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Evaluation of Growth and Yield of Four Maize (*Zea mays* L.) Cultivars Under Northern Sudan Conditions

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ABSTRACT

This study was aimed to evaluate some vegetative and reproductive growth, yield and yield components parameters of Four maize cultivars namely Hudebia-1, Hudeiba-2, Mugtama-45 and Balady. A randomized complete block design with four replications was used to execute the experiment. The experiment was conducted at the Demonstration Farm of the Faculty of Agricultural Sciences – University of Dongola- Sudan (Latitude 19˚ 11˝ N and Longitude 30˚ 29˝ E and altitude 227m ASL) during the summer season 2016. The analysis of variance revealed significant differences among maize cultivars in all vegetative and reproductive growth parameters studied namely. Plant height, stem diameter, number of leaves / plant, days to 50% tasselling, days to 50% siliking and days to maturity. Also , differences among maize cultivars was significant for yield and yield components characters with the exception of number of rows/ cob which exhibited no significant differences, these include cob length, , number of seeds/row, number of seeds/co, 100 seed weight and grains yield. The cultivar Hueiba-2 produced 48% significantly greater yield than Baldy cultivar.

1. Introduction

Maize also name Corn (*Zea mays* L.) is a grain crop that belongs to the family *Poaceae*. The origin of this grain remains unknown, however, many historians believe that maize was first domesticated in Mexico's Tehuacan valley, then introduced to Africa by the Portuguese in the sixteenth century and has become Africa's most important staple food crop (FAO, 2005). Maize is the most important cereal crop in the world after wheat and rice. It has great yield potential and attained the leading position among cereal based on production as well as productivity and that is why it is called "queen of cereals" (Turi *et al.*, 2007). Maize is multipurpose crop, provides food for human, feed for animals and poultry, and fodder for livestock. It is rich source of raw materials for industry. Also, maize is an important source of calories and protein in human lives in many countries of the world and is the main staple food in Africa particularly in eastern Africa (Salami *et al*., 2007). The top ten maize producers in 2016/2017 (production in million metric tons) include United States of America (385), China (219,5), Brazil (91,5), Argentina (37,5), Ukraine (28), India (26), Russia (15,5), South Africa(14,6), Canada (13,2) and Indonesia (10,2) (FAOSTAT, 2017). In the Sudan (117 in the world ranking) , maize "Aish El reef" is the fourth cereal crop after sorghum, wheat and millet. It is cultivated on small scales as subsistent rain fed crop around villages in Nuba mountains, Blue Nile and under irrigation in central and Northern Sudan (Elhassan, 2004). In Sudan, there is strong desire that in years to come maize production will be a real revolution in agriculture; therefore, any research work on maize production will be of a paramount importance (Mukhtar, 2006). The Northern State is characterized by good fertile, suitable climate, in addition to the ground water resource in the Nubian sand stone. In addition, the area is free from diseases and pests compared to other parts of the Sudan. However, generally in the traditional farm of Sudan, the low productivity of maize was attributed to the low yielding cultivars and fertilization. In the Northern State of the Sudan farmers usually concentrate their efforts on the cultivation of winter crops as wheat and faba bean only, while during summer season few areas are cultivated and a large areas left without cultivation, these areas can be used in farming maize for the use as grains and or green fodder, Therefore, this study was conducted to evaluate different maize cultivars grown under Northern State conditions of Sudan.

2. Materials and Methods

Four open pollinated cultivars of maize namely, Hudeiba-1, Hudeiba-2 , Mugtama-45 and Balady were grown at the Demonstration Farm of the Faculty of Agricultural Sciences, University of Dongola- El Seleim- Sudan during the summer season 2016. The Northern State occupies the distant northern part of the Sudan and cited within the desert region with extremely high temperature and radiation in summer and low temperature in winter. In general in Dongola the rainfall is scarce and the wind prevails from the north.

A Randomized Complete Block Design (RCBD) with four replications was used to execute the experiment. The experiment aimed to compare vegetative growth and productivity of four maize cultivars. Maize cultivars

(Hudeiba-1, Hudeiba-2, Mugtama-45 and Balady) was used for the treatment were notified as V1, V2, V3 and V4, respectively. Each Cultivar was grown in four ridges 3meters long at a seed rate of 37.5kg/ha with spacing 20 and 70 cm for intra and inter row spacing, respectively. Planting was done on the second week of March. Three to four seeds were sown per hole and then thinned to one plant three weeks after sowing. The irrigation was applied at an interval of 10 to 12 days and hand weeding was carried out once. Samples were taken randomly from ten plants in the middle of each plot and collected data of vegetative and reproductive growth parameters include plant height, stem diameter, number of leaves / plant, days to 50% tasselling, days to 50% siliking and days to maturity. Yield and yield components characters were cob length, number of rows per cob, number of seeds per row, number of seeds per cob, 1000 seed weight and grains yield. The data were subjected to standard procedure of analysis of variance and then means were separated using least significant difference (LSD) test according to Gomez and Gomez (1984).

3. Result and Discussion

3.1. Performance of cultivars in vegetative and reproductive growth

In this study, four cultivars of maize were compare to vegetative growth and yield components characteristics. Significant differences were found among maize cultivars for vegetative growth characters as presented in table -1. The data presented in table-2 shows that cultivars differ significantly in all vegetative and reproductive growth parameters. Both Hudeiba-1 and Hudeiba-2 matured later than Balady cultivar. This variation could be mainly due to genetic variations between the four cultivars. Differences among maize cultivars in vegetative growth characteristics have been reported by many researchers (Ayub *et al*., 2001; Bertoia *et al*., 2006; Nemati and Sharifai, 2012 and Sharifai *et al*., 2012).

Table 1. F values for the vegetative, reproductive, yield and yield components Parameters of maize (*Zea mays* L.) during the summer season 2016.

Characters	***Maize cultivars***
Plant height (cm)	33.74*
Stem diameter (cm)	18.15*
Number of leaves/ plant	9.49*
Days to 50% tasselling	5.57*
Days to 50% siliking	190.98*
Days to maturity	32.07*
Cob length (cm)	100.46*
Number of rows/ cob	0.96ns
Number of seeds/ row	33.74*
Number of seeds/ cob	18.15*
1000 seed weight (gm)	9.49*
Grains yield (tons/ha)	5.57*

Key : ** means significant at 0.05 probability .* ***Ns*** *means non- significant at 0.05 probability*

Table 2. Performance of cultivars in vegetative and reproductive growth parameters of maize (*Zea mays* L.) during the summer season 2016.

Treatment	***Plant height***	***Stem diameter***	***No of leaves/plant***	***Days to 50% tassel***	***Days to 50% silking***	***Days to maturity***
Hudeiba-1	124.33ab	7.53a	12.15a	86.50a	98.25a	131.25a
Hudeiba-2	138.66a	7.36a	12.30a	84.75a	96.50ab	130.25a
Mugtama-45	121.42ab	5.42b	11.10ab	71.50b	84.00ab	117.00b
Balady	99.01b	5.37b	9.75b	70.00b	79.75ab	116.00b
Overall mean	120.86	6.42	11.33	78.19	89.63	123.63
SE	8.23	0.28	0.62	2.08	5.33	1.65
LSD	26.43	0.90	1.98	6.65	9.36	5.04
C.V%	13.00	8.00	10.00	5.00	11.00	2.00

Means within column followed by the same letter (s) are not significant different according to LSD test at 5%level.

3.2. Performance of cultivars in yield and yield components

There were significant differences among maize cultivars in all of yield and yield components characters with the exception of number of rows / cob, which exhibited no significant differences as shown in table -1. The data which is presented in table -3 shows that improved cultivar Hudeiba-2 produced 48% more grain yield than

traditional cultivar Balady. On the other hand, there were no significant differences in grain yield between Hudeiba-1 and Hudeiba-2 and between Hudeiba-1, Mugtama-45 and Balady. The variation in grain yield among cultivars could be attributed to differences in genetic makeup, environment and interaction between these aspects. Cultivars differences with respect to yield have been reported by Ayub et al. (2003), Ayubet al. (2001) and Bertoia et al. (2006).

Table 3. Performance of cultivars in yield and yield components parameters of maize (*Zea mays* L.) during the summer season 2016.

Treatment	*Cob length*	*No of rows/cob*	*No seeds/ row*	*No of seeds/cob*	*1000 seed weight*	*Yield (tons/ha)*
Hudeiba-1	14.28a	13.43a	19.43ab	258.13ab	241.00a	4.90ab
Hudeiba-2	14.20a	13.65a	22.70a	310.35a	258.75a	6.43a
Mugtama-45	9.93b	13.33a	14.73b	206.70b	204.00b	3.39b
Balady	10,50b	12.73	15.83b	200.23b	198.25b	3.32b
Overall mean	12.23	13.29	18.17	243.85	225.50	4.51
SE	0.42	1.22	1.91	28.24	11.36	0.70
LSD	1.34	3.90	6.11	90.34	36.33	2.25
C.V%	6.00	18.00	21.00	7.00	10.00	30.00

Means within column followed by the same letter (s) are not significantly different according to LSD test at 5%level

5. Conclusion

The result of this study indicate that improved cultivars of maize is better than the traditional cultivar and the cultivar Hudeiba-2 performed better in vegetative growth and yield than the others cultivars. Since there are major winter crops which can be grown in the area (wheat, faba bean, funnel….etc) that compete with maize, the suggestion of growing the maize crop as a summer crop will help in intensification and diversification of the rotations of the agricultural schemes in the northern part of the Sudan.

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