SILAGE QUALITIES, ANTINUTRITIONAL CONTENTS AND FERMENTATION PARAMETERS OF TYPHA (*Typha domingensis*) GRASS WITH OR WITHOUT ADDITIVES

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ABSTRACT

The study evaluates the effects of height at harvest and treatment with molasses-urea on silage qualities, antinutritional and fermentation parameters of Typha (*Typha domingensis*) grass.. The Typha grass were chopped to 2 - 3 cm, compressed in polythene bags after adding of molasses (4.5 g), urea (2.5 g) to 88 g of Typha packed and ensiled for 90 days. Treatments comprised of control (T1); 0.5 m tall Typha grass, T2; 0.5 m tall treated Typha grass with molasses-urea, T3; 1.5 m tall Typha grass and T4; 1.5 m tall Typha grass treated with molasses-urea laid in completely randomized design. The results of the study revealed significant (P<0.05) difference in pH with 4.09 in T1 as compared to T4 with 4.39. All the treatments have pleasant or sweet aroma, pale yellow to light brown colour. Oxalate, Phytate, Saponin, Tannin and Flavonoids were significantly (P<0.05) different among all treatments. Propionic acid (2.97 mM) and Acetic acid (6.02 mM) were significantly (P<0.05) higher in T4 while Butyric acid (0.41m M) is higher in T3. Total volatile acids (49.62 mM), NH_3-H (11.55 mM), Potential gas production (226 m/g in dry matter) and effective dry matter degradability (EDMD) (25%) were significantly (P<0.05) higher in T2 while Methane (4.8 Mol/0.05 mg DM) was higher in T3. It was concluded that Typha grass harvested at 0.5 m height treated with molasses-urea have better silage qualities, NH_3-H, EDMD, lower antinutritional contents and methane content. It is recommended that Typha grass can be ensiled with molasses-urea for better silage qualities and fermentation parameters.

Keywords: Typha, Molasses, Urea, Silage, *Typha domingensis*

INTRODUCTION

The growth of Typha (*Typha domingensis)* in channels, rivers and agricultural lands of the irrigation schemes of northern Nigeria continue to hindered crop production and causes environmental problems with important social implications to the local communities (Hassan *et al*., 2018). Typha is an invasive weed with rapid growth rate and produce huge biomass which could be utilized as novel and alternative feed ingredient for feeding sheep during the dry season (Musa, *et al*., 2020). Therefore, it was conceived that Typha grass can be converted from menace to opportunity for local communities by ensiling it with or without additives. This study was designed to evaluate the effects of height at harvest and treatment with or without molasses-urea on Typha silage qualities, anti-nutrient contents, fermentation parameters and *in vitro* gas production.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm, Department of Animal Science, Faculty of Agriculture, Federal University, Gashua, Yobe state, Nigeria. Fresh samples of Typha grass were harvested at 0.5 m and 1.5 m height using a sickle from riverside of the Hadejia valley, Jigawa State, Nigeria. The samples were oven dried at (45ºC, 48 h) to determine dry matter (DM) content. All samples were ground using (1 mm pore size) with a Wiley mill (model 3: Arthur H. Thomas Co. Philadelphia) and stored in a container before analysis (Hassan et *al*., 2018). Typha silage were prepared as described by (Musa *et al*., 2022). The mixture consisted of 2.5 g of urea which was dissolved in 5ml of water, 4.5 g of molasses was then added to the mixture. The solution was mixed thoroughly and then sprinkled on 88 g of chopped Typha. Four silages were made which include control (T1); 0.5 m tall fresh Typha grass, T2; 0.5 m tall treated Typha grass with molasses and urea, T3; 1.5 m tall Typha grass and T4; 1.5 m tall treated Typha grass with molasses and urea. After ninety (90) days, the fermentation was terminated and the silages was opened for silage quality evaluation.The assessed quality characteristics were colour, aroma and pH as described by (Muhammad et al, 2009). Phyto-chemical constituents were determined using the method described by Sazada *et al*., (2009). Four (4) adult rumen-fistulated ewes were used as rumen fluid donors for *in vitro* incubations to assess gas production kinetics. Experimental procedures were approved by the Animal Experimentation Ethics Committee of the Comunidad Autónoma de Madrid (Approval number PROEX 035/17). Two hundred (200 mg) of dry matter (DM) of each sample were weighed into 60 ml glass vials. For both incubations, ruminal contents of each sheep were collected immediately before the morning feeding, strained through four layers of cheesecloth, and independently mixed with pre-warmed (39^0C) culture medium (without trypticase and NH_4HCO_3) in 1:4 proportion under CO_2 flushing. Two hundred milligram of DM of each sample was weighed into 60 ml vials, which were filled up with 20 ml of the mixture of rumen fluid and culture medium using a peristaltic pump (Watson-Marlow 520UIP31; Watson-Marlow Fluid Technology Group, Cornwall, United Kingdom).Vials were filled with 20 ml of the mixture, capped and incubated at 39ºC for 120 h. Gas production was measured using a pressure transducer and a calibrated syringe at 3, 6, 12, 24 48, 72, 96 and 120 h and the gas produced was released after each measurement. Vials without substrate (blanks; 2 per ruminal inoculum) were included to correct the gas production values for the gas released from endogenous substrates (Martinez, *et al*., 2010). Degradability of DM after 120 h of incubation (DMD_{120}) was determined by weighing 300 mg of DM of each sample into polyester bags which were incubated in an Ankom Daisy II incubator with the mixture of ruminal liquid and the culture medium earlier described. After 120 h, the bags were thoroughly washed with tap water, dried (70ºC, 48 h), and weighed. The analysis of VFA concentrations was conducted by gas chromatography using a Shimadzu GC 2010 (Shimadzu Europe GmbH, Duisburg, Germany) provided with a TR-FFAP column (30 m x 0.53 mm x 1 µm; Supelco, Madrid, Spain) as described by García-Martínez et al. (2005). Samples were stored at 4ºC for 12 h, centrifuged as previously described, and the supernatants were transferred to chromatography vials and the concentration of NH_3–N was determined. The analysis of CH_4 concentrations in the gas samples collected was performed by gas chromatography as described by Martinez *et al*., (2010) and using a Shimazdu GC 14B (Shimadzu Europe GmbH, Duisburg, Germany) equipped with a flame ionization detector and a column packed with Carboxen 1000 (45-60 mesh, Supelco, Madrid, Spain). Data generated were subjected to analysis of variance (ANOVA) using the general linear model (GLM) of the Statistical Analysis System (SAS, 2015). Where significant differences exist least significant difference (LSD) was used at 5% probability level to separate means.

RESULTS AND DISCUSSION

The colour, aroma and pH of Typha harvested and at different heights indicated that all silage were adequately fermented with light brown, pale yellow colour, pleasant and sweet aroma. Kung and Shaver (2002) in their interpretation of silage analysis stated that pleasant or sweet aroma are acceptable quality of a good silage. The range of pH values in current study ranging between 4.09 and 4.18 for 0.5 m and 1.5 m Typha treatment with molasses-urea silages were consistent with the reports of Oduguwa *et al*., (2007) reported pH value less than 4.2 was indicative of silage with good quality except for 1.5 m Typha treated with molasses-urea (4.39). There were significant ($P<0.05$) difference in anti-nutritional contents among all treatments. The oxalate, phytate, saponin, tannin, and flavonoid contents were significantly ($P<0.05$) different among all treatments. Bolsen *et al*, (1991) reported addition of urea to silages caused increase in acetic, propionic and total organic acid levels. The increase in acetic acid depends on either heterofermentation or acetic acid production. Addition of molasses and urea to Typha silages in this study affect dry matter digestibility positively and increased degradation as reported by (Bingol & Baytok, 2003). So also, Methane content and butyric acid were decreased by addition of molasses-urea as reported by (Deniz *et al*., 2001). It was interesting to note that ammonia nitrogen (NH_3 -N) was higher for T2; 0.5 m Typha treated with molasses-urea and this agrees (Cakra *et al*., 2018). There were significant ($P<0.05$) differences in gas production, effective dry matter degradability and *in vitro* dry matter digestibility among all the treatments. Gas production in this study (140 – 210 ml/g DM was similar to that of sorghum silage (200 ml/g DM) reported by (Cakra *et al*., 2018). The effective dry matter degradability obtained in this study was similar to the findings of (Cakra *et al*., 2018) who reported EDMD of 20% for urea treated sorghum silage.

Table 2: Quality characteristics Typha Silage with or without Additive

	Treatments

Parameters	T1	T2	T3	T4	SEM	P-Value
pH	4.09[d]	4.11[c]	4.18[b]	4.39[a]	0.128	0.48*
Colour	Light brown	Pale Yellow	Light brown	Light brown		
Aroma	Pleasant	Sweet	Pleasant	Pleasant		
Rating	3	4	3	3		
Description	Good	Very good	Good	Good		

[abcd:] means separated by different superscripts are significantly ($p<0.05$) different. SEM= Standard error of mean. T1= 0.5m tall Typha, T2=0.5m tall Typha+molasses+urea, T3=1.5m T4=1.5m Tall Typha +molasses+urea

Table 3: Antinutritional content of untreated and molasses-urea treated Typha Silage

	Treatments					
Parameters (%)	T1	T2	T3	T4	SEM	P-Value
Oxalate	1.35[d]	2.17[bc]	2.21[bc]	2.61[a]	0.39	0.002*
Phytate	7.26[c]	7.66[b]	8.12[a]	6.24[d]	0.28	0.004*
Saponin	0.23[bc]	0.13[d]	0.48[a]	0.20[bc]	0.12	0.002*
Tannin	0.01[d]	0.05[ab]	0.03[c]	0.05[ab]	0.01	0.003*
Flavonoids	4.83[a]	4.55[b]	3.25[cd]	3.35[cd]	0.39	0.001*

[abcd:] means separated by different superscripts are significantly ($p<0.05$) different. SEM= Standard Error of Means. T1= 0.5m tall Typha, T2=0.5m tall Typha+molasses+urea, T3=1.5m T4=1.5m Tall Typha +molasses+urea

Table 4: Volatile Fatty Acids, Ammonia and Methane of Untreated and Treated Typha Silage

	Treatments					
Parameters	T1	T2	T3	T4	SEM	P-Value
Propionic acid (mM)	2.81[d]	2.92[b]	2.86[c]	2.97[a]	0.13	0.004*
Acetic acid (mM)	15.28[b]	15.96[c]	15.55[b]	16.02[a]	1.02	0.004*
Butyric acid (mM)	0.29[c]	0.27[d]	0.41[a]	0.32[b]	0.09	0.001*
Acetic-Propionic ratio	5.44[b]	5.47[a]	5.43[c]	5.40[d]	0.05	0.003*
Total Volatile Fatty Acids (mM)	45.37[d]	49.62[a]	46.23[c]	48.81[b]	2.20	0.002*
Methane (Mol/0.5mg DM)	4.3[b]	3.7[d]	4.8[a]	3.9[c]	0.13	0.002*
NH_3(mM)	10.23[d]	11.55[a]	10.69[c]	11.21[b]	0.60	0.001*

[abcd:] means separated by different superscripts are significantly ($p<0.05$) different. SEM= Standard Error of Means. T1= 0.5m tall Typha, T2=0.5m tall Typha+molasses+urea, T3=1.5m T4=1.5m Tall Typha +molasses+urea

Table 5: Gas production kinetics (PGP, c and Lag) and effective dry matter degradability (EDMD) of untreated and molasses-urea treated Typha silage incubated using sheep rumen liquor

	Treatments					
Parameters	T1	T2	T3	T4	SEM	P-value
PGP (ml/g dry matter)	218[b]	226[a]	136[d]	140[c]	4.8	0.001*
c (%/ h)	3.66[b]	3.15[a]	2.41[d]	2.45[c]	0.138	0.003*
Lag (h)	5.61[b]	6.68[a]	3.29[d]	3.33[c]	0.546	0.002*
EDMD (%)	19.6[b]	25.0[a]	18.12[d]	18.23[c]	0.93	0.002*

[abcd:] means separated by different superscripts are significantly ($p<0.05$) different. SEM= Standard error of mean. EDMD: Effective dry matter degradability, T1= 0.5m tall Typha, T2=0.5m tall Typha+molasses+urea, T3=1.5m T4=1.5m Tall Typha +molasses+urea, PGP = Potential Gas Production

CONCLUSION AND RECOMMENDATIONS

Typha silage harvested at 0.5 m height treated with molasses-urea have better silage qualities, NH_3-H, EDMD, methane content and lower antinutritional contents with the exception of saponins and. It is recommended that Typha grass can be ensiled with molasses-urea for better silage qualities and fermentation parameters.

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