Chemical Composition of Silage from Guinea Grass, Cassava Peel, and Brewery Waste as Affected by Ensiling Duration.

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ABSTRACT

The chemical composition of silage from Guinea grass, cassava peels, and brewery waste as affected by ensiling duration was assessed through determination of their proximate composition and fiber fractions. Results showed that the ensiling duration had significant (P<0.05) effect on the parameters determined with crude protein (CP) content ranging between 12.02 and 16.12% and neutral detergent fiber (NDF) was between 50.21 and 65.05%. The CP also varied significantly (P<0.05) among the forage-agro by product mixtures of the silage from 7.65 to 15.17% with CP content of 25%GG+75%BW silage being the highest. The forage-agro by product mixtures had varying (P<0.05) influence on the NDF ranging from 47.72% in 75%CAP + 25%BW to 63.85% in 25%GG + 50%CAP + 25%BW silage. The 25%GG + 75%BW silage could be concluded a better feed resource for ruminant animals for its high crude protein content and relatively lower neutral detergent fiber.

(Keywords: silage, mixture, cassava, forage, Guinea grass)

INTRODUCTION

Livestock are an important part of the farming system in Nigeria, particularly for subsistence and semi-commercial farmers. There is good potential to improve food security and family incomes by improving livestock production. However, a shortage of affordable feeds of adequate quality and quantity, particularly during the dry season is a major obstacle to improving production.

Many agricultural, agro-industrial and fishery by-products have potential as animal feeds (Chedly and Lee, 1999). Many of these products currently are completely unused or are largely wasted due to the inability of farmers to use them before they spoil, as a result of seasonal production peaks and troughs. Consequently these by-products often become pollutants.

Ensiling by-products is a simple and low-cost option, which can preserve feeds that are seasonally abundant for later feeding during periods of feed shortage. Ensiling can also render some previously unpalatable products useful to livestock by changing the chemical nature of the feed. Silage is a very versatile product and can be used as a basal diet or as a concentrate type supplement to other feeds such as forage. Brewery waste (Brewer's grains) is a typical example of such unrealized potential.

Brewery waste is a by-product of ethanol industry which uses cereal grains as feed stock (Szponar *et al*., 2003; Bisaria *et al.,* 1997). When grain is fermented to produce ethanol, primarily the starch is utilized, leaving behind a protein rich residue that can be used in livestock diets. As the ethanol industry grows, greater quantities of distiller's grain will become available for use as animal feed at reasonable cost. Distiller's grain can be exploited to utilize as an unconventional feed resource in ruminants in Nigeria. This study is aim at understudying the role of ensiling duration on several mixture or combination of brewery waste, guinea grass and cassava peel which is also another agro by-product that have been noted as a source of environmental pollution.

MATERIALS AND METHODS

The experiment was carried out in the laboratory of the Department of Pasture and Range Management, Federal University of Agriculture, Abeokuta. The brewery waste (BW) was sourced

from the Nigerian Breweries, Ibadan and cassava peel (CAP) was sourced from the cassava flakes (Gari) processing unit of the Federal University of Agriculture, Abeokuta, respectively. The Guinea grass (GG) was harvested within the University campus. The CAP was wilted for 36 hours to reduce the moisture content and they were chopped to less than 3 cm to make compaction easy while the brewery waste and Guinea grass were air dried for 6 hours. A total of eighty-one (81) laboratory silo in form of glass jars of 960 ml were used for ensiling. The ensiled materials are brewery waste; cassava peel and Guinea grass were filled into the silos in the percentage as represented in Table 1.

Each of the nine (9) forage-agro by product mixture was ensiled for three (3) different numbers of days (30, 60, and 90 days) with 3 replicates. At the expiration of each ensiling duration, the jars were opened, contents thoroughly mixed and sub-samples taken for analyses. The DM content of silage samples was determined by drying in a forced-air oven at 60°C until constant weight was achieved. After drying, samples were ground to pass a 2 mm sieve. The crude protein (CP), ether extract (EE), ash, and non-fiber carbohydrate (NFC) were determined according to AOAC (1995). Neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL) (Van Soest *et al*., 1991), cellulose was taken as the difference between ADF and ADL while hemicellulose was calculated as the difference between NDF and ADF. The experimental design was a 9 x 3 factorial design and data collected were analyzed using the General Linear Model Procedure of SAS (1999) computer package.

RESULTS AND DISCUSSION

Table 2 shows the proximate composition of silages as influenced by ensiling duration and forage-agro by product mixtures. The effect of ensiling duration was significant (P<0.05) on the proximate composition. The dry matter (DM) content of the silage range significantly (P<0.05) from 23.53% in silage ensiled for 90 days to silage (25.65%) ensiled for 30 days. The 25%GG + 75%BW silage was significantly (P<0.05) higher than others in terms of DM. The reduction in the DM content of the silage with increase ensiling duration in this study is in line with the findings of Adegbola and Asaolu (1986) and Akinola (2008). This may be due to loss of soluble carbohydrates during fermentation as reported by Oelberg *et al.* (1993).
The 25%GG + 75%BW silage is considered an ideal silage in terms of DM content as suggested by McCullough (1977) and the DM content of 100%BW silage fell within the range (26-31%) reported by Dong and Ogle (2003) for brewery waste.

The CP content varied significantly with silage ensiled for 30days having the highest (16.13%) value. The CP decreased with increase in the ensiling duration from 30 to 90 days after ensiling. The 25%GG + 75%BW silage had the highest CP value while the 100%CAP silage had the least CP (P<0.05) value. The reduction in the CP content of the silages recorded in this study as influenced by the ensiling duration agreed with the report of Akinola (2008) when Guinea grass, cassava peel and pineapple waste were ensiled at different proportions. Considering feeding lactating cows with the silage within the 90 days of ensiling is a proof that their minimum nutrient requirement will be met according to NRC (1989). The CP contents of the silages in this study are higher than the 7% being level considered minimal requirement for ruminant animals according to Van Soest (1994).

The silage ensiled for 90 days had the highest (P<0.05) NFC value and 100%CAP silage was significantly (P<0.05) the highest (25.48%) in terms of NFC. The higher content of NFC in some of the silage in this study is a clear indication of well fermented and preserved silage as supported by the findings of Ferreira *et al.* (2004).

Table 3 presents the result of the fiber fractions as influenced by the ensiling duration and treatment combination. The NDF content of the silage as affected by the ensiling duration was significantly (P<0.05) different ranging from 50.21% in 90 days ensiled silage to 65.05% in 30 days ensiled silages. The ADF, ADL, hemicellulose contents as affected by the ensiling duration were as observed in the NDF, while the cellulose content did not follow any pattern. The 25%GG + 50%CAP + 25%BW silage had the highest NDF (63.85%) content and the ADF (40.98%) content was observed to be the highest in 100% GG while the least (27.04%) content was observed in 75%CAP + 25%BW. The reduction in the NDF contents of the silage with increase in ensiling duration as observed is in line with the findings of Akinola (2008).

Table 1: Percentage Composition of the Ensiled Materials.

Material	Forage-agro by product mixture (%)								
	1	2	3	4	5	6	7	8	9
Guinea grass (GG)	100	75	25	50	0	25	0	25	0
Cassava peel (CAP)	0	25	25	25	0	50	100	0	75
Brewery waste (BW)	0	0	50	25	100	25	0	75	25
Total	100	100	100	100	100	100	100	100	100

Table 2: Effect of Ensiling Duration on Proximate Composition (%) on Silage Produced from Mixture of Brewery Waste, Cassava Peel Waste and Guinea Grass

Ensiling duration (days after ensiling DAE)	DM	CP	EE	ASH	NFC
30	25.65a	16.13a	3.36c	4.47c	10.99b
60	24.48ab	14.36b	6.46a	7.88b	11.14b
90	23.53b	12.02c	5.33b	10.26a	19.18a
SEM	1.63	1.12	1.01	2.01	2.12
Forage-agro by product mixtures					
100%GG	21.03cd	9.48d	6.50cd	8.13bc	15.58cd
75%GG+25%CAP	21.78cd	12.11bc	6.36cd	7.59c	24.22ab
25%GG+25%CAP+50%BW	25.57b	14.73ab	9.90a	8.62bc	11.59d
50%GG+25%CAP+25%BW	20.97d	13.97b	5.33d	8.20bc	9.96e
100%BW	29.23ab	13.98b	4.13e	9.68b	17.58c
25%GG+50%CAP+25%BW	22.45c	11.68c	7.57c	6.50d	10.40d
100%CAP	16.82e	7.65e	7.43c	8.42bc	25.48a
25%GG+75%BW	30.05a	15.17a	8.55b	7.73c	12.69d
75%CAP+25%BW	25.93b	11.57c	6.83cd	12.30a	21.58b
SEM	1.77	2.43	1.22	1.63	2.11

a-d: mean with same letter along same column are not significantly different (P>0.05); SEM=Standard error mean; DM = dry matter; CP= crude protein; EE= ether extract; NFC = non fibre carbohydrate; GG=Guinea grass; CAP Cassava peel; BW = Brewery waste

Table 3: Effect of Ensiling Duration on Fiber Fractions (%) on Silage Produced from Mixture of Brewery Waste, Cassava Peel Waste and Guinea Grass.

Ensiling duration (days after ensiling DAE)	NDF	ADF	ADL	HEM	CELL
30	65.05a	43.83a	21.86a	21.22a	21.97b
60	60.16b	40.94b	17.00b	19.22ab	23.94a
90	50.21c	34.03c	16.55b	16.18b	17.48c
SEM	3.64	2.74	1.75	2.07	1.11
Forage-agro by product mixtures					
100%GG	60.31b	40.98a	20.17ab	19.33cd	20.81b
75%GG+25%CAP	49.72de	31.43d	13.25d	18.29cd	18.18c
25%GG+25%CAP+50%BW	50.16d	34.90c	20.52ab	15.26d	14.38d
50%GG+25%CAP+25%BW	62.54ab	35.55c	21.71a	26.99b	13.84d
100%BW	54.63c	37.92b	15.79c	16.71d	22.13a
25%GG+50%CAP+25%BW	63.85a	38.05b	17.88b	35.80a	20.17b
100%CAP	51.02d	38.75b	15.75c	12.27e	23.00a
25%GG+75%BW	55.86c	37.57b	20.3ab	18.29cd	17.27c
75%CAP+25%BW	47.72e	27.04e	16.68b	20.68c	10.36e
SEM	3.06	2.28	1.68	2.67	1.03

a-e: mean with same letter along same column are not significantly different (P>0.05); SEM=Standard error mean; NDF = Neutral detergent fibre; ADF= Acid detergent fibre; ADL= Acid detergent lignin; HEMI = Hemicellulose; CELL= Cellulose; GG=Guinea grass; CAP Cassava peel; BW = Brewery waste

This might be because the microbes tend to utilize the NDF as reported by Ely *et al.* (1981) and the highest (63.85%) value of 25%GG + 50%CAP + 25%BW silage is below the critical level as reported by Buxton (1996). The hemicellulose (35.80%) content of 25%GG + 50%CAP + 25%BW silage was the highest. The hemicellulose content of the silage under study fell within the range (11-29%) reported by Aregheore and Ikhatua (1999) except for the hemicellulose content of 25%GG + 50%CAP + 25%BW silage.

CONCLUSION

In conclusion, silage with combination of Guinea grass and brewery waste at proportion of 25% to 75% was better in terms of CP content which was the highest and relatively low fiber fractions.

The CP of the silage been higher than the minimum requirement for maintenance of ruminant animal across the three ensiling duration during the dry season makes them a good supplement for dry season feeding.

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