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Proximate Composition and Physio-Chemical Parameters of Cassava Peel Ensiled with Banana Leaves and Dried Poultry Waste

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ABSTRACT

The study was carried out to determine the physio- chemical parameters, mineral composition and chemical composition of silage. Cassava peel, poultry litter and banana leaves were ensiled for 28 days in four treatments S0, S1, S2 and S3 respectively. S0-100% cassava peel, S1,70%cassava peel+30% poultry litter, S2,70% cassava peel+30% dried poultry waste, S3,40% cassava peel +40%banana leaf+20% dried poultry waste. Result for chemical composition of silage during the experiment shows that S2 has the highest value for dry matter (50.21) and S0 had the lowest value (25.10). S1 had the highest value for crude protein (23.55) and highest of crude fibre (42.70). The pH of the silage ranged from 4.0 -4.4The result for mineral composition of the silage showed that S1 had the highest Calcium (Ca) content of 330.0mg/100g while S0, S2, and S3 showed similarities in values recorded respectively (230.3mh/100g, 250.0mg/100g and 240.0mg/100g). The values for Manganese (Mn), Zinc (Zn) and Copper (Cu) were relatively low. Based on the results of the research, it could be concluded that ensiling of cassava peels, banana leaves and dried poultry waste could be adopted and best utilized as supplementation of feeds for ruminant animals.

INTRODUCTION

Silage-making has great potential to solve seasonal shortage of feed for ruminants in Nigeria by preserving excess forage produced during the wet season for use at the dry period. However, nutritive value of silage prepared from tropical grasses and agricultural wastes is often limited by their low protein content (Gallaher and Pitman, 2001). The lack of good nutritive feed during dry season is partly responsible for low productivity and reproduction in livestock industry. Over the past 20 years there have been major advances in the technology of making and feeding silage (Okiely and Muck 1998). Much of this development has occurred in temperate zones, and there are needs for further research in tropical zones, in areas such as manipulation of microbial fermentation and the development of grass and legume crop silage. Cassava peel, though, low in nitrogen, remains the most outstanding source of energy for ruminants (Adegbola *et al*., 2010). Utilization of crop residue-based diets by supplementing with leaves of multipurpose tree fodder as a cheap protein- rich has been reported (Mousa, 2011). In general, however, the technology is adequate, and the difficulties are in integrating silage into profitable feeding systems. In many tropical countries whole, fresh banana leaves, stalks and pseudostems are chopped and fed either fresh, sun-dried or ensiled. Banana leaves contain about 15% Dry Matter and 10–17% Crude Protein (Chander *et al*., 2008). Banana pseudostems (trunks) and leaves are useful sources of roughage in many tropical countries, mainly during the dry season. They can be chopped and fed fresh or ensiled. As pseudostems are low in protein and minerals, they are more efficiently used when supplemented with rich-protein ingredients, such as copra meal, multi-nutrient feed blocks, cassava leaves, poultry manure and spent grain (FAO, 2011). The use of chopped and ensiled pseudostems is particularly recommended when the bunch has been harvested and plants are cut down; the large quantity of trunks available at harvest time can be safely preserved through a well planned silage operation. The silage is of good quality when chopped pseudostems are properly mixed with an easily fermentable carbohydrate (such as molasses, sliced root vegetables) and protein-rich feeds (such as poultry litter, wet spent grain). Poultry litter includes the beddings and other contamination in the poultry house and the poultry manure. Poultry litter is a good source of nitrogen, protein and ash (Ekanem, 2012). The ensiling of by-products is a simple and appropriate method of conservation. It is the most effective way to improve animal feed resources through the rational use of locally available agricultural and industrial-by products likely to be available to small-scale farmers at village level (Amole and Ayantunde, 2016). The ensiling of the poultry litter is a simple and appropriate method of conservation. It has proved to be an excellent ingredient for cattle feeding, and the process significantly destroys harmful micro-organisms possibly present in poultry litter. Silage made from poultry litter, chopped root crops and bananas by-products provides a balanced diet for dairy cows (Phuong Le Thuy Biah *et al* 2017) This study, therefore, presents the physical characteristics, proximate composition and minerals of cassava peel ensiled with banana leaves and dried poultry waste.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the cattle Unit, Teaching and Research Farm, Oyo State College of Agriculture and Technology, Igboora located between latitude 7°15' North and longitude 3° 30' East with an annual average rainfall of 1278mm and average temperature of 27°C

Silage preparation, chemical analysis and quality assessment

Fresh cassava peel was collected from a *gari* processing unit in Igboora while banana leaves were harvested within the Oyo state college of agriculture and technology, igboora premises and the dried poultry litter were collected at the broiler section of the college. The materials were chopped to a particle size of 2-3cm using an automated chopper. Weighed quantities of each material were mixed in the following proportions; S0-100% cassava peel, S1,70%cassava peel+30% poultry litter, S2,70% cassava peel+30% dried poultry waste, S3,40% cassava peel +40%banana leaf+20% dried poultry waste. Mixtures were packed in triplicates into 4L plastic silos for silage analysis while separate mixtures were packed inside 120L plastic drums. Silages were compacted manually, sealed with polythene sheets and pressed with sand bags to exclude air from the silage. Mini silos were opened at 21 days to determine pH, physical characteristics (colour, smell and texture). The appearance of the silage in term of colour was assessed using a colour chart. The smell and texture of the silage was adjudged by six (6) individuals while the pH of the silage using a pH meter. The proximate composition of silages was determined using the general procedures of AOAC (2005). Dry matter content was determined using a forced draught oven at 65^0C, correcting values for the loss of volatile compounds by multiplying with the factor of 1.056 (Fox and Fenderson, 1978).

Statistical analysis

All data obtained were subjected to analysis of variance (SAS, 1995) and differences between means were considered significant at 5% probability level. Means were separated using Duncan's multiple range tests.

RESULTS AND DISCUSSION

Table 1: Chemical composition of cassava peels ensiled with banana leaves and dried poultry waste

PARAMETERS	SILAGE			
	S_0	S_1	S_2	S_3
Dry Matter (%)	25.10^{c}	25.99^{c}	50.21^{a}	30.21^{b}
Crude Protein (%)	10.60^{c}	15.44^{a}	23.55^{b}	10.95^{c}
Crude Fibre (%)	10.62^{d}	42.70^{a}	30.20^{c}	31.59^{b}
Ether Extract (%)	15.00^{b}	11.00^{c}	9.00^{d}	22.00^{a}
Ash (%)	7.52^{a}	5.50^{c}	7.40^{b}	7.50^{a}

abcd means within the same row with different superscript differ (P<0.05)

S0-100% cassava peel, S1,70%cassava peel+30% dried poultry waste, S2,70% cassava peel+30% dried poultry waste, S3,40% cassava peel +40%banana leaf+20% dried poultry waste

The result of chemical composition of the silage are presented in table 1. S2 had the highest value for dry matter (50.21) and S0 had the lowest value (25.10). S1 had highest value for crude protein (23.55) and highest value of crude fiber (42.70) S0 had lowest value for crude protein and crude fiber respectively (10.60 and 10.62). S3 had the highest value of ether extract (22.00) while S2 had the lowest value of ether extract (9.00). S0 and S3 showed similarities in Ash values of the study respectively (7.52 and 7.50) while S1 had the lowest value of ash (5.50). The dry matter (%) content of silages ranged between 25.10 (S0) and 50.21 (S2). Dry matter content increased with the inclusion of banana stem & leaves in the silages. This agrees with the finding of Olorunnisomo and Fayomi (2012). When they ensiled different legumes of elephant grass with cassava peels. The increase in dry matter across the diets may be attributed to the relatively dry matter of banana standard leaves. Crusde Protein (CP) level obtained in this study was higher (P>0.05) in S1 (23.55) than S2 (15.44) but was similar in S3 and S0 (10.95 and 10.60) respectively. The CP (Crude Protein) levels recorded in the study (10.60 – 23.55%) were higher than the 2.5% reported by Ben Salem *et al* (2004). Also higher than the range of 8.9 – 16% reported by NRC (1981) for maintenance and moderate growth in ruminants. This could be attributed to inclusion of poultry litter (P<) with CP of about 26% (Ensminger, 1977) which makes it a good protein supplement in livestock feeding and protein is needed for growth and development of animals' tissue. Similarly, protein and energy consumption are interlinked. When protein contents of diets are inadequate, intake drops and digestibility of energy is reduced. The CP ranges were sufficiently high to warrant utilization of the plant as a feed resource for ruminant animals. Intake of the experimental animal is maintained at high level without creating health problem, this indicates final chopping of crop residues e.g. Bamboo leaves, cassava peel and proper processing of animal waste which result improved compaction and formation of silage and also improves palatability and intake of silage, also the animals had a positive increase in growth rate and no form of infection from feed as Poultry Litter (PL) are known as ideal medium for the development of fungi (Loveth *et al* 1971).

Table 2: Physio- chemical Parameters of cassava peel ensiled with banana leaves and dried poultry waste

PARAMETER	SILAGE			
	S_0	S_1	S_2	S_3
pH	4.4	4.25	4.10	4.0
Color	Light brown	Brownish green	Dark brown	Light brown
Smell	Pleasant	Pleasant with slight alcoholic smell	Pungent	Slightly pleasant
Texture	Firm and wet	Firm and mist	Firm	Firm
Moldiness	Slightly mould	Average mould	No mould	No mould

S0-100% cassava peel, S1,70%cassava peel+30% dried poultry waste, S2,70% cassava peel+30% dried poultry waste, S3,40% cassava peel +40%banana leaf+20% dried poultry waste

The Physio- chemical Parameters of the silages are shown in Table 4.2. Color of silages varied from Light brown, Brownish green, Dark brown and Light brown which the smell of the silages had a Pleasant, Slightly alcoholic smell typical of fermented cassava and pungent. The PH of the silages ranged from 4.0 -4.4. the texture of the silages ranged from firm, firm and wet and firm and moist white the moldiness ranged from slightly mould, arrange mould and no mould. Good silages mostly presences the original color of pasture or any

forage (‘t Mannatje, 1999). This was in order as the prevalent brown colour which was the colour of the silage after witting the forages. Cassava peel ensiled with poultry litter had unpleasant and pungent smell while silages with banana stem exhibited a pleasant smell which is characteristics of good silage quality which has well preserved (Oduguwa *et al*., 2007). All the silages had a firm texture through with varying moisture content. Silages with cassava peel were observed to be wet while the others were moist. This observation showed that inclusion of cassava peels in the silage enhanced the texture of the mixture. This agrees with the findings of Ososanya and Olorunnisomo (2015) when they reported better texture in brewers’ waste silages ensiled with corn cobs. The lower pH observed with mixture of banana stem and leaves, cassava peel and poultry litter enhanced the quality as there the pH values observed here generally full within the range of 3.5 - 5.5 classified to be pH for good silage (Menesses., *et al.*, 2007).

Table 3: Minerals composition of cassava peel ensiled banana leaves and dried poultry waste

Sample/minerals (Mg/100g)	Ca	P	Mg	K	Na	Mn	Zn	Fe	Cu	
S0	230.3	52.2	165.4		710.3	10.6	0.3	1.5	3.0	1.0
S1	230.0	5.2	205.0	220.0	2.1	0.5	2.1	5.0	1.1	
S2	250.0	30.0	190.0	500.5	5.0	0.4	1.1	4.0	0.5	
S3	240.0	40.4	170.0	412.0	4.0	0.5	1.0	4.5	0.4	

S0-100% cassava peel, S1,70%cassava peel+30% dried poultry waste, S2,70% cassava peel+30% dried poultry waste, S3,40% cassava peel +40%banana leaf+20% dried poultry waste

The mineral composition of banana stem and leaves ensiled with cassava peel and poultry litter. S1 had the highest Calcium (Ca) content of 330.0mg/100g while S0, S2, and S3 showed similarities in values recorded respectively (230.3mh/100g, 250.0mg/100g and 240.0mg/100g). 2 Values were also high with recorded values of 710.3, 500.5 and 412.0mg/100g of Potassium for S0, S2, and S3 respectively. Iron (Fe) content recorded was 3.0mg/100g, for S0 5.0mg/100g, for S1, 4.0mg/100g, for S2 and 4.5mg/100g. Magnesium (Mg) values recorded were 165.4, 205.0, 190.0 and 170.0mg/100g for S0, S1, S2, and S3 respectively. The values for Manganese (Mn), Zinc (Zn) and Copper (Cu) were relatively low. The recorded values of macro and micro minerals in the silages investigated show great potentials for its utilization as feed resources for ruminant animals. The silages samples fell within the range of existing values recommended. The level of the mineral content is below the toxic level and at the required level for the ruminants (NRC, 1980). Sena *et al*., 1998) and Lockett *et al*., (2000) reported 216.00 and 211.00mg/100g DW for Calcium (Ca) respectively. The Iron (Fe) Content of the samples investigated show great potential for adequate erythropeisis in any target farm animal. The highest Fe content 4.5mg/100g was obtained in silage3 when silage contains banana stem, cassava peel and poultry litter. This agrees with the report of Emmanuel and Staples (1990). The values of Fe were within dietary level of 0.001 - 0.1% as recommended by NRC (2001).

CONCLUSION

Based on this study, it could be concluded that addition of cassava peels, banana leaves and dried poultry waste improves silage properties, minerals and proximate composition. It is therefore recommended that the silage could be adopted and best utilized as supplementation of feeds for ruminant animals.

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