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INTERACTION EFFECT OF BOTH SOIL AND FOLIAR APPLICATION OF NPK ON RESPONSE OF CORN VARIETIES IN EGYPT AND MOROCCO

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ABSTRACT

Two field experiments were carried out at Gemiza (ARS), during 2012, 2013. The aim of the study was to evaluate the performance of S.C.167 and T.W.C. 253 maize under the use of different rates of NPK. Fertilizer were tested cross (Cs) , soil application (SA) and foliar one (FA). All the agriculture treatments were used as usual. A split split plot design was used. five traits were studied. Such traits were distributed at ear length, ear diameter, ear height, cob. Weight, and shilling percentage . The obtained results could be summarized as follows :

- Crosses, soil application and foliar application of NPK signifcantly affected most studied traites except ear height, cob. weight, and shilling percentage .
- Significancey was completely absent as respect to first and second order interaction with all studied trait but the superior vlues were produced from combination (T.W.C. 253 × 80% NPK (S.A.)), (T.W.C. 253 × 80% NPK (F.A.)) and (80% NPK (S.A.) × 40% NPK (F.A.))

INTRODUCTION

Maize (Zea mays L.) is one of the most important cereal crops in Egypt as a food crop for both humans and animals and in the same time it needs highly rate of N applied reached to 300kg urea /fed. in normal soils (Nofal and Hinar, 2003) these large quantities of the mineral N-fertilizer cause environmental pollution through drainage water and other N-contaminated water (Mantripukhri, 2006). Maize can be grown as a supplementary crop to decrease the gap between the import and the local production of oil in Egypt.

Nitrogen fertilization is one of the factors that most contributes to an increase in dry matter production of corn (Bernardi et al. 2009). N is required for all stages of plant growth and development because it is the essential element of both structural (cell membranes) and nonstructural (amino acids, enzymes, protein, nucleic acids and chlorophyll) components of the plant (Seilsepour and Rashidi, 2011)

Due to biochemical functions of phosphorus in the plant, the most important of which is the activation of enzymes participating in generating and transformation of energy as well as the synthesis of carbohydrates, proteins and fats, this component controls N metabolism (Potarzycki 2009). Phosphorus translocates from older tissue to new, actively growing tissue quite readily, so discoloration tends to appear on older tissue first.

Phosphorus deficiency is often difficult to diagnose correctly from visual symptoms alone. Soil and plant tissue analyses are required to confirm this deficiency (Hodges 2010). Phosphorus deficient plants are characterized by stunted growth, dark green leaves with a leathery texture, and reddish purple leaf tips and margins. Reddish purple margins are characteristic of P deficiency on corn. Symptoms usually occur on young plants when the soil temperature is below 16oC (Tucker 1999).

Potassium is one of the important macronutrients next to N and P. This nutrient is one of the essential nutrients whose deficiency affects the crop growth and production. Potassium is an activator of many plant enzymes Potassium has important functions in plant water relations where it regulates ionic balances within cells Potassium regulates the leaf stomata opening and subsequently the rate of transpiration and gas exchange. Plants also need K for the formation of sugars and starches, for the synthesis of proteins, and for cell division. It increases the oil content of pistachios and contributes to its cold hardiness (Beede et al. 2011)

So, a study was planned to evaluate the effect of NPK management methods on the yield, yield components and quality attributes of maize hybrids under fertilizer conditions.

MATERIALS AND METHODS

Two field experiments were conducted at Agricultural Research Station at Gemniza, A.R.C Egypt during the two successive years 2012 and 2013. The physical properties were mechanically analyzed, following the method described by Piper (1950).The results are presented in Table (1)

Table(1):Physical properties of the soil at Gemmiza in the two seasons.

	Particle size distribution				
	Sand%	**Silt%**	**Clay%**		
	12.35	39.4	48.6	2012	
	11.82	37.92	50.2	2013	

Also, chemical properties were performed according to Black et al (1965). The results are presented in Table (2).

Table2 : Chemical properties of soil at Gemmiza in the two seasons

Available (ppm)			Soluble Cations and Anions (Meq/L)										
N	**P**	**K**	**Ec Ds/m**	**Ph**	**Ca^{++}**	**Mg^{++}**	**Na^{+}**	**K^{+}**	**HCO_3^{-}**	**Cl^{-}**	**SO_4^{-}**		
44.2	9.9	202.8	0.9	8. 5	8.9	8.0	25.2	0.36	3.1	20.7	18.01	2012	
45.1	9.91	202.5	0.8	8.6	8.8	8.5	25.6	0.39	3.1	21.1	18.00	2013	

In both seasons ,sowing was carried out on June first in both seasons. Sowing was one each rows of 3m long and 60 cm between. Hills were 30 cm apart. Plants were secured to one plant/ hill. Plot size was (3x3) = 9 m^2. NPK fertilizations were running as tested in the study. Weeds were controlled by standard herbicides. Harvest was carried as normal. on jun The other cultural practices were followed as done for corn production.

Table (3) the average of maximum and minimum as temperature degrees, growing degree days (GDD) and heat units (H.U.) during the two seasons at Gemmiza.

		Month						
		Sept.	**Aug.**	**July**	**June**	**May**		
		32.7	35.4	35.4	35.3	32.5	Max.	
		22.5	25.1	25	22.9	20.2	Min.	
		17.6	20.3	20.2	19.1	16.4	GDD	
573	2865	546	629	626	573	491.	H.U.	
		32.6	35	33.1	34.5	33.5	Max. .	
		22.5	24	22.9	22.6	20.4	Min.	
		17.55	19.5	18.0	18.55	16.95	GDD	
556.1	2780.5	554	605	558	555	508.5	H.U.	

Treatments.

A- Corn Cross: (Cs)

Two corn crosses were investigated. The first was a single cross, i. e S.C /167. The second was a triple cross, i. e. T.W.C.353. seeds of two crosses were supplied from F. C. R. I., ARC, Ministry of Agriculture, Egypt.

B- Soil application:(SA)

The three nutrients were added at five rates as next:

1-Rate of (100%NPK, S_1A_1); $N_{120}P_{45}K_{30}$kg/fed
2-Rate of (80%NPK,S_2A_2); $N_{96}P_{36}K_{24}$kg/fed
3-Rate of (60% NPK,S_3A_3) N_{72} $P_{27}K_{18}$ kg/fed
4-Rate of (40% NPK,S_4A_4) $N_{48}P_{18}K_{12}$ kg/fed
5-Rate of (0% NPK,S_5A_5) $N_0P_0K_0$ kg/fed

Nitrogen was spirited at twice. The first and the second rates were before the first and second irrigations, respectively Phosphorus, as super phosphate 33.5%, was added during soil preparation. Potassium, as potassium sulphate 48%), was added at once during planting.

C- Foliar application: (FA)

Five treatments were tested as follows

1-Kristilone(100% NPK, F_1A_1)$N_{20}P_{20}K_{20}$ kg/fed.
2-Rate of (80 % NPK, F_2A_2) (800gm)fed
3- Rate of (60% NPK, F_3A_3)(600gm)fed.
4-Rate of (40% NPK, F_4A_4) (400gm) fed
5- Rate of (0% NPK,F_5A_5) (0%gm)fed.

All tested rates were sprayed at twice, where a half of each rate was used in 300 lit/fed. The first spray was at the fed stage. While, the second spray was done at seventeen leaf one.

Each field experiment was carried out in a (split split plot design) arranged in RCBD with three replications,. Whole plots were devoted to crosses,. Sub- plots were assigned to NPK soil application rates. Meanwhile sub- sub plots were occupied by NPK foliar application.

Studied characteristic:

1- Ear length, cm . (E.L), as average of 10ears random from each experimental plant.

2- Ear Diameter, cm .(E.D), as average of 10 ears random from each experimental plant.
3- Ear weight, gm .(E.W), as average of 10ears random from each experimental plant.
4- Cob .weight, gm.(C.W), as average of 10ears random from each experimental plant.
5- Shelling %.(Sh), as average of 10ears random from each experimental plant.

Statistical Analysis.

I. Analysis of variance :

All obtained means over all meant within each season were subjected to the analysis of variance by F test The differences among means were tested by LSD test.

RESULTS AND DISCUSSION

The results would be mainly presented studied effects as follows:

1- Independent factors effect :

1-A- Corn cross (C_S).

Table (4) presents the effect of corn crosses on different ear traits,ear length, ear diameter, ear height, cob. Weight, and shilling percentage as affected by the tested two crosses in the two studied seasons. Results show significant difference between the two crosses as respects most of traits. With one exception, on ear diameter in S_2 ,where no significant difference was observed.

Data reflect clear superiority of T.W.C 253 over S.C. 167 with most aspects in the two seasons, except ear diameter, even when significance effect was clearly absent. These results mean that the T.W.C 253 has good ear features, forming an arrangement of alternative cooperation, one gives and took. Previously, It was mentioned that T.W.C 253 produced the tallest plants over of S.C 167. Hence, ear height was shorter with the latter cross, in both seasons.

Tallest plants of T.W.C 253 always suit favorable help for vegetative growth , including high no. of leaves and its character, no. of nodes and internodes. These features may promoted ear formation as ,numbers , weights, length, diameter and cob weight. Ear traits were widely investigated. The results showed, in most crosses, that such traits differed among hybrids. Such statement was clearly reported on ear length, (Abo Shetoia et al., 2000). Some authors found similar results. However the trait varied among hybrids, (Gouda et al., 1992 and 1998). Also ear weight.(Mahgoub and El-Shenawy (2005) and El-Galfy et al., 2009). The authors including Azam et al., (2007) and Iqbal et al., (2013) concluded Similar conclusion with respect to cob weight. Shelling percentage was repeated as a different among crosses; Mekkei (1995); Afifi and Khattab, 2011) and Iqbal et al., (2013).

B-Soil Application (SA).

Table (4) declares the obtained means of traits as affected by soil application treatment, in the two successive seasons, 2012, and 2013. In both seasons, Insignificant effects were detected on three traits, viz. no. of ears / plant, ear length ear height and cob weight / plant. These results mean that the previous three traits may be good inherited character, resisting the facters environments by El-Sheikt (1998). There is a difficulty to name those authors but some homes are unforgettable. Among them . Osogie (1998) and Hassan (1999).

The remainder traits were significantly affected by. soil application, however the treatment of 100 % NPK gave the highest products 19.52cm, 143.4cm and 1.48gm in S_1 19.2cm, 140.8cm, and 1.49gm in S2 on traits of ear length ear height, and cob weight. On the reveres control treatment produced the lowest value 19.02cm, 134.9cm, and 1.47gm in S_1 and 18.77cm, 132.3cm, and 1.48gm in S_2 . Moreover control and 100 % NPK treatments subsisted to each other with respect to no. of ears/ plot. Generally, these results mean the use of NPK may encourage the weighed traits such as ear weight. In opposite, no treatment may promotes numerical trait such no. of ears. Mostly, ear length differed from one to another, Gouda (1982) and Rehm et al., (1983) But Raghip (1979) and Salwau (1985) was not significantly affected by N rates.

C-Foliar Application (FA).

The means of the studied traits as affected by foliar application treatments, in the two seasons, are tabulated in table (4). It is clear that significancy differences were only calculated on ear diameter and cob weight/plant in the two seasons, and on ear weight in the second one. For the remained traits, they could be divided in two groups. The first includes ear height, ear length, cob weight in both season, and ear weight/plant in the second one. Such group produced their highest values through the application of 100% NPK. control The second group includes ear diameter and shelling % the last group used treatment for producing superior products 4.6cm and 89% and 4.4cm and 88% Similar results were also reported by . Arif et al., (2006) ;(Alan et al., 2010) and kordi et al., (2013).

Table (4): Means of ear characteristics, influenced by main effects, in first season (S_1) and second one (S_2).

	E. L, cm		E.D, cm		E. H, cm		Cob. Wt./plant, gm		Sh. %	
	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
Cross (Cs)										
S.C.167	18.30b	18.05b	4.8a	4.6a	128.7b	126.2b	1.36b	1.29b	.89	.89
T.W.C. 253	20.30a	19.83a	4.3b	4.4a	150.2a	147.5a	1.46a	1.49a	.88	.88
Soil application (S.A.)										
100% NPK	19.52	19.20	4.37c	4.24c	143.4a	140.8a	1.48	1.49	.88	.88
80% NPK	19.04	18.78	4.5b	4.39bc	142.5a	139.3a	1.42	1.47	.89	.89
60%NPK	19.23	19.01	4.24ab	4.41ab	140.4b	137.4b	1.46	1.47	.90	.88
40%NPK	19.22	18.95	4.61ab	4.53ab	137.9bc	134.3bc	1.42	1.48	.88	.88
0%NPK	19.02	18.77	4.7a	4.55a	134.9c	132.5c	1.42	1.48	.87	.87
Foliar application (F.A.)										
100 %NPK	19.13	18.75	4.59a	4.55a	142.1	138.1	1.52a	1.49a	.89	.88
80%NPK	19.34	19.12	4.56ab	4.45ab	141.3	139.7	1.41ab	1.38ab	.89	.88
60%NPK	19.13	18.91	4.55ab	4.48ab	138.3	135.8	1.39b	1.36b	.88	.88
40%NPK	19.41	19.13	4.50ab	4.45ab	137.8	135.4	1.37b	1.35b	.88	.88
0%NPK	19.03	18.75	4.48b	4.48b	137.8	134.8	1.35b	1.33b	.87	.86
G. Means	19.2	18.9	4.6	4.4	139.6	136.9	1.41	1.39	.88	.88

2- First order interaction :

2-A- (Cross × Soil application) (C_S ×SA).

Table (5) shows significant influences on of (Cross × Soil application) ear diameter, ear position and weight cob/plant, in both seasons. On the contrary, the other two traits (ear length and shelling %) were free from any significant effect in the two seasons too. The later results mean that the differences within each of the two interacted factors were not able to produce an interaction. Oppositely, the former finding, showing significant effects, mean that each level, in every factor successfully interacted with the corresponding ones in the another factor. The combination (SC167 × 80%NPK SA) in both seasons gave the pronounced values on ear diameter, ear position and cob weight/plant, Such findings were 4.7cm, 131.9 cm and 1.6 gm in S1 and 4.6cm, 129.9 cm and 1.5gm in S2, respectively. Similarly,the interaction nitrogen and hybrids showed no significant effect on ears plant .wajid et al., (2007) also reported no significant effect of the interaction of nitrogen and hybrids on ears plant. Turi et al., (2007) found the interaction effect of (C_S×SA) on height of ear length, ear diameter and ear height were statically in significant showing that change in the ear length of all the two hybrids took place in the same manner with change in nitrogen level.

2-B .(Cross × Foliar applications) (C_S ×FA).

Table(5) did not express any significant effect with all respects, it seemed that most of ear traits may be not highly influenced by certain environments. Similar finding were detected by Kordi et al., (2013).

2-C (Soil application ×foliar application) (SA ×FA).

Table (5) presents the calculated means of ear characters as affected by (soil application × foliar application) in seasons of 2012and 2013. Significant differences were only observed with ear diameter and cob weigh/plant, either in the first or second season. Such results mean that most of ear characters, including ear length, ear position and shelling %, did not significantly respond to the interaction effect. Moreover, it was detected that the interaction (80% SA ×40 % FA) produced the highest values on all ear characters (significant or insignificant). 20.2cm, 4.7cm, 152.3cm, 1.5cm, and .89 in S_1 and 19.6cm, 4.5cm, 154.8cm, 1.4cm, and .88 in S_2. This clearly means that promoting ear trait might passed through the use of higher soil application. This result is in opposite of that mentioned on morphological traits which highly acted with higher foliar application on the expanse of soil application. The same results have been already reported by. Kordi et al., (2013).

Table (5): Means of ear characteristics , as affected by first order interactions, in the first season (S_1) and second one(S_2).

	E. L. cm		E.D. cm		E. H. cm		Cob. Wt. gm		Sh. %	
	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
(Cs×SA)										
S.C.167×S_1A_1	19.2	19.0	4.5	4.3	131.3	128.7	1.5	1.4	.85	.89
S.C.167×S_2A_2	19.3	19.3	4.7	4.6	129.9	127.8	1.6	1.2	.95	.90
S.C.167×S_3A_3	19.4	20.1	4.5	4.4	129.0	127.3	1.5	1.4	.88	.87
S.C.167×S_4A_4	19.1	19.2	4.8	4.7	130.8	128.1	1.2	1.2	.90	.89
S.C.167×S_5A_5	19.2	19.3	4.5	4.3	122.9	119.3	1.4	1.4	.86	.84
T.W.C. 253×S_1A_1	19.1	18.7	4.3	4.2	155.5	152.9	1.5	1.5	.89	.89
T.W.C. 253×S_2A_2	19.3	18.1	4.4	4.6	153.2	150.8	1.6	1.6	.88	.88
T.W.C. 253×S_3A_3	19.1	18.9	4.5	4.4	140.8	137.7	1.3	1.5	.87	.86
T.W.C. 253×S_4A_4	19.4	18.2	4.5	4.4	143.8	140.5	1.4	1.4	.88	.87
T.W.C. 253×S_5A_5	19.3	17.8	4.8	4.8	158.0	155.6	1.6	1.5	.88	.87
(Cs×FA)										
S.C.167×F_1A_1	18.3	17.9	4.5	4.3	131.1	128.9	1.5	1.5	.84	.88
S.C.167×F_2A_2	18.3	18.3	4.6	4.4	128.4	126.0	1.3	1.3	.88	.89
S.C.167×F_3A_3	18.1	17.9	4.5	4.4	128.0	125.5	1.3	1.3	.89	.89
S.C.167×F_4A_4	18.6	18.5	4.4	4.3	125.5	123.2	1.4	1.3	.88	.88
S.C.167×F_5A_5	17.9	17.9	4.6	4.4	130.7	127.5	1.3	1.3	.89	.88
T.W.C. 253×F_1A_1	19.9	19.6	4.4	4.4	151.6	148.8	1.5	1.5	.88	.88
T.W.C. 253×F_2A_2	20.4	20.1	4.5	4.5	155.9	152.6	1.5	1.5	.87	.89
T.W.C. 253×F_3A_3	20.1	19.9	4.6	4.5	148.7	146.1	1.5	1.4	.88	.89
T.W.C. 253×F_4A_4	20.3	19.9	4.6	4.5	150.3	147.7	1.5	1.5	.89	.87
T.W.C. 253×F_5A_5	20.1	19.7	4.6	4.5	144.8	142.3	1.4	1.4	.88	.89

3- Second order interaction :

A-(Cross × Soil application × foliar application). (C_S×SA×SF).

The interaction amang (Cross × Soil application × foliar application) had nosignificant effect on all traits on the two studied seasons. Such findings confirmed those results of wajid et al., (2007) and Kordi et al., (2013).

Table 5: Continue ……

	E. L. cm		E.D. cm		E. H. cm		Cob. Wt. gm		Sh. %	
	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2	S_1	S_2
S_1A_1× F_1A_1	18.9	18.3	4.2	4.1	153.5	151.1	1.5	1.4	.88	.88
S_1A_1× F_2A_2	20.2	19.6	4.4	4.2	143.6	141.4	1.6	1.6	.88	.89
S_1A_1× F_3A_3	19.5	19.4	4.4	4.4	143.0	140.6	1.4	1.4	.89	.89
S_1A_1× F_4A_4	19.5	18.9	4.3	4.2	140.0	136.9	1.3	1.2	.89	.80
S_1A_1× F_5A_5	19.9	19.6	4.6	4.5	136.8	134.0	1.2	1.2	.91	.89
S_2A_2× F_1A_1	18.3	17.9	4.6	4.6	134.9	132.1	1.3	1.3	.91	.89
S_2A_2× F_2A_2	19.3	19.1	4.7	4.6	154.8	152.3	1.4	1.4	.89	.89
S_2A_2× F_3A_3	19.5	19.1	4.8	4.7	137.9	136.1	1.5	1.5	.89	.89
S_2A_2× F_4A_4	19.3	19.3	4.3	4.2	140.1	138.6	1.5	1.5	.89	.88
S_2A_2× F_5A_5	19.5	19.2	4.4	4.1	139.9	137.4	1.4	1.4	.88	.88
S_3A_3× F_1A_1	18.2	17.9	4.5	4.2	131.0	129.5	1.4	1.4	.89	.88
S_3A_3× F_2A_2	19.4	19.2	4.6	4.5	133.1	130.2	1.3	1.3	.88	.87
S_3A_3× F_3A_3	19.6	19.4	4.3	4.3	140.1	137.8	1.4	1.4	.88	.87
S_3A_3× F_4A_4	19.5	19.3	4.6	4.6	141.5	138.8	1.4	1.4	.88	.86
S_3A_3× F_5A_5	19.1	18.7	4.6	4.6	128.7	126.1	1.5	1.1	.89	.87
S_4A_4×F_1A_1	19.1	18.9	4.5	4.5	147.5	144.5	1.4	1.4	.89	.88
S_4A_4×F_2A_2	18.9	18.8	4.6	4.5	141.2	138.0	1.2	1.2	.89	.89
S_4A_4×F_3A_3	19.7	18.5	4.7	4.5	134.6	131.6	1.4	1.4	.89	.89
S_4A_4×F_4A_4	19.3	19.5	4.6	4.5	135.7	133.2	1.4	1.4	.87	.86
S_4A_4×F_5A_5	19.9	18.9	4.8	4.8	127.4	124.2	1.1	1.1	.87	.88
S_5A_5×F_1A_1	20.1	19.6	4.6	4.5	139.9	137.1	1.6	1.6	.88	.88
S_5A_5×F_2A_2	18.4	19.8	4.7	4.6	138.2	134.7	1.5	1.5	.89	.87
S_5A_5×F_3A_3	19.2	18.2	4.6	4.5	136.0	132.9	1.2	1.2	.89	.92
S_5A_5×F_4A_4	18.6	19.0	4.7	4.6	132.1	129.7	1.4	1.4	.87	.86
S_5A_5×F_5A_5	17.5	17.3	4.6	4.4	156.0	152.9	1.7	1.6	.82	.83
G. means	19.2	18.9	4.6	4.4	139.5	136.9	1.4	1.4	.88	.88

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التـأثير التفـاعلي للإضـافة الأرضـية والـرش بالأسـمدة النتيروجينيـة والفوسـفورية والبوتاسية على استجابة بعض أصناف الذرة الشامية فى مصر والمغرب

عادل الحسنين[1]، عادل الجناينى[2]، علا البدرى[3] , عفيفى عبد المعبود[4] , أشرف خليفة[5] و محمد شوشة [6].

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أجريت تجربتان منفصلتان فى محطة تجارب مركز البحوث الزراعية بالجميزة فى عام 2012، 2013على بعض هجن الذرة الشامية (2)وعوامل التسميد الأرضية (5)والتسميد بالرش (5).

وكان الهدف الرئيسى من الدراسة على جينيين)أحداهما فردى 167وهجين ثلاثى (253 وكانت هذه الدراسة تحت معدلات مختلفة من إضافة NPKحيث يشمل الإضافة الأرضية على (5)معدلات وأيضاً الإضافة بالرش على (5)معدلات.

وتم تصميم التجربة على النموذج القطع المنشقة مرتين كما تضمنت الدراسة على دراسة 5صفات هم طول الكوز، سمك الكوز، موقع الكوز، وزن القولاحة، نسبة التفريط.

وأظهرت النتائج موضع الدراسة على التأثيرات العوامل المستقلة :

- أثرت العوامل المستقلة معنويا على كل الصفات في موسم الزراعة باستثناء عامل الإضافة بالرش في صفة طول الكوز ، موضع الكوز ، ونسبة التفريط لم تتأثر جميعا بشكل معنوى .
- وكذلك التفاعلات من الدرجة الأولى والدرجة الثانية لم تظهر أى معنوية
- وقد تفوق الهجين الثلاثى على الهجين الفردى في معظم صفات الكوز وأظهرت أعلى النتائج بالنسبة لصفات الكوز هو الهجين الثلاثى NPK 80% ×بالإضافة الأرضية وقد أظهرت أعلى النتائج عن طريق الإضافة بالرش أيضاً كما أظهر التفاعل عن طريق الإضافة الأرضية لل NPK 80%و بالإضافة بالرش .NPK 40%