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ADAPTATION STUDIES ON SOME MAIZE HYBRIDS UNDER SIWA OASIS CONDITIONS

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ABSTRACT

This investigation was conducted under saline new reclaimed area at Siwa Oasis, Desert Research Center during two successive seasons of 2003 and 2004. The main objective was to study the effect of four different foliar application treatments i.e., 2% $MnSo_4$, 2% urea + 3%, sucrose, 20 ppm paclobutrazol (pp333) and tap water as a control on growth traits, yield, yield components as well as chemical composition of four maize hybrids cultivars i.e., S.C. 10, S.C. 122 , T.W.C. 323 and T.W.C. 310. Split plot design with three replications was used, the main plots were devoted at random to the four foliar application treatments, while the four maize hybrids in the sub plots. The obtained results could be summarized as follows:

Generally, foliar applications by 2% MnSo4 , urea 2% +sucrose 3% and 20 ppm paclobutrazol (pp 333) may correct the metabolic disturbance and led to improve growth parameters, yield and yield components as well as chemical composition of maize plants as compared with the control under saline new reclaimed area at Siwa Oasis during both growth seasons. $MnSo_4$ 2% as a foliar application surpassed the other spray treatments for significantly increase in growth traits (i e., plant height, no. of leaves /plant and dry weight/plant) and (ear length (cm), 100 kernel weight (g), kernels weight / ear (g) and grain yield kg/fed) at harvest. Meanwhile, 2%urea + sucrose 3% and 20 ppm paclobutrazol recorded the 2nd & 3rd order respectively. However, spraying maize hybrids with 20 ppm paclobutrazol achieved the earliest cultivars, while $MnSo_4$ 2% led to the latest and , urea 2% + sucrose 3% in between for tasseling and silking . Also, S.C. 10 cultivar surpassed the other hybrids in growth traits, yield and its components during both seasons. Meanwhile, T.W.C. 310 and S.C. 122 recorded the 2nd and 3rd order respectively. S.C.122 was the earliest cultivar, while T.W.C. 310 was the longest and S.C. 10 was in between for tasseling and silking during both seasons, respectively. Furthermore, S.C. 10 hybrid sprayed with 2 % $MnSo_4$ interaction produced the best growth traits, yield and its attributes. NPK, total carbohydrate and oil percentages for grain maize cultivars had a positive effect due to foliar application treatments as compared with the control. However, grains of S.C.10 had the highest values of N P K concentrations and total carbohydrates content than other cultivars under Siwa Oasis conditions. However, T.W.C. 310 was the best cultivar for Oil % .

Keywords: Adaptation–Saline soils–Siwa Oasis-Foliar application-Growth-Yield–maize hybrids -Nutritive values-Chemical composition.

INTRODUCTION

Maize (Zea mays, L.) is a major cereal crop in Egypt. Maize grain is widely used for both human and animal feeding. On the other hand, the agricultural extension through the desert which suffer from saline and drought conditions is the solely solution for increasing crop production in order to match the rapid increase of human population. Siwa Oasis, as a depression

in the Western desert of Egypt, is located within the extremely arid zone. Although a paucity of rainfall or good quality water for irrigation, there is abundant ground water resources without outlet for drainage water. Consequently, Siwa Oasis suffers from water logging and salinity problems in addition to higher solar radiation for cultivation of most field crops, e.g. maize crop, of which is not acquainted by Siwian farmers and their needs for maize grain which is imported from the Delta Governorates. Therefore, better use and management of such water should be made for the development of this area. Many interactions between plant, soil, water and environmental factors influence the plants' ability to be adapted under Siwa Oasis conditions. In this connection, maize cvs may be suitable for Siwa Oasis by altering environmental factors, i.e. humidity and temperature with early planting dates (*Hassan 1998)*. So, increasing maize production through high yielding hybrids coupled with the application 0f improved cultural practices is a must to meet the local great requirements AtaAllah *et al* (2002). Also, early planting dates may enhance salt tolerance and water use efficiency for maize production at Siwa Oasis.

Several investigators showed that maize hybrids differed significantly in growth characters, yield and yield components (Aly *et al.,* 1996; Ata Allah, 1996; El-Gezawy, 1996; Hassan 1999; AtaAllah *et al* 2002; Ayad 2002; Al-Naggar *et al* 2004 and Radwan 2004). Also, hybrids give higher yield than the open pollinated cultivars. Mc Rosite and MacLachlan (1942) in Ottawa, Canada, Kassem (1964), in Egypt and Kolcar and Jovanovice (1975) demonstrated that highest grain yield was given by single crosses also, Voldeng and Blackman (1973) in Oxford, recommended that highest grain yields were produced by hybrids. However, Sc. 10 surpassed the TWC 310, Taba, SC. 156 (yellow maize), and Dahab Giza 2 in ear characters and grain yield (El-sheikh, 1998).

Nitrogen fertilizer as a foliar application or addition through the soil and time of its application was found to be among the most important factors affecting maize productivity. Maize hybrids differed in its productivity and its response to nitrogen fertilization (Hassan, 1995; Ibrahim *et al.,* 1995; El-Gezawy, 1996 and Abou – Zied, 1999). In this concern, significant increases in grain yield/fed and yield attributes were found with increasing N fertilizer rates (Gouda *et al.*, 1993; Amer, *et al.*, 1995; Soliman *et al.*, 1995; Younis *et al.*, 1995; Aly *et al.*, 1996; El- Gezawy, 1996; Lamlom, 1997; Zeidan *et al.*, 1998 and Kamal 2001). Younis *et al.*, 1995 and El-Gezawy, 1996) observed that Times to mid tasseling and silking were significantly decreased with increasing N fertilizer levels. On the contrary, time of N application did not have significant effect on grain yield/ fed and its attributes (Zeidan *et al.,* 1998).

Recently, increasing salt tolerance of plant by using bioregulator or nutrient application is gaining more enhancement in growth and yield of some specific corps. Many investigators reported that recommended of paclobutrazol (pp333) as a foliar application revealed positive effect with wheat plant (El-Shamey and Ibrahim, 2004). The plant growth regulator, paclobutrazol (pp333) is a triazol derivative (Steffens *et al* 1985). Dawh *et al* 1998; El-Desouky and Atawia 1998 found that paclobutrazol reduced the

harmful or negative effects of salinity on growth. Moreover, paclobutrazol has been reported to inhibit GA biosynthesis in plants (Dalziol and Lawrence, 1984. Treatment with paclobutrazol resulted in increase chlorophyll, soluble protein and mineral element concentration in leaf tissue (Wang and Steffens, 1987). Saline soil at Swia oasis deficiency of nutrients is always expected due to the existence of nutrients mostly in forms of low availability (Badawy, 1990), this represent an obvious limiting factor for growth, yield and biochemical aspects of some crops. Micronutrient (Mn) considered as an essential element for plant life, which act as a plant growth hormones and plays a role in the production and functioning of several enzymatic systems in plant. So, it has vital functions in the overall plant metabolism (Badawy 1990).

The purpose of this investigation was to study the effect of urea, Micronutrient (Zn) and bioregulator as foliar applications on the growth, yield and its components as well as chemical composition of four maize hybrids cultivars grown under Siwa Oasis conditions.

MATERIALS AND METHODS

Two field experiments were conducted at the Agricultural Experimental Station, Desert Research Center at Tigzarty Siwa Oasis, western Desert of Egypt during 2003 and 2004 seasons. Such studies was conducted to investigate the effect of four different foliar application treatments(i.e. $MnSO_4$ 2%, urea 2% + sucrose 3%, 20 ppm paclobutrazol (pp333) and tap water as a control) on plant growth characters, yield and yield components of four hybrids maize i.e., S.C. 10, S.C. 122 , T.W.C. 323 and T.W.C. 310 under saline conditions at Siwa Oasis. Each experiment included 16 treatments, i.e. the combination of four foliar application and four maize cultivars, which were arranged in a split plot design with three replications. The main plots were occupied by the four foliar application treatments and four maize hybrids in the sub plots.

Each basic unit included 5 ridges, 60 cm apart and 3.5 m length, comprising an area of 10.5 m^2 (1/400 fed). The soil type of the experimental site was loamy sand in texture with pH 7.7, $CaCO_3$ 30.4%, organic matter 0.5% and E.C 12mmhos/cm. Seeds of maize hybrids were obtained from Agricultural Research Center and were planted on April 10 and 12 in 2003 and 2004 seasons, respectively, in hills at 25 cm apart and irrigated with brackish water which contained 3100 ppm as total dissolved salts. The plants were thinned to one plant per hill at 30 days after sowing (DAS).

Organic manure and calcium superphosphate fertilizers were added during soil preparation at a rate of $20m^3$ and 30 Kg P_2O_5/fed respectively Three equal doses of ammonium nitrate (33.5% N) and . potassium sulfate (48 % K_2O) were added at rate of 60 kg N/fed and 24 kg K_2O/fed after 30 , 45 and 60 days from sowing respectively. Foliar application treatments were carried out twice after 45 and 75 days from sowing using tween 20 as wetting agent.

Two plant samples after 60 days from sowing and at harvest date (130 days from planting date) were randomly taken from each plot to determine

the following traits: plant height (cm), no. of leaves, dry weights /plant (g) and leaf area cm^2 as well as flowering times (50% tasseling and silking). Also, no of ears/ plant , ear length (cm), ear diameter (cm), no. of rows/ear , no. of kernels/row, 100 kernel weight (g), kernels weight/ ear (g) and grain yield kg/fed were recorded. Samples were dried in an oven at 70°C to calculate the dry matter accumulation. Total nitrogen in grain was determined by using the modified Micro kjeldahl method as described by A.O.A.C. (1985). Total carbohydrates in grains was extracted according to Smith *et al* (1964) and estimated colorimetrically by Nelson reagent method as described by Cherry (1973). Oil content of seeds was determined according to A.O.A.C. (1984) by using soxhlet apparatus and petroleum ether as an organic solvent. Phosphorus was determined according to Murphy and Riley (1962). K^+ was measured by using flame photometer "149" as described by Johanson and Ulrich (1959).

Data were subjected to statistical analysis according to Steel and Torrie (1960). LSD was used to detect significant differences.

RESULTS AND DISCUSSION

1- Growth traits

1-1 Effect of foilar application :-

Results in table (1) indicated that foliar application with $MnSO_4$ 2% , urea 2% + sucrose 3% and 20 ppm paclobutrazol (pp333) had significant difference effects on all growth characters for maize cultivars during both seasons under Siwa Oasis conditions. However spraying maize cultivars by $MnSo_4$ 2% recorded the maximum higher rates in plant height (cm), No. of leaves/plant, dry weight/plant (g) and leaf area/plant. The magnitude of such increment reached (11.9, 29.5, 12.4 and 18%)and (11.8, 22.9 ,11.8 and 17.4%) as compared with the control during 1^{st} and 2^{nd} seasons, respectively. On the other hand foliar application with paclobutrazol (pp333) achieved the significantly earliest in flowering times (50% tasseling and silking during both seasons.

Concerning the stimulatory effect of micronutrients on plant growth, it was clearly established that, manganese participates in O_2 – evolving system of photosynthesis and has a role in the production of chlorophyll (Robertson and Lucas, 1976). So, such factors show clearly the important role of Mn in promoting maize growth, root extension, cell division, respiration, N metabolism and activation of enzymes in plant growth (Gardner *et al.*, 1985 and Marschner 1986). These results are in agreement with those reported by Allam and El-Naggar 1992 ; Abdel Salam *et al*, 1993 and El-Sheikh 1998 they found that, Mn sprays on maize cultivars achieved the positive response. Also, Younis *et al.*, 1995 and El-Gezawy, 1996 reported that time to mid tasseling and silking were significantly decreased with increasing N fertilizer levels. In the same direction, growth traits of maize hybrids enhanced by paclobutrazol as a foliar application. This finding may be due to the role of paclobutrazol for reduced harm or negative effect of salinity on growth(El-Desouky and Atawia 1998)and (El- Shamey and Ibrahim 2004).

Table (1): Effect of foliar application on growth characters of maize hybrids cultivars under Siwa Oasis conditions in 2003 and 2004 growing seasons.

Treatments	Plant height (cm)	No. of leaves/ plant	Dry weight /plant (g)	Leaf area cm^2	No. of days	
					50 % tasseling	50% silking
	2003					
Control	169. 4	8. 17	150. 5	122. 0	63. 55	67. 22
Urea 2% + Sucrose 3%	183. 9	10. 25	162. 9	138. 2	63. 06	70. 05
Paclo. 20 ppm	179. 2	9.17	154. 9	132. 8	62. 67	68. 78
$MnSO_4$ 2%	189. 6	10. 58	169 2	143 9	65. 42	71. 48
L.S.D. 5%	3. 17	0. 81	1. 45	1. 54	0. 78	1. 30
	2004					
Control	177. 3	8. 75	152. 9	123. 9	63. 97	69. 00
Urea 2% + Sucrose 3%	193. 1	10. 67	164. 7	138. 8	61. 87	67. 08
Paclo. 20 ppm	189. 6	9. 67	156. 3	133. 5	60. 67	66. 14
$MnSO_4$ 2%	198. 3	10. 75	171. 0	145. 5	62. 63	68. 03
L.S.D. 5%	0. 91	0. 60	1. 21	1. 30	0. 70	0.62

1.2.The difference between hybrids aspects:

With regard to the difference between maize hybrids in growth traits the data in Table (2) revealed that S.C.10 cultivar recorded the highest values for plant height (cm), no. of leaves /plant and leaf area/plant at 60 days after sowing which reached (200.3 cm , 10.17 and 149 cm^2)and (203.8 cm ,10.67 and 149.1 cm^2) during 1st and 2nd season, respectively. Whereas, S.C.122 and S.C.10 was the best one for dry weight /plant (g) in 2003 and 2004 growing seasons, respectively. Meanwhile, T.W.C.323 cultivar recorded the lowest mean values for all growth traits during both seasons under Siwa Oasis condition. Furthermore S.C.122 cultivar was significantly earliest in tasseling (62.33& 61.52) and silking (67.32& 66.38) during both seasons, respectively. On the other hand, T.W.C. 310 cultivar recorded the longest period to tasseling (65.20& 63.28) and silking (71,81 & 68.73) in 2003 and 2004 growing seasons, respectively. Whereas, S.C. 10 cultivar was in between. Such results could be attributed to the genetic constitution of the tested cultivars. Similar results were, also, reported by Gouda *et al* 1992 and El-Sheikh 1998. However, Shafshak *et al* 1994 recorded that S.C. 10 was the earliest in tasseling and silking followed by D.C. 215 and Giza ~2, then T.W.C. 310. Also, it could be concluded that the superiority of S. C. 10and T.W.C. 310 in growth traits may be due to the ability of its cultivars to be adapted under Siwa oasis condition (Hassan,1998). However, its cultivars may be responsed to the most important role by using foliar application treatments in translocation of photosynthate (Ill'Yashuk and Okanenko, 1970 and Marschner and Possingham, 1975) The data of such studies may be

supported by other researchs (El-Kalla *et al* 2001; Radwan *et al* 2001 and Radwan *et al* 2003) they indicated wide differences among maize hybrids in tolerance to stress conditions for limited supply.

Table (2): Varietal differences on growth characters of maize hybrids under Siwa Oasis conditions in 2003 and 2004 growing Seasons.

Treatments	Plant height (cm)	No. of leaves/ plant	Dry weight /plant (g)	Leaf area cm^2	No. of days	
					50 %tasseling	50% silking
	2003					
S.C 10	200. 3	10. 17	169. 2	149. 0	63. 08	68. 13
S.C 122	188. 5	9. 33	158. 5	138. 9	62. 33	67. 32
T.W.C. 323	164. 0	9. 17	150. 8	121. 5	64. 10	70. 29
T.W.C. 310	169. 3	9. 50	158. 9	127. 4	65 20	71. 81
L.S.D. 5%	1. 69	0. 47	1. 14	0. 66	0. 42	0. 68
	2004					
S.C 10	203. 8	10. 67	171. 8	149. 1	61. 47	66. 15
S.C 122	200. 8	9. 67	160. 2	140. 1	61. 52	66. 38
T.W.C. 323	173. 6	9. 33	152. 4	123. 0	62. 88	68. 99
T.W.C. 310	180. 3	10. 17	160. 5	129. 5	63. 28	68. 73
L.S.D. 5%	0. 69	0. 50	0. 68	0. 84	0. 48	0. 86

1.3. Effect of interaction:-

The interaction between different foliar application treatments and maize cultivars had a significant effect on all growth traits at 60 DAS (Table 3). The highest mean values of plant height (cm), no. of leaves /plant, dry weight /plant (g) and leaf area/plant (cm^2) were observed on S.C. 10 when sprayed with $MnSO_4$ 2% during both seasons. .Meanwhile, paclobutrazol (pp333) combined with S.C.122 cultivar was significantly earliest in tasseling and silking in both growing seasons. Whereas, the longest period was achieved by spraying Mn SO_4 2% combined with T.W.C.310 cultivar during 1st season and tap water as a control combined with T.W.C. 310 cultivar during 2nd one.

The data also revealed that, growth characters of maize plants enhanced to a great extent with the supplemental foliar application of Mn^{+2}, compared to the control. In this respect, Allam and El-Naggar 1992 ; Abdel Salam *et al.* 1993 and El-Sheikh 1998 they showed positive response to growth and yield by using Mn^{+2} sprays of maize cultivars. Also El-Sheikh, 1998 found that Giza-2 maize cultivar was significantly earliest. Meanwhile, T.W.C. 310 recorded the longest period and S.C. 10 was between in tasseling and silking, respectively.

Table (3): Effect of interaction between different foliar applications and maize hybrids under Siwa Oasis conditions in 2003 and 2004 growing seasons.

Treatments		Plant height (cm)	No. leaves/ plant	Dry weight /plant (g)	Leaf area cm^2	No. of days	
						50 %tasseling	50% silking
		2003					
Control	S.C 10	181. 3	8. 67	155.8	141.6	61.43	65.43
	S.C 122	174. 5	8. 33	151.5	123.2	62.43	66.10
	T.W.C. 323	158. 2	8. 00	141.0	108.7	64.80	67.37
	T.W.C. 310	163. 4	7. 67	153.6	114.4	65.53	70.00
Urea 2% + Sucrose 3%	S.C 10	204. 3	11. 67	176.2	151.1	63.10	68.13
	S.C 122	193. 1	10 .33	161.2	144.9	62.33	67.77
	T.W.C. 323	167. 2	9.33	153.4	125 7	62.47	71.33
	T.W.C. 310	171. 2	9.67	160.7	130.9	64 33	72.97
Paclo 20 ppm	S.C 10	206. 3	8.67	163.2	147.7	61.97	67.40
	S.C 122	188. 1	8.33	151.1	137 7	61.40	66.23
	T.W.C. 323	158. 2	9.67	149.6	118.3	63.33	70.30
	T.W.C. 310	164. 2	10.00	155.5	127.4	64.00	71.20
$MnSO_4$ 2%	S.C 10	209. 3	11.67	181.4	155.7	65.80	71.53
	S.C 122	198. 3	10.33	170.3	149.9	63.13	69.17
	T.W.C. 323	172. 5	9.67	159.1	133.3	65.80	72.17
	T.W.C. 310	178. 3	10.67	165.8	136.9	66.93	73.07
L.S.D	5 %	6. 34	0.93	2.29	1.33	0.85	1.37
		2004					
Control	S.C 10	187.8	9.33	159.2	141.7	61.70	66.93
	S.C 122	186.3	8.67	154.6	126.0	63.53	68.60
	T.W.C. 323	165.8	8.33	143.0	110.4	65.20	69.60
	T.W.C. 310	169.3	8.67	154.9	117.6	65.47	70.87
Urea 2% + Sucrose 3%	S.C 10	210.3	12.00	177.3	151 7	62.07	66.13
	S.C 122	204.0	10.67	162.7	145.9	60.60	65.80
	T.W.C. 323	175.8	9.67	155.8	125.3	61.40	68 67
	T.W.C. 310	182.2	10.33	162.9	132.5	63.40	67.73
Paclo 20 ppm	S.C 10	204.7	9.67	165.1	146.1	60.53	64.93
	S.C 122	204.2	8.67	152.1	137.3	60.67	64.20
	T.W.C. 323	169.8	9.67	151.1	121.7	61.90	68.03
	T.W.C. 310	179.8	10.67	156.9	129 1	59.60	67.40
$MnSO_4$ 2%	S.C 10	212.3	11.67	185.7	157.0	61.60	66 60
	S.C 122	208.5	10.67	171.4	151.3	61.27	66.93
	T.W.C. 323	182.8	9.67	159.8	134.6	63.00	69.67
	T W.C. 310	189.7	11.00	167.3	138.9	64.67	68.93
L.S.D	5 %	1.81	1.00	1.35	1.67	0.95	1.73

2- Yield and yield componantes

2-1 Effect of foliar application :-

Significant increases in no. of ears/ plant , ear length (cm), ear diameter (cm), no. of rows/ear , no. of kernels/row, 100 kernel weight (g), kernels weight/ ear (g) and grain yield kg/fed. were recorded by using different foliar application as compared with the control during both seasons(Table 4).

Table (4): Effect of foliar application on yield and yield components of maize hybrids in 2003 and 2004 growing seasons

Characters	Foliar application				L.S.D. 5 %
	Control	Urea 2 %+ sucrose 3%	Paclo 20 ppm	$MnSO_4$ 2%	
	2003				
No. of ears/plant	1.00	1.50	1.08	1 52	0.36
Ear length (cm)	19.35	22.90	20.34	24.34	0.90
Ear diameter (cm)	3.73	4.12	3.71	4.36	0.29
No. of rows/ear	12.17	12.33	12.33	12.58	0.31
No. of kernels/ row	29.00	30.83	30.17	31.67	0.67
100 kernel weight (g)	30.54	31.73	30.39	31.10	0.68
Kernels weight g/ear	109.5	122.7	115 4	125.2	1.43
Shelling %	73.93	72.22	73.96	72.02	1.26
Grain yield kg/fed	2172	2498	2348	2547	28.83
	2004				
No. of ears/plant	1.17	1.50	1.33	1.58	0.50
Ear length (cm)	19.96	24.32	22.74	24.75	0.39
Ear diameter (cm)	3.75	4.25	3.96	4.33	0.20
No. of rows/ear	12.25	12.58	12.58	12.67	0 44
No of kernels/ row	29.67	31.33	30.83	31.50	0 99
100 kernel weight (g)	31.08	31.69	31.08	32.42	0.52
Kernels weight g/ear	115.2	126.5	122.2	130.6	1.98
Shelling %	72.28	74.22	73.57	74.17	0.66
Grain yield kg/fed	2301	2573	2484	2654	38.21

Also, foliar application with $MnSO_4$ 2% surpassed the other treatments in yield and its component. The percentages of increments were (25.79, 1.8 ,14.3 and 17.3% in 2003) in ear length (cm), 100 kernel weight (g), kernels weight g/ ear and grain yield kg/fed and (24 ,4.3 ,13.4 and 15.3 % in 2004) growing seasons as compared with the control, respectively. Whereas, urea 2% + sucrose 3% and 20 ppm paclobutrazol (pp333) foliar application recorded the 2nd and 3rd order respectively during both seasons. The increase

in yield and its components might have been resulted from the increase in growth characters by using Mn^{+2} application El-Sheikh 1998. These results are in agreement with those reported by Allam and El-Naggar 1992; Abdel Salam *et al.*, 1993. In this connection, El-Sokkary (1973) reported that desert calcareous soil supply lower amounts of micronutrients to plants than alluvial soils. Also, AtaAllah *et al* 2002 found that application of N fertilizer gave the heighest mean values for 100-grain weight and grain yield /fed . Similar results were repoted by lamlom, 1997; Zedan *et al.*, 1998 ,Kamal 2001 and Radwan *et al.*, 2003. Concerning the role of pp333 for increasing yield and its components. El-Shamey and Ibrahim 2004 found that pp333 had positive effect on leaves number and 100 grains weight of wheat plant. Dawh *et al* 1998 ; El-Desouky and Atawia 1998 found that paclobutrazol reduced the harmful or negative effects of salinity on growth which reflect on yield and its components.

2.2. The difference between hybrids on yield and its components:

In regard to the effect of different maize cultivars on yield and its components in 2003 and 2004 growing seasons at Siwa Oasis, data in Table (5) show that S.C. 10 cultivar recorded the highest mean values for no. of ears/ plant, ear length (cm), no of rows/ear , no of kernels/row, kernels weight g/ ear and grain yield kg/fed which reached 1.42, 23.67 (cm), 12.67, 31.00, 120.8 (gm) and 2475 kg/fed in 2003 and 1.50, 24.25(cm), 12 50,31.67. 127.2 (gm) and 2601 kg/fed in 2004 respectively followed by T W.C. 310,S.C.122 and T.W.C.323 in a descending order.

Table (5) Varietal differences on yield and yield components of maize hybrids in 2003 and 2004 growing seasons.

Characters	Hybrids				L.S.D.5%
	S.C. 10	S.C. 122	T.W.C. 323	T.W.C. 310	
	2003				
No. of ears/plant	1.42	1.17	1.17	1.35	0.48
Ear length (cm)	23.67	22.57	19.58	21.12	1.17
Ear diameter (cm)	4.11	4 05	3.74	4.02	0.20
No. of rows/ear	12 67	12.42	12.25	12.08	0.53
No. of kernels/ row	31.00	30.83	29.50	30.33	1.20
100 kernel weight (g)	30.08	29 81	31.51	32.38	0.44
Kernels weight g/ear	120.8	116.7	115.5	119 7	1 59
Shelling %	73.62	72.78	73.88	71.84	0.98
Grain yield kg/fed	2475	2391	2307	2392	32.88
	2004				
No. of ears/plant	1 50	1.42	1.25	1.42	0.36
Ear length (cm)	24.25	24.10	21.17	22.25	0 70
Ear diameter (cm)	4 12	4.06	3.97	4.14	0 25
No. of rows/ear	12.50	12.58	12.42	12.58	0.73
No. of kernels/ row	31.67	31.00	30.17	30.50	0.83
100 kernel weight (g)	31.61	31.25	31.46	31.96	0.56
Kernels weight g/ear	127.2	123.8	119.6	123.8	2.83
Shelling %	74.34	73 44	72.99	73.46	0.52
Grain yield kg/fed	2601	2534	2391	2486	58.35

Meanwhile, T.W.C.310 was the best one cultivar for 100 kernels weight (gm) during both seasons under Siwa Oasis conditions. These findings may be mainly due to the role of Mn^{+2} application which used in adapted and improving growth characters of S.C.10 cultivar which reflect on yield and its components more than other cultivars. El-Sheikh 1998. Also, Ayad 2002, found that yield and its components of S.C.10 cultivar was better than S.C. Nagah cultivar at Sharkia Governorate. In the same diriction Hassan, 1999 reported that potential yield of two hybrids cvs S.C.103 and T.W.C. 310 surpassed the other maize cvs at any sowing dates at Siwa Oasis condition . However, Tantawy *et al.*, 1998 reported that the greatest grain yield resulted from S.C.10 in the 1st season (29.81 ardab/fed) and T.W.C. 310(28.99 ardab/fed) in the 2nd one. These results are in agreement with those reported by Allam and El-Naggar 1992, Radwan *et al* 2003 on maize cultivars.

2.3. Effect of interaction:

The combined effects of foliar application with different maize cultivars on yield and its components are shown in Table (6). Generally, the highest significant mean values for ear length (cm), ear diameter (cm), no.of kernels/row, kernels weight g/ ear and grains yield kg/fed were obtained by MnSo4 2.0% foliar application combined with S.C.10 hybrid which reached (28.00 cm, 4.46 cm , 32.67, 128.5 g and 2646 kg/fed. in 2003)and (26.17 cm, 4.53 cm 32.67 , 135.0 g and 2768 kg/fed. 1n 2004) growing seasons respectively under Siwa Oasis conditions. However, Urea 2.0% + Sucrose 3.0%combined with S.C. 10 cultivar recorded the second one during both seasons. Whereas, Mnso4 2.0% combined with T.W.C. 310 cultivar marked the highest values for no. of ears/plant and 100 kernels weight (g) during both season. These findings may be related to the response of S.C. 10 variety with foliar application 2% MnSo4. In addition, the increments in yield and its components might have been resulted from the increase in growth characters accompanying Mn^{+2} application (El-Sheikh 1998). These results are in agreement with those reported by Allam and El-Naggar 1992; Abdel Salam *et al.* 1993 consider an essential macronutrient for plant metabolism (Mengel and Kirkby, 1978).

Table (6): Effect of interaction between different foliar application and hybrids maize cultivars on yield and yield componantes in 2003 and 2004 growing seasons.

Treatments		No. of ears/ plant	Ear length (cm)	Ear diameter (cm)	No. of rows /ear	No. of kernels/ row	100 kernel weight (g)	Kernels weight g/ear	Shelling %	Grain yield kg/fed
						2003				
Control	S.C. 10	1.00	20.40	3.73	12.33	29.33	30.00	110.5	73.80	2221
	S.C. 122	1.00	19.77	3.73	12.33	29.33	29.00	106.9	69.87	2149
	T.W.C. 323	1.00	17.70	3.57	12.00	28.00	31.83	109.0	76.33	2134
	T.W.C. 310	1.00	19.53	3.87	12.00	29.33	31.33	111.5	75.70	2184
Urea 2% + Sucrose 3%	S.C. 10	1.67	24.00	4.23	13.00	31.33	30.77	127.6	74.00	2627
	S.C. 122	1.33	24.83	4.17	12.00	31.33	31.33	121.6	73.73	2505
	T.W.C. 323	1.33	20.17	3.83	12.00	30.67	31.67	118.4	72.20	2380
	T.W.C. 310	1.67	22.60	4.27	12.33	30.00	33.17	123.4	68.97	2479
Paclo. 20ppm	S.C. 10	1.33	22.30	4.00	12.67	30.67	29.03	116.8	73.37	2405
	S.C. 122	1.00	20.17	3.63	12.33	30.67	29.00	112.6	72.57	2322
	T.W.C. 323	1.00	18.83	3.63	12.33	29.33	30.87	112.8	76.40	2269
	T.W.C. 310	1.00	20.07	3.57	12.00	30.00	32.67	119.2	73.50	2395
$MnSO_4$ 2%	S.C. 10	1.67	28.00	4.47	12.67	32.67	30.50	128.5	73.30	2646
	S.C. 122	1.33	25.50	4.67	13.00	32.00	29.90	125.7	74.97	2587
	T.W.C. 323	1.33	21.60	3.93	12.67	30.00	31.67	121.7	70.60	2446
	T.W.C. 310	1.73	22.27	4.37	12.00	32.00	32.33	124.8	69.20	2508
L.S.D 5%		0.72	1.81	0.57	0.63	1.35	1.36	2.85	2.51	57.66
						2004				
Control	S.C. 10	1.33	21.17	3.80	12.00	30.67	31.33	117.4	73.07	2359
	S.C. 122	1.33	20.67	3.67	12.33	30.00	31.00	117.2	72.23	2354
	T.W.C. 323	1.00	18.83	3.67	12.33	28.67	30.67	111.1	72.07	2185
	T.W.C. 310	1.00	19.17	3.87	12.33	29.33	31.33	114.3	71.73	2307
Urea 2% + Sucrose 3%	S.C. 10	1.67	25.93	4.33	12.67	32.00	31.77	130.7	75.07	2688
	S.C. 122	1.33	25.33	4.17	12.67	31.33	31.67	127.4	74.33	2622
	T.W.C. 323	1.33	22.17	4.17	12.33	31.33	31.17	121.8	73.50	2447
	T.W.C. 310	1.67	23.83	4.33	12.67	30.67	32.17	126.2	73.97	2535
Paclo. 20ppm	S.C. 10	1.33	23.73	3.80	12.67	31.33	31.17	125.8	74.40	2589
	S.C. 122	1.33	24.40	4.07	12.67	31.33	30.50	123.0	73.17	2533
	T.W.C. 323	1.33	20.67	3.87	12.33	30.00	31.17	117.0	72.97	2350
	T.W.C. 310	1.33	22.17	4.10	12.67	30.67	31.50	112.9	73.77	2464
$MnSO_4$ 2%	S.C. 10	1.67	26.17	4.53	12.67	32.67	32.17	135.0	74.83	2768
	S.C. 122	1.67	26.00	4.33	12.67	31.33	31.83	127.7	74.03	2628
	T.W.C. 323	1.33	23.00	4.17	12.67	30.67	32.83	128.5	73.43	2582
	T.W.C. 310	1.67	23.83	4.27	12.67	31.33	32.83	131.3	74.37	2637
L.S.D 5%		1.00	0.78	0.41	0.88	1.99	1.04	3.95	1.33	76.43

Biochemical aspects: -

Data presented in the Table (7) showed that N P K concentrations and total carbohydrates content as well as oil % were slightly significantly increased in grains of maize hybrids with all foliar application treatments as compared with the control. However, the present results indicate a great similarity between Urea 2% + Sucrose 3% and Mnso4 2% as foliar application for improving N P K concentrations and total carbohydrates content as well as oil % in grains of maize cultivars.

Concerning hybrids, S.C.10 cultivar had the highest values of N P K concentrations and total carbohydrates content than other cultivars under Siwa Oasis conditions. However, T.W.C. 310 was the best cultivar for Oil %

Table (7): Grain composition from NPK , total carbohydrates and oil % for maize hybrids varieties in 2003 growing season.

Treatments		Total nitrogen %	P+ %	K+ %	Total carbohdrads %	Oil %
Effect of foliar application						
Control		1.52	0.36	0.37	69.14	10.84
Urea 2% + Sucrose 3%		1.56	0.39	0.39	69.73	10.97
Paclo. 20 ppm		1.55	0.38	0.38	69.57	10.86
$MnSO_4$ 2%		1.53	0.37	0.37	69.33	10.86
L.S.D. 5%		0.01	0.01	0.1	1.00	0.15
Effect of hybrids						
S.C 10		1.56	0.38	0.39	70.22	10.57
S.C 122		1.55	0.39	0.38	69.46	10.47
T.W.C. 323		1.53	0.37	0.36	69.43	11.06
T.W.C. 310		1.52	0.38	0.37	68.68	11.42
L.S.D. 5%		0.01	0.01	0.01	0.97	0.12
Interaction effect						
Control	S.C 10	0.36	0.38	69.83	10.52	1.54
	S.C 122	0.37	0.37	69.03	10.46	1.53
	T.W.C. 323	0.35	0.36	68.77	11.03	1.51
	T.W.C. 310	0.36	0.36	68.93	11.35	1.50
Urea 2% + Sucrose 3%	S.C 10	0.39	0.40	70.77	10.65	1.57
	S.C 122	0.41	0.38	69.83	10.49	1.57
	T.W.C. 323	0.38	0.37	69.63	11.10	1.55
	T.W.C. 310	0.39	0.39	68.70	11.63	1.55
Paclo 20 ppm	S.C 10	0.38	0.39	70.40	10.56	1.56
	S.C 122	0.39	0.39	69.60	10.46	1.56
	T.W.C. 323	0.37	0.37	69.60	11.06	1.54
	T.W.C. 310	0.38	0.37	68.70	11.36	1.53
$MnSO_4$ 2%	S.C 10	0.37	0.38	69.78	10.56	1.55
	S.C 122	0.38	0.38	69.37	10.47	1.54
	T.W.C. 323	0.36	0.35	69.70	11.05	1.52
	T.W.C. 310	0.37	0.37	68.40	11.36	1.51
L.S.D. 5 %		0.02	0.02	0.02	2.03	0.24

The interaction between foliar application treatments and maize cultivars data in table (7) showed that. S.C.10 cultivar combined with urea 2% + Sucrose 3% as foliar application interaction contained higher values of N P K concentrations and total carbohydrates content than other interaction Meanwhile, T.W.C. 310 was the best cultivar for Oil % with the same foliar application treatment interaction.

The present results indicate a great similarity of the four tested hybrids in their grain content for NPK and total carbohydrates content as well as Oil %. These results are in agreement with that reported by El-Sheikh 1998 on seven maize tested varieties. Also Badr *et al.*, 1997 showed no significant difference among four maize cultivars in NPK and total carbohydrate percentages in grain. Also, increased N% in maize grains due to application of nitrogen fertilizer was reported by Nofal (1994) and El-Sheikh (1998) On the same direction Kabesh *et al* (1988) and Abdel-Salam *et al* (1993) showed that spraying 36 to 54g Mn/fed gave the highest values of N% in grains of maize cultivars. In addition, Tantawy *et al.*, 1998 reported that the Oil % was affected significantly by maize cultivars. The same results were obtained by Esmail (1996).

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دراسات على أقلمة بعض هجن الذرة تحت ظروف واحة سيوة

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أقيمت تجربتان حقليتان خلال موسمى ٢٠٠٣ -٢٠٠٤ فى منطقة تجزرتى بواحة سيوة تحت ظروف الإجهاد البيئى لدراسة تأثير ثلاث معاملات للرش وهى (يوريا ٢% + سكروز ٣% ، باكلوبترازول ٢٠ جزء فى المليون . سلفات منجنيز ٢ %) بالإضافة لمعاملة المقارنة وذلك بالرش بالماء العادى على النمو والمحصول ومكوناته لأربع أصناف من هجن الذرة وهى هجين فردى ١٠ - هجين فردى ١٢٢ - هجين ثلاثي ٣٢٣ - هجين ثلاثي ٣١٠ تحت ظروف واحة سيوة .أتبع تصميم القطع المنشقة مرة واحدة فى ثلاث مكررات حيث نفذت معاملات الرش فى القطع الرئيسية وهجن الذرة فى القطع المنشقة وفيما يلى اهم النتائج .

-أدى الرش بالمعاملات المختلفة إلى استجابة معنوية لجميع صفات النمو والإنتاجية لهجن الذرة مقارنة بمعاملة المقارنة (الرش بالماء العادي) خلال مرحلتي النمو الخضري وعند الحصاد خلال موسمي الزراعة ٢٠٠٣ - ٢٠٠٤ .

- أظهر الرش بسلفات المنجنيز ٢ % لهجن الذرة المختلفة افضل زيادة معنوية في طول النبات - عدد الأوراق على النبات - الوزن الجاف للنباتات وكذلك مساحة الورقة . والذي أنعكس على زيادة المحصول ومكوناته (طول الكوز - وزن ١٠٠ حبة - وزن الحبوب للكوز الواحد - وكذلك وزن الحبوب للفدان خلال موسمي الزراعة. كذلك أدى الرش بالباكلوبترازول ٢٠ جزء فى المليون الى التبكير فى ظهور الشوشة وكذلك الحريرة لمعظم هجن الذرة خلال الموسم الأول والثاني .
- تفوق الهجين الفردى ١٠ تفوقا معنويا فى صفات النمو مما أدى الى تحسين واضح فى المحصول ومكوناته مقارنة بالاصناف الاخرى (هجين فردى ١٢٢ - هجين ثلاثي ٣٢٣ - هجين ثلاثي ٣١٠).
- حقق التفاعل بين الرش بسلفات المنجنيز ٢% للهجين الفردى ١٠ افضل قيم معنوية لمعظم صفات النمو والإنتاجية مقارنة بطرق التفاعل الاخرى خلال موسمين الزراعة ٢٠٠٣ - ٢٠٠٤ .
- أوضحت نتائج التحليلات الكيميائية للحبوب أن معاملات الرش المختلفة أدت الي تحسين واضح فى محتوى الحبوب من النيتروجين - الفوسفور - والبوتاسيوم - الكربوهيدرات بالاضافة الى محتوى الحبوب من الزيت .