Net Journal of Agricultural Science
Vol. 11(2), pp. 25-28, June 2023
DOI: 10.30918/NJAS.112.14.013
ISSN: 2315-9766
Short Communication

Quality, hydrocyanic acid content and acceptability of cassava peels ensiled with brewers' spent grains

Unah, U. L., Inyang, U. A.* and Solomon, I. P.

Department of Animal Science, University of Uyo. P.M.B.1017. Uyo, Nigeria.

Accepted 3 March, 2014

ABSTRACT

In this study, the acceptability of 21-day-old cassava peels ensiled with spent brewer's grains was investigated along with its qualitative properties and hydrocyanic acid content. For the manufacture of silage diets, cassava peels (CPL) and brewers' wasted grain (BSG) were combined as follows: 100% CPL (Diet 1), 50% CPL + 50% BSG (Diet 2), and 40% CPL + 60% BSG (Diet 3). The pH of the silage ranged from 3.76 - 4.63. Diet 1 had a higher aroma of alcohol than the other silages, which were all typically alcoholic. The value of crude protein (CP) increased when more BSG was included. From the analysis, it was shown that the cyanide content of cassava peels reduced to 15.18 mg kg^{-1} when ensiled from 187.50 mg kg^{-1} of the unensiled cassava peels. This indicates that ensiling reduced the antinutritional factor present in the cassava peels. The result of acceptability trials showed that there was a significant difference ($p < 0.05$) in feed dry matter (DM) intake (ranged 311.0 – 514.5 g d^{-1}) with diet 3 recording the highest significant ($p < 0.05$) value of 514.5 g d^{-1}. Diet 3 showed good quality silage, enhanced crude protein composition and could support small ruminants during off periods as against sole feeding of cassava peels.

Key words: Cassava peels, brewers' spent grains, silage, hydrocyanic acid.

*Corresponding author: E-mail: udohinyang@yahoo.com.

INTRODUCTION

Presently, great attention has been directed towards the utilization of available agro-industrial by-products and crop residues as new sources of non-traditional rations for feeding farm animals in the tropics. However, because surplus by-products and crop residues are perishable during overproduction seasons in the tropics, it would be advantageous to develop methods of preservation that would allow these plant materials to be used as animal feeds for longer periods of time (Aguilera et al., 1997). Cassava peels obtained from gari processing are typically abandoned as waste and left to decompose in the open, posing health risks (Oboh, 2006).

Despite the presence of cyanogenic glucosides, these peels could account for up to 10% of the wet weight of the roots, making them a viable resource for animal feeds if appropriately processed by a bio-system (Antai and Mbongo, 1994). Brewers' spent grains, which are the leftovers from the fermentation of grains used to make beer, have been used to feed both ruminant and monogastric animals (Ifut and Inyang, 2007; Westendorf and Wohit, 2002). Direct ensiling technology without using additives is an alternative method that can provide a well-preserved feedstuff at a low cost to be used as animal feed. Hence, the objective of this study was to investigate the free choice intake, silage quality, and hydrocyanic acid of cassava peels ensiled with brewers' spent grains.

MATERIALS AND METHODS

Experimental site

The experiment was carried out at the small ruminant unit of the Department of Animal Science, University of Uyo, Uyo, (Akwa Ibom State) Nigeria between September and

November, 2010.

Feed materials/formulation

Cassava peels were obtained from Nsukara Offot in Uyo, and the brewers' spent grains were purchased from Akwa Ibom State Champion Breweries Plc. The feedstuffs were blended into three silage treatments: 100% (CPL) (Diet 1), 50%CPL + 50% (BSG) (Diet 2) and 40% CPL + 60% BSG (Diet 3). Salt was added at 0.20% per treatment. A 20-litre plastic silo was used for the silage preparation with each silo lined with polythene sheets. The ensilage lasted for 21 days.

Silage quality

Sub-samples of the silages were collected and analyzed for quality. The temperatures of each silage were taken by dipping a laboratory thermometer to a depth of about 30 cm for a period of 3 min. Colour assessment was by visual observation and colour charts. The pH of each diet was determined using a pocket pH meter (Hanna portable metre).

Proximate/hydrocyanic acid analysis

Fresh samples of the feed materials were oven dried for 24 h to a constant weight at 70°C and then milled. The ground samples of both unensiled and ensiled feeds were used for proximate analysis and hydrocyanic acid analysis content using the spectrophotometer. Crude protein, crude fibre and ash in the samples were determined according to methods of A.O.A.C. (1990). Metabolizable energy was calculated using Alderman (1985).

Acceptability trial

The study was carried out at the goatry unit of the University of Uyo, Uyo farm. Six does, aged between 10 and 12 months with a mean weight of 18.30 kg were used in a cafeteria feed preference study which lasted for ten days, including a week for the animals' adaptation to the silage diets offered. The animals were offered about 1 kg of each of the silage diets on a cafeteria basis in three metallic feeding troughs, such that all the animals had free access to each of the diets in the troughs. Forage preference was determined by Karbo et al. (1993) using the coefficient of preference (COP) value. On this basis, a forage was taken to be relatively preferred if the COP value was greater than unity.

Statistical analysis

All data collected were subjected to a one-way analysis of variance using the software package (Statistical Analysis System (SAS) Institute Inc. 1999) and treatment means were compared/separated using the Duncan Multiple Range Test (Duncan, 1955). The statistical design was Completely Randomised Design (CRD).

RESULTS AND DISCUSSION

Table 1 shows the quality of the ensiled diets. The colours obtained in the present study were close to the original colour of the initial materials ensiled and this coincides with the findings of Babayemi et al. (2010). The odour was generally alcoholic and comparable to the findings of Menenses et al. (2007), who reported that the end product (good silage) had a pleasant odour. The pH ranged from 3.76 in silages with 60% BSG inclusion to 4.63 in silages with 100% CPL. The values showed a trend such that 100% CPL>50%CPL>40%CPL. The result obtained here was lower than the range (4.5 – 5.5) reported by Menenses et al. (2007), classified as pH for good silage, except for 100% CPL silage, which fell within the range with a value of 4.63.

Table 2 shows the proximate composition (g $100g^{-1}$ DM), metabolizable energy (MJ kg^{-1}) and hydrocyanic acid (mg kg^{-1}) content of the diets. The DM, CP, Ash, and CF contents of all diets decreased after ensiling. This reduction may be attributed to compaction (DM), proteolysis in CP (Obua, 2005) and the activities of micro-organisms for other parameters.

Table 1: Quality of ensiled cassava peels with or without brewers' spent grains.

	Treatments		
Parameters	**100% CPL**	**50% CPL+50% BSG**	**40% CPL+60% BSG**
Colour	Light brown	Golden brown	Golden brown
Odour	Alcoholic	Alcoholic	Alcoholic (strong)
Temperature (°C)	27.0	28.0	29.5
pH	4.63	3.89	3.76

Table 2: Proximate composition (%), metabolizable energy (MJ kg^{-1}) and hydrocyanic acid (mg kg^{-1}) content of cassava peels ensiled with or without brewers' spent grains.

	Treatments				
Parameters before ensiling	**100% BSG**	**100% CPL**	**50% CPL+ 50% BSG**	**40% CPL+ 60% BSG**	**SEM**
Dry matter	25.80^{c}	34.30^{a}	32.10^{ab}	29.90^{b}	1.02
Ash	4.41^{b}	9.13^{a}	9.19^{a}	8.62^{a}	0.66
Crude protein	29.75^{a}	6.27^{d}	14.00^{c}	19.25^{b}	0.72
Crude fibre	6.98^{a}	10.53^{a}	9.63^{a}	10.64^{a}	0.42
ME	11.41	11.34	11.35	11.35	Nd
HCN	Nd	187.5	Nd	Nd	Nd
After ensiling					
Dry matter	Nd	31.10^{a}	24.10^{b}	29.40^{a}	0.76
Ash	Nd	6.13^{b}	4.00^{c}	8.28^{a}	0.13
Crude protein	Nd	6.27^{c}	10.50^{b}	15.75^{a}	0.41
Crude fibre	Nd	9.30^{a}	8.33^{a}	8.96^{a}	0.66
ME	Nd	11.42	11.41	11.35	Nd
HCN	Nd	15.18	Nd	Nd	Nd

a, b, c = means on the same row bearing different superscripts differ ($p<0.05$) significantly. Nd –Not determined.

The value (CP) obtained in this study was higher than the minimum protein requirement of 10-12% recommended by ARC (1985) for ruminants in 40% CPL + 60% BSG silage mixture while 100% CPL silage was low (6.27%) and 50% CPL + 50% BSG silage mixture was within the ARC range. The BSG also impacted on the mixture by increasing the CP content with its increased inclusion.

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The hydrocyanic acid content as observed from Table 2, reduced from 187.50 mg/kg in unensiled CPL to 15.18 mg/kg in ensiled CPL. The ensiled cyanic value was lower than that reported by Nishida et al. (2007), who stated that naturally fermented CPL after seven days recorded a hydrocyanic acid content of 23.50 mg/kg. This variation may be attributed to species difference or days of ensiling the CPL. The values for energy obtained in this present study ranged from 11.34 – 11.41 MJ/Kg for both unensiled and ensiled samples.

The values were within the range as reported by Nishida et al. (2007) for corn silage (11.39 - 11.84 MJ/Kg). This thus, suggests that CPL-BSG silage can supply metabolizable energy similar to that of corn silage. Table 3 shows the preference of the animals fed on the different silage feed mixtures. The coefficient of preference (COP) value of more than unity was only attained by animals on 40% CPL + 60% BSG silage diet (1.30), implying that it was well accepted. Other silage diets were below unity with 100% CPL recording the lowest (0.79) meaning they were not well accepted. The 60% BSG inclusion was significantly different ($P<0.05$) from the other two treatments, while 100% CPL and 50% BSG inclusion silages were not significantly different ($P>0.05$) from each other.

Table 3: Preference of silage by goats.

Silage	Mean intake (g DM)	COP
100% CPL	311.00^{b}	0.79
50% CPL+50% BSG	361.50^{b}	0.91
40% CPL+60% BSG	514.50^{a}	1.30
SEM	0.04	

^{a,b,c} means within column with different superscripts are significantly different.

Conclusion

1. This study has shown that cassava peel-brewers' spent grains silage mixture is not only feasible but has the potential of meeting the nutritional needs/requirements of ruminants.

2. In addition, the method of preservation solved the problem of hydrocyanic acid by reducing its content.
3. However, a 60 % BSG inclusion in cassava peel silage mixture proved to be good enough in supplementing the diet of ruminants.

REFERENCES

A.O.A.C. 1990. Official methods of analysis 15th ed. *Association of Analytical Chemist*. Washington DC. Pp. 69 – 88.

Aguilera A, Perez-Gil F, Grande D, De La Cruz I, Juarez J, **1997**. Digestibility and fermentative characteristics of mango, lemon and corn stover silages with or without addition of molasses and urea. Small Rumin Res, 26: 87 – 91.

Alderman G, **1985**. Prediction of the energy value of compound feeds. In: Haresign, W., Cole, D. J. A. (eds). Recent Advances in animal nutrition. Butterworths, London. Pp 3 – 52.

Antai SP, **Mbongo** PM, **1994**. Utilization of cassava peels as substrate for crude protein formation. Plant Foods Hum Nutr, 46(4): 345 – 351.

ARC, **1985**. Agricultural Research Council. The nutrient requirements of farm animals. No. 2, Ruminants: Tech. Rev. and Summaries. ARC, London.

Babayemi OJ, Ifut OJ, Inyang UA, Isaac LJ, **2010**. Quality and chemical composition of cassava wastes ensiled with *Albizia saman* pods. Agric J, 5(3): 225 – 228.

Duncan DB, **1955**. Multiple ranges and multiple F-test. Biometrics, 11: 1–42.

Ifut OJ, **Inyang** UA, **2007**. Effect of supplementation with brewers' spent grains on the feeding value of guinea grass and gliricidia forages for WAD goats. Anim Prod Res Adv, 3(4): 301 – 305.

Karbo N, Barnes P, Rudat H, **1993**. An evaluation of browse forage preferences by sheep and goats in the Northern Guinea Savannah Zone, Ghana. In: J. Ndikumana and P. de Leeuw (eds). Proceedings of the 2nd African Feed Resources Network (AFRNET) on sustainable feed production and utilization for smallholder livestock enterprises in sub-saharan Africa. Harare, Zimbabwe. Pp 107 – 110.

Menenses MD, Megias J, Madrid A, Martinez-Teruel F, Hernandez J, **2007**. Evaluation of the phytosanitary, fermentative and nutritive chacteristics of the silage made from crude artichoke (*Cynara scolymus*) by-product feeding for ruminants. Small Rumin Res, 70: 292-296.

Nishida T, Eruden B, Hosoda K, Matsuyama H, Xu C, Shioya S, **2007**. Digestibility, methane production and chewing activity of steers fed whole crop round bale corn silage preserved at three maturities. Anim Feed Sci Technol, 135: 42-51.

Oboh G, **2006**. Nutrient enrichment of Cassava peels using a mixed culture of *Saccharomyces cerevisae* and *Lactobacillus spp.* Solid media fermentation techniques. J Biotechnol. 9(1). Retrieved from (http://www.ejbiotechnology.info/content/vol9 /issue1/full/1/) on 30/12/2011.

Obua BE, **2005**. Forage conservation in Nigeria. Concave publication, Owerri. Pp: 1-94.

Statistical Analysis System (SAS) Institute Inc. 1999, SASSTAT programme, Cary, NC: SAS Institute Inc. 1999.

Westendorf ML, **Wohit** JE, **2002**. Brewing by-products: Their uses as animal feeds. Vet Clin North Am Food Anim Pract, 18(2): 233 – 252.

Citation: Unah UL, Inyang UA, Solomon IP, 2023. Quality, hydrocyanic acid content and acceptability of cassava peels ensiled with brewers' spent grains. Net J Agric Sci, 11(2): 25-28.