SILAGE QUALITY AND ACCEPTABILITY OF SAPONIN-INCLUDED UREA-AMMONIATED MAIZE STOVER BY GOAT

O. KENNETH-OBOSI[1]*, O. J. BABAYEMI[2], AND A. O. ADESANYA[2]
[1]*Research Outreach Department, National Horticultural Research Institute Ibadan*
[2]*Department of Animal Science, University of Ibadan Ibadan. Nigeria*
**Correspondence:oyewonu@yahoo.com;08059729779*

ABSTRACT
Agricultural wastes are good opportunity for settling the problems of competition between humans and animals. Fortification with natural additives can help to improve their utilization. This study was conducted to evaluate silage quality and acceptability of maize stover treated with urea and saponin powder. Graded level of synthetic, *Vernonia amygdalina* saponin (0, 90, 135 and 180mg) and urea (3.6 and 7.2 g) dissolved in 1L of water was mixed thoroughly with 1 Kg of chopped maize stover; ensiled for 14 days. The silage qualities, chemical composition and acceptability using Coefficient of Preference (CoP) of silages by goat were determined. Data were analysed using descriptive analysis and analysis of variance at p=0.05 in a 2x4x3 factorial arrangement.The saponin type have interactive effect on dry matter (p=0.0058), crude protein (0.0134) and ash (0.0123) content of the silages. All the silages made shows characteristics of good silage.The crude protein (p= 0.0366)content is also influenced by the interaction of the three factors; urea level, saponin type and saponin level.Also, 90, 135 and 180mgof*Vernoniaamygdalina* saponin-treated with 3.6g urea and synthetic saponin treated with 7.2 g urea included maize stover silages were acceptable having the CoP greater than unity.
Keywords: Agricultural waste, silage, saponin, urea, acceptability.

INTRODUCTION
Ruminants are characterised by their ability to convert low quality roughage to products that are useful to man. Despite the naturally endowed vegetation in Nigeria,quality forage is usually scarce during dry season (Babayemi *et al.*, 2006).Maize residues which constituteenvironmental pollution have been shown to be potentially useful and readily available in smallholder farming system in southern Nigeria (Fasae, 2009). Binuomote and Babayemi (2012) opined that the seasonality of forages call for conservation through ensilage of forage produced during the rainy season. Urea is a non-nitrogen protein precursor in ruminant feed, as it is necessary for optimal microbial activities in the rumen. The incorporation of saponin a phytochemicalfrom horticultural plants to binds with ammonia-N in silage is advantageous (Kenneth-Obosi, 2015). This is particularly in roughage-based diets, ensuring adequate nitrogen supply. *Vernonia amygdalina* (bitter leaf) a medicinal horticultural shrub found aroundhomestead in Southern Nigeria contains appreciable quantity of saponin (Kenneth-Obosi 2015). Therefore, the aim of this experiment was to determine the effect of saponin on silage quality and acceptability of urea-ammoniated Maize Stover Silage by goats.

MATERIALS AND METHODS
Stover of maize (*Zea mays*) variety was harvested from Teaching and Research Farm, University of Ibadan, Ibadan Nigeria at the peak of dry season (February and March), chopped into 2-5cm pieces size and treated with saponin powder and urea. Saponin was extracted of *Vernonia amygdalina* leaves (Obadoni and Ochuko, 2001). Graded level extracted saponin powders,

synthetic saponin (0, 90, 135 and 180mg) and graded level of fertilizer grade urea solution (3.6g and 7.2g of urea dissolved in 1L of water) were each mixed thoroughly with 1 kg of chopped maize stover. A total of 42 silos were prepared, three silos (replicates) per treatment for all the 14 treatments. The ensiling period was 14days.Silage temperaturewas measured using thermometer, pH (AOAC, 1995), colour using visual observation and colour chart, smell and texture of the silage were assessed by a 5-man panel. Thesamples were oven dried, ground and subjected to proximate (AOAC 1995) and fiber fraction (Van Soest *et al.*, 1991).Ten West African dwarf female goats weighing 10 - 12 kg were used to evaluate the free choice intake of silages in a cafeteria manner, 6 hours daily for 4 days. Experiment was carried out at the Small ruminant unit of the Teaching and Research Farm, University of Ibadan, Nigeria. The forage preferred was assessed according to Babayemi *et al.*(2006).

$$\text{Coefficient of Preference (CoP)} = \frac{\text{Intakes of the individual forages}}{\text{Average intake of the forages}}$$

Hence, silage was inferred to be relatively acceptable provided the CoP was greater than unity.

Data were analysed using descriptive analysis and analysis of variance at P = 0.05. In a 2x4x3 factorial arrangement, means were separated using Duncan multiple range F-test of the SAS (1999)

RESULTS AND DISCUSSION

Saponin addition did not affect the physical characteristics of the silages (Table 1).All silages produced have firm texture, pleasant smell and maintained the original colour of brownish yellow of the dry maize stover from which the silage was made (Falola *et al.*, 2013). pH (5.4 - 6.9) is relatively high this might be due to alkaline treatment, There was slight increase in pH of the silages with increase in urea, while saponin addition did not significantly influence pH. Temperature (28.2 to 31.5^{0}C) produced good quality silage, because above 44^{0}C will produce bad silage by instigating dark brown colouration with tobacco-type smell due to caramelisation of sugars in the silages (McDonald, 1995). Animal selected their feed based on their instinctive characteristics; *Vernonia amygdalina* saponin included urea ammoniated MSS were accepted by the goat at 3.6g (Table 2). Synthetic saponin urea ammoniated MSS were rejected at all level of saponin inclusion, this might be due to difference in taste of *Vernonia amygdalina* saponin; organic/herb additives and synthetic saponin; inorganic/chemical additive. Hence, organic saponin at moderate urea level produces taste acceptable by goat,this taste is masked at high urea. Since, animal preference is determined by the synergetic relationship between a feed taste, chemical composition of feed and nutrient requirement of the animal. Increase in the level of urea increased the level of crude protein content of the MSS (Woyengo *et al.*, 2004). Saponins from these horticultural plants are capable of minimising the inefficient use of dietary nitrogen (Kenneth-Obosi, 2015).Moreover, as the level of urea increased, the ash content increased. Urea and saponin source synergetic affect the ash content of silage. The DM, ash, and ADF contents of the saponin included urea-ammoniated MSS were affected by saponin type with *Vernoniaamygdalina* saponin silagewhich implies mineralisation ability. Acid Detergent Lignin (ADL) of a plant is the most indigestible component of the fibre fraction was relatively reduced in saponin included silages.

CONCLUSION

Since maize stover is available throughout the entire regions in Nigeria this can be fortified with urea and *Vernonia amygdalina* saponin having a great potential towards the alleviation of feeding problem usually encountered by livestock farmer during the dryseason. Thereby converting

agricultural wastes to animal flesh, milk and skin needed for human consumption.

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Table 1: Silage qualities of saponin included urea-ammoniated Maize Stover Silage (MSS)

Silage	Colour	Temp	pH	Texture	Odour
$Urea_{3.6}Synthetic_{90}MSS$	brownish yellow	29.3	5.6	Firm	pleasant
$Urea_{3.6}Synthetic_{135}MSS$	brownish yellow	29.0	5.6	Firm	pleasant
$Urea_{3.6}Synthetic_{180}MSS$	brownish yellow	29.2	5.5	Firm	pleasant
$Urea_{7.2}Synthetic_{90}MSS$	brownish yellow	29.1	5.8	Firm	Pleasant
$Urea_{7.2}Synthetic_{135}MSS$	brownish yellow	30.2	5.7	Firm	Pleasant
$Urea_{7.2}Synthetic_{180}MSS$	brownish yellow	29.8	5.9	Firm	Pleasant
$Urea_{3.6}$ *V.amygalina*$_{90}$MSS	brownish yellow	29.3	5.8	Firm	pleasant
$Urea_{3.6}$*V.amygalina* $_{135}$MSS	brownish yellow	29.0	5.9	Firm	pleasant
$Urea_{3.6}$*V.amygalina* $_{180}$MSS	brownish yellow	29.3	5.9	Firm	pleasant
$Urea_{7.2}$*V.amygalina* $_{90}$MSS	brownish yellow	28.2	6.0	Firm	Pleasant
$Urea_{7.2}$*V.amygalina* $_{135}$MSS	brownish yellow	29.0	6.2	Firm	Pleasant
$Urea_{7.2}$*V.amygalina* $_{180}$MSS	brownish yellow	28.2	6.3	Firm	Pleasant
$Urea_{3.6}MSS$	brownish yellow	29.2	5.9	Firm	pleasant
$Urea_{7.2}MSS$	brownish yellow	28.2	5.9	Firm	Pleasant

Table 2: Acceptability of saponin included urea-ammoniated Maize Stover Silage (MSS) by WAD goats

Silage	CoP	Silage	CoP
$Urea_{3.6}Synthetic_{90}MSS$	0.60	$Urea_{7.2}Synthetic_{90}MSS$	1.22
$Urea_{3.6}Synthetic_{135}MSS$	0.86	$Urea_{7.2}Synthetic_{135}MSS$	1.07
$Urea_{3.6}Synthetic_{180}MSS$	0.75	$Urea_{7.2}Synthetic_{180}MSS$	1.03
$Urea_{3.6}$ *V.amygalina*$_{90}$MSS	1.03	$Urea_{7.2}$*V.amygalina* $_{90}$MSS	0.94
$Urea_{3.6}$*V.amygalina* $_{135}$MSS	1.12	$Urea_{7.2}$*V.amygalina* $_{135}$MSS	0.92
$Urea_{3.6}$*V.amygalina* $_{180}$MSS	1.00	$Urea_{7.2}$*V.amygalina* $_{180}$MSS	1.14
$Urea_{3.6}MSS$	1.18	$Urea_{7.2}MSS$	0.79

CoP: Coefficient of Preference

Table 3: Chemical composition of saponin included Urea-ammoniated Maize Stover Silage (UMSS)

		Mean							
Main Effect	**Parameters**	DM	EE	CF	CP	ASH	NDF	ADF	ADL
Urea Level	3.6	45.38	8.30	32.59	8.26^{b}	12.78	71.26	55.63^{a}	19.10^{a}
	7.2	43.23	7.09	34.07	9.66^{a}	11.54	70.94	52.75^{b}	15.64^{b}
Saponin Level	0	45.78	8.11	32.65	8.97	11.26	73.01	51.35^{b}	18.59
	90	46.09	7.53	34.94	9.59	11.94	72.16	56.40^{a}	19.06
	135	44.61	8.50	33.15	8.51	13.39	69.89	52.84^{ab}	15.36
	180	41.13	6.86	32.45	8.77	11.59	70.30	54.76^{ab}	17.07
Saponin Type	*V.amygdalia*saponin	48.85^{a}	8.33	33.03	6.77	11.30^{b}	71.75	54.85^{a}	17.53
	Synthetic saponin (PC)	39.04^{b}	6.93	33.86	11.14	13.32^{a}	69.81	54.60^{a}	16.92
	Control (NC)	45.78^{ab}	6.93	32.65	8.97	11.26^{b}	73.01	51.35^{b}	18.59
	SEM	3.26	0.75	1.27	1.67	0.75	1.41	1.23	1.60
Interactive Effect		**P-VALUE**							
	SL	0.4518	0.2122	0.2294	0.8587	0.1377	03896	0.0824	0.2485
	ST	0.0058*	0.0701	0.5170	0.0134*	0.0123*	0.1816	0.9471	0.6850
	UL	0.3327	0.0784	0.2204	0.2899	0.1159	0.5889	0.1225	0.0385*
	ST X SL	0.6627	0.6017	0.6329	0.9298	0.0517*	0.7595	0.1358	0.0955
	UL X SL	0.2511	0.6017	0.6329	0.9298	0.0517	0.7595	0.1358	0.0955
	UL X ST	0.7278	0.5149	0.5752	0.9074	0.0230*	0.5515	0.7992	0.0996
	UL X SL X ST	0.4846	0.8398	0.0366*	0.1848	0.1848	0.7241	0.1318	0.2777

a, b means on the same column with different superscripts differ ($p<0.05$). SEM: Standard Error of Mean, SL: Saponin Level, ST: Saponin Type, UL: Urea Level, *: significant probability value, PC: Positive Control, NC: Negative Control.