

[2]Department of Animal Health and Production Technology, Binyaminu Usman Polytechnic, P.M.B. 013 Hadejia, Jigawa State, Nigeria

**Corresponding author email: abubakarkabirusman14@gmail.com (+2348069195933)*

ABSTRACT

An experiment was conducted to study the effects of urea and poultry litter as additives and fermentation days on quality of ensiled rice milling waste. Mixture consisting rice milling waste with urea or poultry litter was ensiled, with three experimental treatments: (T1) rice milling waste without additive (control); (T2) rice milling waste 95% and urea 5% and (T3) rice milling waste 70% and poultry litter 30% on dry matter basis of mixture, respectively using Completely Randomized Design (CRD). All treatments were packed into an open-mouthed kilner jar (cope Bs 910-8, 100mL) for 20 days at room temperature (28 – 30oC). During fermentation process sample per treatment was taken at days; 0, 5, 10, 15, and 20. The result showed that the pH value of all mixed silages significantly increases ($p<0.05$) with ensiling time except for the control in which no significant ($P>0.05$) changes in pH values were observed throughout the ensiling days. Similarly, significant in Color and aroma were observed in mixed silages (T2 and T3) across the fermentation days in comparison with control silage. The overall findings of this study suggested that addition of 5% urea in rice milling waste silage could improve its quality for ruminants' animals' production.

Keywords: Additive; Ensiling; Fermentation; Poultry litter and Urea

INTRODUCTION

Agricultural processing industries are among the major industries that dominate Northern Nigeria, and these industries processed various agricultural products resulting in different types of agro-industrial by-products which are mostly burned and dumped into landfills or used as compost, which is a waste of resources and leads to possible environmental problems because of unsuitable disposal. However, Demand for efficient use of food byproducts is increasing because of economic and environmental concerns (Cao *et al.,* 2018), and these by-products are high in crude protein (Cao *et al.,* 2018), polysaccharide (Yi *et al.,* 2013), fatty acids and vitamins (Cao *et al.,* 2009). Northern Nigeria has long been suffering from shortage of ruminant feedstuff due to seasonal changes and competition with human for consumption in some feedstuffs. With that, some ruminant feedstuff is mainly imported or bought at an expensive cost making the livestock industry less profitable.

Among all the waste product in Nigeria that are used as animal feed, rice milling waste is one of the most abundant and at same time the most unused product. However, rice milling waste is believed to contain various nutrients that may enable it to serve as animal feed. The major challenges are; its high level of fiber and low protein and energy. Studies have shown that the nutritional value of rice milling waste can be significantly improved by processing/treatment techniques such as mechanical treatment, ensilage, biological treatment, and Chemical treatment with alkalis and urea because it lacks most of the essential nutrient beside being low in digestibility (Ubwa *et al.,* 2014). Therefore, to effectively utilize RMW, there is need for improvement of its nutritional value through ensiling with various additives which are used in controlling the fermentation process in order to enhance nutrient recovery and in improvement of silage stability (Oladosu *et al.,* 2016). In this regard, this study was thus designed to determine the effects of additives (urea and poultry litter) and fermentation days on organoleptic characteristics of ensiled rice milling waste.

MATERIALS AND METHODS

Study area

The study was conducted at Department of Animal Science Laboratory; Federal University Dutse, Jigawa State. Dutse lies on latitude: 11.0 °N to 13.0 °N and longitude: 8.0 °E to 10.1 °E (JARDA, 2012).

Experimental design and treatments

The experiment was laid out in a Completely Randomized Design (RCD) consisting three (3) treatments namely: T1 (rice milling waste without additive) serving as control; T2 (95% rice milling waste +5% urea) and T3 (70% rice milling waste + 30% poultry litter) each in triplicate. Data on each replicate was taken 5 times on 5 days interval from day 0 up to day 20.

Preparation of rice milling to be ensiled

Rice milling waste was collected from Majestik Dairy farm Birnin-kudu Jigawa state. Each of the treatments were ensiled in *in vitro* silos and filled to the brim in three replicates. The silos were kept at a temperature for 20 days' incubation period in the laboratory.

Determination of Organoleptic Characteristics of Silage

Based on days' interval during the fermentation, the silos were opened, observed, scored for color and scored for aroma on a subjective score of 1-4 as described in below; then, pH and temperature of the ensiled materials were determined using a combined digital pH/temperature meter model: PHS-25.

Table 1: **Description of Color and Aroma used as Good Silage Indicator**

Score	Color	Aroma
1	Yellowish green	Putrid or rancid
2	Pale yellow	Pleasant
3	Light brown	Sweet smell
4	Dark or Deep brown	Very sweet smell

Source: (Abdurrahaman *et al.,* 2018)

Statistical Analyses

Data collected were subjected to analysis of variance using graph pad prism version 8.02 for windows. Means were separated using turkey's multiple comparable tests.

RESULTS AND DISCUSSION

Silage Color and Aroma

Well fermented silages should not have a strong particular odor due to the production of lactic acid which is nearly odorless. In this research, almost all the treatments showed significant change colour ranging from light brown to brown as shown in Table 2. This may be either because of initial colour of the rice milling waste used (Dried) and the quantity of urea used in T2 (due to ammonia production). When silage has a fruity aroma, it indicates the production of alcohol (Muhammad *et al.,* 2008) in this research all treatments produced varying aroma from pleasant in T1 to putrid or choking smell in T2 and T3. This might be due to the amount of ammonia produced during the fermentation days.

Silage pH and TemperaturepH on fermentation days and treatments was determined as shown in figure 1 both treatments (T2 and T3) showed significant difference ($p>0.05$) as compared to the control (T1) which may be as a result of the stable pH value in RMW (3.5-4.5) (AOAC, 1999). while T2 compare to T1 showed relatively high pH due to quantity of urea used (5%) which deviated from the amount used by (Kung *et al.,* 2018), (Ana Paula *et al.,* 2018) which in both cases the amount used were 2% and 1.5% respectively. In this research, significant change in temperature ($P>0.05$) was noticed in all the treatments from 0 day up to the 15 days after which the temperature in all the treatments became stabilize to about 32°C. Shahowna *et al.,* (2013) reported temperature of 40^0C at 15 days of fermentation depending on the additive used.

Table 2. Effect of fermentation days on colour and aroma in rice willing waste and non-protein nitrogen silage

Treatments	Fermentation days		
		Colour	Aroma
T1 Control 100% RMW	0	3	2
	5	3	2
	10	3	2
	15	3	2
	20	3	2
T2 Rice Milling Waste 95% + 5% Urea	0	3	2
	5	4	1
	10	4	1
	15	4	1
	20	4	1
T3 Rice Milling Waste 70% + 30% Poultry Litter	0	3	1
	5	3	1
	10	3	1
	15	3	1
	20	3	1

Table 3: Effects of pH and Temperature on treatments and fermentation days

		Treatments			p-values		
Parameters	F-Days	T1	T2	T3	Trt	FD	Trt*FD
pH	0	3.23±0.03	9.51±0.00	4.50±0.00	<0.0001	<0.0001	<0.0001
	5	3.67±0.12	9.37±0.03	5.34±0.02			
	10	3.70±0.60	8.94±0.05	5.12±0.01			
	15	4.00±0.60	9.35±0.23	5.94±0.00			
	20	3.9±0.56	8.73±0.03	5.81±0.03			
Temperature	0	29.00±0.60	35.00±0.00	32.00±0.00	<0.0001	0.0171	<0.0001
	5	31.00±0.55	34.33±0.15	33.93±0.22			
	10	32.33±1.20	33.80±0.17	33.57±0.47			
	15	32.33±0.88	32.43±0.24	32.43±0.24			
	20	32.00±0.56	32.73±0.09	32.00±0.15			

T1= Control 100% RMW, T2= Rice Milling Waste 95% + 5% Urea, T3= Rice Milling Waste 70% + 30% Poultry Litter, Trt=Treatment, FD=Fermentation Days

CONCLUSION

There is a strong relationship between the days of ensiling and the type of additive used in silage mixture. The result of this research revealed that ensiling rice milling waste with urea as non-protein nitrogen source for 15 days is more effective as it leads to light brown colour and moderate temperature suitable for fermentation.

REFERENCES

Abdurrahaman, S. L., Abubakar, S. A., Hamza, F. A., Umar, A. M. And Muhammad, (2018) Effects of graded levels of molasses, salt and urea on physiochemical components of rice straw silage *Journal Animal Production Research* 30(1):79-86 ISSN 0189-0514

Ana Paula M. D., Santos E. M, Juliana S. D. O., Ossival L. R., Alexandre F. P. Ricardo M. A. A., Alberto J. D., S. & Gildenia A. P. (2018) Effects of urea addition on the fermentation of sorghum (*Sorghumbicolor*) silage, *African Journal of Range & Forage Science*, 35:1, 55-62, DOI: 10.2989/10220119.2018.1458751

AOAC. (1999). Association of Official Analytical Chemists. Washington D.C: William Tryd Press Richmond Virginill

Cao Y., Cai Y., Hirakubo T., Fukui H., and Matsuyama H. (2018). Fermentation characteristics and microorganism composition of total mixed ration silage with local food by-products in different seasons. *Animal Science Journal*, 82, 259–266.

Cao Y, Takahashi T, Horiguchi K I. 2009. Effects of addition of food by-products on the fermentation quality of a total mixed ration with whole crop rice and its digestibility, preference, and rumen fermentation in sheep. *Animal Feed Science and Technology,* 151, 1–11.

JARDA, (2012). Jigawa State Agriculture and Rural Development Authority Metrological Station Report: Temperature and Rainfall.

Kung L. Jr., R. D. shaver, R. J. Grant, and R. J. Schmidt. (2018). Silage review: interpretation of chemical, microbial, and organoleptic components of silages. *Journal of dairy science*.

Muhammad, I. R., Baba, M., Mustapha, A., Ahmed, M. Y., and Abdurrahman, L. S.(2008). Use of Legumes in the Improvement of Silage Quality of Columbus Grass (Sorghum alumum).*Research Journal of Animal Science*, 2 (4) 109-112.

Oladosu M. Y., Rafii M. Y., Abdullah N., Magaji U., Hussin G., Ramli, A. and Miah G. (2016). Fermentation quality and additives: A case of rice straw silage. *BioMed Research International*. Volume 2016: 1 – 14.

Shahowna E. M., A. G., Mahala, A. M., Mokhtar, E. O., Amasaib and Balgees. Evaluation of nutritive value of sugar cane bagasse fermented with poultry litter as animal feed (2013). *African Journal of Food Science and Technology* Vol. 4(4) pp. 44-47

Ubwa S. T., James A., Barnabas A. O. and Esther O. (2014) Studies on urea treated rice milling waste and its application as animal feed. Vol. 8(2), pp. 23-31, DOI: 10.5897/AJPAC2013.0532 *Academic Journals* http://www.academicjournals.org/AJPAC

Yi Y. B., Ha M. G., Lee J. W., Park S. M., Choi Y. H. and Chung C. H. (2013). Direct conversion of citrus peel waste into hydroxyl methyl furfural in ionic liquid by mediation of fluorinated metal catalysts. Journal of Industrial and Engineering Chemistry, 19, 523–528.