INNSPUB

International Journal of Agronomy and Agricultural Research (IJAAR)
ISSN: 2223-7054 (Print) 2225-3610 (Online)
http://www.innspub.net
Vol. 19, No. 3, p. 1-8, 2021

RESEARCH PAPER OPEN ACCESS

# Evaluation of some maize (*Zea mays* L.) genotypes for resistance to stem borer (*Chilopartellus* (Swinhoe) infestation under surface irrigation at Takroof, Kassala State, Sudan

**Abdullah E. Yousif[1], Ibrahim E Ibrahim[2], Atif Ibrahim Abuali[*3], Modammad Elnazeer[1], Mohammadein B. Elhassan[3], Elharth H. Bakheet[1]**

[1]Kassla and Gash research Station, Agricultural Research Corporation (ARC), Sudan

[2]*Soba Saline and Sodic Soils Reclamation Research Station, Sudan*

[3]*Environment, National Resources and Desertification Research Institute, National Centre for Research, Sudan*

[3]*Gezira Research Station, Agricultural Research Corporation (ARC) Medani, Sudan*

**Article published on September 30, 2021**

**Key words:** Stem borer, Maize, Resistance, Yield, Yield components

**Abstract**

The field experiments were conducted at Agricultural Research Corporation (ARC) , Kassala and Gash Research Station Farm, Takro of, Sudan. During the two winter seasons (2016/017 and 2017/018) respectively to evaluate some grain maize genotypes for resistance to stem borer and identify the most tolerance of these genotypes to Stem Borer infestation. Thirteen (STB.G1, STB.G2, STB.G3, STB.G4, STB.G5, STB.G6, STB.G7, STB.G8, STB.G9, STB.G10, STB.G11) maize genotypes were used in this study: with two check of maize variety (check. 1(Mugtama45) and ckeck. 2 (Var.113),). The experiments were arranged in Randomized Complete Block design (RCBD) with three replications. The data collected were used in this study were : Germination percentages, plant population, plant height, ear height, ear length, days to 50% Tasselling, days to 50% silking, ear length, ear diameter, cob diameter, number of rows/ear, number of kernels/row, 100 Kernel weight and Yieldkg/ha. Results showed that the most encouraging genotypes (STB.G 11, STB.G10, STB.G 4, STB.G 6 and STB.G8) of maize production at Kassala state were obtained a high value for potential of grain yield (4132, 3723, 3611, 3302 and 3264kg/ha) respectively, and for the most important of yield components. Among the traits considered, the yield (kg/ha) was the most promising as an indicator of tolerance to stem borer infestation.

* **Corresponding Author:** Atif Ibrahim Abuali ✉ abbualii@yahoo.com

## Introduction

Maize (*Zea mays* L.), (2n=20) a diploid crop represents one of the most important cereals. Maize is one of the highest value crops; with multimillion dollar annul contribution to agriculture. The great adaptability and high yielding capacities, and its use as a food, feed and forage crop has led to the possibility of massive scale production of the crop. Maize has developed in its non-food usage comprising a major source of ethanol for fuel in USA, and it was known for its pharmaceutical and medicinal uses.

In addition, maize has occupied the Centre stage in the transgenic plant controversy serving as one of the first food crop with commercialized transgenic varieties. Maize has a highly desirable chemical characteristics, it contains about 0.7% - 1.3% ash, 3.2% - 7.7% fats, 7.7% - 14.6% protein, 0.80% - 2.32% crude fiber and 69.6% - 74.54% carbohydrates, as reported Ullah *et. al.,* (2010). About 50% to 55% of total maize production is used as food in developing countries Kumar *et. al.,* (2007). Maize is a monoecious plant with male and female flowers separated on the same plant. It is a highly cross-pollinated crop (95%) although self-pollination may reach up to 5% (Poehlman and Sleper (1995), Due to its high cross pollination characteristics, maize is grown in a wide range of environments. It ranks third worldwide in importance after wheat *(Triticum* spp.) and rice (*Oryza* spp.) (FAO.1995). Maize was probably originated in the Highland of South Mexico and Central America (Poehlman, 1997). 1995). Global production of maize reached 622 million metric tons in 2003-2004 (USDA-FAS, 2005). Maize is an alien crop to the Sudan. Recently, special emphasis had been given to increase maize production for bread and animal production (Nour, 2001). Large investments in maize production in Sudan sparked by Arab countries and local investors to produce maize grains for poultry and dairy production (Salih *et al.*, 2008). Maize is grown along the River Nile Banks, Toker and Gash Deltas as flush irrigation crop, in Blue Nile, Gedarif and Nuba mountains as rain fed crop. The increase in demands for food due to global population growth constitutes a challenge to researchers, which should estimate them to work hard to satisfy this need. Hence, The National Maize Research Program of ARC (Agricultural Research Corporation) released different genotypes of maize to be grown in various environments. However, the objectives of this study were to evaluate some genotypes and landraces resistance to stem borer under Kassala State condition, Sudan.

## Materials and methods

Thirteen genotypes of maize were used in this study. Eleventh of them were collected from different part of Sudan and two were local open pollinated varieties. The fields experimental were conducted during two consecutive seasons 2016/017 and 2017/018, respectively, at Agricultural Research Corporation (ARC), Kassala and Gash Research Station Farm, Takro of, Kassala State, Sudan. The location is at latitude 34° 12′ and 36° 57′ East, and between longitude 14°12′ and 17°12′ North. The river Gash irrigates about 30,000 ha. There are two types of soil known locally as (lebad) and (padobe) , labade soil is rich in silt and constitute major soil type of Gash. Both experiment Thirteen genotypes of maize were used in this study (STB.G1, STB.G2, STB.G3, STB.G4, STB.G5, STB.G6, STB.G7, STB.G8, STB.G9, STB.G10, STB.G11, check. 1(Mugtama45) and ckeck. 2(Var.113)). Elevent of them were collected from different part of Sudan and two were local open pollinated varieties. Randomize Complete Block design with three replications were used in this study. All cultural practices were applied in both locations as recommended by ARC Each genotype was represented by a plot of two rows of five meter length, no fertilizer and/or pesticide were applied. Hand weeding was executed at 2$^{nd}$, 6$^{th}$ and 8$^{th}$ weeks after planting to kept plot free of weeds.

From five randomly selected plants of each plot for data collection. Field germination percentage , Plant stand, Days to 50% tasseling, Days to 50% silking, Plant height (cm), Ear height(cm), Ear length (cm), Ear diameter(cm), Cob diameter(cm), Number of rows/ear, Number of kernel/row, 100 Kernels weight (g) and Grain yield (kg/ha) were collected from two locations .Data were Statistically analysis by using SAS 2004 Computer.

Based program, analysis of variance for each variable was attained and means were separated using Duncan Multiple Range Test, transformation was made when needed. Correlated yield with traits, according (Gomez and Gomez, 1984).

*Lay out of experiment*

Randomized Complete Block Design (RCBD) with four replicates was used in the field experiments. Each batch of the genotypes was subjected to natural infestation by the spotted stem borers in the field. Each genotype was represented by a plot of two rows, five meter long with spacing of 20 × 80cm between holes and rows.

*Data collection*

Data on the following parameters were collected; Field germination percentage , Plant stand, Days to 50% tasseling, Days to 50% silking, Plant height (cm), Ear height (cm), Ear length (cm), Ear diameter (cm), Cob diameter (cm), Number of rows/ear, Number of kernel/row, 100 Kernels weight (g) and Grain yield (kg/ha).

*Statistical Analysis*

All collected data of each season was analysed separately, and then combined, analysed for the two seasons using (SAS, 2004) Computer Based program. Analysis of variance for each variable was attained and means were separated using Duncan Multiple Range Test, transformation was made when needed. Phenotypic Correlated between yield and other traits was conducted according (Gomez and Gomez, 1984).

**Results and discussion**

*Germination Percentage*

In Takro of site, analysis of variance revealed that, there were non-significant difference was detected among genotypes and at both seasons for germination percentages. In the first season 2016, the germination percentage was ranged between (93.3 to 99.5%) for STB.G.1 and STB.G.10 respectively while, in the second season 2017 the germination percentage ranged between (96.1 to 99%) for (Mugtama45) and (STB.G.4) respectively. The combined analysis of variance for germination percentage of all tested genotypes for the two seasons, showed that, there were non-significant differences among genotypes and their interaction, with respect to the seasons there were significant differences observed.

*Plant Stand*

Regarding, plant stand in Takro of site, the thirteen maize genotypes showed significant differences for the first season 2016, with the mean ranged between (106–250) plants per hectare for (STB.G.4, STB.G.8 and STB.G.10) and 71,875 for Var.113 in 2016 (Table 1), while in the second season 2017 there were non-significant difference observed and the mean ranged between 133 -594 plants per hectare for (STB.G.8) and 117,578 for STB.G.4 (Table 2). The combined analysis of variance of the two seasons at Takro of area showed that, significant differences were observed for the seasons. Whereas, non-significant differences was detected among genotypes and for their interaction with seasons for plant stand (Table 3).

*Days 50% to tasselling*

In Takro of site, significant difference was observed among maize genotypes for days to 50% tasseling in the first season 2016 which was ranged between 58 and 66 day for Var.113 and STB.G.5 respectively, while non- significant difference was recorded for the same genotypes in the second season.

Combined analysis of variances showed that, the days to 50% tasselling were significantly different among maize genotypes and their interaction with season was significant as showed in (Table 3).

*Days to 50% Silking*

At Takro of sites, combined analysis for days to 50%silking showed that, non- significant difference was detected among the genotypes, but highly significant difference was observed between the two seasons, also non-significant difference was observed for interaction among genotypes and seasons (Table 1 and 2).over all means across the two seasons was range from 63 to 73 days (Table 3).

*Plant height (Cm)*

In Takro of site, for both seasons there was non-significant differences among genotypes, with respect

to plant height, which ranged between 146.6cm for STB.G.4 to 102.5cm for Var.113 in the first season and from 191.3cm for STB.G.11 to 126.3cm for STB.G.5 in the second season, the obtained results for the combined analysis are highly significant differences between seasons (Table 1).

**Table 1.** Means of some traits for the experiment of screening some maize genotypes for yield during the first season 2016 (Tacroof ,Kassala, Sudan).

| Entries | Germ% | Plt Pop /ha | Ph (cm) | Earh(cm) | Earn | Earl(cm) | Eard (cm) |
|---|---|---|---|---|---|---|---|
| STB.G.1 | 93.3 | 100000ab | 125a | 56ab | 128125a | 12.2ab | 3.3ab |
| STB.G.2 | 97.6 | 79688 ab | 122.1a | 28.5c | 73438ab | 13.2a | 3.4a |
| STB.G.3 | 98.1 | 89063ab | 124.98a | 51.5b | 87500Bab | 13.2a | 3.4a |
| STB.G.4 | 98.6 | 106250a | 147.6a | 54.5ab | 109375ab | 13.5a | 3.3ab |
| STB.G.5 | 99.4 | 92188Ba | 130.8a | 60.3a | 123438a | 13.6a | 3.2ab |
| STB.G.6 | 96.2 | 90625ab | 128.6a | 54.8ab | 9062ab | 12.8ab | 3.5a |
| STB.G.7 | 96.2 | 92188ab | 105.1a | 50b | 85938 ab | 12.4ab | 3.4a |
| STB.G.8 | 99.1 | 106250a | 123.0a | 52.8ab | 106250 ab | 12.8ab | 3.4a |
| STB.G.9 | 97.6 | 90625ab | 136.6a | 52.8ab | 98438 ab | 13.6a | 3.4a |
| STB.G.10 | 99.5 | 106250a | 115.1a | 50.3b | 118750 a | 13.7a | 3.5a |
| STB.G.11 | 97.6 | 92188ab | 134.9a | 54.5ab | 87500ab | 13.3a | 3.5a |
| check.1(Mugtama45) | 94.3 | 82813ab | 109a | 56.7ab | 71875ab | 12.7ab | 3.1ab |
| ckeck.2(Var.113) | 97.4 | 71875b | 102.5a | 32c | 51563b | 10.6b | 2.8b |
| S E ± | 0.5 | 2925.95 | 0.27376 | 1.4 | 5407.82 | 0.2 | 0.05 |
| CV | 3.9 | 21.8 | 20.6 | 9.9 | 37.8 | 10.8 | 10.5 |
| Sig | 0.7 (ns) | * | ns | ** | ** | * | * |

Germ: germination%, Plt Pop/HA: number of plants/hectare, PH (cm): plant height, earH (cm): ear height, earn: ear number, earL (cm): ear length and ear Dcm: ear diameter.

**Table 1.** Continued…

| Entries | Tess (day) | Silk (day) | Cobd (cm) | NR/Ear | ke/r (no) | Kerw (gms) | Yield (kg/ha) |
|---|---|---|---|---|---|---|---|
| STB.G.1 | 62ab | 66a | 2.1bc | 12.9a | 25.8a | 12.8de | 991.9b |
| STB.G.2 | 64 ab | 66a | 2.3ab | 14.2a | 28.6a | 13.5dec | 1553.3ab |
| STB.G.3 | 62ab | 65a | 2.4a | 13.5a | 25.4a | 18.4ab | 1966.6ab |
| STB.G.4 | 61bc | 68a | 2.5a | 14.5a | 26.5a | 16.8Badc | 2640.5a |
| STB.G.5 | 66 a | 70a | 1.98dc | 13.3a | 25.7a | 17.6bac | 1568.0ab |
| STB.G.6 | 62 Bac | 67a | 2.2bac | 14.05a | 27.5a | 16.7Bdac | 2659.5 a |
| STB.G.7 | 62 0ab | 66a | 2.3bac | 13.2a | 24.2a | 18.2bac | 2057.8 ab |
| STB.G.8 | 62 ab | 67a | 2.4ab | 13.6a | 26.6a | 16.5Bdac | 2088.8 ab |
| STB.G.9 | 65 0ab | 70a | 2.2Bac | 13.3a | 27.7a | 12.9de | 1723.4 ab |
| STB.G.10 | 64 ab | 69a | 2.3ab | 13.6a | 27.4a | 20.1a | 2914.1a |
| STB.G.11 | 63 ab | 70a | 2.3ab | 13.6a | 28.4a | 16.7bdac | 2543.6a |
| Local check. 1(Mugtama45) | 62 0ab | 66a | 2.3ab | 12.9a | 26.3a | 13.5bdec | 2375.9 ab |
| Local ckeck.2(Var.113) | 58 c | 62a | 1.8d | 14.4a | 20.8a | 6.6E | 1025.6b |
| Standard Error ± | 0.4 | 0.1 | 0.03 | 0.3 | 3.2 | 0.5 | 135.7 |
| Coefficient of Variation | 4.2 | 1.4 | 8.1 | 10.7 | 32.1 | 17.9 | 43.7 |
| Sig | * | 0.4 ns | * | ns | ns | ** | * |

*Means followed by the same letter in the same column were not significant different according to Duncan Multiple Range Test (DMRT) at 0.05 level of prob. 50% tasseling (tess), 50% silking (silk), cob diameter (cobd), number of rows per cob (rows), number of kernels per row (nker), 100kernel weight (kerw), and Seed yield.

These results are in agreement with Shah *et al.* (2000), who reported significant differences of amount of variability for different morphological traits. According, to the results, STB.G.4, STB.G.11, STB.G.5 and STB.G.9 were highest genotypes in this study for this trait.

*Ear height (Cm)*

At Takro of site, in the first season 2016, there were highly significant differences observed for ear height among genotypes. The highest ear height was (56.7cm) recorded for the genotype STB.G. mug. While, the lowest one was 28.5cm obtained by the genotype STB.G.2. In the second season 2017.

The ear height differences among tested genotypes was statistically not significant (Tables 1 & 2). Combined analysis of variance of this trait showed that, highly

significant differences were detected for the seasons and genotypes. On the other hand, the interaction between the genotypes and seasons was a significant too.

*Number of ears/plant*

At Takro of location, and in the first season 2016, the number of ears/plants hewed significant differences among genotypes.

The number of ears ranged between (128125 and 51563/ hectare) for STB.G.1 and STB.G.var.113, respectively. While in the second season 2017the number of ears was (259375 and 77969 /hectare) for STB.G.8 and STB.G.10 respectively. Combined analysis of variance, showed that highly significant differences between entries and their interaction with seasons but non-significant differences were observed on number of ears.

**Table 2.** Means of some traits from the experiment of screening of some maize genotypes for yield atTakroof, Kassala, Sudan in season2017.

| Entries | Germ (%) | Plt Pop/ha | Earh (cm) | Ph (cm) | Eard (cm) | Earl (cm) | Earn(no) |
|---|---|---|---|---|---|---|---|
| STB.G.1 | 97.6a | 129688a | 72a | 178a | 3.5a | 13.7250a | 120833(336)a |
| STB.G.2 | 98.2a | 129297a | 69a | 166.7a | 3.6a | 14.2000a | 93490(334)a |
| STB.G.3 | 98.5a | 128906a | 74a | 185a | 3.6a | 13.9250a | 103125(344)a |
| STB.G.4 | 99a | 117578a | 72a | 182.7a | 3.4a | 14.5500a | 100521(299)a |
| STB.G.5 | 98.7a | 132813a | 49.3a | 126.3a | 3.4a | 14.9000a | 125260 (352)a |
| STB.G.6 | 98.1a | 128906a | 72a | 174a | 3.5a | 13.4500a | 104167(338)a |
| STB.G.7 | 97.5a | 128516a | 75.7a | 179.3a | 3.6a | 13.9750a | 77969 (252)a |
| STB.G.8 | 98.6a | 133594a | 78.3a | 182.3a | 3.6a | 14.1500a | 259375(542)a |
| STB.G.9 | 98.5a | 131250a | 73.7a | 190.7a | 3.5a | 14.0750a | 108073(341)a |
| STB.G.10 | 97.6a | 131250a | 71.7a | 154.3a | 3.5a | 13.8250a | 97396(270)a |
| STB.G.11 | 98.8a | 131250a | 70.3a | 191.3a | 3.6a | 14.0750a | 84896(285)a |
| Local check.1(Mugtama45) | 96.1a | 127734a | 65.0a | 168.5a | 3.4a | 14.1000a | 85938 (312)a |
| Local ckeck.2(Var.113) | 96.2a | 127344a | 68.7a | 161.7a | 3.6a | 12.9125a | 81510(330)a |
| Standard Error ± | 2.4 | 3539.13 | 2.3 | 5.5 | 0.04 | 0.4 | 5905.3 |
| Coefficient of Variation | 42.4 | 13.6 | 21.4 | 23.7 | 23.2 | 13.3 | 109(36.3) |
| Sig | ns | ns | ns | ns | ns | 0 ns | 0 ns |

Germ: germination %, ptst/No: number of plants/hectare, ptht/cm: plant height, earh/cm: ear height, earn/no: ear number, earl/cm: ear length and eard/cm: ear diameter.

**Table 2.** Continue…

| Entries | Tess (day) | Silk (day) | Cobd (cm) | Rows (no) | Nker (no) | Kerw (gms) | Yield (kg/ hectar) |
|---|---|---|---|---|---|---|---|
| STB.G.1 | 62 a | 70 a | 2.3 a | 14 a | 28.5bac | 12.6 a | 2138.7 a |
| STB.G.2 | 62 a | 70 a | 2.3 a | 15 a | 31bac | 13 a | 2571.6 a |
| STB.G.3 | 61 a | 70 a | 2.4 a | 14 a | 29.7bac | 15 a | 2754.8 a |
| STB.G.4 | 62 a | 71 a | 2.4 a | 14 a | 33.3 a | 14 a | 2749.9 a |
| STB.G.5 | 63 a | 70 a | 2.2 a | 13 a | 30bac | 15.1 a | 2735.2 a |
| STB.G.6 | 60 a | 68 a | 2.3 a | 14 a | 28.6bac | 15 a | 3169.6 a |
| STB.G.7 | 62 a | 71 a | 2.3 a | 14 a | 31bac | 14.1 a | 2405.9 a |
| STB.G.8 | 61 a | 70 a | 2.4 a | 14 a | 32ba | 13..6 a | 2937.0 a |
| STB.G.9 | 62 a | 70 a | 2.3 a | 14 a | 26.5bac | 12.1 a | 2535.5 a |
| STB.G.10 | 64 a | 73 a | 2.3 a | 13 a | 32.7ba | 15.7 a | 2408.2 a |
| STB.G.11 | 63 a | 71 a | 2.3 a | 13 a | 22.8c | 13.6 a | 2230.8 a |
| LOCAL CHECK.1 (MUGTAMA45) | 62 a | 72 a | 2.3 a | 14 a | 30.7bac | 13.4 a | 2584.5 a |
| LOCAL CKECK.2 (VAR.113) | 58 a | 63 a | 2.2 a | 13 a | 23.5ba | 14.1 a | 2231.6 |
| STANDARD ERROR ± | 1.7 | 1.9 | 0.4 | 0.4 | 0.9 | 133.9 | 25.1 |
| Coefficient of Variation | 4.9 | 8.2 | 8.2 | 8.2 | 15.6 | 24.5 | 35.2 |
| Probability | 0.08 | 0.1 | 0.5 | 0.6 | 0.02 | 0.7 | 0.9 |

*Means followed by the same letter in the same column were not significant different according to Duncan Multiple Range Test (DMRT) at 0.05 level of prob. Tess: 50% tasseling, silk: 50% silking, cobd: cob diameter, rows: number of rows per cob, nker: number of kernels per row, kerw: 100 kernel weight ,and yieldkg/ha.

*Ear length (cm)*

In Takro of site, significant differences were observed in ear length of the different tested genotypes for the season 2016, while in 2017 non-significant was showed by their interaction (Table 1, 2 & 3).

*Ear diameter*

Measuring of ear diameter at Takro of site proved significant differences (P> 0.05) among genotypes for the first 2016 season, while in the second season 2017 non-significant differences and also for interaction of season with genotypes (Table 1, 2 & 3 ).

**Table 3.** Means of some traits from the experiment of screening of some maize genotypes for resistance to stem borer at Takro of, Kassala, Sudan in season 2016 and 2017 (interaction).

| Entries | Germ (%) | Plt pop/ha | Ph (cm) | Earh (cm) | Earn (no) | Earl (cm) | Eard (cm) |
|---|---|---|---|---|---|---|---|
| STB.G.1 | 98a | 129688a | 160bac | 65.5a | 120833(331)a | 13.7ab | 2.5a |
| STB.G.2 | 98a | 129297a | 148.1bac | 51.5b | 93490(282)ba | 14.2ab | 3.5a |
| STB.G.3 | 98a | 128906a | 154.5bac | 67.9a | 103125.9304)ab | 14Ba | 3.6a |
| STB.G.4 | 99a | 117578a | 170.2ab | 67.6a | 100521(327)ab | 14.6ab | 3.4a |
| STB.G.5 | 99a | 132813a | 166.4ab | 69.8a | 125260(305)ab | 14.9a | 3.4a |
| STB.G.6 | 98a | 128906a | 151.6bac | 66.6a | 104167(302)ab | 13.5ab | 3.5a |
| STB.G.7 | 97a | 128516a | 146.8bc | 66.5a | 77969(306)ab | 14Ba | 3.6a |
| STB.G.8 | 99a | 133594a | 156.6bac | 70.5a | 259375(331)a | 14.2ab | 3.6a |
| STB.G.9 | 99a | 131250a | 164.8ab | 66.1a | 108073(312)ab | 14.1ab | 3.5a |
| STB.G.10 | 98a | 131250a | 138.2c | 65.8a | 97396(327)a | 13.8ab | 3.5a |
| STB.G.11 | 99a | 131250a | 167.9ab | 64.6a | 84896(308)ab | 14.1ab | 3.6a |
| Local check.1(Mugtama45) | 96a | 127734a | 147.7bac | 66.3a | 85938(292)ab | 14.1ab | 3.4a |
| Local ckeck.2(Var.113) | 96a | 127344a | 150.2bac | 56.4b | 81510(269)b | 13b | 24.1a |
| SE± | 0.30 | 1658.22 | 3.47 | 1.63 | 12027.34 | 0.18 | 0.08 |
| Coefficient of Variation | 3.1 | 12.1 | 12.5 | 10.7 | 12.4 | 10.7 | 4.3 |
| sig | ns | ns | ns | ** | ** | ns | ns |

*Means followed by the same letter in the same column were not significant different according to Duncan Multiple Range Test (DMRT) at 0.05 level of prob. Germ: germination%, ptst/No: number of plants /hectare, ptht/cm: plant height, earh/cm: ear height, earn/no: ear number, earl/cm: ear length and eard/cm: ear diameter.

**Table 3.** continue.

| Entries | Tess (day) | Silk (day) | Cobd (cm) | Rows (no) | Nker (no) | Kerw (gms) | Yield (kg/hectar) |
|---|---|---|---|---|---|---|---|
| STB.G.1 | 62a | 70a | 2.3bac | 14a | 29a | 12.6bc | 2138.7(44.2)b |
| STB.G.2 | 62a | 70a | 2.3bac | 15a | 30a | 13bc | 2571.6(47.4)b |
| STB.G.3 | 61a | 70a | 2.4a | 14a | 28a | 15.1ab | 2754.8(48.3)b |
| STB.G.4 | 62a | 71a | 2.4a | 14a | 30a | 14bac | 2749.9 (51.9)ab |
| STB.G.5 | 63a | 70a | 2.2c | 13a | 30a | 15.1ab | 2735.2(45.5)b |
| STB.G.6 | 60ab | 68a | 2.3bac | 14a | 29a | 15ab | 3169.6(51.4)ab |
| STB.G.7 | 62a | 71a | 2.3bac | 14a | 29a | 14bac | 2405.9(49.3)b |
| STB.G.8 | 61a | 70a | 2.4ab | 14a | 31a | 13.6bac | 2937(49.4)b |
| STB.G.9 | 62a | 70a | 2.3bac | 14a | 30a | 12.1c | 2535.5(48.9)b |
| STB.G.10 | 64a | 73a | 2.3bac | 13a | 29a | 15.7a | 2408.2(50.4)b |
| STB.G.11 | 63a | 71a | 2.3bac | 13ab | 30a | 13.6bac | 2230.8(54)ab |
| Local check.1(Mugtama45) | 62a | 72a | 2.3bac | 14a | 29a | 13.4bac | 2584.5(66.3)a |
| Local ckeck.2(Var.113) | 58b | 63b | 2.2bc | 12b | 24b | 14bac | 2231.6(39.5)b |
| STANDARD ERROR ± | 0.31 | 0.59 | 0.02 | 0.16 | 0.48 | 0.33 | 136.06 |
| Coefficient of Variation | 4.4 | 7.1 | 7.9 | 11.3 | 13.2 | 16.2 | 35.5 |
| Probability | 0.02 | 0.02 | 0.1 | 0.5 | 0.9 | 0.9 | 0.07 |

*Means followed by the same letter in the same column were not significant different according to Duncan Multiple Range Test (DMRT) at 0.05 level of prob. Tess: 50% tasseling, silk: 50% silking, cob D: cob diameter, rows: number of rows/cob, NKer/row: number of kernels per row, kerw: 100kernel weigh.

*Cob diameter*

(Tables 2 & 3), presented the results of cob diameter for the tested genotypes at Takroof site. Significant differences (P> 0.05) were observed among genotypes for thecob diameter on the first season 2016. Whereas, non-significant differences were detected for the same trait in the second season 2017, on the other hand the combined analysis revealed that non-significant was

recored for their interaction. The cob diameter range was between 2.2 to 2.4cm.

*Number of rows /ear*

In Takro of, number of rows/ear among genotypes was statistically not significant for both seasons and ranged between 12 and15 (Table.3).

*Number of kernels/row*

In Takro of, during the first season 2016, the number of kernels/row showed that, non-significant difference was recorded among the tested genotypes. Moreover, in the second season 2017 the analysis of variance relived that, significant difference was found (P>0.05) among the genotypes also. Generally, means were ranged between 21 to 29 for Var.113, STB.G.2 and between 23 to33 for STB.G.11, STB.G.4 for both consecutive seasons, respectively.

*Hundred Kernels weight (g)*

At Takro of site in 2016, the tested genotypes showed that, significant difference for the weight of 100 kernels (P<0.01). The highest weights of 100 kernels were attained by the genotype STB.G.10 (20.1 grams) while the smallest weight was obtained by var.113 (6.6 grams).

*Grain yield (kg/ha)*

In Takro of site, the analysis of variance revealed that, significant differences among genotypes for grain yield in the first season 2016 and means ranged between 2914kg/ha to 992kg/ha for STB.G.10 and STB.G.1 respectively. Non-significant differences was observed between tested genotypes in the second season 2017, means ranged from 3170kg/ha to 2139 (kg/ha) for STB.G.6 and STB.G.1, respectively. For this trait, combined analysis of variance, revealed that non-significant difference was obtained among the genotypes and for two seasons.

**Conclusions**

This study revealed that, maize can be produce under normal irrigation system at Kassala state. Takro of experimental farm soil was considered as a real Gash soil which is very fertile, and the cost of production is very cheap when compared with other production areas in Kassala state and Sudan. Generally, it seems to be the most encouraging genotypes to be used for maize production at Kassala state were STB.G.4, STB.G.6, STB.G.8, STB.G.10 and STB.G.11.According to the highest potential grain yield and some other important yield components and to some extend its tolerance to stem borer infestation.

**Recommendations**

The genotypes (STB.G.4, STB.G.6, STB.G.8, STB.G.10 and STB.G.11) could be used in a commercial production under Kassala environment. In this study percentage of infestation caused by stem borer is correlated negatively with grain yield so control measures should be applied in order to reduce damages on plants and increase productivity. Studies dealing with optimum sowing dates, plant population densities, water regime, intercropping, fertilization and survey to determine pests and disease should be undertaken to release complete package of information for local farmers and businessmen**.**

**Acknowledgement**

Our heartfelt appreciation and gratitude to the Academy of Science, Agricultural Council for Research Corporation, and our thankfulness also extended to the Staff of Kassala and Gezira Research Stations, Sudan, for their support and valuable efforts in analysing the data, encouragement provided and valuable contribution during this study.

**References**

**AOAD**. 2008. Arab Organization for Agricultural Development Statistics Yearbook, Vol. 28 Khartoum**.**

**FAO.** 1995. Food And Agriculture Organization. (1995). Production Year book.Vol. 49. FAO, Rome Italy.

**Gomez KA, Gomez AA.** 1984. Statistical procedures for agricultural Research. John Wiley and sons, Inc. London, UK (2nd Edtn) 13-175.

**Nour AM.** 2001. Screening maize (*Zea mays*) genotypes for striga hermonthica resistance in Sudan: a three -year progress report18:54 Seventh Eastern and Southern Africa Regional Maize Conference 11th-15th February, 2001. pp. 179-182.

**Poehlman JM, Sleper DA.** 1995. Breeding Filed Crops 4th edition. Iowa State University Press, Ames, USA.

**Salih MA, Ali SE, Babiker EA, Ali NA.** 2008. Effects of nitrogen source on yield and nitrogen use efficiency of two maize (*Zea mays L.*) varieties. Sudan Journal of Agricultural Research **12,** 11-22.

**Thimothy DH, Harvey PH, Dowswell CR.** 1988. Development and spread of improved maize varieties and hybrid in developing countries. Bureau for science and technology. Agency for International development, Washington, D.

**USDA- FAS.** 2005. United States Department of Agriculture, Foreign Agricultural Service World Agricultural Production Circular Series WAP 02- 05. USDA- FAS, Washing to.