EFFECT OF UREA TREATMENT AND PERIOD OF PRESERVATION ON PHYSICAL AND NUTRITIVE VALUE OF SUGARCANE TOP SILAGE

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Abstract
Urea treatment is one of the methods of improving the nutritive value of low quality crop residues for efficient utilization by animals. This study investigated the effect of different levels of urea (0, 2, 4 and 6%) and preservation periods (14, 28 and 42 days) on physical and nutritive value of sugarcane top silage. Sugarcane tops were treated with 0, 2, 4 and 6% urea solution/kg DM SCT and ensiled for 14, 28 and 42 days. All silages contained 20g molasses. The physical characteristics and chemical composition of the silages were determined. Results revealed that the physical characteristics (colour, odour and mouldiness) of sugarcane top silage improved with addition of urea. The dry matter, NDF and ADF contents of silages decreased significantly ($P < 0.05$) with increased in the period of preservation. However, 2% urea treated sugarcane top silage recorded the lowest NDF, ADF and ADL content. The crude protein content was significantly highest ($P < 0.05$) in 6% urea treated silage (13.18%) and in silage kept for 42 days (12.05%). Ensiling periods and levels of urea treatment had no significant different ($P > 0.05$) on the ether extract content of the silages while the ash content was significantly highest ($P < 0.05$) in silage kept for 42 days. The study deduced that treating sugarcane top with urea and ensiling for 42 days improved its nutritive value.

Keywords: sugarcane top, urea, preservation period, nutritive value

Introduction

Feed shortage experienced during the dry season, is a major hindrance to increased livestock production in the Sub-Saharan African countries (Agyemang, 2002). The quality and quantity of grazing pasture fall rapidly during the dry season, leaving crop residues as the major feed resource. However, these residues are low in nitrogen and high in crude fibre resulting in low intake and digestibility and hence, marked weight loss and low productivity. Utilization of crop residues during dry season to achieve certain production goals such as growth, reproduction or lactation required some level of processing and/or supplementation. This helps in proper rumen functioning by supplying sufficient nitrogen for the growth of cellulolytic bacteria. Urea is a source of supplementary nitrogen in form of non-protein nitrogen. It is rapidly broken down in the rumen and hence requires a source of readily available energy to prevent its lost from the system as ammonia (Smith, 2002). Sugarcane top sugarcane derived during harvesting of the cane and had been considered as important feed resource for ruminant in the tropics (Preston and Leng, 1991). It is usually available when other green fodders are scarce and its highly palatable with good voluntary consumption by ruminant (Tadasse *etal*., 2014). However, it is lacking in protein and some minerals and as such been regarded as poor quality roughage (Leng and Preston, 1985). Treating sugarcane top with urea which is a source of nitrogen could serve as a means of improving its nutritive value and preserving it for dry season feeding. This study therefore, investigated the effect of different levels of urea and preservation periods on the nutritive value of sugarcane top.

Materialsandmethods

The sugarcane tops were collected fresh immediately after harvesting, chopped into small pieces (about 2-4cm) and allowed to wilt overnight by spreading it in a well ventilated shed. The chopped sugarcane tops were then treated with fertilizer grade urea by thoroughly dissolving 0, 2,4 or 6% urea (on dry matter basis) in water separately for 10 minutes, mixed well with 20g molasses before being mixed with sugarcane tops on a clean concrete floor. The properly mixed samples were firmly packed and pressed sufficiently to make airtight by hand pressure into respective 1kg capacity plastic buckets already double lined with black polythene bags. After filling, the bags were tightly tied to eliminate air penetration. Heavy stones were then placed on each bucket until the expiration of fermentation. Each treatment was replicated three times and the ensiled samples were kept at room temperature (28 to 32^{0}C) for 14, 28 and 42 days.

A laboratory thermometer was inserted into the silage at opening to determine the temperature. Samples were taken at random from three silage bags per treatment at day 14, 28 and 42. This was done by taking sub-samples from each silage bags at different points and depths and mixed together. Samples taken were observed for physical characteristics in terms of colour, odour and mouldiness. Colour assessment was done using visual observation with the aid of colour chart while the odour of the silages was relatively assessed as to whether nice, pleasant, fruity or pungent. Mouldiness of the silage was assessed by five different people and observations made were recorded.

Part of the samples taken was used for the silage chemical analysis in terms of crude protein, ether extract, and ash according to the procedure of AOAC (2005). The fibre fractions; neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were also determined according to Van Soest *etal.* (1991). Fresh sugarcane top was analysed for its chemical composition. All data collected were arranged in a 4x3 factorial design and were subjected to Analysis of Variance (ANOVA) while significant differences among means were compared using Duncan's Multiple Range F-test (SAS, 1999). Data were analysed using model;

$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \Sigma_{ijk}$ where Y_{ijkl} is the observed value of the dependent variables, μ is population mean, α_i is the main effect of levels of additive, β_j is the main effect of ensiling periods, $(\alpha\beta)_{ij}$ is the interaction effect of additive and period of ensiling and Σ_{ijk} is the random residual error.

Results and discussion

The chemical composition of fresh sugarcane top and sugarcane top silage is shown in Table 1. The fresh sugarcane top contained 62.50g/kg crude protein which was similar to the values of 60 and 64g/kg reported by Chaudry and Naseer (2008) and Kumarmath *etal.* (2004) respectively. However, the value was lower than 72.44 g/kg reported by Tiwari *etal.* (2013). The determined crude protein content of sugarcane top was lower than 8% crude protein required to satisfy the maintenance of ruminants (Norton, 2003). Therefore, supplementation will be required when SCT is to be fed to small ruminant in Nigeria. The ash content obtained for SCT was similar to the value reported by Chaudry and Nasser (2008) and Alemzadeh and Noroozy (2006) (85g/kg and 70g/kg respectively) while the NDF, ADF and ADL were slightly higher than values (650, 401 and 127 g/kg) reported by Chaudry and Naseer (2008). The variation observed in the nutrient contents of sugarcane top compared with the findings of other researchers might be due to differences in the variety, harvesting stage and fertilization practices adopted (Tadesse *etal.*, 2014). The DM and OM contents of SCT silages decreased ($p<0.05$) with advance of ensiling period and decreasing in DM content with increase in ensiling period is in line with the findings of several authors (Jolaosho *etal.*, 2013 and Dele *etal.*, 2013). This decrease in DM content may be due to loss of soluble carbohydrate during fermentation as reported by Oelberg *etal.* (1993). The reduction in OM content might be due to the higher values of ash released as ensiling period increases.

The NDF and ADF contents of all urea treated silages decreased significantly ($P < 0.05$) as ensiling period increased with silage ensiled for 42 days having the lowest values. This is in contrast with the findings of Lounglawan *etal.* (2011) who reported increase in the NDF with increase in ensiling duration. Decrease in the fibre fractions observed in this study might be as a result of microbes in the silage utilizing the NDF with increase in ensiling period as stated by Ely *etal.* (1981).

Addition of urea increased significantly ($P < 0.05$) the CP content of the silage compared to 0% urea treated silage. This agrees with the previous work that addition of urea to cereal straw silages significantly increased crude protein content (Dass *etal.*, 2000). This increase in crude protein might be due to enhancement in nitrogen content by the addition of nitrogenous substrate (urea) as reported by Ngyven *etal.* (2001). The highest NDF, ADF and ADL contents observed in 0% urea treated silage and least values recorded in 2% urea treated silage was in line with the findings of Keskin and Yilmaz (2005) who observed decreased NDF in urea plus molasses treated sorghum silage. However, NDF values recorded for all silages were lower than the critical level of NDF (75%) above which the NDF inhibits feed intake (Buxton, 1996) because NDF is a useful indicator of forage intake potential which declines with increasing NDF values.

Table 2 presented the physical properties of sugarcane top treated with urea. The colour observed at all levels of urea inclusion and at all ensiling periods were acceptable colours for good silages (Bates, 1998). The silage colour improvement as ensiling periods increased was normal as Hiep and Man (2003) had observed changes in colour and improvement in brown colour of maize stover silage from 20 to 50 days. The pungent smell and absence of mould observed in all urea treated silage indicated effect of ammoniation (Sundstol and Coxworth, 1984). The strong ammonia smell suggested a higher ammonia concentration in the silages which may have prevented the growth of mould by acting as a fungicide which agrees with the findings of Fadel Elseed *etal.* (2003). This implies that urea could be used for long term preservation of sugarcane top silage as presence of mould in silage is undesirable because it uses silage nutrients and toxin are sometimes produced (Man and Wiktorsson, 2003). The temperature range observed in the urea treated silages was similar to the range (25 – 27.50C) reported by Babayemi (2009) for silage from Guinea grass. Temperature is considered as one of the essential factors affecting colour change, the lower the temperature, the less will be the colour change (Babayemi, 2009). Excessive heat production had been reported to results in maillard or browning reaction which can reduce digestibility of protein and fibre components (Bolsen *etal.*, 1996).

Conclusion

Results of this study revealed that addition of urea helped to improve physical and nutritive properties as well as preservation capacity of sugarcane top. Addition of 2% urea and 42 days of ensiling improved the cell wall constituents of sugarcane top. Therefore, sugarcane top may be ensiled for 42 days by adding 2% urea.

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Table 1: Effect of ensiling periods and levels of urea treatment on chemical composition (%) of sugarcane top silage

	DM	OM	CP	EE	Ash	NDF	ADF	ADL
Fresh SCT	35.20	92.00	6.25	3.00	8.00	70.00	42.60	14.03
Ensiling periods (days)								
14	31.26^{a}	92.96^{a}	11.10^{b}	2.18	7.04^{b}	69.61^{a}	38.76^{a}	12.49
28	29.64^{b}	92.67^{a}	11.58^{ab}	2.08	7.33^{b}	68.20^{b}	38.09^{a}	12.12
42	29.80^{b}	91.94^{b}	12.05^{a}	2.18	8.06^{a}	65.37^{c}	36.50^{b}	11.41
SEM	0.32	0.26	0.60	0.11	0.26	0.67	0.74	0.31
Level of urea (%)								
0	31.09^{a}	93.84^{a}	7.71^{c}	2.13	6.16^{b}	69.50^{a}	40.76^{a}	13.04^{a}
2	30.52^{a}	92.00^{b}	12.43^{b}	2.28	8.00^{a}	65.27^{c}	34.78^{c}	10.83^{c}
4	29.49^{b}	92.03^{b}	12.93^{b}	2.18	7.97^{a}	67.60^{b}	37.56^{b}	12.24^{b}
6	28.84^{c}	92.22^{b}	13.18^{ab}	1.98	7.78^{a}	68.53^{ab}	38.03^{b}	11.90^{b}
SEM	0.38	0.22	0.21	0.11	022	0.80	0.55	0.28

^{a,b,c}, *Means on the same row having different superscripts are significantly different ($P < 0.05$), DM -dry matter, OM-organic matter, CP -crude protein, EE-ether extract, NDF -neutral detergent fibre, ADF -acid detergent fibre, ADL-acid detergent lignin, SCT sugarcane top*

Table 2: Physical properties of urea treated sugarcane top silage

Parameters	Ensiling periods (days)	Level of urea (%) 0	2	4	6
Colour	14	Greenish yellow	Green	Green	Green
	28	Greenish yellow	Greenish brown	Greenish brown	Greenish brown
	42	Greenish yellow	Greenish brown	Greenish brown	Greenish brown
Odour	14	Pleasant	Pungent	Pungent	Pungent (strong)
	28	Pleasant	Pungent	Pungent	Pungent (strong)
	42	Pleasant	Pungent	Pungent	Pungent (strong)
Mouldness	14	Slightly mouldy	Absent	Absent	Absent
	28	Slightly mouldy	Absent	Absent	Absent
	42	Slightly mouldy	Absent	Absent	Absent
Temperature (ºC)	14	26.00	26.20	26.20	26.15
	28	26.00	26.05	26.30	26.20
	42	26.02	26.25	26.30	26.50