

PHYSICOCHEMICAL CHARACTERISTICS OF GRAIN SORGHUM (*Sorghum bicolor* L.) SILAGE AS INFLUENCED BY VARIETY AND PLANTING DATE

*¹Munza, B. M., ²Hassan, M. R., ³Tanko, R. J., ²Yashim, S. M., ²Zakka, T., and ²Adewumi, A.E.

¹Department of Animal Science, University of Maiduguri, Maiduguri, Nigeria

²Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria

³National Animal Production Research Institute, Ahmadu Bello University, Zaria, Nigeria

*Corresponding author: bellomunza@gmail.com; Tel: +2347038737250

ABSTRACT

An experiment was conducted to evaluate the physicochemical characteristics of two grain sorghum varieties as influenced by planting date in Shika-Zaria. A laboratory trial of representative samples of silages using the two varieties (Samsorg-16 and Samsorg-17) and three planting dates (15th June, 30th June and 14th July) in a 2 x 3 factorial arrangement denoted as A, B, C, D, E and F was made in glass jars from chopped forage material harvested at booting stage. The forage was ensiled for 21 days in glass jar. There was no significant ($P>0.05$) effect of variety on temperature and pH of ensiled grain sorghum (Table 1). The temperature for both varieties was 22.93°C while pH observed ranged between 3.82 and 3.83 for Samsorg-16 and Samsorg-17 varieties, respectively. Variety had effect on dry matter, crude protein, neutral detergent fibre, acid detergent fibre, calcium and phosphorus composition of ensiled grain sorghum. Planting date had significant ($P<0.05$) effect on all the parameters measured in which silage made from sorghum planted on 15th June recorded higher temperature, dry matter, crude protein, neutral detergent fibre and acid detergent fibre. It is therefore recommended that for good quality silage, Samsorg-17 variety should be planted on 15th June.

Key words: Silage, sorghum, variety, physicochemical and planting date.

INTRODUCTION

The adaptive nature of sorghum, its potential to produce higher tonnage of green forage and its diverse uses make it a valued tool and one of the best choices for forage growers and dairy farmers demanding high quality feed stocks (Iqbal and Bethune, 2015). Genotype or variety and planting date plays an important role in determining yield and quality of sorghum hence, its silage physicochemical composition (Diawara, 2012). Silage is made to conserve the grass or other herbage with a minimum loss of nutritive value by fermentation of soluble carbohydrates in an anaerobic environment into organic acids, preferably lactic acid, which reduce pH inhibiting normal aerobic bacterial action (Saarisalo *et al.*, 2007). Water soluble carbohydrates (WSC) in ensiled crops are a source of energy for bacteria to produce lactic acid and lower pH to <4.2 for good silage quality (McDonald *et al.*, 1991). Although excellent silages can be made from sorghums but crude protein (CP) concentrations decrease with increase in stage of maturity (Pholsen and Higgs 2005). Sorghum silage has the potential to bridge the gap between animal feed supply and demand particularly during drier months (Oliver *et al.*, 2004). Hence, the experiment was conceived to determine the physicochemical characteristics of two grain sorghum varieties silage as influenced by planting date in Shika, Zaria, Nigeria.

MATERIALS AND METHODS

SILAGE PREPARATION AND SAMPLING

In 2018 growing season at National Animal Production Research Institute (NAPRI), Shika, five (5) seeds of Samsorg-16 and Samsorg-17 grain sorghum were planted on ridges at 2 cm depth at plant spacing of 15 x 85 cm using the planting dates and later thinned to two (2) plants/ stand after twelve (12) days so as to have a uniform plant population of (13,333 stands/ha). A uniform dose of 120 kg/ha NPK (20:10:10) was applied to sorghum seedlings at 2 and 5 weeks after sowing as first and second doses, respectively. Forage material was harvested at 14 weeks after sowing (booting stage), then chopped to 2 cm with a forage chopper. The chopped forage material was ensiled in glass jars. A laboratory trial of representative samples of silages using the two varieties and three planting dates denoted as A, B, C, D, E and F was made in glass jars. The temperature and pH of the silage was measured with thermometer and pH meter. Proximate and detergent analyses were determined using the method of AOAC, (2005) and van-Soest *et al.* (1991), respectively in the Central Laboratory of NAPRI, Shika, Zaria. While mineral analysis was determined by AOAC (2005) methods using the Atomic Absorption Spectrophotometer.

STATISTICAL ANALYSIS

Data generated were subjected to ANOVA using General Linear Model Procedure of SAS (2005). Significant means will be compared using the Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSIONS

There was no significant ($P>0.05$) effect of variety on temperature and pH of ensiled grain sorghum (Table 1). The temperature for both varieties was 22.93°C while pH observed ranged between 3.82 and 3.83 for Samsorg-16 and Samsorg-17 varieties, respectively. There was significant ($P<0.05$) effect of variety on DM, CP, NDF, ADF, Ca and P composition (Table 1) of ensiled grain sorghum. Dry matter, crude protein and calcium were 4.86%, 34.93% and 25.00% higher in Samsorg-17 than Samsorg-16 sorghum silages, respectively. Neutral detergent fibre, acid detergent fibre and phosphorus were 13.98%, 14.83% and 33.33% higher in Samsorg-16 silage than Samsorg-17 silage, respectively. The variation observed may be attributed to the varietal difference in which the yellow colour of Samsorg-17 sorghum grains could be responsible for the high crude protein. The DM and ADF obtained in this study was higher than the values reported by Kumari *et al.* (2013) for chopped sweet sorghum silage. Significant ($P<0.05$) planting date effect was observed for temperature, pH, DM, CP, NDF and ADF (Table 1) of ensiled grain sorghum. The pH obtained in this study is within 4.2 and below reported by Iqbal and Bethune (2015) that must be attained for a good quality silage. Mineral elements play special roles in the proper functioning of the rumen microorganisms especially those which digest plant cellulose, utilization of energy, protein and metabolism among other functions (McDowell *et al.*, 1993). The P content was lower than (0.4-0.9g/day) required for growing goats (Fjell *et al.*, 1991). The Ca concentration was within the daily requirement for goats (0.4-1.1g/ca/day) reported by (Ishiaku *et al.*, 2016). There was significant ($P<0.05$) interaction effect between variety and planting date on parameters measured except pH.

Table 1: Physicochemical composition of ensiled grain sorghum as influenced by variety and planting date and their interaction

<i>Chemical composition (%)</i>								
	T°C	pH	DM	CP	NDF	ADF	Ca	P
<i>Variety</i>								
Samsorg-16	22.93	3.83	71.70 ^b	6.78 ^b	62.79 ^a	47.34 ^a	0.42 ^b	0.06 ^a
Samsorg-17	22.93	3.82	75.36 ^a	10.42 ^a	54.01 ^b	40.32 ^b	0.56 ^a	0.04 ^b
SEM	0.001	0.06	0.79	0.47	0.50	0.50	0.01	0.01
P-value	0.050	0.983	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
<i>Planting date</i>								
15 th June	24.00 ^a	4.01 ^b	74.70 ^a	12.94 ^a	66.13 ^a	51.07 ^a	0.50 ^b	0.05 ^b
30 th June	23.00 ^b	4.20 ^a	73.40 ^b	6.62 ^b	55.62 ^b	47.09 ^b	0.44 ^c	0.04 ^c
14 th July	21.80 ^c	3.27 ^c	74.49 ^a	6.25 ^b	53.45 ^c	33.34 ^c	0.53 ^a	0.06 ^a
SEM	0.01	0.04	0.53	0.31	0.33	0.33	0.01	0.01
P-value	<0.001	<0.001	0.092	<0.001	<0.001	<0.001	<0.001	<0.001
<i>Interaction</i>								
V x P	<0.001	0.230	0.009	<0.001	<0.001	0.015	<0.001	<0.001

^{abc} Means with different superscripts within column differed significantly, SEM = standard error of mean, DM = dry matter, CP = crude protein, NDF = neutral detergent fibre, ADF = acid detergent fibre, Ca = calcium, P = phosphorus

CONCLUSION

It can be concluded that silage made from Samsorg-17 sorghum give the highest DM, CP and Ca while higher NDF and ADF were obtained in Samsorg-16 sorghum silage whereas sorghum planted on 15th June recorded the highest DM, CP, NDF and ADF. It is therefore recommended that for good quality silage Samsorg-17 should be planted on 15th June.

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