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RESPONSE OF THE MAIZE (*Zea mays* L.) HYBRIDS TO THE DIFFERENT FORMS OF NITROGEN AND PHOSPHORUS FERTILIZERS UNDER THE ENVIRONMENTAL CONDITIONS OF SIWA OASIS REGION IN EGYPT

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This research was carried out during the 2003 and 2004 seasons under the salinity conditions at Siwa Oasis to find out responsive effects of the nitrogenous and phosphorus fertilizers on some agronomic traits in maize hybrids (namely Single-cross,S.C.129; Double-cross, D.C. 215; and Three ways-cross, T.W.C. 310 for Plant height (PH) ; Ear length (EL) ; Ear height (EH) ; Ear diameter (ED) ; Number of rows/ear (NRE) ; Number of kernels/row (NKR) ; Ear weight (EW) ; 100 kernel weight (HKW) ; Grain yield/plant (GYP) and Grain yield (GYA).

Three doses of the nitrogen fertilizer; (Ammonium nitrate, AN 33%; Ammonium sulphate, AS 20.5% and Uria, U 46.5%) and two doses of phosphorus fertilizer (Calcium super phosphate, CSP 15.5%P_2O_5 and Triple phosphate, TP 45% P_2O_5) were used. Combined analysis of the years indicated that D.C. 215 overed for examined yield and yield components. Using Ammonium nitrate as a source of nitrogen has been given the best result than adding Triple phosphate as a source of P_2O_5 had been better than the other two fertilizer regimes for yield and yield components. The favorable results of the combination interaction between hybrids, nitrogen and phosphorus fertilization was indicated by adding (AN) 33%N + (TP) 45%P_2O_5 with D.C.215. This combination caused significant increasing in plant height, number of kernels / row and grain yield ardab/fed. (21082 cm, 47.95 NKR and 17.92 ardab/fed. respectively). The stepwise multiple linear regression analysis was applied to study relationship between the variables of the three maize hybrids over the different nitrogen and phosphorus

fertilizer doses in this study. Two, five and two variables were significantly contributed to the total variation with 90.08 %, 95.59 % and 93.0% for D.C 215, T.W.C 310 and S.C 129 hybrids, respectively. The path coefficient analysis indicated that ear height and ear weight. for D.C215; plant height, ear height , ear diameter, no. of kernels/row , 100 kernel weight . for T.W.C 310 and ear height and 100 kernel weight for S.C 129, were 88.31%, 95.15% and 90.59% for D.C215; T.W.C 310 and S.C129, respectively of the total contribution.

Keywords: maize (*Zea mays* L.), Siwa Oasis, Egypt, hybrids, nitrogen sources,,phosphorus sources, salinity, yield and its components, stepwise multiple regression, path coefficient.

Region of the Siwa Oasis is located within the extremely arid zone, which characterized by low rain fall, very high midday solar radiation, flux densities, abundant sun shine, extreme temperature, high evapotranspiration potentials and a paucity of the good quality water for irrigation where salinity and heat are the main problems during the cultivation of maize. Egyptian growers are not acquainted with this crop in the Siwa Oasis Region. Therefore, they imports this from the Delta Governorates zone. Maize (*Zea mays* L.) is one of the most important cereals in Egypt and in the world. It is grown throughout the temperate and the tropical regions of the world. It takes third place, after wheat and rice, in the world production of cereal. Therefore, many efforts are focused for increasing the productivity of this crop by growing high yielded varieties under most favorable cultural conditions. It was reported that growth and agronomic characters of the maize's plant weight (cm), stem diameter (cm) and barren plants % traits were affected by the application of nitrogen and phosphorus fertilizer (El-Ashmoony *et al.*, 1985; El-Kholy, 1987; Hegazy *et al.*, 1996; Badawi and El-Moursy, 1997; Nassar *et al.*, 2001).On the other hand, phenotypic correlation coefficients was simply measures of the natural association without consider its result while path coefficient analysis specifies the causes and measures their relative importance in plants. Salem *et al.* (1983) reported that number of ears/plant and 100 kernel weight had little direct effect, while number of kernel/ear showed some effect on grain yield of maize. Sadek *et al.* (1992) and Salama *et al.* (1994) concluded that seed index and ear diameter were the most effective characters (directly and indirectly) contributed of the grain yield/plant of maize. Soliman *et al.* (1995) found that grain yield /plant was significantly correlated with ear length, ear diameter and number of kernels/row of maize. They added that both number of ears/plant and ear length exhibited direct effect on grain yield/plant and

indirect effect via number of ears/plant. Nasr and Geweifel (1991), El-Rassas and El- Rayes (1992) and El-Sergany (1992) reported that stepwise multiple linear regression was more efficient than full model of regression. It is used to determine the best predictive equation for the yield. The objective of this study was to investigate the effect of different nitrogen and phosphorus fertilizer doses on three maize hybrids under the salinity conditions at Siwa Oasis, and to estimate and find out the relative importance the hybrids.

MATERIALS AND METHODS

Two field experiments were carried out at Tegzerty Research Station, Siwa Oasis, Desert Research Center in Egypt during the 2003 and 2004. Sowing was made on 15/3/2003 and 28/3/2004 in the first and second seasons, respectively. Results of physical and chemical properties of the experimental site's are presented at tables (1a and b).

TABLE (1a). Soil physical properties of the experimental site's soil at different depths

Depth (cm)	$CaCO_3$ %	Particle size distribution (mm) as %				Texture
		Coarse Sand (1-0.5)	Fine Sand (0.25-0.1)	Silt 0.05-0.002	Clay <0.002	
0-30	37.72	7.97	77.04	14.99	-	Sandy Loam
30-60	59.42	6.44	77.78	15.78	-	Sandy Loam

TABLE (1b). Soil chemical properties analysis of the experimental site's soil at different depths

Depth (cm)	PH	EC (mmhos/cm)	Anions (meq/L)				Cations (meq/L)			
			CO_3^-	HCO_3^-	SO_4^{--}	Cl^-	Ca^{++}	Mg^{++}	Na^{++}	K^+
0-30	7.97	8.92	Nil	2.0	18.73	63.9	35.2	4.8	43.48	1.15
30-60	7.83	8.43	Nil	3.0	23.37	64.9	36.3	5.9	47.17	1.90

Soil of the experimental site was characterized by sandy loam texture, shallow to medium, $CaCo_3$ content that varies between 37.72 to 59.42, CL^- and Ca^{++} contents are high. Mechanical and chemical soil analysis of the experimental site is presented in tables (1a and b).

The experiment has 18 treatments which are distributed in split-split plot design with four replications. The main plots represented three maize hybrids (namely, Single-cross,S.C.129; Double-cross, D.C. 215 and Three ways-cross, T.W.C. 310) (Table 2). Three dosages of nitrogen (Ammonium nitrate, AN 33%N, Ammonium sulphate, AS 20.5% N and Uria, U 46.5% N) were assigned as sub-plots, and two dosages of phosphorus fertilizers

(Calcium super phosphate, CSP 15.5% P_2O_5 and Triple phosphate, TP 45% P_2O5) were designed as sub-sub plots. Nitrogen fertilizer at a rate of 120 kg/fed was applied into 3 equal doses at sowing, 4 and 8 weeks after sowing. Similarly, 31 kgP_2O_5 phosphorus fertilizer was given during the soil-bed preparation. While potassium was applied at the rate of 24 kg K_2O/fed. in two equal doses (after 4 and 8 weeks from planting dates).

TABLE (2). Hybrids, their origin's and pedigrees

Hybrids	Origin	Pedigree
S.C.129	Egypt	628x612
D.C.215	Egypt	103 (7x34) x 107 (58x62)
T.W.C.310	Egypt	34 x S.C.10(sids63 x sids7)

In addition, 20m^3/fed. organic manure was given to the soil before the sowing (Table 3).

TABLE (3). Chemical analysis (%) of applied manure

Season	Moisture content	Organic carbon	Total nitrogen	C/N ratio	Organic matter
2003	10.3	21.41	36.82	10.0	2.12
2004	19.42	19.34	34.17	13.0	1.45

The sub-sub plot was 10.5 m3 (3x3.5m) containing 5 ridges, and planting were made in hills 20 cm apart on one side of the ridge. Weeds were controlled by cultural methods and all seedlings were thinned as to be one plant per hill after 28 days from the sowing. The previous crop was alfalfa in both seasons. Plants were irrigated with brackish water which contained 2500-2800 ppm as dissolved salts (Table 4).

TABLE (4). Chemical composition of the irrigation water sample in Tegzerty farm.

Season	PH	Ec ds/m	Cations (meq/L)				Anions (meq/L)			
			Ca^{++}	Mg^{++}	Na^{++}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}
2003	8.26	4.37	7.5	10.0	28.0	1.23	-	1.8	36.25	8.68
2004	8.32	4.35	7.8	12.1	31.3	1.20	-	1.7	38.4	8.7

Data Collection and Statical Analyses.

Yield and its components were recorded at the maturity. After 115 days for plant height, PH (cm);Ear length, EL (cm); Ear height, EH (cm); Ear diameter, ED (cm); Number of rows/ear, NRE; Number of kernels/row, NKR; Ear weight, EW (gm); 100 kernel weight, HKW (gm); Grain yield/plant, GYP (gm) and Grain yield, GYA ardab/fed. (ardab 140kg seed).

All data were subject to statistical analysis as described by Snedecor and Cochran (1980), and the least significant differences (L.S.D) at 5% level were calculated. Combined analysis of the two seasons was performed by using the Mstat-C Statistical Software (Russell, 1991) after the Bartlet test. Stepwise multiple linear regressions were calculated as described by Draper and Smith (1966). The path coefficient analysis was done by Dewey and Lu (1959) and Wright (1921) for all observed data in this study.

RESULTS AND DISCUSSION

1-Hybrid Differences

Investigated characters were significantly affected from the hybrids and D.C.215 hybrid surpassed both S.C.129 and T.W.C.310 for all characters. These results indicate that the double crosses of maize to give the highest yield and its components under salinity conditions. Moreover, superiority of D.C.215 in grain yield production is attributed for better yield of the four lines which compose the hybrid. But, T.W.C.310 involved three lines only followed by S.C.129. Concerning the response of grain yield and its attributes of maize hybrids D.C. 215 was superior to that of the other maize hybrids (Table 5). This indicates that, D.C. 215 is more salt tolerant than the other maize hybrids. These results may be attributed to increase no. of rows / ear, no. of kernels / row and 100 – kernel wt. EL- Sheikh (1998) reported that D.C. Taba and Dahaby produced the maximum number of rows / ear, and S.C. 10 and 156 Y maize varieties gave the highest means of plant height and position. EL-Hosary and EL-Badawy (2005) found that the three double crosses (106X158) X (101XL56), (106X1006) X (101X1012) and (158X1006) X (L56X1012) gave the highest significant yield compared with the control variety (Namely S.C. 3062).

TABLE (5). Effect of hybrids, nitrogen and phosphorus fertilizers on yield and yield components of maize under the saline conditions at Siwa Oasis region.

Treatments		Plant Height (cm)	Ear length (cm)	Ear height (cm)	Ear diameter (cm)	no. of rows /ear	no. of kernels /row	Ear weight (gm)	100 kernel weight(gm)	Grain yield plant(gm)	Grain yield (ardab/fed.)
Varieties	D.C.215	216.83	25.78	114.45	5.72	16.29	49.66	219.81	33.48	183.71	18.85
	T.W.C.310	188.99	24.19	108.35	5.47	14.86	47.04	203.65	31.03	167.12	15.84
	S.C. 129	181.46	20.48	102.69	5.07	13.30	44.40	183.16	29.33	158.95	14.03
	L.S.D	1.051	0.998	3.023	0.072	0.652	0.877	6.295	0.612	9.019	0.386
Nitrogen fertilizer	AN	202.53	24.70	111.78	5.56	15.48	48.95	213.19	32.39	176.97	17.37
	AS	196.14	23.51	108.18	5.48	14.93	47.08	203.23	31.47	170.35	16.25
	U	188.16	22.24	105.53	5.23	14.06	45.06	190.21	29.99	162.46	15.09
	L.S.D	0.333	0.323	0.472	0.067	0.259	0.374	3.583	0.318	3.518	0.320
Phosphorus fertilizer	CSP	189.48	22.75	105.86	5.38	14.54	46.02	194.37	30.54	165.30	15.63
	TP	202.04	24.22	111.14	5.46	15.10	48.04	210.05	32.03	174.56	16.85
	L.S.D	0.391	0.202	0.567	0.024	0.157	0.211	2.126	0.173	2.014	0.113

D. C. 215: Double cross(V1) ; T.W.C.310: Three ways cross(V2) : S.C.129: Single cross(V3).
AN: Ammonium nitrates33%N (N1); AS: Ammonium sulphate22.5% N (N2) ; U: Uria 48% N (N3).
CSP: Calcium super phosphate15.5%P_2O_5 (P1); TP:Triple phosphate 45% P_2O_5 (P2) .
L.S.D.at 0.05 level.

2-Effect of Nitrogen Fertilizer

The doses of the nitrogenous fertilization significantly affected all characters in this study. According to the results, ammonium nitrate, AN 33%N was the best source of nitrogen, it gave the highest values for all characters. It was followed by ammonium sulphate, AS 20.5%N and urea, U 46.5%N (Table 5). Obtained results were in agreement with by Eid (1977). The effect due to the AN 33%N application may be attributed to the differences in previous soil management and texture (Kucey, 1986) or soil reaction as shown from the soil analysis. Osman *et al.* (1991) stated that nitrate fertilizers especially for slow-acting forms, were better than ammonia and amide fertilizers for their effects on the biological processes and mummification of plant matter. Ammonium sources produce acidity during nitrification. The final acidity may be greater of the NH_4 is associated with an acidic anion such as sulfate (SO_4). Thus, the ammonium sulfate is usually the most acidic **N** source and nitrate sources accompanied by basic cations such as Na^{++}or Ca^{++} may be raise the soil PH. Mello *et al.* (1984) found that **N** source significantly affected 100 – kernel weight, the highest value was recorded with the addition of (AN), whereas, addition of calcium nitrate was associated with the lowest value. These results were also recorded by Chabalier (1985), Hammam (1995) and Abdel–Hameed (2005).

3- Effect of Phosphorus Fertilizer

Dosages of the phosphorus fertilizer have significantly affected all studied characters (Table 5). The results reveal that the triple phosphate fertilizer was the best source of phosphorus under salinity condition, it gave the highest values of all characters followed by calcium super phosphate, CSP 15.5% P_2O_5. This increase may be due to high percent rate of phosphorous element in triple phosphate, TP compared with calcium super phosphate.

4- Interaction Effects

4-1. Interaction effect between hybrids and nitrogen fertilizer

Plant height, ear height, ear diameter, number of kernels/row, ear weight, 100-kernel weight and grain yield / fed. were significantly affected by the interactions of the nitrogen fertilizer and the three varieties (D.C. 215; T.W.C. 310 and S.C.129).The highest values were taken from the V1XN1 (Namely,D.C.215 X AN 33%) for the above mentioned characters being 223.72 cm, 117.97 cm, 5.82 cm, 51.96, 236.27 gm, 35.22gm and 20.42 ardab/fed., respectively. While the lowest values were obtained with V3 X N3 (Namely, S.C 129 X U 46.5 %), as 176.51 cm,99.41 cm,4.91 cm, 42.64, 175.75 gm, 28.21 gm and 13.01 ardab/fed., respectively (Table 6). These results were recorded by Hassan and Gaballa (2000) and Ahmed *et al.* (2002).

TABLE (6). Interaction between hybrids and nitrogen fertilizer on yield and its components of maize plants grown under saline conditions at Siwa Oasis region.

Varieties	Nitrogen fertilizer	Plant Height (cm)	Ear Length (cm)	Ear Height (cm)	Ear diameter (cm)	no.of rows/ear	no.of kernels /row	Ear weight (gm)	100 kernel weight (gm)	Grain yield plant (gm)	Grain yield (ardab /fed.)
D.C.215	AN	223.72	27.26	117.97	5.82	16.94	51.96	236.27	35.22	192.56	20.42
	AS	216.95	25.60	114.39	5.73	16.52	50.22	222.69	33.77	185.08	18.72
	U	209.8	24.48	110.98	5.61	15.42	46.81	200.47	31.44	173.50	17.41
T.W.C.310	AN	197.12	25.24	110.67	5.63	15.64	48.73	212.13	31.67	172.72	16.77
	AS	190.34	24.48	108.18	5.62	15.02	46.64	204.42	31.12	167.76	15.86
	U	179.52	22.83	106.19	5.17	13.93	45.73	194.40	30.31	160.88	14.87
S.C. 129	AN	186.73	21.60	106.68	5.22	13.84	46.17	191.17	30.27	165.63	14.91
	AS	181.14	20.45	101.97	5.08	13.23	44.37	182.57	29.52	158.22	14.17
	U	176.51	19.39	99.41	4.90	12.82	42.64	175.75	28.21	152.99	13.01
L.S.D		0.576	N.S	0.818	0.1166	N.S	0.648	6.207	0.552	N.S	0.554

D. C. 215 : Double cross(V1) ; T.W.C 310. Three ways cross(V2) : S.C.129: Single cross(V3).
AN: Ammonium nitrates33%N (N1); AS. Ammonium sulphate22.5% N (N2) ; U: Uria 48% N (N3).
L.S.D.at 0.05 level

4-2. Interaction effect between hybrids and phosphorus fertilizer

Plant height, number of kernels/row, ear weight and grain yield / fed. were significantly affected by the varieties (D.C. 215; T.W.C. 310 and S.C.129) and phosphorus fertilizer. The highest values were obtained from the V1XP2 (Namely, D.C.215 X TP 45% P_2O_5) as 220.38 cm, 51.30, 230.54 gm and 19.67 ardab/fed., respectively. While the lowest values were obtained from the V3 X P1 (Namely, S.C.129 X CSP15.5% P_2O_5 for the same characters, 174.42 cm, 43.73, 167.70 gm and 13.54 gm, respectively (Table7).

TABLE (7). Interaction among hybrids and phosphorus fertilizer on yield and its components of maize plants grown under saline conditions at Siwa Oasis region.

Varieties	Phosphorus fertilizer	Plant height (cm)	Ear length (cm)	Ear Height (cm)	Ear diameter (cm)	no.of rows/ear	no.of kernels /row	Ear weight (gm)	100 kernel weight (gm)	Grain yield plant (gm)	Grain yield (ardab /fed.)
D.C.215	CSP	213.27	25.07	111.94	5.68	15.93	48.03	209.08	32.72	179.55	18.04
	TP	220.38	26.49	116.96	5.76	16.66	51.30	230.54	34.24	187.83	19.67
T.W.C.310	CSP	180.76	23.52	105.67	5.45	14.58	46.29	197.34	30.31	161.08	15.30
	TP	197.23	24.85	111.03	5.45	15.14	47.78	209.97	31.76	173.16	16.37
S.C. 129	CSP	174.42	19.64	99.95	5.01	13.10	43.73	176.70	28.59	155.22	13.54
	TP	188.51	21.32	105.42	5.12	13.49	45.05	189.63	30.08	162.68	14.52
L.S.D		0.677	N.S	N.S	N.S	N.S	0.365	3.683	N.S	N.S	0.196

D. C. 215: Double cross (V1); T.W.C.310: Three ways cross(V2) : S.C.129: Single cross(V3).
CSP: Calcium super phosphate15.5% P_2O_5 (P1); TP:Triple phosphate 45% P_2O_5 (P2).
L.S.D. at 0.05 level.

4-3. Interaction effect between nitrogen and phosphorus fertilizer

Plant height, ear length, number of kernels/row and ear weight were significantly affected by the interaction between nitrogen and phosphorus fertilizers. The highest values were obtained from the N1 X P2 (Namely, AN 33% N X TP 45% P_2O_5) as 209.20 cm, 23.60 cm, 50.26 and 222.11 gm

respectively. While the lowest values were obtained by N3 X P1 (Namely, U (46.5%) X CSP (15.5% P_2O_5) as 183.66 cm, 21.67 cm, 44.31 and 184.63 gm, respectively (Table 8).

TABLE (8). Interaction among nitrogen fertilizer and phosphorus fertilizer on yield and its components of maize plants grown under saline conditions at Siwa Oasis region.

Nitrogen fertilizer	Phosphorus fertilizer	Plant height (cm)	Ear length (cm)	Ear height (cm)	Ear diameter (cm)	no.of rows /ear	no.of kernels /row	Ear weight (gm)	100 kernel weight (gm)	Grain yield plant (gm)	Grain yield (ardab /fed.)
AN	CSP	195.86	23.80	109.67	5.50	15.16	47.64	204.28	31.52	171.66	16.72
	TP	209.20	23.60	114.48	5.61	15.79	50.26	222.11	33.26	182.28	18.02
AS	CSP	188.93	22.77	105.23	5.44	14.66	46.10	194.21	30.72	166.17	15.59
	TP	203.36	24.26	111.07	5.51	15.19	48.06	212.25	32.22	174.54	16.91
U	CSP	183.66	21.67	103.20	5.20	13.80	44.31	184.63	29.38	158.07	14.57
	TP	193.56	22.81	107.86	5.26	14.31	45.81	195.78	30.59	166.85	15.62
L.S.D		0.677	0.348	N.S	N.S	N.S	0.365	3.683	N.S	N.S	N.S

AN: Ammonium nitrates33%N (N1); AS: Ammonium sulphate22.5% N (N2) ; U: Uria 48% N (N3).
CSP: Calcium super phosphate15.5%P_2O_5 (P1) ;TP:Triple phosphate 45% P_2O_5 (P2).
L.S.D.at 0.05 level.

4-4. Interaction effect between hybrids, nitrogen and phosphorus fertilizer

Plant height, number of kernels/row and grain yield / fed. were significantly affected by the interaction between varieties (D.C. 215; T.W.C. 310 and S.C.129), nitrogen and phosphorus fertilizers. The height values were taken from the V1 X N1 X P2 (Namely,D.C.215, AN33% and TP 45% P_2O_5) as 228.23 cm, 54.22 and 21.47 ardab/fed. respectively. While the lowest values were obtained from the V3 X N3 X P1 (Namely, S.C.129 X U 46.5% X CSP 15.5%) as 170.58 cm, 41.95 and 12.48 ardab/fed., respectively (Table 9).

5- Stepwise Regression Analysis

This type of analysis is used to study the relationship between the variables of the treated hybrids and grain yield ardab/fed. is dependent variable in this study. The prediction equation for the three hybrids was given in table (10). Ear height and ear weight were significantly contributing the variation in D.C215, with relative contribution (R^2%) of 90.08% for all variables and accepted variables contributed by 88.31%. The plant height, No. of kernels/row, ear diameter, ear height and 100-kernel weight, were significantly contributing to variation in T.W.C 310, with relative contribution of (R^2%) equal to 95.59% for all variables and contribution of 95.15% for accepted variables;100-kernel weight and ear height were significantly contributed the variation in S.C129, with relative contribution (R^2%) equal to 93.0% for all variables and contribution 90.59% for accepted variables (Table10).These results reveal that yield of T.W.C 310 was affected by five independents variables than the other hybrids which were

affected by two independents only which need more studies to determine another accepted variables which contribute to variation of grain yield ardab/fed.

TABLE (9). Interaction among hybrids, nitrogen and phosphorus fertilizers on yield and its components of maize plants grown under saline conditions at Siwa Oasis region.

Treatments			Plant height (cm)	Ear length (cm)	Ear length (cm)	Ear diameter (cm)	no.of rows /ear	no.of kernels /row	Ear weight (gm)	100 kernel weight (gm)	Grain yield plant (gm)	Grain yield (ardab /fed.)
D.C.215	AN	CSP	219.22	26.18	115.67	5.76	16.55	49.70	225.58	34.43	188.00	19.38
		TP	228.23	28.33	120.28	5.88	17.33	54.22	246.97	36.02	197.12	21.47
	AS	CSP	211.82	24.88	111.00	5.70	16.10	48.72	208.42	32.95	180.97	17.83
		TP	222.08	26.32	117.78	5.75	16.95	51.73	236.97	34.60	189.20	19.62
	U	CSP	208.78	24.15	109.15	5.58	15.13	45.67	193.23	30.77	169.82	16.90
		TP	210.82	24.82	112.82	5.65	15.70	47.95	207.70	32.12	177.18	17.92
T.W.C.310	AN	CSP	190.37	24.53	107.87	5.62	15.33	47.90	204.58	30.82	165.55	16.27
		TP	203.88	25.95	113.48	5.64	15.95	49.57	219.68	32.52	179.88	17.28
	AS	CSP	180.30	23.82	105.53	5.56	14.78	45.67	198.05	30.43	162.25	15.30
		TP	200.38	25.15	110.83	5.64	15.25	47.62	210.80	31.80	173.27	16.42
	U	CSP	171.60	22.22	103.62	5.12	13.63	45.32	189.38	29.67	155.45	14.33
		TP	187.43	23.45	108.77	5.21	14.23	46.15	199.42	30.95	166.32	15.42
S.C. 129	AN	CSP	177.98	20.68	103.67	5.12	13.58	45.33	182.67	29.30	161.43	14.50
		TP	195.48	22.52	109.68	5.31	14.10	47.00	199.67	31.25	169.83	15.32
	AS	CSP	174.68	19.60	99.36	5.02	13.08	43.92	176.17	28.77	155.28	13.63
		TP	187.60	21.30	104.58	5.13	13.38	44.82	188.98	30.27	161.15	14.70
	U	CSP	170.58	18.63	96.83	4.88	12.63	41.95	171.27	27.70	148.93	12.48
		TP	182.43	20.15	101.98	4.92	13.00	43.33	180.23	28.72	157.05	13.53
L.S.D			1.173	N.S	N.S	N.S	N.S	0.632	N.S	N.S	N.S	0.339

D. C. 215: Double cross(V1); T.W.C.310: Three ways cross(V2); S.C.129: Single cross(V3).
AN: Ammonium nitrates33%N (N1); AS: Ammonium sulphate22.5% N (N2); U: Uria 48% N (N3).
CSP: Calcium super phosphate15.5%P_2O_5 (P1); TP: Triple phosphate 45% P_2O_5 (P2).
L.S.D.at 0.05 level.

5-1. Phenotypic correlation coefficients.

For each studied hybrids based on the combined data over the two seasons; nitrogenous and phosphorus fertilizers forms were calculated among all possible combinations of the grain yield, plant height, ear height, ear diameter, ear length, ear weight, no. of kernels/row, no. of rows/ear, 100-kernel weight. As seen in table(11), highly significant and positive correlations were found for ear diameter with no. of kernels/row and ear weight for D.C 215, except plant height. Plant height with ear diameter and significant with no. of rows/ear for S.C.129 and no significant between plant height with ear diameter and significant with ear weight in T.W.C 310. This indicates that ear length, ear height, ear diameter, no. of rows/ear, no. of kernels/row, ear weight and 100 kernel weight play an important role in the determining of the grain yield (Table 11).

TABLE (10). Accepted and removed variables according to stepwise analysis and their relative contributions (R^2%) in grain yield variance of hybrids.

D.C. 215 (V1)	
Prediction equation	Y= -6.383 + 0.142 EH + 0.04 EW
R^2%for all variables	90.08%
Acceptance variables	Eh – EW
R^2% for accepted variables	88.31%
Removed variables	PH – EL - ED – NRE – NKR – HKW
T.W.C. 310 (V2)	
Prediction equation	Y= -9.563 + 0.032 PH – 0.059 EH + 1.068 ED + 0.189NKR + 0 356 HKW
R^2%for all variables	95.59%
Acceptance variables	PH – EH – ED – NKR – HKW
R^2% for accepted variables	95.15%
Removed variables	EL – NRE – EW
S.C. 129 (V3)	
Prediction equation	Y= -4.079 + 0.045 EH + 0.456 HKW
R^2% for all variables	93%
Accepted variables	EH – HKW
R^2%for acceptance variables	90.59%
Removed variables	PH – EL – ED – NRE – NKR – EW

PH = Plant height, cm; EL= Ear length, cm; EH= Ear height, cm; ED= Ear diameter, cm; NRE= Number of rows/ear; NKR= Number of kernels/row; EW= Ear weight, gm; HKW= 100 kernel weight, gm.

TABLE (11). Simple correlation coefficients between grain yield and yield components.

Hybrids	Traits	PH	EL	EH	ED	NRE	NKR	EW	HKW
D.C. 215	EL	.187							
	EH	.043	.870**						
	ED	-.038	.697**	.822**					
	NRE	.067	.847**	.929**	.880**				
	NKR	.120	.870**	.881**	.576	.796**			
	EW	.168	.905**	.824**	.567	.822**	.882**		
	HKW	.258	.918**	.852**	.684**	.851**	.910**	.909**	
	GYA	.088	.858**	.885**	.684**	.861**	.885**	.908**	.900**
T.W.C. 310	EL	.693**							
	EH	.716**	.874**						
	ED	.525	.763**	.849**					
	NRE	.712**	.799**	.826**	.780**				
	NKR	.789**	.859**	.791**	.557*	.834**			
	EW	.630*	.864**	.787**	.716**	824**	.770**		
	HKW	.681**	.903**	.828**	.709**	.808**	.830**	.926**	
	GYA	.785**	.907**	.855**	.805**	.855**	.853**	.885**	923**
S.C. 129	EL	.818**							
	EH	.787**	.898**						
	ED	.563	.654**	.816**					
	NRE	.610*	.860**	.785**	.545				
	NKR	.752**	.900**	.791**	.517	.838**			
	EW	.704**	.907**	.792**	.658**	.776**	.809**		
	HKW	.767**	.873**	.816**	.749**	.732**	.823**	.944**	
	GYA	.810**	.879**	.856**	.784**	.727**	.835**	.883**	.939**

PH = Plant height, cm; EL= Ear length, cm; EH= Ear height, cm; ED= Ear diameter, cm; NRE= Number of rows/ear; NKR= Number of kernels/row; EW= Ear weight, gm; HKW= 100 kernel weight, gm; GYA= Grain yield ardab/fed.

5-2. Path coefficient

Path coefficient was calculated according to Wright (1921). Grain yield ardab/fed. is dependent and the others are independent variables in this study. The major aim of the calculation was to determine the direct and indirect effects of different traits on grain yield which helps in selecting the high yielded hybrids under the suitable nitrogen and phosphorus fertilizers dosages. According to the results, ear height and ear weight were the most prominent direct and their indirect effects on the grain yield of the D.C.215 with the highest relative important value being 18.12% and 31.1%, respectively. Plant height, ear height, ear diameter, no. of kernels/row and 100- kernel weight had the most prominent direct and indirect effects on the grain yield in T.W.C. 310 with the highest relative importance values being 8.56% and 9.62% for ear diameter and 100 kernel weight respectively. For S.C129, ear height and 100-kernel weight were the most prominent direct and indirect effects in grain yield with the highest relative important values being 7.06% and 52.6%, respectively. The total contribution of these characters over all variation were 88.31%, 95.15% and 90.59% for D.C215, T.W.C 310 and S.C 129, respectively (Table 12).

TABLE (12). Direct and indirect effects of yield components and their relative contribution in grain yield of the three maize hybrids at the study.

D.C. 215			T.W.C. 310			S.C. 129		
Variables	CD	RI%	Variables	CD	RI%	Variables	CD	RI%
EH	0.181	18.12	PH	0.053	2.3	EH	0.071	7.06
EW	0.311	31.1	EH	0.075	3.25	HKW	0.522	52.19
EH x EW	0.391	39.1	ED	0.197	8.56	EH xHKW	0.313	31.34
Residual	0.117	11.69	NKR	0.063	2.74	Residual	0.094	9.41
Total	1.000	88.31	HKW	0.221	9.62	Total	1.000	90.59
			PH x EH	-0.09	3.91			
			PH x ED	0.107	4.65			
			PH x NKR	0.091	3.96			
			PH x HKW	0.147	6.4			
			EH x ED	-0.21	8.96			
			EH x NKR	-0.11	4.73			
			EH x HKW	-0.21	9.26			
			ED x NKR	0.124	5.4			
			ED x HKW	0.296	12.87			
			NKRx HKW	0.196	8.52			
			Residual	0.049	4.85			
			Total	1.000	95.15			

CD= Coefficient of determination; RI%= Relative importance;
PH= Plant height, cm; EL= Ear length, cm; EH= Ear height, cm; ED= Ear diameter, cm;
NKR= Number of kernels/row; EW= Ear weight, gm; HKW= 100 kernel weight, gm.

CONCLUSION

The obtained results revealed that relative contribution of the treatments was affected by different maize hybrids. This can explain the

genetic structure and difference of the hybrids. Moreover, ear height, ear weight, 100- kernel weight, ear diameter, no. of kernels/row were considered the major yield components and every maize breeder should take into account them for developing high yielded maize hybrids under the salinity conditions .

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استجابة هجن الذرة الشامية لصور التسميد الآزوتي والفوسفاتي تحت الظروف البيئية بواحة سيوة فى مصر.

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أجريت هذه الدراسة بمزرعة مركز بحوث الصحراء بواحة سيوة ذات طبيعة التربة المالحة وذلك خلال عامي ٢٠٠٣ , ٢٠٠٤ بهدف دراسة تأثير صور مختلفة من الأسمدة الآزوتية والفوسفاتية على الأهمية النسبية وسلوك بعض صفات النمو والمحصول لثلاث هجن من الذرة الشامية(هجين فردى ١٢٩ , هجين زوجي ٢١٥ , هجين ثلاثي ٣١٠) وكانت الأسمدة الآزوتية المستخدمة فى صورة نترات امونيوم(٣٣% ن) , كبريتات أمونيوم (٢٠,٥% ن), يوريا (٤٦,٥% ن) وكانت صور السماد الفوسفاتي المستخدم هي سوبر فوسفات الكالسيوم(١٥,٥% فو٢أ٥), تربل فوسفات(٤٥% فو٢أ٥) وأجريت الدراسة على الصفات (طول النبات – طول الكوز – وزن الكوز – ارتفاع الكوز – قطر الكوز – عدد الصفوف بالكوز – عدد الحبوب بالصف – وزن المائة حبة – وزن محصول النبات – وزن محصول الفدان ! (أردب/فدان) وأظهرت نتائج الدراسة مايلى:

١–تميز الهجين الزوجي ٢١٥ على الهجن الأخرى فى جميع الصفات تحت الدراسة , كما أظهرت الدراسة تفوق واضح لتأثير سماد نترات الأمونيوم كمصدر للنتروجين على الأسمدة الأخرى , وتفوق السماد تربل فوسفات على سوبر فوسفات الكالسيوم وكانت أفضل صور التفاعل بين الهجن والأسمدة الآزوتية والفوسفاتية هي بإضافة نترات الأمونيوم (٣٣%ن) + تربل فوسفات(٤٥% ن) مع الهجين الزوجي (٢١٥) وذلك تحت الظروف البيئية لواحة سيوة.

٢–أظهرت النتائج أن هناك ارتباطا موجبا عاليا بين جميع الصفات تحت الدراسة ووزن محصول الفدان (أردب/فدان) للهجن الثلاثة عدا صفة طول النبات في الهجين الزوجي (٢١٥) .

٣–أثبت تحليل الانحدار المتعدد المرحلي أن أكثر الصفات مساهمة في التباين الكلى في الهجين الزوجي٢١٥هي وزن الكوز وارتفاع الكوز وفى الهجين الثلاثي ٣١٠ كان ممثل فى وزن المائة حبة, ارتفاع الكوز, قطر الكوز, ارتفاع النبات و عدد البذور فى الكوز. وفى الهجين الفردي ١٢٩ كان ممثل فى وزن المائة حبة وارتفاع الكوز.

٤–اظهر تحليل معامل المرور أن أكثر الصفات مساهمة بطريق مباشر وطريق غير مباشر فى الاختلافات الكلية لمحصول الهجين الزوجي ٢١٥ كان ممثل فى ارتفاع الكوز ووزن الكوز وللهجين الثلاثي ٣١٠ , ارتفاع الكوز وارتفاع النبات وقطر الكوز وعدد البذور في الصف ووزن المائة حبة, وللهجين الفردي ١٢٩ كان ممثل فى ارتفاع الكوز ووزن المائة حبة, بمساهمة قدرها ٨٨,٣١%, ٩٥,١٥%, ٩٠,٥٩% من التباين الكلى للهجين الزوجي ٢١٥ والهجين الثلاثي ٣١٠ وللهجين الفردي ١٢٩ على الترتيب.

٥–أوضحت الدراسة أن الأهمية النسبية لمكونات المحصول فى الذرة الشامية قد تأثرت باختلاف الأصناف وذلك راجع إلى اختلاف التركيب الوراثي لهذه الهجن مع أختلاف مصادر التسميد الفوسفاتي والنيتروجيني, كما أن صفات وزن الكوز وارتفاع الكوز ووزن المائة حبة وقطر الكوز وعدد الحبوب/الصف هي من أهم الصفات المحصولية التي يجب أن يسعى المربى لأخذها في الاعتبار عند أستنباط هجن جديدة تتلاءم مع الظروف البيئية فى ظروف الأراضي المالحة.