J. Plant Production, Mansoura Univ., Vol. 6 (4): 505 - 516 , 2015

EFFECT OF BOTH SOIL AND FOLIAR APPLICATION OF NPK ON RESPONSE OF CORN VARIETIES .

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ABSTRACT

A field experiment was 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 and methodes of application soil application and foliar one. All the agriculture treatments were used as usual. A split split plot design was used. five traits were studied. Such traits were no. of kernels /rows, no. of rows /ear ,no. of kernels / ear, Grains weight /ear and yield/fed. The obtained results could be summarized as follows:

- Main effects significantly affected most studied traits.
- The most recommended independent factor treatments for superior grain yield/fed were SC.167 × SA 60% NPK ×SF40% NPK or T.W.G. SA 100% NPK × SF 40% NPK .
- The first order interactions among the levels of the three studied factors seemed to be the most acceptable combinations for excellent grain yield/fed.
- Significancey was completely absent as respect to second order interaction with all studied trait. Except only grain yield / fed. was significant .But the superior combination SC167 × SA 100% NPK × FA 80% NPK or T.W.C 353 ×SA 80% NPK × FA 40 % NPK .

INTRODUCTION

Maize cultivation is developed al over the world and dedicated the third rank after wheat (Kuchaki 1994). Maize is one of the most important cereal crops in Egypt , because of its production and consumptions. Grain yield is the most important economic goal in maize production. Grain yield depends on the genetic potential of species (Asghari and Hanson, 1984). Climatic conditons and nutrients have an important role in achieving this genetics potential (Asghari and Hanson, 1984; Eichelberger et al. 1989).

Nitrogen is one of the most important nutrients with considerable effect on quality and quantity of maize(Dampney and Salmon, 1990).The shortage of nitrogen in plants causes leaves to become yellow, to lower plant growth and to reduce the quality and quantity of the crop (Sarmadnia and Kuchaki, 1991). Feeding plants via leaf is mostly used for applying low-consumption elements and in it is more common for horticultural crops. It has been reported that, although the foliar application of some common elements including nitrogen cannot met the whole nutrient requirement of plants, but it can play as a complementary practice in crop production. Late solution spraying of nitrogen is not effective in increasing grain yield, because the most parts of the yield has been established in previous stages. (and Kordi et al.,2013).

Recently, the foliar application of nutrients has become an important practice in the crop production while soil application of fertilizers remains the basic method of feeding the majority of crop plants (Alam et al., 2010). Nitrogen application as foliar spraying can be effective in the reduction of soil nitrogen use and so the loss of nitrogen leaching or de-nitrification in soil. Another advantage of nitrogen foliar application is that it can complete the applied starter fertilizer in the soil and the rapid absorption of nitrogen by the plant (with more than 80% recycling of the applied nitrogen). Nitrogen foliar application at flowering stage provides the direct flow of assimilates to the locations with more metabolic demand i.e. grains (Sarandon and Gianibeli, 1990). Although soil application is the most efficient way to apply fertilizer, foliar application of fertilizer has showed excellent results in some crops and should only be viewed as temporary or emergency solution(Hamayun et al., 2011).

Phosphorus plays a key role in energy transfer and is essential for photosynthesis and other chemico-physiological processes in plants (Tanweer et al.,2011). Phosphorus is the important element that interferes on zinc uptake ,as zinc uptake by plants reduces by increasing phosphorus in soil .(Das et al.,2005 and Salimpour et al .,2010).

Potassium(k) is considered as the most important essential major plant nutrient due to its cascade of roles in plant physiology and biochemistry (Nawaz et al.,2006; Zia-ul-hassan et al.,2011). Apart from its important roles in plant physiology and biochemistry .k has also been considered as the major yield and quality contributing nutrient in maize production (Bukhsh et al., 2012).The involvement of K in maize nutrition ensures optimum yield and quality (white 2003;Bukhsh et al., 2012 and Kubar et al.,2013).

Proper management of NPK are one of the most important factors in increasing maize yield. The selection of appropriate fertilization method of nitrogen, phosphorus and potassium is important for achieving maximum yield reducing negative environmental consequences (Iqbal et al., 2009). The selection of efficient fertilization methods and planting proper hybrids can be a great help in increasing the yield and the quality of grain maize. Therefore, this study aimed to determine the best hybrid and to evaluate the effects of nitrogen fertilization methods on grain maize yield and grain quality.

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

Analysis	seasons	Particle size distribution			Textural class
		Clay%	Silt%	Sand%	
Mechanical	2012	48.6	39.4	12.35	clay
	2013	50.2	37.92	11.82	

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

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

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.

Seasons	Temp. c	Month					H. U/year	Average/ year
		May	June	July	Aug.	Sept.		
2012	Max.	32.5	35.3	35.4	35.4	32.7		
	Min.	20.2	22.9	25	25.1	22.5		
	GDD	16.4	19.1	20.2	20.3	17.6		
	H.U.	491.	573	626	629	546	2865	573
2013	Max. .	33.5	34.5	33.1	35	32.6		
	Min.	20.4	22.6	22.9	24	22.5		
	GDD	16.95	18.55	18.0	19.5	17.55		
	H.U.	508.5	555	558	605	554	2780.5	556.1

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 spilited 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- No. of kernels /rows,(K/R).
2- No. of rows /ear ,(R/E).
3-No. of kernels / ear, (K/R).
4- Grains weight /ear ,gm.(GWt/E).
5- yield/fed ,ard (Y/fed).

Statistical Analysis.
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 according to the studied traits follows:

1- Independent factors effect :
A- Corn cross (C_S).

Means of the five studied traits of grains / ear as affected by two investigated crosses in both seasons, are presented in Table (4). The analysis of variance showed significant differences on all respects in the two seasons. Data declared superiority of the single cross over the three way one . These results could be contributed to the genetical structure of the single cross. Such structure always allows of high benefit of the environments surrounded the plant. Such benefit could be turn in directly and indirectly the studied characters, increasing their products. The products values of 42.3, 14.3, 612.04, 205gm and 34.3ard in $S_1$and 42.5,13.9,587.97,195 gm and 33.49ard in S_2 with respect of S.C. 167 were for the traits: no. of rows / ear, no. of kernels / ear, kernels/ row, grain weight/ ear and grains yield/fed respectively. Traits of kernels / ear recorded in many studies that crosses significantly varied as regards no. of kernels/ear ,(Abo-Shetaia et al., 2000), no. of kernels /rows, (Iqbal et al., 2013), no. of rows / ear, (Abo-Shetaia *et al.*, 2000), grains weight/ ear, and grains yield/fed (Bruns and Abbas, 2003); Alias et al., 2010) and Iqbal et al., 2013). But Tanweer et al., (2011) found insignificant differences among crosses regarding the previous traits.

B- Soil application:(SA)

Table (4) representes the effect of soil application of NPK on , in the two seasons 2012 and 2013. All traits were significantly affected by varying soil application treatments, These results agreed with the finding of . Mikhail (1978) ; Mahgoub (1979) and Khalifa *et al.,* (1983)

Data declared that the greatest products of all the studied traits were produced when either 100 or 80% NPK were applied. Although the absence of significance between the two previous treatments, each of them significantly exceed the remained treatments. It seemed that NPK at higher rates (over 60 %) enhanced the growth of corn plants. Such promoting effect were turn in grains traits/ear and grains yield/fed. The results herein are in close of Dauda, *et al.,* (2008); Dorivar *et. al .,* (2012) and Jithendsa *et al.,* (2013).

Table (4): Means of no. of kernels/row, no. of rows /ear , no. of kernels / ear,no. of grains weight /ear, and yield/fed , characteristics, influenced by main effects in first season (S_1) and second season (S_2).

Traits Season Main Effect	No. K./R		No. R/E		No. K/E		G.Wt/E. gm		G.Y./Fed. ard.	
	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	42.3a	42.5a	14.3a	13.9a	612.04a	587.97a	205a	195a	34.3a	33.49a
T.W.C. 253	39.8b	38.5b	13.7b	13.4b	545.26b	515.90b	156b	150b	29.4b	28.34b
Soil application (S.A.)										
100% NPK	38,3c	37.6c	13.4c	12.5c	557.7c	523.8c	162c	153c	31.30b	30.25b
80% NPK	41.1b	40.9b	14.2a	14.5a	583.8b	578.6b	197a	190a	36.80a	33.89 a
60% NPK	43.9a	42.5a	14.9a	14.4a	601.4a	569.5a	198a	193a	33.93a	32.55a
40% NPK	41.5b	41.5b	13.7b	13.3b	581.1b	554.4ab	176b	172b	29.10c	29.35c
0% NPK	41.0b	40.7b	13.6b	13.5b	569.5b	533.2b	170c	155c	28.12d	28.56d
Foliar application (F.A.)										
100 % NPK	40.5	40.8	14.14a	13.75b	589.2	549.9	182b	175b	32.92	31.41
80% NPK	41.3	40.4	14.08ab	13.79a	580.9	556.6	191a	178a	32.53	32.15
60% NPK	42.0	41.3	14.14a	13.83a	594.3	571.0	194a	180a	32.22	31.85
40% NPK	41.2	40.3	13.88b	13.63b	571.6	550.1	173c	170c	31.54	30.48
0% NPK	40.9	40.1	13.82b	13.42b	557.5	531.9	162d	160d	30.04	28.71
G. Means	41.1	40.6	14.0	13.6	578.9	551.9	180.5	172.6	31.85	30.92

C- Foliar application: (FA)

It is clear that the significant effects were detected on no. of grains/ ear only in S_1. In addition, grain weight / ear was significantly affected by foliar application in both seasons are presented in Table (4). These results are in convenient with. Zeidan *et al.,* (2006) Hamideh (2010) and Tanweer *et al.,* (2011). Although the significancy was absent as respects the two studied traits, in both seasons the use of 80% NPK and control treatment always produced the greatest and lowest products respectively. It was recordedthat highest grains yield / fed produced 32.5 ard / fed in S_1 , respectively.32.15 in S_2 .The results are supported by the findings of .Tashiro *et al.,* (2002). Abad *et al,* (2004); Hamideh (2010) and kordi *et al.,* (2013).

2- First order interaction :

(Crosses × Soil application) (C_S ×SA).

Data presented in Table (5) indicates that only grain weight / ear and grains yeild/ fed, in both seasons, were significantly affected by the combination of cross × soil application, In spite of the absence of significance regarding no. of kernels /rows, no. of rows /ear and no. of kernels/ear, It was observed that the combination (S.C.167×80%NPKSA) produced the heaviest grain weight/ ear. The latter trait was 240 gm and 35.8 ard in S_1 as well as 225gm and32.5ard in S_2. Similar findings were published by. Iqbal *et al.,* (2009).

(Crosses × Foliar applications) (C_S ×FA).

As previously mentioned with ear traits, no significant symptoms were observed herein too. (Table, 5, The present results confirmed those obtained by. Ahamed (1889 Tanweer et al., (2011) and Afifi et al., (2011).

Table (5)show also that grain yield /fed was significantly affected by the interaction between crosses and foliar application. The highestyield was produced from the interactionof SC164x80% NPK . A good attention was significantly affected that the same combination gave the lightest positive values on morphological characters, ear traits and grain characters, It seemed that yield either/ plant or fed respected the positive effect of the combination on the three groups of characters which were turn in yield. In general the results are in convenient with those found by . Alam et al. (2010); Afifi et al (2011); Hamayun et al. (2011) and Kordi et al., (2013) on grain yield.

(Soil application ×foliar application) (SA ×FA).

Table (5) indicates the obtained means of grain traits, as affected by (soil application × foliar application) in 2012 and 2013 seasons. Significancy was completely absent with most of grain traits. The only significance effect was observed with grain weight/ ear. In both seasons the interaction (60% SA× 60% FA) gave the remarkable products means on all the five grain traits.42.6, 15.1, 678.9, 29.3 gm, and 203 gm in S_1 and 42.6, 15.1, 672.5, 31.4gm, and 182gm in S_2.These results mean that most of grain traits are good inherited ones, resisting the effect of the environment factors. Moreover, it seemed that the positive effects of the interaction promoting no. of row/ ears, no of grains / rows, no. of grain/ ear and 100 kernel weight were turn, in grain weight/ ear. It could be added herein that traits in relation with dry matter accumulation such as grain traits require the middle levels of both soil and foliar application. (Hamideh et al., (2010) ; Afifi *et al.,* (2011) ; Aref (2012) and Kordi *et al.,* (2013))

It appeared that the encouragement of higher soil application on ear traits as well as the promoting effect of middle soil application, on grain traits were turn in grains yield/ fed, which expressed its highest value when(100% SA was × 80% FA) was used 33.3ard/fed. in S_1 and 34.9ard/fed. in S_2. Similar results had also been reported by some other researchers . Boateng, *et al.,* (2006) ; Dauda, *et al.,* (2008); Afifi *et al.,* (2011) and Aref (2012) and Dechassa Hirpadibaba *et al.,* (2013).

Table (5): Means of no. of kernels/row, no. of rows /ear , no. of kernels / ear ,no. of grains weight /ear, and yield/fed characteristics, as affected by first order interaction in season (S_1) and second season (S_2).

Traits Season Interaction	No. k/R		No. R/E		No. G/E		G .wt./E gm		G.Y./Fed. ard.	
	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	43.1	42.9	14.8	14.2	637.9	609.2	218A	203A	31.7baB	29.3aB
S.C.167×S_2A_2	45.3	44.8	15.7	15.0	711.2	672.0	240A	225A	35.8aA	32.5aAB
S.C.167×S_3A_3	42.6	41.8	14.2	14.0	604.9	585.2	197B	190B	26.8bC	28.7aAB
S.C.167×S_4A_4	42.9	41.5	13.7	13.6	587.7	564.4	188B	178C	31.7aB	29.2aAB
S.C.167×S_5A_5	39.7	39.8	13.0	12.6	516.1	501.5	141D	135D	29.5Cc	22.2bA
T.W.C. 253×S_1A_1	42.0	41.9	14.2	13.8	596.4	578.2	172C	174C	32.8bA	32.9bB
T.W.C. 253×S_2A_2	44.8	43.4	14.4	13.2	645.1	616.3	208C	199B	33.5aaB	35.9aA
T.W.C. 253×S_3A_3	38.8	37.8	13.9	13.9	539.3	535.1	157C	147D	31.3ab	32.2aA
T.W.C. 253×S_4A_4	36.7	36.5	13.1	13.8	480.8	439.1	143D	144D	31.9aAb	30.4abBC
T.W.C. 253×S_5A_5	36.7	36.1	12.8	13.6	469.8	421.9	137D	140D	28.4dD	28.1dDD
(Cs×FA)										
S.C.167×F_1A_1	42.6	41.9	14.5	14.7	627.7	630.6	207A	203A	32.4	31.7
S.C.167×F_2A_2	43.6	41.4	14.8	14.9	655.3	646.7	206A	202A	32.6	31.8
S.C.167×F_3A_3	43.1	42.5	13.9	13.7	599.1	582.3	197A	190A	32.2	31.2
S.C.167×F_4A_4	40.1	42.2	13.7	13.8	549.4	573.9	181B	185B	32.4	30.7
S.C.167×F_5A_5	39.7	41.5	13.4	13.3	531.9	552.0	180B	184B	32.1	30.2
T.W.C. 253×F_1A_1	40.5	38.5	13.6	13.7	550.8	527.5	170C	162C	31.4	29.2
T.W.C. 253×F_2A_2	40.1	37.9	14.8	13.9	591.9	526.8	175C	170C	32.1	30.5
T.W.C. 253×F_3A_3	39.8	37.5	14.4	13.6	571.3	510.0	163D	143D	31.5	29.6
T.W.C. 253×F_4A_4	39.4	37.3	14.3	13.4	562.0	519.0	162D	145D	30.6	28.6
T.W.C. 253×F_5A_5	39.3	35.2	13.3	13.5	550.6	515.0	155D	142D	30.9	28.9
(S.A. × F.A.)										
S_1A_1× F_1A_1	36.1	36.0	13.6	13.6	501.0	489.6	144D	136D	32.6aA	37.3aA
S_1A_1× F_2A_2	34.7	33.7	14.8	14.8	523.6	498.8	147D	139D	33.3aA	34.9aAB
S_1A_1× F_3A_3	41.7	41.2	14.2	14.7	633.0	605.6	175C	165C	31.4abA	33.9aAB
S_1A_1× F_4A_4	39.6	38.7	14.7	14.7	599.1	568.9	164C	156C	31.8aB	34.3aAB
S_1A_1× F_5A_5	39.2	38.3	13.8	14.8	561.0	528.5	151C	141C	31.0abAB	32.5bA
S_2A_2× F_1A_1	41.3	41.0	13.6	13.6	536.7	557.6	174C	167C	30.7aB	29.2aB
S_2A_2× F_2A_2	42.2	41.3	14.4	14.4	627.7	594.7	191B	184B	32.6abAB	34.7aA
S_2A_2× F_3A_3	41.5	40.3	14.8	14.8	634.2	596.4	193B	188B	37.7aA	34.7abAB
S_2A_2× F_4A_4	39.6	37.7	14.0	14.7	599.1	564.2	175C	162C	32.2baB	31.1bA
S_2A_2× F_5A_5	39.2	35.9	13.5	13.8	555.9	495.4	168C	162C	32.6abAB	29.8cA
S_3A_3× F_1A_1	42.3	41.3	14.1	14.1	599.4	582.3	179C	170C	35.9aA	28.5bcA
S_3A_3× F_2A_2	42.6	41.4	13.6	13.6	589.4	563.0	165C	166C	36.6dA	24.5bC
S_3A_3× F_3A_3	44.3	42.6	15.1	15.1	678.9	672.5	203A	201A	37.3cA	29.1Bb
S_3A_3× F_4A_4	42.7	40.5	13.6	12.6	558.0	503.3	187B	175B	30.8bA	30.3bAB
S_3A_3× F_5A_5	42.3	42.7	13.0	13.0	559.9	555.1	190B	173B	32.6bA	30.2bcBC
S_4A_4×F_1A_1	43.9	41.9	13.4	13.4	598.3	561.5	209A	191A	33.5aA	31.5aB
S_4A_4×F_2A_2	44.0	43.5	12.9	12.9	587.6	561.2	198A	195A	29.5Bc	29.7bcB
S_4A_4×F_3A_3	43.6	42.6	13.5	13.5	598.6	575.1	223A	190A	26.9bcD	27.2bcD
S_4A_4×F_4A_4	42.2	40.9	13.3	13.3	581.3	544.0	179C	170C	28.7Bcd	26.5bC
S_4A_4×F_5A_5	41.1	41.7	13.8	13.8	577.2	575.5	195A	192A	38.1aA	36.7aA
S_5A_5×F_1A_1	39.4	38.9	14.8	14.1	575.5	548.5	188B	185B	31.3aA	30.3aA
S_5A_5×F_2A_2	40.1	39.9	13.4	13.4	557.3	534.7	185B	187B	32.1bcA	30.7aA
S_5A_5×F_3A_3	40.7	40.7	13.5	13.1	543.2	533.2	177C	173C	32.3bcA	30.4aA
S_5A_5×F_4A_4	41.0	41.9	13.6	13.6	567.6	569.9	167C	176C	28.9bA	28.6bB
S_5A_5×F_5A_5	40.4	39.9	12.9	12.9	541.5	554.7	168C	170C	24.8dD	23.7bC
G. means	41.1	40.6	14	13.6	578.9	551.9	180.5	172.6	31.85	30.92

3- Second order interaction :

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

Also herein, no significant difference was detected with all respects. This means that the combination among different levels of the three factors did not show any significant effect. But grain yield / fed showed significant differences as a result of the effect of the interaction, in both seasons. It that maximum grain yield/ fed was 36.6ard/fed. in S_1 and 35.5ard/fed. and in S_2 . The previous two yields were produced by the combination (SC167 × SA 60% NPK × FA 40% NPK), (Table, 7). These results agreed with the finding of. Yousuf and Saleem, (2001).

Table (6): Means of no. of kernels/row, no. of rows /ear , no. of kernels / ear ,no. of grains weight /ear, and yield/fed characteristics, as affected by second order interaction in season (S_1) and second season (S_2).

Interaction / Traits / Season	G.Y./Fed. Ard.	
	S_1	S_2
(C. S.A. ×FA)		
(S.C. S.A. × F.A.)		
S.C. S_1A_1× F_1A_1	37.3AA	37.7AA
S.C.S_1A_1× F_2A_2	34.0AA	34.5AA
S.C.S_1A_1× F_3A_3	277DD	28.7CC
S.C.S_1A_1× F_4A_4	31.5CC	30.2BB
S.C.S_1A_1× F_5A_5	37.1AA	33.7AA
S.C.S_2A_2× F_1A_1	33.1BB	33.1AA
S.C.S_2A_2× F_2A_2	33.0BB	34.7AA
S.C.S_2A_2× F_3A_3	33.5BB	32.5BB
S.C.S_2A_2× F_4A_4	33.1BB	30.9BB
S.C.S_2A_2× F_5A_5	29.9DD	32.6BB
S.C.S_3A_3× F_1A_1	32.5BB	32.7BB
S.C.S_3A_3× F_2A_2	31.9CC	32.7BB
S.C.S_3A_3× F_3A_3	32.7BB	31.2BB
S.C.S_3A_3× F_4A_4	36.4AA	32.5BB
S.C.S_3A_3× F_5A_5	33.8BB	32.5BB
S.C.S_4A_4×F_1A_1	35.9AA	33.6AA
S.C.S_4A_4×F_2A_2	38.3AA	36.0AA
S.C.S_4A_4×F_3A_3	32.2BB	32.9BB
S.C.S_4A_4×F_4A_4	31.8CC	29.9CC

Table (6)

Traits / Season / Interaction	G.Y./Fed. Ard.	
	S_1	S_2
S.C.$S_5A_5 \times F_1A_1$	30.7CC	31.9BB
S.C.$S_5A_5 \times F_2A_2$	33.8AA	32.0BB
S.C.$S_5A_5 \times F_3A_3$	32.3BB	31.5BB
S.C.$S_5A_5 \times F_4A_4$	29.9DD	28.8DD
S.C.$S_5A_5 \times F_5A_5$	28.9DD	28.3DD
(T.W.C. SA× FA)		
T.W.C. $S_1A_1 \times F_1A_1$	35.4AA	34.3AA
T.W.C. $S_1A_1 \times F_2A_2$	31.4BB	29.3CC
T.W.C. $S_1A_1 \times F_3A_3$	34.6AA	35.2AA
T.W.C. $S_1A_1 \times F_4A_4$	36.9AA	36.6AA
T.W.C. $S_1A_1 \times F_5A_5$	29.7CC	26.6DD
T.W.C. $S_2A_2 \times F_1A_1$	32.7BB	32.2BB
T.W.C. $S_2A_2 \times F_2A_2$	32.2BB	32.1BB
T.W.C. $S_2A_2 \times F_3A_3$	35.7AA	33.0BB
T.W.C. $S_2A_2 \times F_4A_4$	37.5AA	33.5BB
T.W.C. $S_2A_2 \times F_5A_5$	29.6CC	29.5CC
T.W.C. $S_3A_3 \times F_1A_1$	32.2BB	29.8CC
T.W.C. $S_3A_3 \times F_2A_2$	33.5AA	33.8BB
T.W.C. $S_3A_3 \times F_3A_3$	29.8CC	29.8CC
T.W.C. $S_3A_3 \times F_4A_4$	27.9DD	27.6DD
T.W.C. $S_3A_3 \times F_5A_5$	29.8CC	28.4DD
T.W.C. $S_4A_4 \times F_1A_1$	39.8AA	33.8BB
T.W.C. $S_4A_4 \times F_2A_2$	31.4BB	32.7BB
T.W.C. $S_4A_4 \times F_3A_3$	30.8CC	31.6BB
T.W.C. $S_4A_4 \times F_4A_4$	30.2CC	32.4BB
T.W.C. $S_4A_4 \times F_5A_5$	30.1CC	29.3CC
T.W.C. $S_5A_5 \times F_1A_1$	28.2DD	29.0CC
T.W.C. $S_5A_5 \times F_2A_2$	25.0DD	32.4BB
T.W.C. $S_5A_5 \times F_3A_3$	30.9CC	27.1DD
T.W.C. $S_5A_5 \times F_4A_4$	33.0BB	28.2DD
T.W.C. $S_5A_5 \times F_5A_5$	22.1DD	23.9DD
G. means	31.85	30.92

DISCUSSION

In both seasons, such excellent yield had insignificant difference with some combinations including (SC167×SA 60% NPK × FA 40% NPK), (TWC 353 × SA 40 % NPK × FA 100% NPK), (TWC 353 × SA 100 % NPK × FA 40% NPK) and (T.W.C 353 × SA 60 % NPK × FA 80 % NPK). These equilibrated give a good chance for preferring the use of one factor instead of another, for example the use of T.W.C 353 reduced the levels of soil application and foliar application as compared with used with SC 167 consequently, it may stated herein that the combination (T.W.C 353 × SA 80 % NPK × FA 60 % NPK) could be recommended for use, regarding all respects. These results are in agreement with those obtained . Afifi *et al.,* (2011); Hamayun *et al.* (2011) and Aref (2012) ; Dechassa Hirpadibaba *et al.,* (2013). and Kordi *et al.,* (2013).

REFERENCES

Abo-Shetaia, A. M.A.; Abdel-Gawad, A.A.; Mahgoub, G.M.A. and El-Koumy, M.B.A (2000): Effect of inter and intera-ridge distance between plants on yield components of four yellow maize hybrids (*Zea mays* L.). Arab. Univ. J. Agric. Sci. Ain Shams Univ., Cairo, 8(2): 647- 662.

Afifi, M.H.M; Khalifa, R.Kh. M., and Camilia, Y. Eldewiny (2011): Urea foliar application as a partial substitution of soil applied nitrogen fertilization for some maize cultivars grown in newly cultivated soil. Australian Journal of basic and applied sciences, 5(7): 826-832.

Ahmed, M. A. (1989): Effect of nitrogen fertilizer levels on yield and its components of some white and yellow maize cultivar grown in Egypt. Egypt J. Agron, 14 (1-2): 187-200.

Alam, S.S. Moslehuddin, A.Z.M. Islam, M.R. Kamal, A.M. (2010): Soil and foliar application of nitrogen for Boro Rice (BRRldhan 29). Journal of Bangladesh Agricultur University. 8 (2): 199-202.

Alias, M. A.; Bukhsh, H. A.; Ahmed , R.; Malik, A.U.; Hussain, S. and Ishaque, M. (2010): Agro physiological traits of three maize hybrids as influenced by varying plant density. J. Animal and Plant Sci., 20 (1): 34- 39.

Asghari, M. Hanson, R.G. (1984): Nitrogen, climate and previous crop effect on maize yield and grain N. Agronomy Journal. 76: 537- 542.

Boateng, S.A.; Zickermann, J. and Kornahrens, M. (2006): Poultry manure effect on growth and yield of maize, West African J. Applied Econlogy 9:1-18.

Bruns, H. A. and Abbas, H. K. (2003): Effect of plant populations on maize hybrids in the subtropical mid South USA. Maydica, 48: 21- 27.

Bukhsh, M. A.; R. Ahmad, J. Iqbal, M. M Maqbool, A. Ali, Ishaque, M. and Hussain, S. (2012): Nutritional and Physiological Significance of Potassium Application in Maize Hybrid Crop Production. Pak. J. Nutr., 11 (2): 187-202. canopy architecture and light attenuation. Field Crops Res. 71: 183-193.

Das, K.R. ; Dange, T.N. and Shivanada, P.S. (2005): Interaction between phosphorus and zinc on the biomass yield and attributes of the medicinal plant stevia (Stevia rebaudiana). Science World Journal, 5:390-395.

Dampney, P.M.R. Salmon ,S.E. (1990): The effect of rate and timing of late nitrogen applications to bread making wheats as ammonium nitrate or foliar urea-N, and the effect of foliar sulphur application. I. Effect on yield, grain quality and recovery of nitrogen in grain. Aspect of Applied Biology. 25: 229-242.

Dauda, S.N.; Ajayi, F.A., and Dor, E.N.(2008): Growth and yield of watermelon (*Citrullus lunatus*) as affected by poultry manure application, J. Agric. And Social Sci 4(3): 121-124.

Dechassa ,H. D. C. S. Hunshal, S. M., Hiremath, J. S. Awaknarar, M. C. Wali, B. T. Nadagouda, and Chandrashekar , C. P. (2013): Performance of maize (Zea mays L.) hybrids as influenced by different levels of nitrogen, phophorus, potassium and sulphur application. Karnataka J. Agric. Sci., 26 (2): 194-199

Dorivar A.; Ruiz D. and Mueller, N.(2012): Improving Corn and Soybean yields with starter and foliar fluid fertilizers. Dep.of Agronomy, Kansas state university.

Eichelberger, K.D. Lambert, R.J. Below, F.E. Hageman, R.H.(1989): Divergent phenotypic recurrent selection for nitrate reductase activity in maize. II. Efficient use of fertilizer nitrogen. Crop Science. 29: 1398-1402.

Gomez, K.A. and Gomez, A.A. (1984): Statistical Procedures for Agric. Research. 2nd ed. John Wiley & Sons, Inc., USA.

Hamayun, M. Afzal Khan, S. Latif Khan, A. Shinwari, Z.K. Ahmad, N. Kim, Y.H. Lee, I.J. (2011): Effect of foliar and soil application of, Nitrogen, phosphorus and potassium on yield components of lentil. Pakistan Journal of Botany. 43 (1): 391-396.

Hamideh, S. S.; Mehrdad ,Y. and Reza A. (2010): Effect of nitrogen foliar application in different concentration and growth stage of corn (Hybrid 704). Advances in Environmental Biology, 4(2): 291-298.

Iqbal, M., K. Khan, H. Rahman and Bakht, J. (2009): Genotypic and phenotypic associations among physiological traits insubtropical maize. Sarhad J. Agric. 25(4): 551-556.

Jithendra, D.B. G.V. Basvaraju, G.Sarika and.Amrutha, N. (2013): Effect of Fertilizer Levels and Planting Geometry on Growth and Seed Yield of Single Cross Maize Hybrid NAH-2049 (Nithyashree). G.J.B.A.H.S.,Vol.2(3):216-220.

Kubar, S.; Zia-ul-hassan, A.; Shah, I. Rajpar, and Qureshi, S.A. (2013): Response of maize to a novel organic potassium fertilizer developed from fruit and vegetable wastes. Pak. J. Agri., Agril. Eng., Vet Sci., (1): 1-12.

Mekkei, M.E.R. (1995): Effect of water stress on growth, yield and yield components of some maize cultivars. M. Sc. Thesis. Fac. Agric. Cairo Uni.

Nawaz, I., Zia-ul-hassan, A. M. Ranjha and Arshad, M.(2006): Exploiting genotypic variation among fifteen maize genotypes of Pakistan for potassium uptake and use efficiency in solution culture. Pak. J. Bot., 38: 670-681.

Salimpour, S.; K. Khavazi; H. Nadian; H. Besharati; Miransari, M. (2010): Enhancing phosphorous availability to canola (*Brassica Napus* L.) using P solubilizing and sulfur oxidizing bacteria, Australian Journal

Snedecor, G.W. and W.G. Cochran, (1990): Statistical methods 8th ed. Iowa State Univ.

Souza ,S.R.; Strak, E.M.and Fernandes, M.S. (1993): Effect of supplemental-nitrogen on the quality of rice proteins. Journal of Plant. Nutrition. 16: 1739- 1751.

Tanweer, M.; Muhammad, A.; Shahid, H.; Muhammad, T. and Khalid, M. (2011): Effect of Different Rates of Nitrogen and Phosphorus fertilizers on growth and yield of Maize): J. Agric. Res., 2011, 49(3): 333-339.

Tashiro, T. ; M. Hiroaki; S. Satoh and Junji, T. (2002): Germanium does not substitute for boron in cross – linking of rhamnogalacturonan II in pumpkin cell walls, American Society of plant Biologists, Doi: 10. 1104/: 9514.

White, J. (2003): Potassium nutrition in Australian high –yielding maize production systems – a review. Paper presented at the 5 th Australian Maize Conference, 18-20 th February 2003. Toowoomba, Queensland.

Yousuf, M. and M. Saleem, M. (2001): Correlation analysis of S_1 families of maize for grain yield and yield components. Int'l. J. Agric. & Biol. 3(4): 387-388.

Zia-ul-hassan, M. Arshad and Khalid, A. (2011): Evaluating potassium-use-efficient cotton gentypes using different ranking methods. J. Plant Nutr., 34: 1957-1975

تأثيرالإضافة الأرضية والرش بالأسمدة النتيروجينية والفوسفورية والبوتاسية على استجابة بعض أصناف الذرة الشامية.

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أجريت تجربتان منفصلتان فى محطة تجارب مركز البحوث الزراعية بالجميزة فى عام 2012، 2013عل ىبعض 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 5صفات من صفات المحصول كما تضمنت الدراسة التأثيرات المستقلة والتفاعلات فيما بينهم الأحادية والثنائية .

وأظهرت النتائج موضع الدراسة على التأثيرات العوامل المستقلة :

- أثرت العوامل المستقلة وكذلك التفاعلات من الدرجة الأولى معنوية على معظم الصفات في موسم الزراعة باستثناء طول النبات في التأثير بالإضافة بالرش في الصفات المورفولوجية وإن التفاعلات من الدرجة الثانية لم تظهر أى تأثيرات معنوية على جميع الصفات باستثناء صفة المحصول .
- ويمكن التوصية بزراعة الهجين الفردى مع التسميد الأرضى بنسبة 80% و 40% بالإضافة بالرش، ويمكن القول بثقة كبيرة أن التفاعل من الدرجة الأولى بين هذه المعدلات وكذلك تفاعلها من الدرجة الثانية تحقق أعلى محصول من الحبوب على وحدة المساحة عند زراعة الهجين الفردى مع التسميد الأرضى 80% والتسميد بالرش 60% أو زراعة الهجين الثلاثى بنسبة الإضافة الأرضية 80% والإضافة بالرش . 40%