MINERAL ANALYSIS OF ENSILED RICE MILLING WASTE ENHANCED WITH NON-PROTEIN NITROGEN SOURCES

[1]Muhammad[*], A.S., [2]Umar, A.M., [2]Abdurrahaman, S.L., [1]Muhammad, Y. and [1]Dahiru, M.

[1]Department of Animal Health and production, Binyaminu Usman Polytechnic, PMB 013, Hadejia Jigawa State, Nigeria.

[2]Department of Animal Science, Federal University Dutse, PMB 7156, Dutse Jigawa State, Nigeria.

[*]Corresponding author: asmuhammad369@bupoly.edu.ng (+2347064788419)

ABSTRACT

An experiment was conducted to examine the effects of Urea and Poultry litter (PL) in enhancing the physiochemical qualities and mineral contents of ensiled rice milling waste (RMW) in a completely randomized design (CRD). 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 and mineral 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. There was no significant difference ($P > 0.05$) in the Calcium content except for treatment C. Significant differences ($P<0.05$) were recorded for both Phosphorus and Sodium contents of the compounded silages. Treatment D leads in Phosphorus content, while treatment A leads in Calcium content. 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, Poultry litter, Rice milling waste, Urea.**

INTRODUCTION

Livestock usually derive most of their dietary nutrients from the feed they eat; however, significant quantities of minerals may be obtained from water and soil sources. Feed sources of minerals are generally divided into various base feedstuffs such as range or pasture plants, harvested forages, concentrates and mineral supplements (McDowell, 2005). However, efforts to minimize the cost of mineral supplementation in livestock production require a thorough knowledge of the supply and availability of mineral nutrients in feed and forages (Dost *et al*., 1990). 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). 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 and mineral contents 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. Sodium (Na) was determined by PEP7 flame photometer, phosphorus (P) by 6505 Ultraviolet visual spectrophotometer and calcium was determined by titration.

The data generated were subjected to the analysis of variance (ANOVA) using completely randomized design (CRD) of GENSTAT (2014) package, 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 non-protein nitrogen sources

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.

Mineral contents of ensiled rice milling waste enhanced with non-protein nitrogen sources.

The mineral contents of the silage were presented in Table 2. There was no significant difference ($P > 0.05$) in the Calcium content except for treatment C (0.0290). Significant differences ($P < 0.05$) were recorded for both Phosphorus and Sodium contents of the compounded silages. Treatment D (60% RMW + 40PL) leads in Phosphorus content (0.260%), while treatment A (100% RMW) leads in Sodium content (0.089%).

Calcium (Ca): Ca requirements of grazing ruminants are influenced by animal type and level of production, age and weight (McDowell, 2005). Reuter and Robinson (1997) suggested Ca requirement for maintenance of growing and lactating sheep to be 1.2-2.6 g/kg. Ca concentrations in the range of 2-6 g/kg, with higher requirements for lactation have been variously recommended for cattle and sheep (Khan *et al*., 2006). **Phosphorus (P):** P requirements of most species are 0.16 to 0.4% P of ration dry matter, many of our traditional feed sources contain adequate or abundant phosphorus for supporting animal growth and milk production (NRC, 2001)**. Sodium (Na):** The Na requirement for ruminants is although debatable yet its adequate range from 1-4 g/kg has been recommended (Underwood, 1981; Littledike and Goff, 1987). All the minerals (Ca, P and Na) in the compounded silages were below recommended levels for ruminant animals as reported by McDonald *et al.,* (1998), Abubakar *et al.,* (2015). This could be related to inherent low mineral content of the Rice Milling Waste and also the level of fertilizer applied in the field while growing the crop. Consequently, feeding of these silages may require mineral supplementation.

Table 2: Mineral composition of ensiled rice milling waste enhanced with non-protein nitrogen sources

Treatment	Calcium (%)	Phosphorus (%)	Sodium (%)
A	0.210^{b}	0.190^{b}	0.089^{a}
B	0.140^{b}	0.210^{b}	0.065^{c}
C	0.290^{a}	0.10^{c}	0.068^{bc}
D	0.180^{b}	0.260^{a}	0.070^{b}
LSD	**0.070**	**0.028**	**0.004**

[a, b, c, d] Means with different superscripts along rows differ significantly at (P < 0.05)

CONCLUSION AND RECOMMENDATION

It was concluded that, treatment C (80% Rice Milling Waste + 20% Poultry Litter) should be used to enhance the nutritional quality of ensiled rice milling waste. Although, feeding of these silages may require mineral supplementation.

REFERENCES

Abdullahi, A.Y., Muhammad, A.S., Zango, M.H., Madaki, S., Dambatta, M.A., Suleiman, I.O., Bala, A.G., Abubakar, A., Nasir, M., Khaleel, A.G., Ibrahim, U. and Hassan, A.M. (2019). In-vitro evaluation of nutritional quality of ensiled Rice Offal enhanced with Non-protein Nitrogen sources and soybean meal residue.*Nigerian Journal of Animal Production* 46(1): 236-245

Abubakar, S.A., Muhammad, I.R., Sani, S.S., Amodu, J.T., Muhammad, R.H. and Akpensuen, T.T. (2015). Evaluation of Maiwa Millet (*Pennisetum gluacum L.)* Ensiled with Trailing Tropical Legumes. *Journal of Animal Production Research.* 27:184-194.

Akinwande, B.A., Abiodun, O.A. and Adeyemi, I.A. (2013) Effect of steaming on properties of yam flour. *Nutrition and Food Science* 43(1): 31–39.

Amodu, J.T. and Abubakar, S.A. (2004). Forage Conservation Practices.In: Jerome O. Gefu and Joshua T. Amodu (eds). A training manual edited by NAPRI, ABU Zaria Nigeria pp. 60 – 65.AOAC (2005). Association of Analytical Chemists, Official methods of analysis. 15thed., Washington DC.

Babayemi, O. J., Ifut, O. J., Inyang, U. A. and Isaac, L. J. (2010). Quality and chemical composition of cassava waste ensiled with Albiza saman pods. *Agricultural Journal 5(3):* 225 – 228.

Dost, M., Hussain, A., Khan, S. and Bhatti, M.B. (1990). Locational differences in forage yield and quality of maize cultivars. *Pakistan Journal of Scientific and Industrial Research.* 33: 454-456.

Foulkes, D. (1998). *Rice as a livestock feed.*No.J22 Agdex No: 121/10 ISSN No: 0157-8243.

GENSTAT (2014). General Statistics Software for Windows 15th Edition. VSN International, Hemel Hempstead, UK. Web page: Genstat.co.uk.

Khan, Z.I., A. Hussain, M. Ashraf and L.R. McDowell. 2006. Mineral Status of Soil and Forages in South Western Punjab, Pakistan. *Asian-Australian Journal of Animal Sciences,* 19(8): 1139-1147.

Kung, L. and Shaver, R. (2002). Interpretation and Use of Silage Fermentation Analyses Reports. *Focus on Forage*, 3, 1-5.

Leterme, P., Thewis, A. and Culot, M. (1992). Supplementation of Pressed Sugar-beet Pulp Silage with Molasses and Urea, Laying Hen Excreta or Soybean Meal in Ruminant Nutrition. *Animal and Feed Science Technology.* 39(3-4): 209-225

Littledike, E.T. and J. Goff. (1987). Interactions of Ca, P, Mg and Vitamin D, that influence their status in domestic meat animals. *Journal of Animal Science*, 65: 1727-1743.

McDowell, L.R. (2005). Feeding minerals to cattle on pasture. *Animal and Feed Science and Technology*. 60: 247-271.

McDonald, P., Henderson, A.R. and Heron, S.J.E. (1998). *The Biochemistry of Silage*. 2nd Edition. Chalcombe Publications Marlow, Bucks. Pp. 17-30.

NAERLS and PCU (2004). National Agricultural Extension and Research Liaison Services and Projects Coordination Unit. *Field situation assessment of 2004*. In:Maikano A. (2007).Utilization of rice milling waste in practical ration of broilers.*The Zoologist*. 5:1-7.

NRC (2001). National Research Council. Nutrient Requirements of Dairy Cows. *The National Academies Press*. Washington, USA.

Omotola, K.M. and Ikechukwu, A. (2006). *Rice milling in Nigeria*. *Journal of Agricultural Technology* 8(4): 1207-1216.

Reuter, D.J. and J.B. Robinson. (1997). Plant Analysis. An Interpretation Manual. 2nd edition, CSIRO Publishing: Melbourne.

Roy S. and Rangnekar D.V. (2006). Farmer adoption of urea treatment of cereal straws for feeding animals in Mithila Milk Shed, India. *Livestock Research and Development* 18(8).

Thipwimon C.,Shabbir H.G. and Suthum, P. (2004). Environmental profile of power generation from rice husk in Thailand. *The Joint International. Conference on "Sustainable Energy and Environment."*.

Underwood, E.J. 1981. *The mineral nutrition of livestock*. Commonwealth Agricultural Bureaux, Slough, England, p. 10.

Wattiaux, M. (2000). *Introduction to silage making.* The Babcock Institute University of Wisconsin. Retrieved from www.babcock.cals.wisc.edu/downloads/d u/du-502.en.pdf.