

# EVALUATION OF SOME MAIZE VARIETIES TO SOIL MOISTURE STRESS

By

**Mehasen, S. A. S. and N. Kh. El-Gizawy**

**Agron. Dep. Fac. Agric., Moshtohor, Benha Univ.**

## ABSTRACT

Field experiments were carried out at the Agriculture Research and Experimental Center Faculty of Agriculture Moshtohor, Banha Univ. in 2008 and 2009 seasons to study the performance of 5 maize varieties i.e., ( S.C. Hitec, S.C.10, T.W.C Hitec, T.W.C 329 and Giza 2) under 4 irrigation levels (100% field capacity ( $I_1$ ), 80% field capacity ( $I_2$ ), 60 % field capacity ( $I_3$ ) and 40 % field capacity ( $I_4$ )). A split plot arrangement of a randomized complete block design with three replications was used with irrigation levels as main plots and maize varieties as subplots. The obtained results could be summarized as follows: single crosses of maize significantly surpassed other cross hybrids in growth characters, yield and yield components. Increasing irrigation levels from  $I_3$  (60 % of field capacity) to  $I_1$  (100 % of field capacity) gives significant for growth, yield and yield components with insignificant differences between  $I_1$  (100% of field capacity) and  $I_2$  (80 % of field capacity).

**Key words:** *Maize, varieties, grain yield and irrigation levels*

**Corresponding Author: Mehasen, S. A. S.,** Department of Agronomy, Faculty of Agriculture Benha University, Egypt. PO Box 13736

## INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops in Egypt and the world. Maize is still a major traditional food and feed crop in many regions. Furthermore, the grain is a key industrial raw material for very diverse purposes. In Egypt great attention has been paid to increase its total production. This could be achieved by using high yielding cultivars. Egypt lies in arid and semi-arid regions. Field crop production in such soils is faced by the prevalence of a number of rather extreme and detrimental conditions i.e, limited water supply and drought conditions. Irrigating for maximum crop yield and quality is often a matter of timing as well as correct amounts, it is necessary to have a good understanding of the crop water needs and timing, as well as knowledge the physical and chemical soil characteristics such as available water holding capacity and infiltration rate.

Water supply is limiting factor for crop production. **Nour El-Din et al. (1986)** found that decreasing available moisture content in root zone significantly impaired maize yield, **El Refaie et al. (1988)** concluded that seasonal water consumptive use values for maize were 58.3 54.9 and 4 when irrigated at 25, 50 and 75% deficit from the available water, respectively. **Diab (1994)** found that most of maize growth attributes, yield and its components decreased when water supply of drip irrigation decreased from 3300 to 1800 m<sup>3</sup>/fed. **Haikel and El-Badry (1995)** found that drip irrigation system with 2688 or 3160 m<sup>3</sup>/fed was more effective to produce higher values of yield and its components of maize as well as water use efficiency. **El-Moweih et al. (1999)** reported that increasing drip irrigation intervals from 4 to 7 days decreased growth and yield attributes of maize as well as the value of water use efficiency.

**El-Ganayni et al. (2000)** showed that shortening irrigation intervals delayed flowering, decreased 100-kernels weight of maize. On the other hand, increasing the available soil moisture depletion to 20% gave the highest grain yield, followed by 35 and 50%. **Hussein et al. (2001)** found an increase in yield and its attributes of maize by using 3360 m<sup>3</sup> water/fad, with drip irrigation comparing with 1680 or 5040 m water/fad. Monthly water consumptive use reached its peak during July and August. **Saied (2002)** found that the impact of both soil moisture depletion and nutrient on elemental composition of plant organs and their yields are also importance for the growing crops. Also, **Ibrahim et al. (2005)** showed that the irrigation of maize plants at 50% available soil moisture depletion (ASMD) achieved a significant increase for plant height, ear length, 100-kernels weight and grain and straw yields/fad, as well as water use efficiency as compared with the other treatments (30 and 70% ASMD). **El-Sayed (2006)** indicated that irrigation maize plants at 25% available soil moisture

depletion (ASMD) gave the highest values for plant height and ear length, while 50% ASMD gave the highest values for 100-grain weight, ear weight and ear and grain yields/fad; on the other hand, irrigation at 75% ASMD gave the highest values for shelling percentage and protein percentage in the two seasons.

In this connection, maize cultivars differ in grain yield and yield components as reported by **El-Bana (2001); El-Wakil (2002); Hamed (2003); El-Aref *et al* (2004); Nofal *et al* (2005); Moser *et al* (2006); Atta (2007) and Hassan *et al* (2008).**

The aim of this investigation was to study the effect of soil moisture on yield and yield components of five maize varieties.

## **MATERIALS AND METHODS**

This investigation was conducted at the Agricultural Research and Experimental Center of the Faculty of Agriculture, Moshtohor, Kalubia Governorate, Benha University, Egypt, in 2008 and 2008 seasons, to study the effect of 4 irrigation levels [100% field capacity ( $I_1$ ), 80% field capacity ( $I_2$ ), 60 % field capacity ( $I_3$ ) and 40 % field capacity ( $I_4$ )] on yield and yield components for five maize varieties [Single cross 10 (S.C. 10), Single cross Haitec (S.C. Haitec), Tray way cross Haitec (T.W.C. Haitec), Tray way cross 329 (T.W.C. 329) and synthetic variety Giza 2 (G 2)].

The soil type was clay with pH value of 8.06 and 8.02 in the first and second growing seasons, respectively. The experimental sites were preceded by clover in the two seasons. Maize hybrids namely S.C. Haitec and T.W.C. Haitec were developed by Haitec Company. Maize varieties namely S.C. 10, T.W.C. 329 and Giza 2 were developed by Maize Research Section, Field Crops Research Institute, ARC, Giza, Egypt.

In each experiment, 20 treatments which were the combination of four irrigation levels and five maize varieties are tested in a split plot design with three replicates. Irrigation levels were devoted to the main plots, while maize varieties were assigned to the sub-plots. Each sub-plot was 10.5 m<sup>2</sup> (1/400 fed) consisting of 5 ridges, 3.5 m long and 70 cm width while, the distance between plants was 25 cm.

Moisture content and water consumptive use per unit area was calculated according to the equation described by Israelsen and Hansen (1962). The physical properties of experimental soil site i.e. field capacity, wilting point percentage, available moisture and bulk density were determined and recorded. The average values of these measurements at different soil depths down to 45 cm are presented in **Table (1)**.

**Table 1. Physical properties of the experimental soil site in 2008 and 2009 seasons**

Soil depth (cm)	2008 season				2009 season			
	Field capacity %	Available water %	Wilting point %	Bulk density (g cm <sup>-3</sup> )	Field capacity %	Available water %	Wilting point %	Bulk density (g cm <sup>-3</sup> )
<b>0-15</b>	44.65	25.40	19.25	1.24	44.81	25.23	19.58	1.23
<b>15-30</b>	41.50	23.65	17.85	1.28	42.21	24.11	18.10	1.26
<b>30-45</b>	39.40	22.46	16.94	1.33	39.85	22.82	17.03	1.30
<b>Average</b>	41.85	23.83	18.00	1.28	42.29	24.05	18.23	1.26

At planting, super phosphate (15.5%), at a rate of 30 kg P<sub>2</sub>O<sub>5</sub>/fed was applied. Maize grains were planted on 15<sup>th</sup> and 25<sup>th</sup> May in the first and second seasons, respectively. Thinning took place 21 days after sowing to secure one healthy plant per hill. All recommended cultural practices for the region were followed in both seasons.

#### **Studied attributes:**

At harvest ten individual plants were taken at random from middle ridge each sub-plot to determine plant height (cm), ear height (cm), stem diameter (cm), No of ears plant<sup>-1</sup>, ear weight (g), ear length (cm), ear diameter (cm), No. of rows ear<sup>-1</sup>, No. of grains row<sup>-1</sup>, ear grain weight (g), 100-grain weight (g), shelling percentage and grain yield plant<sup>-1</sup>(g). Grain yield feddan<sup>-1</sup> (kg) was determined on the whole sub plot basis. The grain yield was adjusted to 15.5% moisture content.

Analysis was done for the data of variance of each season separately and combined analysis of variance for two seasons was conducted testing the error homogeneity according to Gomez and Gomez (1984). L.S.D test at 0.05 level of probability was used to compare between means.

## **RESULTS AND DISCUSSION**

#### **Effect of Irrigation levels:**

Data presented in **(Tables 2, 3, 4, 5 and 6)** showed the effect of irrigation levels on yield and yield attributes of maize in the two seasons and their combined analysis. Irrigation levels had significant effects in both seasons and their combined analysis on plant height, ear height, stem diameter, ear weight, ear length, ear diameter, No. of rows ear<sup>-1</sup>, No. of grains row<sup>-1</sup>, ear grain weight, 100-grain weight, grain yield plant<sup>-1</sup> and grain yield feddan<sup>-1</sup>. These characters were increased with increasing irrigation levels from I<sub>4</sub> (40% of field capacity) to I<sub>1</sub> (100% of field capacity) with no significant differences between I<sub>1</sub> (100% of field capacity) and I<sub>2</sub> (80% of field capacity) in ear weight in the combined analysis, ear diameter in the first season and No. of rows ear<sup>-1</sup> in the first and second seasons. The relative increase (combined data) due to increasing irrigation levels from I<sub>4</sub> to I<sub>1</sub> were 13.5, 15.0, 20.7, 11.2, 27.4, 21.1, 4.0, 40.1, 13.7, 27.8, 10.0 and 19.7% in plant height, ear height, stem diameter, ear weight, ear length, ear diameter, No. of rows ear<sup>-1</sup>, No. of grains row<sup>-1</sup>, ear grain weight, 100-grain weight, grain yield plant<sup>-1</sup> and grain yield feddan<sup>-1</sup>, respectively.

Results in **(Tables, 3 and 5)** indicated that increasing irrigation levels from I<sub>4</sub> (40% of field capacity) to I<sub>1</sub> (100 % of field capacity) did not significantly affect No. of ears plant<sup>-1</sup> in the second season and shelling percentage in the combined analysis. Combined data revealed that, maximum average of No. of ears plant<sup>-1</sup> (1.13 ear) and shelling percentage (86.3%) were recorded when irrigation level was I<sub>1</sub> (100% of field capacity), while minimum average of spike length (1.08 ear) and shelling percentage (85.2%) were recorded when irrigation level was I<sub>4</sub> (40% of field capacity).

The decreases in yield and yield attributes due to maize irrigate at I<sub>4</sub>(40% of field capacity) may be due to changes patterns of plant growth and development.

In general, the aforementioned results of soil moisture stress, increasing or decreasing soil moisture stress, may be attributed to the unbalanced soil water-air

**Table 2. Plant height, ear height and stem diameter of maize as affected by irrigation levels, varieties and interaction in 2008(S1), 2009(S2) and combined analysis.**

Treatments	Plant height (cm)			Ear height (cm)			Stem diameter (cm)		
	S1	S2	Comb	S1	S2	Comb	S1	S2	Comb
<b>Irrigation levels (I)</b>									
I <sub>1</sub>	311.6	303.6	307.6	141.7	137.0	139.3	2.52	2.38	2.45
I <sub>2</sub>	299.8	290.5	295.2	131.2	128.9	130.0	2.34	2.23	2.28
I <sub>3</sub>	290.3	276.8	283.6	127.8	124.2	126.0	2.19	2.08	2.14
I <sub>4</sub>	276.4	265.6	271.0	122.5	119.8	121.1	2.08	1.97	2.03
L.S.D at 5%	3.5	3.9	2.3	1.3	2.1	1.1	0.06	0.06	0.04
<b>Varieties (V)</b>									
S.C. 10	308.5	296.4	302.5	137.2	132.0	134.6	2.45	2.31	2.38
S.C. haitic	290.8	283.2	287.0	133.5	131.0	132.2	2.35	2.24	2.30
T.W.C.haitic	283.8	275.1	279.5	127.0	126.0	126.5	2.20	2.10	2.15
T.W.C. 324	288.5	277.0	282.8	126.5	124.1	125.3	2.25	2.10	2.18
Giza 2	301.0	288.8	294.9	129.7	124.1	126.9	2.15	2.07	2.11
L.S.D at 5%	4.8	3.5	2.9	1.9	2.5	1.6	0.08	0.06	0.05

I<sub>1</sub>=100% field capacity, I<sub>2</sub>= 80% field capacity, I<sub>3</sub>= 60 % field capacity, I<sub>4</sub>= 40% field capacity

**Table 3. No. of ears plant, ear weight and ear length of maize as affected by irrigation levels, varieties and interaction in 2008(S1), 2009(S2) and combined analysis.**

Treatments	No. of ears plant <sup>-1</sup>			Ear weight (g)			Ear length (cm)		
	S1	S2	Comb	S1	S2	Comb	S1	S2	Comb
<b>Irrigation levels (I)</b>									
I <sub>1</sub>	1.18	1.13	1.16	276.6	266.2	271.4	21.6	20.2	20.9
I <sub>2</sub>	1.16	1.10	1.13	270.3	261.0	265.6	20.4	18.7	19.6
I <sub>3</sub>	1.13	1.10	1.11	262.4	256.0	259.2	18.8	16.8	17.8
I <sub>4</sub>	1.09	1.08	1.08	248.8	239.4	244.1	17.2	15.7	16.4
L.S.D at 5%	0.08	N.S	0.06	3.5	3.7	7.5	0.8	0.8	0.5
<b>Varieties (V)</b>									
S.C. 10	1.28	1.19	1.23	278.0	270.1	274.0	21.9	20.0	21.0
S.C. haitic	1.18	1.10	1.14	273.5	266.0	269.7	20.5	18.6	19.5
T.W.C.haitic	1.05	1.06	1.06	257.8	250.7	254.2	18.5	17.2	17.9
T.W.C. 324	1.10	1.09	1.10	254.5	244.0	249.2	18.3	16.6	17.5
Giza 2	1.08	1.06	1.07	258.8	247.5	253.1	18.4	16.7	17.6
L.S.D at 5%	0.04	0.07	0.04	2.8	2.6	6.0	0.6	0.5	0.4

I<sub>1</sub>=100% field capacity, I<sub>2</sub>= 80% field capacity, I<sub>3</sub>= 60 % field capacity, I<sub>4</sub>= 40% field capacity

relations that lead to reducing the photosynthesis activity and unbalanced relations between plant hormones and biological processes in the whole plant organs. These adverse conditions in the treated soils are undoubtedly of great importance throughout the vegetative growth and dry matter accumulation in the maize plants.

These results are in agreement with those obtained by **Nour El-Din *et al.*** (1986), **El Refaie *et al.*** (1988), **Diab** (1994), **Haikel and El-Badry** (1995), **El-Moweih *et al.*** (1999), **El-Ganayni *et al.*** (2000), **Hussein *et al.*** (2001), **Saied** (2002), **Ibrahim *et al.*** (2005) and **El-Sayed** (2006).

**Table 4. Ear diameter, No. of rows ear and No. of grains row of maize as affected by irrigation levels, varieties and interaction in 2008(S1), 2009(S2) and combined analysis.**

Treatments	Ear diameter (cm)			No. of rows ear <sup>-1</sup>			No. of grains row <sup>-1</sup>		
	S1	S2	Comb	S1	S2	Comb	S1	S2	Comb
<b>Irrigation levels (I)</b>									
I <sub>1</sub>	5.29	5.28	5.28	13.0	12.8	12.9	48.6	47.1	47.9
I <sub>2</sub>	5.28	5.14	5.21	12.6	12.5	12.6	45.9	44.2	45.1
I <sub>3</sub>	4.95	4.91	4.93	12.4	12.3	12.3	39.5	37.4	38.4
I <sub>4</sub>	4.33	4.40	4.36	12.4	12.4	12.4	35.7	32.7	34.2
L.S.D at 5%	0.06	0.05	0.04	0.4	0.3	0.2	1.3	1.9	1.0
<b>Varieties (V)</b>									
S.C. 10	5.27	5.02	5.15	12.7	12.5	12.6	46.4	44.2	45.3
S.C. haitic	5.11	4.95	5.03	12.4	12.4	12.4	45.0	43.7	44.3
T.W.C.haitic	4.86	5.05	4.95	12.3	12.3	12.3	40.8	38.3	39.5
T.W.C. 324	4.77	4.91	4.84	12.5	12.7	12.6	39.9	38.3	38.8
Giza 2	4.79	4.72	4.75	13.0	12.7	12.9	40.1	37.8	39.0
L.S.D at 5%	0.07	0.06	0.06	0.5	0.2	0.3	1.1	1.4	0.9

I<sub>1</sub>=100% field capacity, I<sub>2</sub>= 80% field capacity, I<sub>3</sub>= 60 % field capacity, I<sub>4</sub>= 40% field capacity

**Table 5. Ear grain weight, shelling% and 100-grain weight of maize as affected by irrigation levels, varieties and interaction in 2008(S1), 2009(S2) and combined analysis.**

Treatments	Ear grain weight (g)			Shelling%			100-grain weight (g)		
	S1	S2	Comb	S1	S2	Comb	S1	S2	Comb
<b>Irrigation levels (I)</b>									
I <sub>1</sub>	235.8	232.7	234.3	85.2	87.5	86.3	35.2	33.7	34.5
I <sub>2</sub>	228.6	226.8	227.7	84.6	86.9	85.7	33.4	32.0	32.7
I <sub>3</sub>	220.8	217.6	219.2	84.1	85.0	84.5	31.5	29.6	30.5
I <sub>4</sub>	208.1	204.0	206.1	83.6	85.2	84.4	28.6	25.5	27.0
L.S.D at 5%	3.8	2.9	2.1	0.7	1.0	N.S	1.1	0.8	0.6
<b>Varieties (V)</b>									
S.C. 10	232.8	228.8	230.8	83.7	84.6	84.2	34.8	32.7	33.7
S.C. haitic	229.5	226.5	228.0	83.8	85.1	84.5	33.4	31.5	32.4
T.W.C.haitic	220.0	217.9	218.9	85.3	86.8	86.1	31.8	29.7	30.7
T.W.C. 324	218.0	214.7	216.4	85.6	88.0	86.8	30.5	28.3	29.4
Giza 2	216.4	213.5	215.0	83.6	86.2	84.9	30.3	28.7	29.5
L.S.D at 5%	2.0	1.8	1.3	1.3	1.2	2.1	0.7	0.9	0.6

I<sub>1</sub>=100% field capacity, I<sub>2</sub>= 80% field capacity, I<sub>3</sub>= 60 % field capacity, I<sub>4</sub>= 40% field capacity

**Table 6. Grain yield plant<sup>-1</sup> and grain yield Fed<sup>-1</sup> of maize as affected by irrigation levels, varieties and interaction in 2008(S1), 2009(S2) and combined analysis.**

Treatments	Grain yield plant <sup>-1</sup> (g)			Grain yield Fed <sup>-1</sup> (Kg)		
	S1	S2	Comb	S1	S2	Comb
<b>Irrigation levels (I)</b>						
I <sub>1</sub>	282.3	277.2	279.7	3480	3317	3398
I <sub>2</sub>	275.0	270.5	272.7	3328	3202	3265
I <sub>3</sub>	267.9	262.8	265.3	3131	3020	3076
I <sub>4</sub>	256.8	251.6	254.2	2860	2816	2838
<b>L.S.D at 5%</b>	<b>3.5</b>	<b>4.4</b>	<b>2.5</b>	<b>60</b>	<b>59</b>	<b>37</b>
<b>Varieties (V)</b>						
<b>S.C. 10</b>	280.4	274.4	277.4	3400	3280	3340
<b>S.C. haitic</b>	274.5	270.1	272.3	3366	3229	3297
<b>T.W.C. haitic</b>	267.7	263.5	265.6	3055	3000	3028
<b>T.W.C. 324</b>	265.2	259.6	262.4	3075	2962	3018
<b>Giza 2</b>	264.6	259.9	262.2	3101	2973	3037
<b>L.S.D at 5%</b>	<b>2.3</b>	<b>2.5</b>	<b>1.7</b>	<b>44</b>	<b>43</b>	<b>30</b>

I<sub>1</sub>=100% field capacity, I<sub>2</sub>= 80% field capacity, I<sub>3</sub>= 60 % field capacity, I<sub>4</sub>= 40% field capacity

## 2- Varietal differences.

Results in **(Tables 2, 3, 4, 5 and 6)** indicated that maize varieties exhibited significant differences for grain yield and all studied yield attributes in both seasons and their combined.

The combined analysis data in **Table (2)** revealed that, S.C.10 hybrid significantly surpassed other varieties in plant height, ear height and stem diameter of maize. S.C.10 gave the highest values of plant height (302.5 cm) followed by Giza 2 variety (294.9 cm), ear height (134.6 cm), followed by S.C. haitic (132.2 cm) and stem diameter (2.38 cm) followed by S.C. haitic (2.30 cm), while T.W.C. haitic had shorter plants (279.5cm), T.W.C. 324 gave the lowest value of ear height (125.3 cm) and Giza 2 gave the lowest value of stem diameter(2.11 cm).

The average of both seasons data in **Table (3)** demonstrate that S.C.10 produce highest values of No. of ears plant, ear weight and ear length of maize follow by S.C. haitic.

Combined data given in **Table (4)** showed significant differences among maize varieties in each of ear diameter, No. of rows ear and No. of grains row of maize. It is clear from Table (4) that S.C.10 significantly surpassed other varieties in ear diameter and No. of grains row. Meanwhile, Giza 2 variety significantly surpassed other varieties in No. of rows ear.



Data in **(Tables 5 and 6)** show effect of the varietal differences on weight of grains ear<sup>-1</sup>, shelling percentage, 100-grain weight, grain yield plant<sup>-1</sup> and grain yield feddan<sup>-1</sup> of maize were significantly affected by the five maize varieties under study. Maize hybrid S.C.10 gave higher mean values of the above mentioned parameters except shelling%. These differences may be due to the genetical differences between the five studied maize varieties. The results of varietal differences in yield and yield attributes in this study are in agreement with those obtained by **El-Bana (2001); El-Wakil (2002); Hamed (2003); El-Aref *et al.* (2004); Nofal *et al.* (2005); Moser *et al.* (2006); Atta (2007) and Hassan *et al.* (2008).**

### **3. Interaction effect:**

Significant effect of interaction between irrigation levels and maize varieties was obtained for growth, yield and yield components except No. of ears plant<sup>-1</sup>, ear length, No. of rows ear<sup>-1</sup>, ear grains weight, grain yield plant<sup>-1</sup> and shelling% in the combined analysis **(Table 7)**. This result indicates that the maize varieties responded similarly to the irrigation levels. For eight exceptional traits, significant interaction indicates that factors were not independent in their effect, the simple effects of a factor differ and the magnitude of any simple effect depends upon the level of the other factor of the interaction term. Where factors interact, a single factor experiment will lead to disconnect and possibly misleading information. With regard to plant height, ear height, stem diameter, ear weight, ear diameter, No. of grains row<sup>-1</sup>, 100-grain weight and grain yield fed<sup>-1</sup> S.C. 10 gave the highest values followed by S.C. haitic at I<sub>1</sub> treatment (100% field capacity). The significance of this interaction may be due to the different responses of each hybrids to the different irrigation levels.

**Table7. Effect of the interaction between irrigation levels and maize varieties on yield and yield components (combined analysis over two seasons 2008 and 2009).**

Irrigation levels Varieties								
	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	I <sub>4</sub>
	<b>Plant height (cm)</b>				<b>Ear height (cm)</b>			
S.C. 10	316.3	309.6	300.1	283.8	144.8	138.1	132.1	123.3
S.C. haitic	303.0	294.6	280.0	270.5	142.0	135.3	130.1	121.6
T.W.C. haitic	294.5	283.1	274.5	265.8	134.1	128.6	123.5	120.0
T.W.C. 324	311.6	286.6	273.0	260.0	137.8	122.8	121.3	119.5
Giza 2	312.5	301.8	290.3	275.0	138.0	125.3	123.1	121.3
L.S.D. at 5%	5.8				3.1			
	<b>Stem diameter (cm)</b>				<b>Ear weight (g)</b>			
S.C. 10	2.61	2.50	2.25	2.18	286.0	278.0	272.0	260.3
S.C. haitic	2.56	2.40	2.15	2.08	281.8	273.8	269.1	254.3
T.W.C. haitic	2.31	2.18	2.11	2.00	264.1	261.8	252.6	238.5
T.W.C. 324	2.48	2.18	2.08	1.98	261.6	255.8	249.0	230.6
Giza 2	2.28	2.16	2.10	1.90	263.6	258.8	253.3	237.0
L.S.D. at 5%	0.10				9.0			
	<b>Ear diameter (cm)</b>				<b>No. of grains row<sup>-1</sup></b>			
S.C. 10	5.46	5.35	5.13	4.65	51.1	49.8	42.5	37.8
S.C. haitic	5.43	5.23	4.95	4.53	52.5	49.1	40.3	35.5
T.W.C. haitic	5.23	5.28	4.98	4.33	45.1	43.0	37.6	32.5
T.W.C. 324	5.13	5.15	4.81	4.28	46.0	41.3	35.5	32.5
Giza 2	5.16	5.05	4.78	4.03	44.6	42.1	36.3	32.8
L.S.D. at 5%	0.09				1.8			
	<b>100-grain weight (g)</b>				<b>Grain yield (kg fed<sup>-1</sup>)</b>			
S.C. 10	37.6	36.0	31.6	29.8	3626	3525	3220	2991
S.C. haitic	35.6	33.8	31.5	28.8	3576	3480	3190	2945
T.W.C. haitic	33.5	31.5	30.6	27.5	3250	3090	2983	2788
T.W.C. 324	32.6	31.0	29.1	25.0	3270	3095	2973	2736
Giza 2	33.0	31.1	29.8	24.1	3270	3137	3013	2730
L.S.D. at 5%	1.2				61			

I<sub>1</sub>= 100% field capacity, I<sub>2</sub>= 80% field capacity, I<sub>3</sub>= 60 % field capacity, I<sub>4</sub>= 40% field capacity

#### E- Correlation study:

The simple correlation coefficients between some possible pairs of the studied maize traits of the combined analysis are presented in **Table (8)**. Grain yield per feddan was positively and high significantly correlated with, plant height, ear height, stem diameter, No of ears plant<sup>-1</sup>, ear weight, ear length, No. of rows ear<sup>-1</sup>, No. of grains row<sup>-1</sup>, ear grain weight, 100-grain weight and grain yield plant<sup>-1</sup>. Therefore, selection for each of these traits, is more effective for obtaining new higher yielding hybrids. Also, significant positive phenotypic correlation values were observed between grain yield/plant and each of the other yield components. These results

might indicate that selection for high values of the characters are more effective for increasing grain yield per fed and plant. Significant positive phenotypic correlation values were found between ear grain weight and each of plant height, ear height, stem diameter, No of ears plant<sup>-1</sup>, ear weight, ear length, No. of rows ear<sup>-1</sup>, No. of grains row<sup>-1</sup>, 100-grain weight and grain yield plant<sup>-1</sup> indicating that selection for these traits are very effective for increasing grains weight ear<sup>-1</sup>. Similar results were obtained by **Hamed (2003)**.

**Table 8. Correlation coefficient between yield and some yield components of maize varieties (combined over the two seasons 2008and 2009).**

Yield components	1	2	3	4	5	6	7	8	9	10	11
Grain yield (kgfed <sup>-1</sup> )	.849 **	0.938 **	0.951 **	0.760 **	0.947 **	0.943 **	0.421 **	0.975 **	0.971 **	0.961 **	0.971 **
1- Plant height (cm)	1.000	0.863 **	0.854 **	0.617 **	0.792 **	0.847 **	0.680 **	0.853 **	0.832 **	0.865 **	0.856 **
2- Ear height (cm)		1.000	0.946 **	0.690 **	0.868 **	0.938 **	0.498 **	0.936 **	0.929 **	0.925 **	0.919 **
3- Stem diameter (cm)			1.000	0.768 **	0.873 **	0.934 **	0.476 **	0.954 **	0.931 **	0.933 **	0.932 **
4- No of ears plant				1.000	0.793 **	0.800 **	0.291 *	0.676 **	0.706 **	0.927 **	0.728 **
5- Ear weight (g)					1.000	0.944 **	0.323 **	0.906 **	0.951 **	0.956 **	0.940 **
6- Ear length (cm)						1.000	0.426 **	0.939 **	0.960 **	0.971 **	0.947 **
7- No. of rows ear <sup>-1</sup>							1.000	0.431 **	0.382 **	0.411 **	0.457 **
8- No. of grains row <sup>-1</sup>								1.000	0.974 **	0.961 **	0.953 **
9- Ear grains weight (g)									1.000	0.989 **	0.968 **
10- Yield plant <sup>-1</sup> (g)										1.000	0.976 **
11-100-grain weight (g)											1.000

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## تقييم بعض أصناف الذرة الشامية للاجهاد المائي

صديق عبد العزيز صديق محيسن\* ، ناصر خميس بركات الجيزاوي\*

\* قسم المحاصيل - كلية الزراعة بمشتهر - جامعة بنها- مصر.

أجريت هذه الدراسة بمركز البحوث الزراعية بكلية الزراعة بمشتهر - جامعة بنها- مصر ، خلال موسمي ٢٠٠٨ ، ٢٠٠٩ م بهدف دراسة تأثير أربعة مستويات من الري ( الري عندما تصل نسبة الرطوبة بالتربة الي ١٠٠% من السعة الحقلية- الري عندما تصل نسبة الرطوبة بالتربة الي ٨٠% من السعة الحقلية- الري عندما تصل نسبة الرطوبة بالتربة الي ٦٠% من السعة الحقلية- الري عندما تصل نسبة الرطوبة بالتربة الي ٤٠% من السعة الحقلية) على المحصول ومكوناته لخمس اصناف من الذرة الشامية (هجين فردى - ١٠ - هجين فردى هايتك- هجين ثلاثي هايتك- هجين ثلاثي ٣٢٤- والصنف التركيبي جيزة ٢). ويمكن تلخيص النتائج المتحصل عليها فيما يلي :

- أظهرت النتائج تفوق الهجين الزوجي ذهب والهجين الفردي ٣٠٨٠ معنويا بنقص في عدد الأيام من الزراعة وحتى ظهور ٥٠% من النورات المذكرة والمؤنثة مقارنة بالتراكيب الوراثية الأخرى. كما أظهرت النتائج أن الهجين الزوجي ذهب والهجين الفردي ٣٠٨٠ والهجين الفردي ٥٥٠ هي الأفضل في معظم الصفات التي درست علي المحصول ومكوناته . وقد تفوق الهجين الزوجي ذهب والهجين الفردي ٣٠٨٠ و ٥٥٠ في كمية محصول الحبوب /فدان دون فروق معنوية . بينما أعطي الهجين الفردي ٥٤٠ أقل محصول حبوب / فدان ومعظم مكوناته .
- أدت زيادة الكثافة النباتية من ٢٠ ألف إلي ٣٠ ألف نبات/ فدان إلي زيادة في عدد الأيام من الزراعة وحتى ظهور ٥٠% من النورات المذكرة والنورات المؤنثة وكذلك زيادة في ارتفاع النبات والكوز من سطح الأرض . ومن جهة أخرى أدت زيادة كثافة النباتات من ٢٠ ألف إلي ٣٠ ألف نبات/ فدان إلي نقص معنوي في معظم صفات المحصول ومكوناته علي أن زيادة الكثافة النباتية من ٢٠ ألف إلي ٢٤ ألف نبات / فدان لم يكن لها تأثيرا معنويا علي محصول الحبوب / نبات والنسبة المئوية للتفريط ومحصول الحبوب /فدان .
- أظهرت النتائج وجود تأثير معنوي للتفاعل بين هجن الذرة الشامية الصفراء والكثافة النباتية علي وزن الكوز ووزن حبوب الكوز والنسبة المئوية للتفريط وذلك للتحليل المشترك وكان أعلى وزن للكوز وحبوب الكوز للهجين الفردي ٥٥٠ عند كثافة ٢٠ ألف نبات / فدان .
- أوضحت علاقة الارتباط بين الصفات المختلفة ومحصول الحبوب للفدان والنبات الفردي أن وزن حبوب الكوز ووزن الكوز من أهم الصفات التي لها تأثير علي وزن المحصول.
- بناء علي ما تقدم فإن هذه الدراسة توصي بزراعة الهجين الزوجي ذهب أو الهجن الفردية ٣٠٨٠ أو ٥٥٠ مع استخدام كثافة نباتية ٢٠ أو ٢٤ ألف نبات للفدان بالزراعة علي خطوط متباعدة ٧٠ سم ولزراعة علي جور متباعدة ٢٠ أو ٢٥ سم مع ترك نبات واحد بالجورة .

