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SOME QUALITY ASPECTS OF DIFFERENT SORGHUM FORAGE (*SORGHUM BICOLOR* L. MOENCH) GENOTYPES GROWN UNDER RAIN-FED AND IRRIGATION CONDITION

Salah Eldeen E. Ahmed[1], Ahmed M. El Naim[1], Abderhim A. Jabereldar[1] Mohammed Alhadi Ebrahiem[2*]

[1]Department of Crop Science, Faculty of Natural Resources and Environmental Studies, University of Kordofan, El-Obeid, Sudan
[2]Department Animal Production, Faculty of Natural Resources and Environmental Studies University of Kordofan, El-Obeid, Sudan

Abstract. This work was designed to evaluate the effect of genotype on forage quality under rain-fed and irrigation condition. Field experiments were carried out at the Experimental Farm, Faculty of Natural Resources and Environmental Studies University of Kordofan, Elobeid. The experiments were implemented during rainy season (2014/2015) and winter season (2015/2016). The treatments were arranged in a randomized complete block design (RCBD) with three replications. The results indicated that, the genotype had significant effects ($P \geq 0.05$) on most of the measured attributes. The genotypes Pioneer and Taqqat.9A were superior and better for forage quality: highest crude protein and a lesser crude fiber and hence recommended to areas facing shortage of rainfall.

Keywords: *forage crop, quality, irrigation, pasture.*

Corresponding Author: *Mohammed Alhadi Ebrahiem, Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan El-Obeid, Sudan,*
e-mail: mahaali5656@gmail.com

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1. Introduction

Sorghum (*Sorghum bicolor* (L.) Moench) is a cereal plant member of the family of Poaceae (Adeyeye & Adesina, 2013). Also is well adapted to hot and dry environments (Yan *et al.*, 2012). The production of forage crops is very important for livestock in Sudan (MAR, 2003). Locally in North Kordofan State the latest estimates of the livestock population of Kordofan (MAW, 2007) indicated that, there are now 31 million heads, composed of 8, 12.5, 8, and 3 million of cattle, sheep, goats and camels respectively. And the diminishing amount of fodder produced in naturally due to the expansion of rain-fed agriculture on the expensive of range land. Forage quality means the ability and the extent to which forage has the potential to produce a desired animal response. Many factors influence forage quality, one of them is forage cultivars. Secondarily environmental factors such as soil type, fertility, day length, and temperature during plant growth (Ball, 2000). Mohammad, (1989) reported variations in fodder quality traits of sorghum genotypes under diverse environment maximum, acid detergent, fiber, were observed at the optimum environment (irrigated) while maximum crude protein, were produced under rain fed conditions. Understanding the response of genotypes for specific area with high yield and good quality is of great importance;

hence the aim of this study was to evaluate the quality performance of sorghum genotypes under rain-fed and irrigation condition in North Kordofan state.

2. Material and methods

2.1. Experimental Site

This study was carried at the Experimental Farm of crop Sciences Department, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan, Latitudes (11°15¯) and (16°30¯) N and longitudes (27°33¯) and (32°45¯)E. The climate of the area is arid and semi arid with sandy soil, annual rain fall ranges between 350-450 mm (Ahmed, 2009). Average maximum daily temperature ranges between 30-40°C throughout the year.

2.2. Plant material

Six local tested sorghum genotypes (Taqqat.7B, Taqqat.9A, Taqqat.5A, Gasabi, Geshaish and Nabig) were used in this experiment. These genotypes are characterized as early maturing genotypes. The mentioned genotypes were collected from Khor-Taqqat area, North Kordofan state. Beside three other genotypes cultivated in the irrigated area include Pioneer (introduced hybrid), Abu70-Aliab from Hudeiba (ARC) and Piper (Grawia) obtained from Sudanese Arabic seed company (ASSCO), were represent the improved sorghum fodder genotypes, and aish-Baladi collected from Merowi area.

2.3. Experimental design and field layout

Tow field experiments were conducted during rainy season (2014/2015) the ten genotypes followed (RCBD) with three replications. The seeds were equally distributed manually on lines 70 cm apart with seed rate of 30 kg/fed; the plot size was (3×3m) consisted of five rows. Hand weeding was carried out during the experiments in two times. Winter season experiment was carried out under irrigated conditions during 2015/2016. Irrigation was handled every 7 days. Land was disc ploughed and leveled. The individual plot size was (3×3m) and 70 cm apart consisted of three rows. The irrigation adopted in this trial was surface irrigation, and applied by using pumping machine through valve and tube of 2-inches diameter and the amount of irrigation water was added at rate of 50 mm /irrigation, according to (FAO, 2012) recommendation. The total amount of irrigating water for irrigation was 650 mm. The crop was sown manually on 1^{st} of February 2014 / 2015. Manual weeding was practiced two times during the both seasons; the first one was after two weeks from sowing and the second weeding after a month from the first. Irrigation water was equally applied at seven days intervals to all experimental plots for establishment of plants till they were 21 days old. An irrigation interval was applied thereafter.

2.4. Quality determination

A composite sample collected randomly from inner rows (constant weight) from each experiment at 50 % flowering stage and the samples were analyzed for proximate composition according to AOAC (1990). Measured parameters include ash %, crude protein, crude fiber and ether extractable fats %.

2.5. Statistical Analysis Procedure

The data recorded on quality traits, were statistically analyzed by statistical package for RCBD trial, as described by Gomez and Gomez (1984), by using computer program (MSTATE), Duncan's multiple range tests was used to separate the differences between treatment means.

3. Results and discussion

3.1. Performance of quality traits during rainy seasons (2014/2015) and winter seasons (2015/2016)

Analysis of variance showed significant difference (P≥0.05) in ash percentage during both seasons. Genotype Gassabi obtained maximum percentage of ash (7.91%) followed by Nabig, while genotype Taqqat.7B registered the lowest percentage (5.68%) in rainy season. Highest percentages of 12.41, 11.29, and 10.69 were obtained by genotypes Gassabi Geshaish and Grawia, respectively in winter season; in contrast the lowest percentage was recorded by Taqqat.9A.The mean value of winter season was greater than rainy season for ash percentage. These variations could be attributed to differences in genotypes to absorb nutrients due to variable rooting pattern in the same soil. Results are in agree with that of Ayub, *et al.* (2010) who, found significant differences for total ash content among different sorghum forage genotypes.

Forage contains high crude protein content considered as a good quality. Genotype Taqqat.9A achieved the highest values (12%) of crude protein during rainy seasons while hybrid Pioneer had the highest crude protein (11.4%) during winter seasons (Fig.1). This variation in crude protein might be attributed to relative contribution of leaves to total biomass and high concentration of protein in dry matter content. These results are consistent with those of Ayub et al. (2012); Sarfraz, *et al.* (2012) and Silungwe, (2011), whom found that, there were significant differences among sorghum forage cultivars in crude protein percentage. Also Mohammad (1989), reported variation in fodder yield and quality traits of sorghum under diverse environments. The higher value of crude protein was observed under rain-fed conditions (Table.1).

At both season, the genotypes differed significantly (P≥0.05) for ether extractable fats (EE%) table (1). Genotypes Aish-Baladi and Taqqat.5A had the highest percentage (4%) followed by cultivar Abu70, while the lowest value obtained by genotype Taqqat9A (0.10%) during rainy season, whereas at winter season genotypes Abu70, Taqqat5A, Grawia and Pioneer recorded the highest values (3.20, 3.0, 2.80, and 2.80%) successfully, followed by Taqqat.9A. The lesser percentage of (1.40%) was produced by genotype Taqqat7B. These differences among genotypes may be attributed to differences in genetic traits of crop plants. These results agreed with those of Shobha *et al.* (2008), Mahammed and Moataz (2009) and Ayub *et al.* (2010). They found that, significant difference in ether extractable fats of different cultivars.

The forage containing low crude fibre content is better in quality (Sher, 2013). In this study, the highest crude fiber was obtained during rainy seasons. Genotype Abu70 (Aliab) produced the highest crude fiber during the two rainy seasons. While local genotype Nabig produced maximum crude fiber during both winter seasons. Sudan grass (Grawia) had the lowest values during winter seasons. This variation in crude fiber might be to genetic-make up of theses genotypes and adaptability to different environmental condition. Abd-Elbakheit (2007), reported that, crude fibre was slightly higher in Abu Sabein compared to Sudan grass, also differences in crude fibre between genotypes have already been reported by Ayub et al. (2010) and Abusuwar and Hala (2010). Mohammad, (1989) reported that, there was a significant difference among sorghum varieties regarding crude fibre. Relatively over mean in rainy season greater for this trait (Fig.2), this might be due high increased in bulk material during rainy season than winter seasons.

4. Conclusion

According to preceding results, it can be concluded that different genotypes have different performance in terms of forage quality. For animal feeding the better forage genotype was Taqqat.9A Taqqat.9A and Gassabi when cultivated in the rainy season for its high contents of the available crud protein. On the other hand hybrid Pioneer had the highest crude protein during winter seasons. So it recommended as winter season forage while Taqqat.9A as rainy season forage in North Kordofan state, Sudan. In general, the highest crude fiber contents were obtained during the rainy season for all genotypes. Therefore, genotypes Pioneer, Taqqat.7B, Taqqat.9A and Gassabi performed better for forage quality than all studied genotypes when cultivated during winter season.

Table.1 Effect of genotypes on some quality traits of sorghum in rainy and winter seasons

Genotypes	**Rainy season 2014/015**			**Winter Season 2015/016**		
	C.P%	EE%	C.F%	C.P%	EE%	C.F%
Taqqat.9A	12.0 [a]	0.1 [d]	35.0 [bc]	10.2 [b]	2.6 [ab]	31.5 [d]
Pioneer	9.4 [cd]	2.5 [bc]	33.0 [bc]	11.6 [a]	2.8 [a]	33.3 [c]
Taqqat.7B	9.3 [cd]	2.0 [c]	35.5 [bc]	10.3 [b]	1.4 [d]	31.0 [d]
Aish–Baladi	6.5 [f]	4.5 [a]	35.5 [bc]	11.1 [a]	1.8 [cd]	35.2 [b]
Abu70	7.2 [f]	3.5 [ab]	45.0 [a]	11.4 [a]	3.2 [a]	36.0 [b]
Taqqat.5A	8.3 [e]	4.0 [a]	33.5 [bc]	9.9 [b]	3.0 [a]	31.3 [d]
Nabig	8.9 [de]	1.5 [c]	38.5 [b]	10.1 [b]	1.8 [cd]	49.0 [a]
Grawia	10.0 [bc]	2.0 [c]	34.0 [bc]	8.8 [c]	2.8 [a]	29.0 [e]
Geshaish	10.1 [bc]	2.0 [c]	34.0 [bc]	9.7 [b]	1.8 [cd]	31.3 [d]
Gassabi	10.4 [b]	1.5 [c]	32.0 [c]	5.5 [d]	2.2 [bc]	30.5 [e]
Grand mean	**9.2**	**2.4**	**35.6**	**9.95**	**2.3**	**33.8**
SE±	0.02	0.02	0.44	0.14	0.10	0.32
C.V%	4.39	7.00	7.13	4.37	13.75	3.03

* Values in same row with different superscripts differ significantly (P≤0.05).

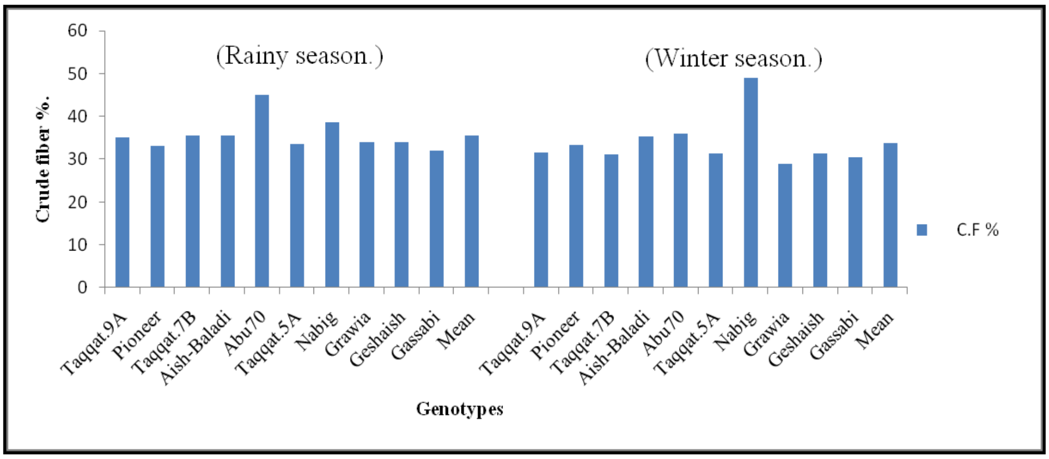

Figure.1 Crude protein percentage of 10 sorghum genotypes, grown under different environments

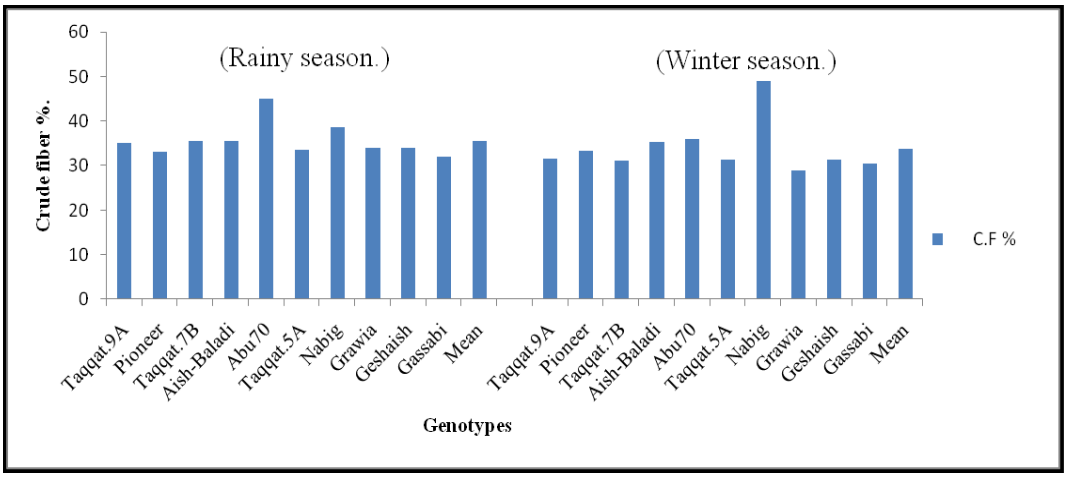

Figure.2 Crude fiber percentage of 10 sorghum genotypes grown under different environments

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