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Silage Quality and Preference of Centrosema Leaf Ensiled With Different Levels of Cassava Peels by Goats

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Abstract
In this study, *Centrosema pubescens* leaf (CL) was ensiled with different proportions of cassava peel (CP). Physical characteristics, chemical characteristics and proximate composition of the silage mixtures were determined while preference of West African Dwarf goats for the mixtures was determined using five bucks. Treatments consisted of the following CL-CP mixtures; 70: 30, 60:40, 50:50, 40:60 and 30:70. All the silage types formed good silage and silage acidity increased from 4.4 to 3.95 while colour varied from pale to light green as the proportion of cassava peel in the silage mixtures increased. All silages had a firm texture with pleasant and slightly alcoholic and fruity smell. Dry matter and nitrogen free extract of silage increased as the proportion of cassava peel in the mixtures increased while crude protein and crude fibre (CF) reduced. DM, crude protein and CF varied from 24.84 to 31.31%, 8.50 -19.24% and 11.17 – 13.85%, respectively. The preference by goats was 53.57, 66.67, 80.35,96.43 and100% for 70:30, 30:70, 60:40, 40:60 and 50:50 CL-CP silage mixture, respectively. These results indicate that addition of cassava peel to Centrosema leaf enhanced the silage characteristics and acceptability of centrosema leaf silage by goats.

Keywords: *Centrosema pubescens* cassava peel, silage, acceptability, goats

Introduction

The availability of green forage is mostly seasonal, only in rainy season, when plant growth is high. The seasonal scarcity can considerably be reduced by conserving the surplus forage during high fodder availability period. Silage making has great potential to solve the seasonal shortage of feed for ruminants in Nigeria by preserving excess forage produced during the wet season for use at the dry period (Olorunnisomo and Adesina, 2014). The problem of low quality feeds and forage scarcity during the dry season can be reduced drastically by utilizing legumes and agro-industrial by-products (AIBPs) like cassava peels (Olorunisomo and Fayomi, 2012). Legumes such as *Centrosema pubescens* are fairly abundant in humid Southeastern Nigeria and generally contain high crude protein and could improve feed quality of grasses and AIBPs for ruminant production.

However, legume forage usually makes poor silage due to its low content of carbohydrates and high buffering capacity (Wilkins, 2001). Hence they require the addition of readily fermentable carbohydrates (RFC) such as cassava peels in order to obtain good silage (Olorunisomo and Fayomi, 2012). Its addition to legume forage can enhance fermentation and improve energy concentration ensuring that silage produced is of high quality that could serve as a feed for goats during the rainy and dry season. Silages could be used as a buffer to overcome feed gap that arises from seasonal fluctuations in other feed sources. Although silage technology has been available for years, their use in the traditional sheep and goat production has not been popular.

The study, therefore, presents the estimated quality, nutritive value and preference of West African Dwarf goats for Centrosema foliage ensiled with different proportions of cassava peel.

Materials and Methods

Location: The study was carried out at the Sheep and Goat Unit of the Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. The experimental site bears the coordinates of $5^0$28' North and $7^0$32' East and lies at an altitude of 122m above sea level. Average rainfall is 2169.88mm in 148-155 rain days. The relative humidity is over 72% on the average and monthly ambient temperature ranges between 17 ^{0}C and 36 ^{0}C with an average of 26 ^{0}C (NRCRI, 2004).

Source/procurement of forage and cassava peels: The fresh leaves of the forage plant *Centrosema pubescens* (Cento) and cassava peels were harvested from plots and secondary bushes within the Michael Okpara University of Agriculture, Umudike campus while fresh cassava peels were collected from local garri processing units in Umudike, Nigeria.

Preparation of silage: The forage crop *Centrosema pubescens* and cassava peels were wilted for 6-12 hours and chopped to 2 - 4cm in length using a matchet. Weighed quantities of cut *Centrosema* were mixed with chopped cassava peel in the following proportion; 70:30 , 60:40, 50:50, 40:60 and 30:70 of *Centosema*-cassava peel, designated diets 1, 2, 3, 4 and 5, respectively. The mixtures were be ensiled in 4-litre plastic buckets (mini silos) in triplicates for laboratory analysis and for acceptability study. Silages were impacted manually, sealed with polythene sheets and pressed with sandbags to exclude air from the silage. Five silage mixtures were produced.

Silage examination and laboratory analysis: At 30 days of ensiling, the silos were opened and the silages were visually assessed. The physical parameters (color, smell (odor), texture, mouldiness) were recorded. Temperature of the fermented product at different depths of the container was observed and recorded using the compost thermometer. The pH of the silage mixtures from different mini silos was measured. A representative silage sample from plastic mini-silo was taken into labeled poly bag for proximate analysis using AOAC (1990) method. Dry matter (DM) was determined using a forced draught oven at 65^{o}C, correcting values for the loss of volatile compounds by multiplying with the factor of 1.056 (Fox and Fenderson, 1978). During sampling, which was done in triplicate, the silages were visually assessed and compared in terms of physical properties, adapted and modified by the procedure of Hassan (2004).

Acceptability / preference study: Five West African Dwarf bucks goats aged about 12 - 24 months and weighing between 7 and 12 kilogrammes were used for the preference trial. Animals were treated against internal and external parasites, housed in a group in a pen for one week adaptation period before the experiment commenced. The silage mixtures (1 kg each on a wet basis) were offered in various troughs in the pen for a period of 7 days. Location of silages within the pen was interchanged daily to prevent association of diets with a particular location. Fresh water was offered free choice on a daily basis. Silage intake were measured 3 hours after it was offered by deducting remnants, but animals were allowed eat the remnant silage for the rest of the day. The coefficient of preference (COP) was calculated as the ratio of individual silage intake to the average intake of all silages. When values are equal to 1 or greater, the forage is considered to be acceptable to the animals (Babayemi, 2007). The preference using relative preference index (RPI) was calculated by dividing the total intake of each silage mixture by the total intake of the most consumed silage mixture. The results obtained were then multiplied by 100 (Larbi *et al.*, 1993). The RPI was used in ranking the silage mixtures. The silage eaten most (highest DMI) was ranked 1 and the least eaten ranked 5; the other silages were ranked between 2 to 4.

Experimental design and statistical analysis: The experimental design was a Complete Randomized Design, where each of the six goats represented a replicate. Intake of the silages by the goats was determined and the data collected. Silage intake, mean values for the proximate composition and physical characteristics of the silages were analyzed by one- way analysis of variance. Treatment means were compared using Duncan's Multiple Range Test (SPSS, 1989).

Results and Discussion

The proximate composition of the silage is as shown in Table 1. The dry matter (DM) (%) content of the silages ranged from 24.84% (diet 1) to 31.31% (Diet 5) and increased with the inclusion of cassava peel in the silage mixtures. This agrees with the findings of Olorunnisomo and Fayomi (2012) and Olorunnisomo and Adesina (2014), when they ensiled different legumes or elephant grass with cassava peels and ensiled moringa leaf with different levels of cassava peels. The increase in DM across diets may be attributed to the relatively high dry matter of cassava peels. The reverse is the case with ash content, which decreased as the cassava peels increased in the silage diets. This may be as a result of the higher ash content of Centrosema compared to cassava peels. This indicates that centrosema silage may serve as a good source of minerals in ruminant diets.

Table 1: Proximate composition of *Centrosema pubescens* leaves ensiled with cassava peels

Silage mixture	Proximate DM	Composition CP	(%) CF	EE	Ash	NFE
70:30	24.84^{d}	19.24^{a}	13.85^{a}	5.51	10.68^{a}	25.88^{d}
60:40	26.54^{c}	16.86^{b}	13.58^{a}	4.50	9.97^{b}	28.55^{c}
50:50	29.02^{b}	13.52^{c}	13.16^{a}	4.55	9.80^{b}	29.95^{bc}
40:60	29.38^{b}	11.16^{d}	12.41^{b}	4.30	8.70^{c}	34.05^{b}

30:70	31.31[a]	8.50[e]	11.17[c]	4.00	6.20[d]	38.82[a]
SEM	0.30	0.60	0.16	0.18	0.07	1.35

[abcd]Means in a row with superscripts are significantly different (p<0.05). SEM = Standard error of the means.

The crude protein (CP) of the silage mixtures decreased with increasing levels of cassava peels and ranged from 8.50% for diet 5 to 19.24 % for diet 1. This could be attributed to the level of CP of cassava peel, however, the CP meets the critical protein requirement of ruminants which is 7.7% or 70g/kg DM (NRC, 1981). The minimum protein content recommended for ruminant diet is 10-12% (ARC, 1985). It may be safe to conclude that ruminants fed centrosema- cassava peel silage may only require extra protein supplementation at high proportion of cassava peel incorporation (70% of the mixture).

The physical characteristics of the silages are as shown in Table 2. Colour of silages varied from pale green with brown and white speckles, light green with brown and white speckles to light brown while the smell/odour of the silages had a pleasant and slightly alcoholic smell typical of fermented cassava. Good silage usually preserves the original colour of any forage and has a pleasant and fruity smell which is characteristic of good quality silage which was well preserved (Oduguwa *et al.,* 2007; Obua, 2005). The light green colour is indicative of improved fermentation (Olorunnisomo and Adesina, 2014).All the silages had a firm texture though with varying degree of moistness. Silage with 70% centrosema and 30% cassava peel (diet 5) was observed to be slightly wet while others were moist.

Table 2: Silage characteristics and preference of goats for centrosema leaf-cassava peel silage

Parameters	*70:30*	*60:40*	*50:50*	*40:60*	*30: 70*	*SEM*
pH	4.4	4.25	4.10	4.00	3.95	
Colour	Pale green	brownish green	light green	light green brown	Light brown	
Smell	Pleasant with slight alcoholic	Pleasant with slight alcoholic smell	Pleasant with slight alcoholic smell	Pleasant slight alcoholic	Pleasant with strong alcoholic	
Mouldiness	Slightly mould	Average mould	Without mould	Slight	Average	
Texture	Firm and slightly wet	Firm and moist	Very Firm and moist	Very firm	Very firm	
Temp	28^{0}C	27. ^{0}C	26.5^{0}C	26^{0}C	26^{0}C	
Intake (g/d)	450	675	840	810	560	21.46
COP	0.67	1.01	1.26	1.21	0.84	
RPI/Rank	53.57/5th	80.35/3rd	100/1st	96.43/2nd	66.67/4th	

[abcd]Means in a row with superscripts are significantly different (p<0.05). SEM = Standard error of the mean. RPI=Relative preference index, COP=Coefficient of preference. Temp =Temperature, Rank=Ranking

The pH of the silages ranged from 3.95 to 4.4, and was within the acceptable range of 3.5 -5.5 for good silage (Obua, 2005; Menesses *et al.,* 2007). The acidity increased as the proportion of cassava peel in the mixture increased, showing that cassava peels improved fermentation of centrosema leaf. A similar trend was observed when cassava peel was ensiled with tropical forage crops (Olorunnisomo and Fayomi, 2012; Olorunnisomo and Adesina, 2014). The colour, smell and texture of the silage apparently improved with a higher proportion of cassava peel in the mixture. This confirms earlier reports that cassava peel had a positive influence on silage characteristics of tropical forages (Olorunnisomo and Adesina, 2014)

Preference of goats for Centrosema ensiled with different proportions of cassava peel is shown in Table 2. Preferences indices showed that goats prefer silages with equal or close to equal proportions of centrosema and cassava peel. The COP values showed that the 60:40, 50:50 and 40:60 mixtures were more acceptable to goats than either 70:30 or 30:70 mixtures. The low COP of less than 1for 70:30 and 30:70 mixtures suggest that goats were averse to diets with a high proportion of centrosema leaf and cassava peel. Based on relative preference index (RPI) (%), the order of preference by goats in this study was; 50:50> 40:60 >60:40 > 70:30 > 30:70 of *Centosema*-cassava peel silage. The trend indicates that addition of cassava peel to centrosema forage enhanced its acceptability to goats.

Conclusion

It could be concluded based on this study that addition of cassava peel to Centrosema leaf improved silage characteristics and acceptability of Centrosema leaf silage by West African Dwarf goats.

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