



## Identification of some improved sorghum genotypes with high yield potential and good agronomic performance

ABUBAKAR, A.

Department of Agricultural Education, School of Vocational Education,  
Federal College of Education (Technical), Bichi, P.M.B. 3473, Kano, Kano State, Nigeria.

**ABSTRACT:** Grain yields and growth performances of thirteen (SSD-35, PSL985061, IRAT-204, NR71176, 90SN-7, SEPTON82, NR71186, KL2, NR71151, MMCUS, PSL9404, KL1 and FARAFARA) sorghum (*Sorghum bicolor* (L) Moench), genotypes were evaluated for two years (2010-2011) at, Federal College of Education (Technical) Bichi, Sudan Savanna agro-ecological zone of Nigeria (Latitude 12° 14' – 14° 15' N and longitude 8° 14' – 12° 14' E). The experimental design was randomized complete block with four replications. Each experimental Plot was 4 x 4 metres in total area of 25 x 15 metres. Yield and growth parameters were taken on the sorghum plants and the data subjected to Analysis of Variance (ANOVA), while mean comparisons were performed using Duncan Multiple Range Test (DMRT) at 5% probability. Septon-82 was the highest yielding sorghum genotype with a yield of over 7000kg/ha, while significantly lowest yield of 1463kg/ha was recorded for Farafara-local sorghum variety. Maximum plant height of 3.9 metres and longest days (167) to maturity were obtained for Farafara while the variety IRAT-204 gave the shortest plant height (1.2 metres) and shortest days (112 days) to maturity.

**Keywords:** Sorghum, genotypes, yield, growth parameters, Sudan savanna.

JoST. 2012. 3(2): 84-88.

Accepted for Publication, October 14, 2012

### INTRODUCTION

Sorghum (*Sorghum bicolor* (L) Moench) is a self pollinating, diploid ( $2n = 2x = 20$ ) with a genome ( $1C = 735\text{Mbp}$ ). Sorghum is the fifth most important crop in the world after wheat, rice, maize and barley and is the dietary staple of more than 500 million people in more than 30 countries. It is grown on 42m hectares in 98 countries of Africa, Asia, Oceania, Europe and the Americas (Doggett, 1988). Sorghum or guinea corn is the cereal crop mostly grown in northern Nigeria. Small quantities are produced in the derived guinea savanna areas of Oyo State. It is mainly produced in Kano, Katsina,

Bauchi, Borno and Niger States. Other areas of sorghum production include Benue, Kaduna, Sokoto, Plateau and Kwara states of Nigeria. (Philip, *et al.*, 2006).

Sorghum exhibits reasonable drought tolerance due to the followings: (i) ability to produce seeds where other crops will not thrive. At the time of pollination, when maize requires maximum moisture for successful pollination, sorghum will withstand moisture stress and still have effective pollination. So moisture stress is no limitation to sorghum pollination (ii) extensive root system (iii) Sorghum can tolerate flood condition better

<sup>1</sup>Correspondence to: Abubakar, A., abubakar\_bdlzz@yahoo.com

than any other cereal crop excepts rice (Philip, *et al.*, 2006). Sorghum is an important food, fodder and cash flow crop in West Africa and especially in the Sudan savanna of Nigeria. Sorghum grains form an important source of cheap energy food, containing approximately 17% carbohydrate (Alabi, 2005). Local varieties show considerable variation, but are generally tall and late maturing. Sorghum production in Sudan savanna is often limited by inadequate and erratic rainfall, insect pest, disease attack, low soil fertility and lack of improved varieties. Insecticides are rarely used by farmers on sorghum even though insect pest can cause up to 100% loss of sorghum grain yields (ICRISAT, 2010). The International Crops Research Institute for the Semi – Arid Tropics (ICRISAT) in collaboration with National Research Institutes

in the Sudan savanna has developed improved sorghum cultivars adapted to several regions and cropping systems. These varieties are superior to the local cultivars in many respects (highly yielding, resistant to major pest and disease, early maturity, drought tolerant and high nutritive value). Some of these varieties have been released in Nigeria and about 80 other countries (ICRISAT, 1993). It is therefore necessary to evaluate the improved varieties and encourage widespread adoption because of their higher yield. This study is aimed at identifying suitable sorghum genotype which has displayed good yield potential and agronomic performance for release to farmers in Northern Nigeria and for further genetic manipulation by scientists/geneticists.

## MATERIALS AND METHODS

### Field Trial

Twelve improved varieties of sorghum and a local variety were grown under rain fed conditions at the research farm of the Department of Agricultural Education, Federal College of Education (Technical) Bichi (Lat: 12° 14' – 14° 15'N and Long. 8° 14' – 12° 14'E), Kano State during 2010 and 2011 cropping seasons. The varieties were sourced from International Cereal Research Institute for the Semi-Arid Tropics (ICRISAT), Kano Station. The trial site was cleared of stones and previous plant roots and ridged mechanically using the Department of Agricultural Education Tractor. Each trial plot was 4 x 4 metres in a total area of 25 x 15metres. A randomized complete block design was set up with four replications. The seeds of each of the varieties were sown at the rate of three seeds per hole on rows of 100cm apart and spaced 50cm between stands (100 x 50cm). After germination the plants were thinned to one plant per stand.

The plots were maintained by manual weeding, 2, 5 and 8 weeks after germination. 32kg N/ha of Calcium Ammonium Nitrate (CAN) and 32kg/ha of phosphorous dioxide ( $P_2O_5$ ) as single super phosphate fertilizer were applied as basal fertilizer, while 32kg N/ha of CAN was applied 3 weeks as top dressing. At maturity, heads from sorghum plants in the three central rows as net plot were cut using sickle and sun dried for 8 days, also the stalks were carefully uprooted and sun dried for three weeks. Threshing was done manually by beating the sorghum heads in bags with short stout stick, the sorghum grains and stalks were weighed using electronic weight scales.

Sorghum grain – yields and growth parameters were measured and data obtained were analyzed using Statistical Package for the Social Sciences (SPSS) while mean comparisons were made using Duncan Multiple Range Test (DMRT) at 5% probability.

## RESULTS AND DISCUSSION

The significant mean grain yields and agronomics parameters observed in the thirteen sorghum genotypes show genetic variability among the genotypes evaluated (Table 1). Significantly higher yields were observed in improved varieties while low grain yield was observed in local variety (Fig. 1).

This finding agrees with those of Clark and Carpenter (2000), Francis (2007) and Texas (2010). The highest grain yield value of 7102.9kg/ha and threshing percentage (72%) was recorded for SEPTON – 82 while local variety – Farafara obtained 1463.8kg/ha (Fig 1). Days to flowering (52), and days to maturity (91) were shorter (early) in IRAT-204 compared to the longest days to flowering (109) and maturity (Late) (167) for farafara (Table 1).

These genotypes, SEPTON-82 and IRAT-204 could be introduced to farmers in this agro-ecological zone for high grain yield and early maturity respectively. The plant height ranged from 3.9m in Fara-fara to 1.2m in IRAT-204 with significant ( $P < 0.05$ ) differences between the varieties. Significant ( $P < 0.05$ ) differences were recorded between the genotypes for the stalk weight. SEPTON – 82 produced the largest stalk of 7803.5kg/ha and SSD-35 produced the least stalk weight of 4757.8kg/ha (Table 1) others were intermediate between these. The non-significant differences in stalk weight between some of the genotypes implies that any of the genotypes could be adopted by the farmers for livestock feed/fodder, fuel, and building materials in Sudan Savannah zone of Nigeria (Table 1). Number of striga-emerged per plot ranged from none in IRAT-204, 90SN-7, SEPTON-82, NR-71186, KL2, MMCUS +o eight (8) in Farafara (Table 1). Clark (1998) also reported that some improved varieties of sorghum showed complete resistance to *Striga hermontica*. The six identified striga resistance

sorghum genotypes should be multiplied and made available to farmers in Sudan Savannah zone of Nigeria. Singh (2010), observed that sorghum output in Sudan Savannah zone of Nigeria can be increased if the farmers have easy access to striga resistance sorghum seeds.

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**Table 1: Mean Grain yield and Agronomic Indices of the Sorghum Genotypes for two Crop Years (2010 – 2011)**

S/N	Genotypes/ Varieties	DTF	DTM	PL.HT (M)	Grain Yield kg/ha	Stalk Yield (kg/ha)	Striga per plot	Threshing %
1	SSD-35	89 <sup>b</sup>	127 <sup>b</sup>	2.50 <sup>b</sup>	4215.3 <sup>f</sup>	4757.8 <sup>c</sup>	1 <sup>c</sup>	44 <sup>d</sup>
2	PSL985061	69 <sup>d</sup>	112 <sup>d</sup>	2.18 <sup>c</sup>	4501.3 <sup>e</sup>	4903.2 <sup>c</sup>	2 <sup>b</sup>	46 <sup>d</sup>
3	IRAT-204	52 <sup>c</sup>	91 <sup>c</sup>	1.20 <sup>d</sup>	4780.8 <sup>c</sup>	5210.6 <sup>b</sup>	-	51 <sup>c</sup>
4	NR-71176	81 <sup>c</sup>	122 <sup>c</sup>	2.25 <sup>c</sup>	6301.4 <sup>b</sup>	6601.1 <sup>a</sup>	2 <sup>b</sup>	53 <sup>c</sup>
5	90SN-7	69 <sup>d</sup>	130 <sup>b</sup>	2.49 <sup>b</sup>	6214.6 <sup>b</sup>	6714.9 <sup>a</sup>	-	66 <sup>b</sup>
6	SEPTON82	81 <sup>c</sup>	110 <sup>d</sup>	2.10 <sup>c</sup>	7102.9 <sup>a</sup>	7803.5 <sup>a</sup>	-	72 <sup>a</sup>
7	NR-71186	81 <sup>c</sup>	122 <sup>c</sup>	2.26 <sup>c</sup>	6200.1 <sup>b</sup>	6821.4 <sup>a</sup>	-	64 <sup>b</sup>
8	KL2	87 <sup>b</sup>	130 <sup>b</sup>	2.46 <sup>b</sup>	5815.8 <sup>c</sup>	6164.5 <sup>a</sup>	-	41 <sup>d</sup>
9	NR71151	63 <sup>d</sup>	103 <sup>d</sup>	2.51 <sup>b</sup>	5169.7 <sup>d</sup>	5651.4 <sup>b</sup>	-	43 <sup>d</sup>
10	MMCUS	89 <sup>b</sup>	129 <sup>b</sup>	2.55 <sup>b</sup>	5234.1 <sup>d</sup>	5423.3 <sup>b</sup>	-	37 <sup>c</sup>
11	PSL9404	67 <sup>d</sup>	106 <sup>d</sup>	2.05 <sup>c</sup>	4677.3 <sup>e</sup>	5251.8 <sup>b</sup>	3 <sup>b</sup>	38 <sup>e</sup>
12	KL1	89 <sup>b</sup>	129 <sup>b</sup>	2.56 <sup>b</sup>	4332.4 <sup>f</sup>	4932.6 <sup>c</sup>	3 <sup>b</sup>	36 <sup>c</sup>
13	Fararafara (Local Variety)	109 <sup>a</sup>	167 <sup>a</sup>	3.90 <sup>a</sup>	1463.8 <sup>g</sup>	6293.5 <sup>a</sup>	8 <sup>a</sup>	32 <sup>f</sup>

Significant at 0.05 probability level.

Means followed by same letter are not statistically different using LSD at 0.05 probability level.

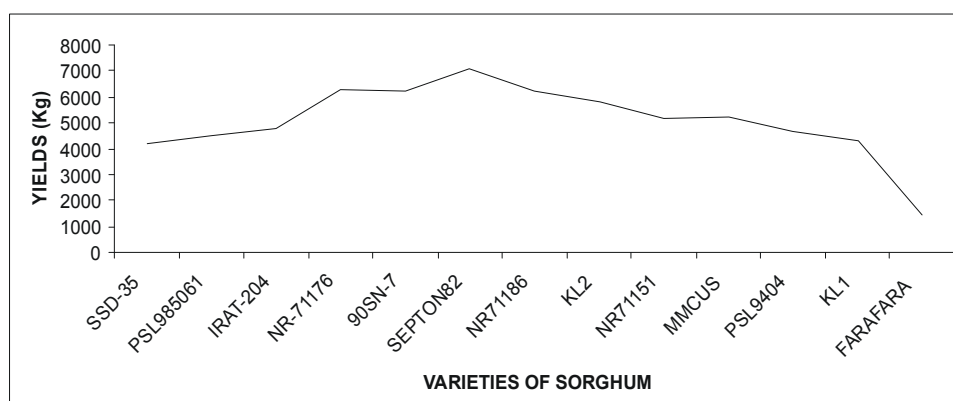
KEY

DTF = Days to flowering

DTM = Days to maturity

PL.Ht= Plant Height (Metres)

Kg/ha = Kilogram per hectare



**Figure 1: Yields of the thirteen varieties of sorghum**

## CONCLUSION

The six genotypes – IRAT-204, 90SN-7, SEPTON-82, NR-71186, KL2, and MMCUS performed well in the grain yield and agronomic indices. These genotypes were resistant to striga weed (IRAT-204 no striga), high yielding (SEPTON-82. 7000kg/ha), matured early (NR71151-103 days) as they can escape drought and with added potential of double cropping in some years. These genotypes are therefore recommended for (i) multiplication and wide-

spread adoption by farmers in Sudan savannah zone of Nigeria, and (ii) further testing in other agro-ecological zones in Nigeria. Tatum, (2009), observed that formal education had positive influence on adoption of farm innovation by farmers in Northern Nigeria. Therefore Government/ Extension agents should organize workshop, seminar and field demonstration on improved sorghum genotypes for farmers in Sudan Savannah zone of Nigeria.

## ACKNOWLEDGEMENT

The author is grateful to International Cereal Research Institute for the Semi-Arid Tropics

(ICRISAT), Kano Station for providing sorghum seeds used for the trial.

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