International Scholars Journals

African Journal of Agronomy ISSN 2375-1185 Vol. 4 (7), pp. 260-263, July, 2016. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

Performance of different maize (*Zea mays L.*) genotypes under field conditions

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Accepted 15 June, 2016

Nine open-pollinated maize genotypes were evaluated for two seasons in 2007/08 and 2008/09 at the experimental farm, University of Sudan Science and Technology, Shambat. The study was conducted to assess the magnitude of genetic variability in maize genotypes for vegetative, yield and yield components under field conditions. Randomized complete block design with three replications was used for laying out the experiment. The results showed that there were non-significant differences-1 for most character under study, except the plant height, stem diameter, number of rows cob and ear length in the first season and for days until 50% flowering and 100-seed weight in the second season. Frantic genotype had maximum average seed weight (426.8g) in the first season while Huediba-1 had maximum seed weight (590.2g) in the second season. Giza 2 genotype had maximum grain yield (0.821 ton/ha) in the first season, while maximum grain yield ton/ha was recorded in Panama (0.456 ton/ha). Data recorded for heritability showed that stem diameter had maximum heritability (67.02%) in the first season while the maximum heritability (84.57%) was recorded for days to 50% flowering in the second season. The present study revealed considerable amount of diversity among the tested populations which could be manipulated for further improvement in maize breeding.

Keywords: Genetic, variability, genotypes heritability, maize.

INTRODUCTION

Maize (Zea mays L.) ranks as one of the world's three most important cereal crops. It is cultivated in a wider range of environments than wheat and rice because of its greater adaptability (Koutsika-Sotiriou, 1999). It is grown at latitudes varying from the equator to slightly north and south of latitude 50^0, at meter elevation from sea level to over 3000 meters above sea level under heavy rain-fed and semi-arid conditions, and cold and very hot climates. In Sudan, maize is considered a minor crop and it is normally grown in Kordofan, Darfur and Southern States or in small irrigated areas in the Northern states, with average production of about 0.697 ton/ha (FAO, 2005). In the traditional farm of Sudan, the low productivity of maize was attributed to the low yielding ability of the local open – pollinated cultivars that are normally grown and the greater sensitivity of the crop to water stress (Saliem, 1991). Recently, there has been an increasing interest in developing maize production in Sudan. However, work on maize improvement in Sudan is limited and only three cultivars have been released. These are var.113, a selection from local material; Giza 2 and Mogtamaa 45.

Genetic improvements in traits of economic importance, along with maintaining sufficient amount of variability are always the desired objectives in maize breeding programs (Ali, 1991; Hallauer and Miranda, 1988). Grzesiak, (2001) observed considerable genotypic variability among various maize genotypes for different traits. Ihsan et al. (2005) also reported significant genetic

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Table 1. Name, description and average number of days to 50% flowering for the nine maize genotypes used in the present study

No.	Name of genotype	Description	Days to 50% flowering
1	Frantic	Received from ARC	62.30
2	Huediba 1	Open –pollinated variety improved by ARC	60.84
3	Balady	Local variety	50.84
4	Huediba 2	Open –pollinated variety improved by ARC	59.65
5	Giza 2	Introduced by ARC from Egypt	64.30
6	Mogamaa45-1	Introduced by ARC from Egypt	62.64
7	Var 113	Local material selected by ARC	58.00
8	Mogtamaa45-2	Introduced by ARC from Egypt	59.15
9	Panama	Introduced and released by ARC	61.50

ARC: Agricultural Research Corporation, Sudan.

Table 2. Analysis of variance mean squares for nine vegetative traits and some yield components of maize genotypes evaluated during 2007/08 and 2008/09 seasons.

Character	ANOVA Means Square			
	Season 2007/08	CV%	Season 2008/09	CV%
Plant height (cm)	402.16*	6.31	0.207 ns	14.4
Days to 50%floweing	273.63**	3.30	48.833**	3.97
Stem diameter (cm)	1.113**	5.61	0.698 ns	12.94
Number of seeds/ cob	2911.03 ns	13.08	26230.47 ns	16.72
Number of rows/cob	1.24**	3.73	1.025 ns	6.64
100- seed weight (g)	1.61 ns	9.24	14.57*	13.71
Seed weight (g)	105.05 ns	17.43	706.00 ns	28.46
Ear length (cm)	2.89*	7.35	3.606 ns	9.87
Gr ain yield (ton/ha)	2.37 ns	16.73	0.024 ns	29.74

CV%: Coefficient of variation. *: significant at the 0.05 probability level; **: significant at the 0.01 probability level; ns: non-significant.

differences for morphological parameters in maize genotypes.

The objectives of the present study are to evaluate the performance of different maize genotypes under field conditions and to assess the magnitude of diversity among the characters.

MATERIALS AND METHODS

Nine open-pollinated maize genotypes (Table 1) were evaluated at Shambat (15° 30'N; 32° 31' E) during two consecutive seasons of 2007/08 and 2008/09 under irrigation conditions. A randomized complete block design with three replications was used for laying out the experiment in the field. Each genotype was grown in four rows, five meters long. Seeds were sown manually in holes along the ridges at a rate of three seeds/holes and then thinned to two plants/hole three weeks after sowing. Spacing was 20 cm between holes and 70 cm between ridges. Sowing dates were July 29th for the first and August 2nd for the second seasons respectively. At sowing, 85 kg/ha of urea was applied. Weeding was carried out by hand hoeing two time for each seasons. Data were recorded on eight traits, namely plant height, days to 50% flowering, stem diameter, number seeds/cob, number of rows /cob, 100-grain weight, seeds weight, ear length and grain yield (ton/ha). Analysis of variance of the data was carried out according to the procedure described by Gomez and Gomez (1984) for each season separately and broad sense heritability values as suggested by Johnson et al. (1955).

RESULTS AND DISCUSSION

The analysis of variance mean squares releaved significant differences among maize genotypes for most of the traits measured in both seasons (Table 2). This variation could be attributed to genetic and environmental effects. Moreover, the results revealed highly significant differences among the mean values for most of the traits,

Table 3. Genotypic coefficient of variation, phenotypic coefficient of variation and heritability for nine traits evaluated in diferent maize genotypes during tw

Character	Season 2007/08			Season	
	Phenotypic - ^{2}Ph	Genotypic - σ^2g	Heritability - h^2	Phenotypic - ^{2}Ph	Genotypi
Plant height (cm)	274.70	128.73	46.86	0.09	0.012
Days to 50% floweing	13.83	10.19	73.63	39.16	33.13
Stem diameter (cm)	0.48	0.32	67.02	0.18	0.109
Number of seeds/ cob	2,911.03	423.67	14.56	2.49	0.684
Number of rows/cob	6.35	1.78	28.00	6,269.23	2,254.09
100- seed weight (g)	2.64	-0.52	-19.53	449.96	128.02
Seed weight (g)	135.53	-15.24	-11.24	8.88	1.54
Ear length (cm)	1.70	0.59	34.68	1.49	0.57
Grain yield (ton/ha)	2.67	-0.15	-5.62	0.017	0.004

Table 4. Mean yield and growth traits for the investigated maize genotypes evaluated during the growing seasons of 2007/08.

Genotypes	Plant height		Days to flowering (50%)		Stem diameter		Number of seeds		Number of seed rows		Ear length (cm)		See (g)
	2007/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/08	08/09	07/0
Mogtema 45,1	198.6	186	60.67	64.6	7.30	6.3	70.49	67.44	18.53	21.76	14.77	14.3	375
Frantic	187.2	190	58.33	66.3	7.25	6.5	78.12	84.11	19.37	21.47	15.91	13.4	425
Huediba 1	195.3	230	60.67	61.0	6.96	7.0	62.23	82.64	17.83	22.39	13.57	13.2	384
Panama	181.4	271	61.00	62.0	6.92	6.3	70.55	76.42	19.70	19.57	13.70	15.2	380
Huediba 2	177.1	121	53.00	66.3	5.96	6.1	64.76	51.01	19.67	18.00	14.00	12.9	349
Giza 2	181.6	186	62.33	66.3	8.30	6.0	80.71	48.87	19.23	20.25	15.91	12.2	426
Balady	203.7	152	54.67	47.0	6.77	6.5	67.47	47.48	19.30	16.24	13.17	13.1	347
Mogtema 45,2	187.8	182	56.00	62.3	7.16	7.0	71.53	57.02	19.00	20.78	14.07	15.7	397
Var 113	211.9	162	55.00	61.0	6.99	6.4	67.98	52.44	20.40	18.32	14.17	15.6	345
Mean	191.6	180	57.96	62	7.07	6.1	70.42	63.04	19.23	19.86	14.36	15.34	381
LSD	162.0	157.2	48.67	52.13	5.97	5.42	61.05	54.06	16.36	16.69	12.17	12.06	402
SE +	6.98	9.96	1.10	0.95	0.23	0.12	7.09	0.28	1.03	0.19	0.61	0.10	328

that is plant height, days to 50% flowering, stem diameter, number of rows/cob and ear length during the first season 2007/08 and for days to 50% flowering and 100-seed weight during the second season 2008/09 (Table 4).

Different researchers have reported significant amount of variab including top-c varieties (Samp

(1995) and Abudeif (2003) indicated significant difference among genotypes for maize character. Our results are in line with those of Grzesiak (2001), who also observed considerable genotypic variability among various maize genotypes. Similarly, Sokolov and Guzhva (1997) reported pronounced variation for different morphological traits among inbred lines. Different hybrids have also been evaluated for morphological and agronomic traits, showing significant amount of variation among the genotypes under studies. Ihsan et al. (2005) and Shah et al. (2000) have reported significant amount of variability for different morphological traits. Mitchell-Olds and Waller (1985) have also reported increased performance of heterogeneous populations over those that resulted from selfing. Such genotypes can help farmers to compensate their inputs, as compared to hybrid cultivars, which demand a strict crop production package.

The results showed that Frantic genotype which has high grain yield (ton/ha) average over two seasons (Table 4) could be recommended for general cultivation under field conditions of Sudan (Low, medium and high estimates of broad sense heritability were found in different plant traits under study (Table 3). Highest heritability estimates were found in days to 50% flowering (79.1%) and by plant height (36.4%). Swamy et al. (1971) Patil et al. (1972) and Singh and Chaudhry (1985) also reported similar findings. They computed high heritability estimates for grain yield /plant, days taken to silking and plant height. Bhalla et al. (1986) also reported high heritability for grain yield/ plant and plant height. Results of the present studies are also supported by Jha and Ghosh (1998).

It can be concluded that, highly significant differences were detected among the genotypes; however, the evaluated genotypes can be used to launch crossing activities, leading to developing high- yielding maize hybrids and synthetic varieties.

ACKNOWLEDGMENT

The authors are grateful to College of Agricultural Studies, Sudan University of Science and Technology for supporting part of this research.

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