EFFECT OF SILO TYPES ON SILAGE CHARACTERISTIC AND CHEMICAL COMPOSITION OF ENSILED AGRO-INDUSTRIAL BY-PRODUCTS

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ABSTRACT

This research was carried out to investigate the effects of different silo types on chemical composition and fermentation profile of ensiled agro-industrial by-products. Three different silo-types; Plastic bucket (T1), Pit (T2) and Polythene bag (T3) were used to ensile 25% wheat offal and 75% cassava peels and all treatments were replicated 4 times in a completely randomized design. Ensiling lasted for 21 days after which they were opened for physical characteristics assessment and chemical composition evaluation. Ten WAD sheep were used for acceptability study using standard procedure. Colour (dark brown), odour (fruity), texture (firm) and no seepage were observed across the treatments. There was a significant (P<0.05) difference in the silage pH and temperature which ranged from 4.00 - 4.33 and 33.28^{0}C-33.78^{0}C respectively. There was also a significant (P<0.05) difference in the crude protein and dry matter which ranged from 7.67% - 8.43% and 35.37% - 37.28% respectively. However, there was no significance (P>0.05) in Neutral Detergent Fiber (NDF) 47.37%-46.29%, Acid Detergent Fiber (ADF) 25.83%-24.59% and Acid Detergent Lignin (ADL) 7.34%-6.59%. The Coefficient of Preference of the silages was greater than the unity of one. It can be concluded that silage in polythene silo gave the best quality.

Keywords: polythene bag, plastic bucket, pit, silage evaluation

INTRODUCTION

Paucity of feed for ruminants in the dry season has become a re-occurring challenge in Nigeria. This challenge has led to communal clashes among livestock and crop farmers (Ajayi et al., 2019). Conservation of abundant feed resources via flexible and adoptable silos is one of the measures to abate the challenge of insufficient feed for ruminant most especially in the dry season, as the country is blessed with quantum of underutilised crop residues and agro-industrial by-products during the production period.

However, the high cost of silo materials and construction by smallholders farmers as reported by (Olorunisomo, 2015) are major challenges in conservation of surplus forages, agro-industrial by-products and crop residues for use in the off season. Therefore, this study was carried out to determine the effect of different silo-types on the physical and chemical composition of ensiled agro-industrial by-products.

MATERIALS AND METHOD

This study was carried out at the small ruminant unit in the University of Ibadan Teaching and Research Farms. Plastic buckets (20liters capacity) polythene bags, were purchased from a nearby market, pit silo with depth of 17inches and breadth of 15inches was dug and all replicated four times. The composition of silage in the three silo types (Plastic bucket (T1), pit (T2) and polythene bag (T3)) was 25% wheat offal + 75% cassava peels. They were thoroughly mixed and compressed with bags filled with sand placed on each of the silos and kept in a cool, dry and rat proof room. Ensiling lasted for 21 days, physical characteristics was carried out as reported by (Ajayi and Joseph, 2019). Proximate analysis of the silage was done according to AOAC (1990) and fibre fraction according to Van Soest *et al.*, 1991. Ten matured sheep were used for the acceptability study using cafeteria method for five days. Consumption was measured by the deduction of the remnants from the amount offered and the co-efficient of preference (CoP) value calculated as the ratio of the intakes for the individual silage to the average intake of all the silages. Coefficient of preference (CoP) = Intake of individual silage offered

$$\frac{\text{Mean intake of the silage types}}{}$$

If CoP is < 1, the material is poorly accepted and when > 1, the material is well accepted. (Karbo *et al*., 1993). All data obtained were subjected to the analysis of variance (ANOVA) while means were separated using Duncan's Multiple Range Test SAS (1999) package.

RESULTS AND DISCUSSION

Presented in Table 1 are the physical characteristics of ensiled cassava peel and wheat offal in different silo types. The temperature ranged from 33.28^{0}C to 33.78^{0}C, these values falls within the range reported by (Adesogan and Newman, 2010). The pH values ranged from 4.00 to 4.33 which corresponds to (Seglar, 2003) report that, the lower the pH, the better preserved and more stable is the silage. The silages from the three different silos had a dark brown colour, with little or no difference from the colour of the original materials ensiled, corroborating the report of Oduguwa et al. (2007).
Shown on Table 2 is the chemical composition of ensiled wheat offal and cassava peels in different silo types. The dry matter (DM) and crude protein (CP) ranged from 35.37 - 37.28% and 7.67 - 8.43%, respectively. The weight of the sand bags also improves the DM by maintaining tight contact between the plastic film and the silage according to the findings of (McDonnell and Kung, 2006). The significant difference in the DM content of the three silo types could be due to the fact that polythene bags and plastic bucket retained DM compared to pit which corroborate the findings of (Johnson and Harrison, 2001). The loss of DM in the pit silo may be due to exposure to surface oxygen which is not so in the plastic bucket and polythene silos (Rafiuddin *et al*., 2017). The variation in the CP across the treatment could be as a result of changes in the ambient temperature of the silos (Rafiuddin *et al*., 2017).

Table 3 discussed the acceptability and coefficient of preference of ensiled cassava peel and wheat offal in different silo types. Coefficient of preference (CoP) of the silages varied from 1.59 to 1.72 which shows that all the silage in each of silo types were preferred by the animals.

Table 1: Physical characteristics of ensiled cassava peel and wheat offal in different silos types.

Parameter	Bucket	Pit	Polythene Bag	SEM
Temperature(^{0}C)	33.78^a	33.28^b	33.78^a	0.15
Ph	4.03^b	4.33^a	4.00^b	0.031
Colour	Dark Brown	Dark Brown	Dark Brown	-
Texture	Firm	Firm	Firm	-
Odour	Fruity	Fruity	Fruity	-
Seepage	No	No	No	-

^{ab} means in the same row with different superscript are significantly (P<0.05) different SEM (Standard Error Mean)

Table: 2 Chemical composition of ensiled cassava peel and wheat offal in different silo types

Parameter	Bucket	Pit	Polythene Bag	SEM
CP	7.96^{ab}	7.67^b	8.43^a	0.17
DM	37.28^a	35.37^b	36.92^{ab}	0.56
NDF	47.37	46.29	46.73	0.65
ADF	25.83	24.59	25.14	0.57
ADL	7.34	6.72	6.59	0.31

^{ab} means in the same row with different superscript are significantly (P<0.05) different
CP (crude protein), DM (dry matter), NDF (neutral detergent fibre), ADF (acid detergent fibre), ADL (acid detergent lignin), SEM (Standard Error Mean)

Table 3: Coefficient of preference of ensiled cassava peel and wheat offal in different silo types

Treatment	Coefficient of Preference (CoP)
Bucket	1.72
Pit	1.68
Polythene Bag	1.59

CONCLUSION

In the quest for affordable, sustainable and reliable silo type by smallholders ruminant farmers the study revealed that polythene bags can be used as silo to produce quality and all year round feed for ruminant animals.

REFERENCES

AOAC, 1995. The official methods of analysis. Association of official analytical chemist, 16thEdn Washington DC, pp: 69-88.

Ajayi M. O., Akintola A. J. and Babayemi, O. J., 2019. Coping strategy among crop and livestock farmers in agrarian community of Fashola, Oyo state, Nigeria. Nigerian J. Anim. Sci. 2019, 21 (3): 160-171

Ajayi, M. O. and Joseph, E., 2019. Characteristics of ensiled cassava leaves and maize stover as dry season feed for ruminants. Nig. J. Anim. Prod. 2019, 46(4): 273-281

Adesogan, A .T. and Newman, Y. C. 2010. Silage Harvesting, Storing, and Feeding. SS-AGR-177/AG180: Forage Management (Florida Forage Handbook). Pp. 1-7.

Babayemi, O .J. and Bamikole, M. A. 2006. Effect of *Tephrosia candida* DC leaf and its mixtures with guinea grass on the *in vitro* fermentation changes in feed for ruminants in Nigeria. *Pakistan Journal of Nutrition* 5: (1): 14 – 18.

Johnson, L.M. and Harrison, J. H., 2001. Scientific aspects of silage making. Proc. 31st. Alfalfa and Forage Symposium, Modesto, Cooperative Extension, University of California (Davis). Dec. 12-13.

Karbo, N., P., Barnes and Rudat, H. 1993. An evaluation of browse forage preference by sheep and goat in northern Savanna zone Ghana. In: J. Ndikumanaan, P. De Leeuw (Eds). Proceeding of the 2nd African Feed Resource Network (AFRNETA) on sustainable feed production and utilization smallholder of livestock enterprises in sub – Saharan African.Harare,

McDonell, E. E., and Kung, L. Jr. 2006. An update on covering bunker silos. University of Delaware, Newark. Accessed Jan. 23, 2017. https://cdn.canr.udel.edu/wp- content/uploads/ 2014/02/CoveringBunkerSilos000.pdf.

Oduguwa, B.O., Jolaosho, A.O. and Ayankoso, M.T. 2007. Effect of ensiling on the physical properties, chemical composition and mineral contents of Guinea grass and cassava tops silage. Nigerian Journal of Animal Production. 34: 100 – 367.

Olorunnisomo, O. A., 2015. Silage-making and its influence on cattle production at the University of Ibadan. *Trop. Anim. Prod. Invest. 18 (2): 91-98 ISSN: 1115-2540*

Rafiuddin, M., Abdullah, K., Javed, M. A. Jabbar, M. Q. Shahid, P. S. Jan, M. Ramzan, M. A. Khan and Ahmad, M., 2017. Comparison of Silo Types on Chemical Composition and Physical Quality of Silage Made From Maize, Sorghum and Oats Fodders. The Journal of Animal & Plant Sciences, 27(3): 2017, Page: 771-775 ISSN: 1018-7081

Seglar, W. J. 2003. Fermentation Analysis and silage quality testing. In Proceedings of the Minnesota Dairy Health Conference, University of Minnesota. Pp. 119 – 135.

Statistical Analysis System Institute Inc. 1999**.** SAS STAT programme, Cary, NC: SAS Institute Inc.

Van Soest, P. J. 1994. Nutritional Ecology of the Ruminant, second ed. Cornell University Press, Ithaca, NY, USA.