EFFECT OF ENSILED SWEET POTATO VINES TREATED WITH ADDITIVES ON PHYSICAL PROPERTIES AND *IN VITRO* GAS PRODUCTION

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ABSTRACT
This study was carried out to look at the effect of ensiled sweet potato vines treated with molasses, urea and yeast at five weeks. Two varieties of sweet potato vines silage (SPVS) were made with no additive as control T1, with urea T2, with molasses T3 and with yeast T4. The data collected was analyzed using line with marker chat in Microsoft Excel office Software for pH. ANOVA was used to analyze in vitro gas production using SPSS version 20, where significant differences occurred, the means was separated using general linear model.The results showed that King J had a better silage compared to Dan china variety of SPV on control and urea except for molasses and yeast which had equal pH values of 4.5 and 4.8 each respectively for the two varieties. Among the additives, control produced the best silage for King J variety followed by molasses, yeast and urea.The results for in vitro gas production showed that King J and Dan china varieties were significantly different (P<0.05) at 3, 6, 9, 12, 18, 21 and 24hr except 15hr on all the treatments. In conclusion, this studies confirmed that the addition of molasses, urea, and yeast improved silage quality of two varieties of sweet potato vines silage King J and Dan china including the control, with King J as superior variety in terms of silage, while Dan china is better on in vitro gas production. Molasses, urea and yeast are said to be recommended as additive in silage making using sweet potato vines.
KeyWords: Ensiled, Sweet Potato Vines, Additives, Physical Properties and In vitro Gas.

INTRODUCTION

The main factor limiting the productivity of livestock amidst global challenges is inadequate supply of good quality feed especially during dry season. Considerable quantities of crop residues are generated every year in the tropics and subtropics of most African countries. Most of these crop residues are suitable for feeding livestock, however, because of lack of technical-know-how, they are considered as waste and are disposed. Using crop by-products have some advantages such as ameliorating the problem of feed shortage, decrease in cost of feeds and alleviating the menace of pollution. One of such feedstuffs is sweet potato vines (SPV) which after harvesting can remain green and be a valuable forage for ruminants and other livestock species. (Yacout *et al*., 2016).

Utilization of sweet potato vines in livestock feeding could help to reduce some of the nutritional problems associated with the dry season feeding globally during which time the crude protein content of native grasses falls below the minimum threshold level for animal maintenance and production. Increasing the amount of sweet potato vines in Napier-based diets improved crude protein, feed intake and rumen NH_3-N production. (Mohammed *et al*., 2019).

Sweet potato forage is mainly a source of protein and contains about 15-30 % CP per Kg DM, but quality depends on proportion of leaves and stems, the latter containing much less protein than the leaves. Sweet potato leaves and vines can be preserved by ensiling (Mohammed *et al*., 2019); (Lebot, 2009**).** After harvest, green and healthy materials are chopped to 0.2-0.5 cm length and carefully sundried for one to four hours in the sun so that moisture content is reduced by 40-45 %. (Lebot, 2009).

Sweet potato vines can be fermented with poultry manure, resulting in a higher crude protein, DM and ash contents than in other silages. Ensiling provides a clean silage that does not contain aflatoxins, *Salmonella* and *Escherichia coli* (Lebot, 2009**).**

MATERIALS AND METHODS

Samples of sweet potato vines were obtained from two cultivars of sweet potato vines, *King J and Dan china* planted by Agronomy Department of Bayero University, Kano, while molasses, urea and

yeast were used as additives. Samples were opened at 5th week to evaluate pH, and *in vitro* gas production.

The study was conducted at two locations, first was silage making, physical analysis conducted at the Livestock Teaching and Research Farm and Laboratory of the Department of Animal Science, Faculty of Agriculture, Bayero University Kano located on the coordinates of Longitude 9° 30' and 12° 30' North and Latitude 8° 42' and 9° 30' East in the semi-arid region in Northern Nigeria. The area has two seasons, the wet (May-September) and dry seasons (October- April). The annual temperature and rainfall ranges between 21°C and 39°C and 787mm to 960mm respectively (KNARDA, 2001). While the second was on *in vitro* gas production study carried out in the Department of Animal Science, Ruminant Microbiology Laboratory, Faculty of Agriculture and Forestry, University of Ibadan Nigeria. The University of Ibadan (UI) is located five miles (8 kilometres) from the center of the major city of Ibadan in Western Nigeria located on the coordinates of Latitude: 7° 23' 28.19" N and Longitude: 3° 54' 59.99" E. (https://latitude.to/articles-by-country/ng/nigeria/15223/university-of-ibadan)

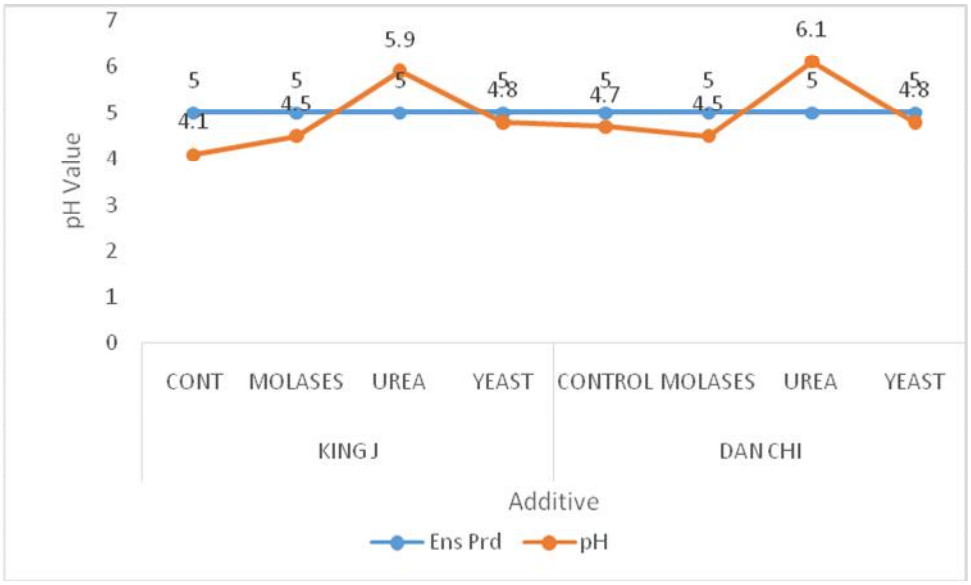
A total of 24 bottles were used for the silage preparation. Two varieties of sweet potato vines; *King-J* and *Dan china* were used as samples having 12 for each. The varieties were collected from Bayero University Kano, Faculty of Agriculture, Farm and Research unit in Kano State, and was chopped with cutlass to about 2 to 5 cm. The chopped forages were treated with (i) no additives (control); (ii) molasses; (iii) urea and (iv) yeast. Distilled water (1%) was added to the *King-J* and *Dan china* without additive as control in treatment 1 and the *King-J* and *Danchina* with added molasses, urea and yeast as treatments 2, 3 and 4 to adjust the moisture contents of the experimental forages. Thereafter, the experimental forages were packed tightly in bottles. Air was withdrawn from the bottles by means of a vacuum sealer. The bottles were stored at room temperature (27°C to 30 °C). The triplicate silages per treatment were opened at 5th week of ensiling for physical analysis and *in vitro* gas production.

The data collected was analyzed using line with marker chat in Microsoft Excel office Software for pH, while ANOVA was used for *in vitro* gas using SPSS version 20, where significant differences occurred, the means was separated using general linear model.

Results and discussion

pH Values for *king J* and *Dan china* Varieties of Sweet Potato Vines Silage (SPVS) at Week Five

pH values for *King J* and *Dan china* varieties of sweet potato vines silage (SPVS) at week five is presented in figure 1. The pH values of *King J* and *Dan china* varieties of SPVS of treatments 1, 2, 3 and 4 (control, molasses, urea and yeast) respectively fall under acidic conditions. Based on pH values on control, molasses, urea, and yeast, with the pH values of 4.1, 4.5, 5.9 and 4.8 for *King J* and 4.7, 4.5, 6.1 and 4.8 for *Dan china* variety. *King J* variety made a better silage as compared to *Dan china* on control and urea at week five, while there were equal pH values of molasses and yeast with 4.5 and 4.8 for molasses and yeast respectively. Among the additives, control seems to produce better silage followed by molasses, yeast and urea. Urea treatment at five week had the highest pH values of 5.9 and 6.1 for *King J* and *Dan china* varieties respectively at five weeks though under acidic condition as compared to control, molasses and yeast treatments which confirms the statement of Bolsan, Ashbell and Wilkison (1995) and Kuttu *et al*. (2020) which says, addition of ammonia increases the pH level of silage to 6 or 9.



Key: DAN CHI= Dan china, CONT= Control, Ensprd= Ensiling period

Figure 1: pH Values for *king J* and *Dan china* Varieties of Sweet Potato Vines Silage (SPVS) at Week Five

The *in Vitro* Gas Production of *King J* and *Dan china* Varieties of Sweet Potato Vines Ensiled with Molasses, Urea and Yeast at Five Weeks

The *in vitro* gas production of sweet potato vines ensiled with molasses, urea and yeast is shown in Table 1. *King J* and *Dan china* varieties were significantly different (P<0.05) at 3, 6, 9, 12, 18, 21 and 24n hrs except 15 hrs in control, molasses, urea and yeast. *Dan china* produced less gas than *King J* variety in control, molasses, urea and yeast treatments at 3 hrs, same was observed at 6 hrs and 9 hrs of incubation except on molasses treatment. At 12 hrs, molasses treatment was same at 38.00 for the two varieties but more gas was produced on control, urea and yeast on *King J* variety. At 18, 21 and 24 hrs of incubation, *King J* produced more gas than *Dan china* variety on all treatments except urea treatment.

Table 1. *In Vitro* Gas Production of *King J* and *Dan china* Varieties of Sweet Potato Vines Ensiled with Molasses, Urea and Yeast at Five Weeks

Incubation Period	Vine	Ensiling Period	Control	Molasses	Urea	Yeast	SEM	LOS
3HRS	*King J*	5	19.00	21.33	18.00	19.67	3.34	*
	Danchina	5	16.00	23.33	15.33	12.66	3.34	
6HRS	*King J*	5	28.67	30.33	23.00	26.67	3.71	*
	Danchina	5	19.00	34.67	20.33	16.00	3.71	
9HRS	*King J*	5	32.00	35.00	25.33	28.67	4.24	*
	Danchina	5	21.33	35.67	23.67	17.67	4.24	
12HRS	*King J*	5	35.00	38.00	27.33	30.33	4.21	*
	Danchina	5	26.33	38.00	29.33	21.00	4.21	
15HRS	*King J*	5	35.33	39.00	29.33	30.67	3.78	NS
	Danchina	5	27.33	38.00	30.33	23.33	3.78	
18HRS	*King J*	5	37.00	39.00	29.33	32.33	3.49	*
	Danchina	5	30.00	38.00	31.00	23.33	3.49	
21HRS	*King J*	5	39.67	39.33	29.67	34.00	3.57	*
	Danchina	5	32.00	38.67	32.33	23.33	3.57	
24H	*King J*	5	40.00	39.33	29.67	34.00	3.56	*
	Danhina	5	32.33	38.67	33.67	24.67	3.56	

SEM: Standard error means, LOS: Level of significance, HRS: Hours, NS: Not significant

CONCLUSION AND RECOMMENDATION

Based on the results presented, this studies confirmed that the addition of molasses, urea, and yeast improved silage quality of two varieties of sweet potato vines silage *King J* and *Dan china* including the control, with *King J* as superior variety in terms of silage, while *Dan china* was better on in vitro gas production. Molasses, urea and yeast are said to be recommended as additives in silage making using sweet potato vines.

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