Shelf Life Potential and Microbial Load of Varying Mixtures of Grass-Legume Pellets: A Dry Season Feed

O. A. Aderinola
Ladoke Akintola University of Technology, Nigeria

S. T. Oyewole
Ladoke Akintola University of Technology, Nigeria

D. O. Okunlola
Ladoke Akintola University of Technology, Nigeria

SHELF LIFE POTENTIAL AND MICROBIAL LOAD OF VARYING MIXTURES OF GRASS-LEGUME PELLETS: A DRY SEASON FEED

*Aderinola O.A., Oyewole S. T. and Okunlola D. O.
Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
*oaaderinola@lautech.edu.ng; tpoyewole@yahoo.com; dookunlola@lautech.edu.ng

Abstract
The effects of storage duration (0, 6 and 12 weeks), storage medium (plastic container, polythene bag and jute sack) and varying mixture of grass-legume (60% *Panicum maximum* (6Pm); 30% *Panicum maximum* + 30% *Lablab purpureus* (3Pm3Lp); 40% *Panicum maximum* + 20% *Lablab purpureus* (4Pm2Lp); 40% *Panicum maximum* + 20% *Stylosanthes hamata* (4Pm2Sh) and 30% *Panicum maximum* + 30% *Stylosanthes hamata* (3Pm3Sh)) on shelf life and microbial load of grass-legume pellets were examined in the derived savanna zone of Nigeria (Latitude 8^0N, Longitude 4^0E) using a 3 x 3 x 5 factorial arrangement using completely randomized design with Microbial concentrations were significantly affected ($p<0.05$) with plastic container having the lowest counts of total coliform (0.73 x 104cfu/l), total bacteria (2.05 x 104cfu/g), total fungi (1.12 x 104cfu/g) and total microbial concentration (4.07 x 104cfu/g). The study revealed that grass-legume pellet has good storage value and can be fed to ruminants as dry season feed.
Key words: Panicum, Stylosanthes, Lablab, Ruminant, Forage conservation.

INTRODUCTION

Forage conservation methods in various forms have been employed to ameliorate the condition of nutritional stress experienced by ruminant animals in the dry season when the available forages are of low nutritive quality and inadequate in quantity. Various studies have been done on silage (Asaolu *et al.,* 2015) and hay production (Kaiser & Evans, 1997) which are means of forage conservation. Pelletizing is the process of compressing or molding a material into the shape of a pellet, it has the benefits of preserving the feed for a longer period, holding the feed together better during handling, increasing bulk density and improving palatability thereby enhancing its intake by animals (Fasae, 2014). This paper therefore investigated the shelf life potential and microbial concentrations of varying mixtures of grass-legume pellets as dry season feed.

MATERIALS AND METHODS

The experiment was carried out at the Pasture Unit of the Teaching and Research Farm, Ladoke Akintola University of Technology (LAUTECH), Ogbomoso, Nigeria. The area is located at Latitude 8^0N, Longitude 4^0E with annual rainfall of 1270 to 2030 mm, which occurs in 7-10 months with a peak between July and September of the year. The temperature of the area ranges between 28^0C to 33^0C, with humidity of about 74% all year round except in January when the dry wind blows from the North (Olaniyi, 2006).

Samples comprising of five varying mixtures of grass-legume:
6Pm: 60% *Panicum maximum (6Pm),*
3Pm3Lp: 30% *Panicum maximum* + 30% *Lablab purpureus (3Pm3Lp),*
4Pm2Lp: 40% *Panicum maximum* + 20% *Lablab purpureus (4Pm2Lp),*
4Pm2Sh: 40% *Panicum maximum* + 20% *Stylosanthes hamata (4Pm2Sh)* and
3Pm3Sh: 30% *Panicum maximum* + 30% *Stylosanthes hamata (3Pm3Sh)*; harvested from an experimental plot at 8 weeks after planting were air dried, milled and mixed with other fixed ingredients (Table 1) and later pelletized to average length of 40mm using 6mm mesh (Oyewole & Aderinola, 2019) and stored at room temperature for three storage periods (0, 6 and 12 weeks), in three medium of storage (plastic container, polythene bag, jute sack).

Chemical Analysis, microbial load determination and Data collection

Pellet samples from the three storage medium were taken for microbial load analyzes using standard procedures of Taylor *et al.* (1997). Data obtained were subjected to analysis of variance (ANOVA) procedure and the treatment means were separated using Duncan's multiple range test (DMRT) of SPSS (2010).

RESULTS

The results as presented in Table 2 showed that the effects of storage period, storage media and varying mixtures of grass-legume on the microbial concentration (cfu/g) of the experimental pellets were significantly different ($p<0.05$) across the treatments. It was observed that total coliform counts (TCC), total bacterial counts (TBC), total fungi counts (TFC) and total microbial counts (TMC) were increasing with the duration of storage periods. The effect of storage media and varying grass-legume mixture were significant ($p<0.05$) on the microbial concentrations. Plastic container had minimal concentrations while Pellet 6Pm had lowest ($p<0.05$) microbial concentrations except for TCC. Pellet from 3Pm3Lp was observed the lowest ($p<0.05$) for TCC concentration (1.10×10^4). All the microbial concentrations (cfu/g) were significantly ($p<0.05$) influenced by factors interactions.

DISCUSSION

The increase observed with increasing days of storage agreed with the report of (Ibeanu *et al.,* 2015) who examined the shelf life of cereal-legume-oil seed flour. The authors ascribed the increase to high water activity and probably high pH value. The stored pellets in this study might have reduced in DM and high in pH values. Mijinyawa (2002) reported that the functional requirement of storage medium is its capability of retaining the quality of the stored materials for as long as possible which is evident in this study. Plastic container minimized microbial concentrations for the stored pellets. The lowest microbial load for pellets stored in the plastic container could be attributed to ability to resist environmental humidity. This was in consonance with the report of Ekemezie *et al.* (2007) who reported that the quality of any stored feed was affected by high humidity which promotes microbial growths. However, the minimum microbial concentration obtained in plastic container disagreed with the report of Odukoya *et al.* (2013) who evaluated the shelf life of bovine blood rumen digesta mixture using different storage medium and concluded that the use of local basket and jute bag were the best media as a result of free flow of air in and out of the media of storage. The differences in the studies could be attributed to the material used as test ingredient and the condition of storage (Muraina *et al.,* 2013). Plastic medium best preserved the quality of the pellets. The higher microbial concentrations in pellets with grass-legume mixtures as compared to sole Panicum based pellets could be associated with variants in nutritional constituents and moisture content. This agreed with the report of Jeffrey *et al.* (1998) who observed that protein ingredients served as vehicle for bacterial contaminate while Aderinola *et al.* (2014) reported that increase in water soluble carbohydrates could affect quality of stored materials. Increase in water soluble carbohydrates will increase the feed DM loss during storage, thus enhance bacterial proliferation. Nevertheless, all the observed values were less than half a million, which was regarded to be satisfactory for animal consumption (Wilson and Sperber, 1981). Therefore, all the pellets are safe for ruminant consumption without any adverse effect.

CONCLUSION AND IMPLICATION

The microbial load increased with duration of storage in the plastic container preserved the stored pellets best. Pellet with 60% *Panicum maximum* had lowest concentration of microbes. This study concluded that the grass-legume pellets can be stored in plastic container for a period of 12 weeks with a tolerable microbial load. Thus, these pellets can be fed to ruminant during the dry season.

Table1: Composition of Experimental Pellets

Ingredient	***6Pm***	***3Pm3Lp***	***4Pm2Lp***	***4Pm2Sh***	***3Pm3Sh***
Panicum maximum	60.00	30.00	40.00	40.00	30.00
Lablab purpureus	____	30.00	20.00	____	____

Stylo hamata	____	____	____	20.00	30.00
BDG	21.00	21.00	21.00	21.00	21.00
Cassava Peels	16.00	16.00	16.00	16.00	16.00
Potash	2.00	2.00	2.00	2.00	2.00
Salt	1.00	1.00	1.00	1.00	1.00
	100.00	100.00	100.00	100.00	100.00
Proximate Analysis					
Dry Matter	93.13	93.22	94.10	93.05	94.04
Crude Protein	16.62	16.84	17.10	16.93	17.32
Ether extract	3.56	3.52	3.65	3.63	3.63
Crude fibre	19.77	20.32	20.84	21.16	21.32
Ash	7.13	7.36	7.40	7.34	7.43

Table2: Effect of storage period, storage media and varying mixtures of grass-legume on the microbial concentration (cfu/g) of the experimental pellets

Factor	Total Coliform Count	Total Bacterial Count	Total Fungi Count	Total Microbial Count
Storage durations				
Initial	0.4×10^{4c}	1.36×10^{4c}	0.47×10^{4c}	3.22×10^{4c}
6 weeks	1.83×10^{4b}	3.15×10^{4b}	2.70×10^{4b}	6.84×10^{4b}
12 weeks	2.19×10^{4a}	3.93×10^{4a}	3.39×10^{4a}	7.72×10^{4a}
SEM	0.02	0.07	0.10	0.11
Storage medium				
Plastic	0.73×10^{4c}	2.05×10^{4c}	1.12×10^{4c}	4.07×10^{4c}
Polythene	2.17×10^{4a}	3.57×10^{4a}	3.04×10^{4a}	7.07×10^{4a}
Jute sack	1.54×10^{4b}	2.82×10^{4b}	2.40×10^{4b}	6.65×10^{4b}
SEM	0.02	0.07	0.12	0.13
Varying mixtures of grass-legume				
6Pm	1.40×10^{4c}	2.01×10^{4e}	1.20×10^{4e}	5.04×10^{4e}
3Pm3Lp	1.10×10^{4e}	2.54×10^{4c}	1.77×10^{4d}	5.53×10^{4d}
4Pm2Lp	1.53×10^{4b}	2.22×10^{4d}	2.26×10^{4c}	6.02×10^{4c}
4Pm2Sh	1.28×10^{4d}	3.44×10^{4b}	2.63×10^{4b}	6.37×10^{4b}
3Pm3Sh	2.07×10^{4a}	4.90×10^{4a}	3.12×10^{4a}	6.63×10^{4a}
SEM	0.02	0.07	0.10	0.11
P–value				
Storage x Media x VGL	<0.001*	<0.001*	<0.001*	<0.001*

[a,b,c,d,] :Means carrying different superscript are significantly different ($p<0.05$); SEM: standard error of mean; *6Pm: 60% P. maximum; 3Pm3Lp: 30% P. maximum + 30% L. purpureus; 4Pm2Lp: 40% P. maximum + 20% L. purpureus; 4Pm2Sh: 40% P. maximum + 20% S. hamata; 3Pm3Sh: 30% P. maximum + 30% S. hamata;* Plastic: plastic container; Polythene: polythene bag; ns: not significant ($p>0.05$); * = significant ($p<0.05$)

References

Aderinola, O.A, Lateef, O.A, Binuomote, R. T, Adeeyo, A and Jekayinfa, O. A. (2014). Nutritional and microbial contents of varied combination of ensiled *Panicum maximum* and *Veteria nigritana* grass. International J. Food, Agric. and Vet. Sci., 4(1):141-148.

Asaolu, V. O., Binuomote, R. T., Okunlola, D. O. and Oyelami, O. S. (2015). Characteristics of *Moringa olifera* silage with mixtures of *Panicum maximum* and wheat offals. *J. Nat. sci. Res.,* 5(18)121-130.

Ekemezie, A. A., Nworgu, F. C., Babajide P. A. and Adeusi, R. A. (2007). A guide to the principles and practices of crop production. Panes Press ltd. Lb. Nig. Pp. 48-51

Fasae, O. A. (2014). Evaluation of cassava leaf pellets as dry season feed in smallholder sheep production. Nigeria J. Animal Sci., 16(1):116-123.

Ibeanu, V. N., Ene-Obong, H. N., Peter-Ogba, G. U. and Onyechi, U. A. (2015). Microbiological evaluation and shell life of seed floor mixes used for infant feeding in rural northern Nigeria. *African Journal of Biotechnology,* 14(20): 1781-1723.

Jeffrey, J. S., Kirk, J. H., Atwill, E. R and Cullor J. S. (1998). Prevalence of selected microbial pathogens in processed poultry waste used as daily Cattle feed. Poultry Sci., 77:808-811.

Kaiser, A. G. and Evans, M. J. (1997). Forage conservation on Australian dairy farms. Animal industries report No. 3, NSW Agriculture, Orange, p.18.

Mijinyawa, Y. (2002). Farm Structure. Ibadan, Nigeria: Alvelemhegbe Pub., p. 16.

Muraina, T. O., Onifade, O. S., Dele, P. A., Olanite, J. O., Amahwe, O. J., Kadri, S. F. and Okpiaifoh, C. I. (2013). Effect of storage conditions and storage periods on proximate composition and *in vitro* gas production of hay produced from two *Stylosanthes* species. The proc. of the 38th Ann. Conf. of the Nig. Soc.for Ani. Prod. (NSAP), 17-20 March, 2013. River State University of Science and Technology, PortHarcourt. Pp 259-262.

Wilson, D. and Sperber D. (1981). On grice's theory of conversation. In P. Werth (ed.) Conversation and Discourse. London: Croom Helm. 155-178. Reprinted in Kasher (ed.) IV: 347-368

Odukoya, S. O., Abiola, S. S. and Sogunle O. M. (2013). Shelf life evaluation of bovine blood rumen digesta mixture (BBRDM) using different storage medium. Animal science association of Nigeria. Proceeding of the 18th annual conference, September, 8-12, Abuja.

Olaniyi J. O. (2006). Influence of Nitrogen and Phosphorus fertilizers on seed yield and quality of Egusi melon (Citrullus lanatus (Thunb) Mansf) in Ogbomoso, Southwestern Nigeria. Ph.D Thesis, University of Ibadan, pp 57-155

Oyewole Sunday and Aderinola Olusola (2019). growth performance and bio-economic indices of varying mixtures of grass-legume pellets fed to west african dwarf (wad) goats. *Journal of biology, agriculture and healthcare*, 9(24): 55- 62.

SPSS (2010). Statistical Package of Social Science. Personal Computer Version 19.0, Michigan Avenue, Chicago Illinois, USA.

Taylor, D. J., Green, N. P. O. and Stout, G. W. (1997). Microbiology and Biotechnology: Biological Science. Third edition (Cambridge University Press, South Africa) 378 – 388. ISBN: 978-0-521-63923-1