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EFFECT OF SOME AGRONOMIC PRACTICES ON YIELD AND ITS ATTRIBUTES OF SOME YELLOW MAIZE HYBRIDS

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ABSTRACT: Two field experiments were carried out in an administration field at Sheet Al Hawa Village, Kafr Sakr district, Sharkia Governorate, Egypt, during the two successive summer seasons of 2013 and 2014 to find out the effect of four N levels (30, 60, 90 and 120 kg N/fad.) as well as three phosphorus fertilization regimes (30 kg P_2O_5 fad., phosphorien and 15 kg P_2O_5/fad., with phosphorien) on yield potentiality of three yellow maize hybrids (SC 168, SC167 and TWC 352). The results could be summered as follows: In case of douple eared plants: Results revealed that the three maize hybrids gave significant differences in the majority of the studied characters of maize crop, since the SC 167 hybrid was superior in most yield attributes as it recorded high value in each of ear length, number of grains/row and hundred grain weight, followed by SC 168 and TWC 352 in descending order. Results of the combined analysis revealed that each N increment from 30 to 60 and 90 and then to 120 kg N/fad., significantly increased ear length, but this response was up to 90 kg N/fad., in each of number of grains/row and number of rows/ear, whereas hundred grain weight responded up to 30 kg N/fad., Addition of 15 kg P_2O_5/fad., with phosphorien gave high value in each of ear length, number of grains/row, number of rows/ear and hundred grain weight. In case of mono eared plans: The findings revealed that the three maize hybrids gave significant differences in the majority of the studied characters of maize crop, since the SC 167 hybrid was superior in most yield attributes and grain yield/ fad., followed by SC 168 as well as TWC 352. This superiority was expressed in ear length, number of grains/row, hundred grain weight, ear grain weight, while TWC 352 was superior in number of rows/ ear. Results of the combined analysis revealed that each nitrogen increment up to 90 kg N/fad., was accompanied by a significant increase in ear length, number of grains/row, whereas each of number of rows/ear and ear grain weight as well as grain yield/fad., responded up to 120 kg N/fad. In addition, the studied treatments showed that the application of 15 kg P_2O_5/fad., along with bio- fertilizer phosphorien gave the highest mean records in each of ear length, number of rows/row, hundred grain weight, ear grain weight whereas when maize plants were fertilized by 30 kg P_2O_5/fad., or phosphorien only gave higher grain yield/fad. The most interaction effect was observed between maize hybrids on one hand and each of N level and phosphorus treatments on the other hand. SC 167 had the highest grain yield averages under both 120 kg N/fad., and addition of phosphorien, whereas TWC 352 recorded the lowest grain yield under 30 kg N and phosphrien only.

Key words: N-level, hybrids, corn, biofertilizer, phosphorien.

INTRODUCTION

Maize is one of the most important cereal crops under global cultivation and in Egypt. Maize is considered as one of the main cereal crops, ranks the third after wheat and rice. Increasing productivity of land area can be achieved by cultivating high yield cultivars and hybrids paralleled with improved agronomic practices. Several investigators showed that maize hybrids were significantly different in grain yield and its components (**Abd El-Maksoud and Sarhan, 2008; Attia *et al.*, 2009; Abdou *et al.*, 2012; Mukhtar *et al.*, 2012;**

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Radma and Dagsh, 2013; Modhej *et al.*, 2014). In this respect, **Sharifi *et al.* (2009)** showed that maize hybrids (SC 504, SC 404 and DC 370) significantly differed in plant height, stem diameter, number of kernels row^{-1}, cob length, number of kernels ear^{-1} and grain yield fad.$^{-1}$, **Golezani and Tajbakhsh (2012)** reported that the highest grains per plant and grain yield were obtained by SC- 604, followed by SC-500, OSSK-602 and DC-370, respectively. Maximum grain weight of maize hybrids mainly influenced by grain filling rate rather than by grain filling duration. **Kandil (2013)** indicated that maize hybrids exhibited significant differences in maize growth, crop yield and its components. Wherein hybrid, SC 10 showed the maximum values of all parameters without significant difference with TWC 329 in most of characteristics over other two maize hybrids (SC 122 and SC 129). **Hejazi and Soleymain (2014)** indicated that several hybrids of maize (Single cross 704, single cross 640 and single cross 540) were significantly differed in number of rows per ear, number of grains per row, number of grains per ear, grain weight per ear and grain yield. **Sorkhi and Fateh (2014)** found that number of ears/m^2 of SC 320 hybrid was significantly higher than SC 301 hybrid, but number of grains ear^{-1} and 1000- grain weight in SC 320 hybrid was significantly lower than SC 301 hybrid.

Nitrogen is one of the most important nutrients limiting maize yield in various parts of the world. Accurate fertilizer N recommendations for yellow maize production for important maximizing productivity. Several researches reported a beneficial effect for N application to maize among them (**Darwich, 2013; El-Moursy, 2013; Kandil, 2013**). The results of some research work showed that the optimum N fertilizer level varied in amounts ranging between 90 and 100 Kg N/fad. (**Hejazi and Soleymani, 2014; Khan *et al.,* 2014; Modhej *et al.,* 2014; Olusegun, 2015; Seadh *et al.,* 2015**). Moreover, other studies stressed the need of maize plants to N fertilizer levels up to 120 Kg N/fad., (**El-Sobky, 2014; Sorkhi and Fateh, 2014; El-Kholy, 2015; Ikramullah *et al.,* 2015**). In all these responses, the significant increase of yield was attributed to the significant increase of yield attributes.

Phosphorus, also, plays a central role in plants in energy transfer and protein metabolism. Because of the rapid fixation of available P under Egyptian soil conditions, the application of P before planting is a common practice. some authors reported significant increase in yield and attributes of maize due to the increase of P level up to 30 kg P_2O_5/fad., (**Alias *et al.,* 2003; Iqbal and Chauhan, 2003; Khan *et al.,* 2005; Ahmad *et al.,* 2007**). Other authors reported that maize responded to more additions of P reaching 35 Kg P_2O_5/fad. (**Hussain *et al.*, 2007; Salih *et al.*, 2007; Yosefi and Mousari, 2011; Zafar *et al.,* 2011**).

Bio-fertilizers usually contains microorganisms having specific function such as P solubilizing bacteria to solubilize P from the soil and fertilizers to be available to plants. **Lin *et al.* (1983)** noticed that increasing yield was attributed to the plant growth promoting substances by root colonizing bacteria more than the biological nitrogen fixation, stated that yield increased due to promoting root growth which in turn enchancing nutrients and water uptake from the soil. **Glass (1989)** noticed that, The low availability of P to plants is because the vast majority of soil P is found in insoluble forms, and plants can only absorb P in two soluble forms, the monobasic (H_2PO_4) and the dibasic (HPO_4)$^{2-}$ ions. **Chabot *et al.* (1993)** recorded that, application of biofertilizers increased growth and yield in many researches. **Karimian (2000)** noticed that: Grain crops in general, and corn in particular have high demand for chemical fertilizers. Therefore, application of biological products to supply grain with nutrients is essential for a good yield and to improve quality of agricultural produce, production stability and thus making a contribution to national food security in the society at large without the release of chemical toxins. **Jat and Shaktawat (2003)** confirmed satisfactory results from the use of phosphate biological fertilizer, compared to triple super phosphate fertilizer in corn, soybean and wheat crops, confirming the satisfactory effect of this fertilizer. It was also clear that phosphate biological fertilizer leads to a considerable increase in yield. Therefore, based on existing experience and evidence, it is crucial that

phosphate fertilizer is supplemented with microorganisms that can solve phosphate and maximize the effect of phosphorus absorption for decreasing chemical fertilizer consumption **(Behbahani and Khayyam, 2004). Bolan and Duraisamy (2003)** described that application of phosphate solubilizing bacteria (PSB) play a significant part in phosphorus nutrition by improving phosphorus accessibility to the plants through the release of organic and inorganic soil phosphorus pools by mineralization and solubilizing bacteria as inoculants enchance phosphorus uptake. **Pradhan and Sukla (2005)** recorded that, the organisms possessing phosphate solubilizing ability called phosphate solubilizing organisms (PSMs), which are reterred to a group to soil microorganisms that are a component of P cycle, capable of dissolving insoluble forms of phosphates into plant available forms. Several groups of microorganisms including fungi, bacteria and actinomycetes are known as efficient fixed P solubilizers, **Sundara *et al.* (2002)**.

Shevananda (2008) recorded that, application of biofertilizers became of great necessity to get a yield of high quality and to avoid the environmental pollution. **Xiao *et al.* (2011)** observed that phosphorus, is the second most important macronutrient required by the plants, next to nitrogen, is reported to be a critical factor of many crop production systems, due to the fact that the limited availability in soluble forms in the soils. **Beyranvand *et al.* (2013)** suggested that effect of nitrogen and phosphate biofertilizers were evaluated positively, there were an increase in plant height, ear weight, and number of grains per cob, grain yield and biomass yield.

MATERIALS AND METHODS

Two field experiments were carried out in an administration field at Sheet Al Hawa Village, Kafr Saker District, Sharkia Governorate, Egypt, during the two successive summer seasons of 2013 and 2014 to find out the response of three maize hybrids (*Zea mays* L.) to different levels of nitrogen fertilizer and addition of phosphorus fertilizer and the biofertilizer phosphorien.

Studied Factors

Maize hybrids (H), (Main plots)

1- Yellow single cross (SC) 168

2- Yellow single cross (SC) 167

3- Yellow three way cross (TWC) 352

The three maize hybrids were kindly released by maize Res. Dept., ARC.

Nitrogen levels

The four nitrogen levels were 30, 60, 90 and 120 kg N/fad.

Phosphorus fertilization regimes (Sub-sub plots)

1- 30 Kg P_2O_5/fad. 2- Biofertilizer phosphorien

3- 15 kg P_2O_5/fad., + phosphorien

Each plot consisted of six ridges, each ridge was 3 m long, 80 cm in width 25 cm between hills and one blank ridge was left between plots. The outer two ridges (1^{st} and 6^{th}) were considered as borders. The previous crop was faba bean in both years. Planting was done on June 4^{th} in 2013 season, and June 3^{rd} in 2014 season. Phosphorus was applied in form of ordinary super phosphate (15.5% P_2O_5) and applied at the mentioned levels before planting, phosphorien wass mixed with seeds just before sowing. Two grains were hand planted in each hill. Thinning to one plant per hill was done before the first irrigation. Hoeing twice was done for controlling weeds before the first and second irrigations, respectively.

Nitrogen fertilizer in form of urea (46.6% N), was applied in two equal doses according to experimental rates before the first and the second irrigations, respectively. Recommended pest control was applied when necessary.

Experimental Design

A split-split plot design of three replications was used. Main plots were occupied by the three maize hybrids, nitrogen fertilizer levels in sub-plots and phosphorus fertilization regimes were in sub sub plots according to **Steel and Torrie (1980)**.

Soil Sampling and Analysis

The soil samples of the experimental fields in both seasons were laboratory analyzed and their physical and chemical properties are shown in

Table 1. Both physical and chemical analyses of the soil used were carried out by following the method described by **Jackson (1958)**. Whereas N, P and K elements as well as some micronutrients were determined by applying the procedure documented by **Lindsay and Norvell (1978)**.

Studied Characters

Yield and yield attributes

At harvest, the following yield attributs were recorded on ten plants and ears:

1- Ear length when maize plants carried one or douple eared plants.

2- Ear diameter: It was measured by using a varnier caliper as the means of random five ears.

3- Number of rows/ear when maize plants carried one or douple eared plants.

4- Number of grains/row when maize plants carried one or two ears/plant.

5- Ear grain weight.

6- Hundred grain weight for plants which carried one or two ears/plant.

7- Grain yield in ardab per faddan. It was recorded at harvest from the second and thrid ridges of each plot. Grain yield was adjusted to moisture content of 15-5% and transformed to ardab per faddan (one ardab = 140 kg and one faddan 4200m^2).

Statistical Analysis

The date were statistically analyzed according to **Gomez and Gomez (1984)**, using computer MSTAT- C statistical analysis package (**Freed *et al.*, 1989**). Treatment meani were compared according to the LSD test. In the tables of the analysis of variance *, ** indicate significance at 0.05 and 0.01 levels of probability, respectively as described by **Waller and Duncan's (1969)**.

Table 1. The physical and some chemical properties of the experimental site (0 - 30 cm depth) averages of both seasons

Property	2013	2014
Mechanical analysis		
Sand (%)	24.55	24.80
Silt (%)	27.80	28.70
Clay (%)	47.55	46.50
Soil texture	Clay	Clay
Chemical analysis		
pH	8.20	8.75
OM (%)	1.75	1.45
Available N (ppm)	28.0	35.0
Available P (ppm)	9.11	8.12
Avaidable K (ppm)	1150	1100
Ecmm/cm	2.25	2.15

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RESULTS AND DISCUSSION

Yield and Yield Attributes

Ear length (cm)

Results presented in Table 2 reflect the influence of N fertilizer levels and addition of P levels and phosphorien on ear length of three yellow maize hybrids when maize plants carried one or douple eared plants.

Maize hybrids differences

In both seasons and their combined, SC 168 and SC 167 had higher ear length value than TWC 352 in mono eared plants. But in douple eared plants, the results indicated clearly that SC 167 was always superior in ear length. This was completely true in the first season and their comained analysis. The differences in ear length among the three maize hybrids might be attributed to the genetically variation. Similar maize hybrids changes in ear length was obtained by **Abd El-Maksoud and Sarhan (2008), Atiaa *et al.* (2009), Abdou *et al*. (2012) and Mukhtar *et al.* (2012)**.

Nitrogen levels effect

It is evident from Table 2 that each N increment up to 120 kg N/fad., produced a significant increase in ear length of the douple eared plants in both seasons and their combined, but application of 90 kg N/fad., was quite enough to produce the highest average ear length when maize plants carried one ear/plant in the second season and their combined. Superiority in ear length with application of N fertilizer could be ascribed to the role of nitrogen in stimulating the capacity of plants in building metabolites and this might account much for the superiority in ear length.

Also, it is worth to note that nitrogen effect on ear length could be expounded by its role in encouraging amino acids synthesis including tryptophan, which considered the major substrate for indol acetic acid (IAA) which help ears to grow longer.

Increasing ear length of maize due to N fertilizer application was also reported by **El-Moursy (2013), Kandil (2013), Khan *et al.* (2014) and Hejazi and Soleymain (2014)**.

Phosphorus fertilizer and phosphorien

Significant differences in maize ear length due to phosphorus fertilizer and addition of phosphorien were observed in the two seasons and their combined when maize plants carried one or two ears/plant. Treated plants with 15 kg P_2O_5 + phosphorien ranked first in ear length when carried two ears/plant while addition of 30 kg P_2O_5/fad., came in the second rank, but addition of phosphorien only ranked third without significant differences between phosphorien and addition of 15kg P_2O_5 + phosphorien in mono eared plants in the two seasons.

The increasing of ear length with chemical P fertilizer was also reported by **Alias *et al.* (2003), Iqbal and Chauhan (2003) and Khan *et al.* (2005)**.

The positive impact of phosphorus chemical fertilization on maize ear length was also confirmed by **Lin *et al.* (1983) and Glass (1989)**.

Interaction effect

It is evident from Table 2-a that growing maize under both 60 and 120 kg N/fad., ear length of SC 167 was longer than SC 168 and TWC 352 in both mono and douple eared plants. In this respect, it is noticed that ear length of SC 167 responded to N fertilizer more than each of SC 168 and TWC 352 when maize plants carried one ear/plant, but when carried two ears/ plant the three maize hybrids responded to N fertilizer up to 120 kg N/fad.

SC 168 hybrid had longer ears compared with SC 167 and TWC 352 under each of 30 k P_2O_5/fad., and phosphorien whereas under 15kg P_2O_5/fad., + phosphorien SC 167 had longer ear length than the other two hybrids in one ear/ plant.

When maize plants carried two ears/ plant the three maize hybrids had longer ear length under 15 kg P_2O_5/fad., + phosphorien, on other hand, SC 167 had longer ear length under phosphorien only or 15 kg P_2O_5/fad., + phosphorien. Maize hybrids SC 168 and SC 167 had the same ear length when maize was grown under 30 kg P_2O_5 (Table 2-b).

Table 2. Ear length (cm) of maize as influenced by the different treatments during 2013 and 2014 seasons

Main effects and interactions	Ear length (cm) mono eared plants			Ear length (cm) douple eared plants		
	2013	2014	Combined	2013	2014	Combined
Maize hybrids (H)						
SC 168	24.18a	24.72a	24.45a	22.43b	22.30a	22.37b
SC 167	24.08a	24.68a	24.38a	22.95a	22.33a	22.64a
TWC 352	19.76b	20.30b	20.02b	18.74c	18.64b	18.69c
F. test	**	**	**	**	**	**
Nitrogen level (kg N/fad.) (N)						
30	22.41b	22.50c	22.45d	21.17c	20.25d	20.71d
60	22.97a	22.75b	22.86c	20.96d	20.83c	20.89c
90	22.86a	23.82a	23.34a	21.45b	21.33b	21.39b
120	22.46a	23.86a	23.16b	21.91a	21.95a	21.93a
F. test	**	**	**	**	**	**
Phosphorus fertilization regimes (p)						
30 kg P_2O_5/fad.	22.53b	22.73b	22.63c	21.32b	21.03b	21.21b
Phosphorien	22.70a	23.44a	23.07b	20.91c	20.44c	20.67c
15 kg P_2O_5/fad. + phosphorien	22.80a	23.53a	23.16a	21.90a	21.74a	21.82a
F. test	**	**	**	**	**	**
Interactions						
H×N	**	**	**	**	**	**
H×P	**	**	**	**	**	**
N×P	**	**	**	**	**	**

Table 2-a. Effect of interaction between N fertilizer levels and maize hybrids on ear length (combined data)

Maize hybrids (H)	N levels (kg N/fad.)			
	30	60	90	120
		Mono eared plants		
	C	B	A	B
SC 168	23.74a	24.32b	25.31a	24.43b
	D	B	C	A
SC 167	23.59a	24.55a	24.26b	25.11a
	B	C	A	BC
TWC 352	20.04b	19.7c	20.44c	19.44c
		Douple eared plants		
	D	B	C	A
SC 168	21.30b	22.50b	22.37b	23.29a
	C	B	B	A
SC 167	21.67a	22.81a	22.86a	23.21a
	B	D	C	A
TWC 352	19.16c	17.37c	18.95c	19.29b

Table 2-b. Effect of interaction between maize hybrids and phosphorus fertilization regimes on ear length (combined data)

Maize hybrid (H)	Phosphorus fertilization regimes		
	30 kg P_2O_5/fad.	Phosphorien	15 kg P_2O_5 /fad. + phosphorien
		Mono eared plants	
	B	A	A
SC 168	24.33a	24.56a	24.46b
	C	B	A
SC 167	24.14b	24.33b	24.67a
	B	A	A
TWC 352	19.42c	20.3c	20.36c
		Douple eared plants	
	B	C	A
SC 168	22.59a	21.45b	23.06b
	B	C	A
SC 167	22.62a	22.11a	23.19a
	B	B	A
TWC 352	18.72b	18.46c	19.20c

It is evident from Table 2-c, that the application of 90 kg N/fad., under any phosphorus fertilizer used, produced the longest ear length when maize plant carried one ear/plant, moreover, ears became longer under 120 kg N/fad., in douple eared plants. The uppermost ear length (23.87 cm) was obtained under the application of both 90 kg N/fad., and 15 kg P_2O_5 + phosphorien, while the shortest ear length (22.29 cm) was attained due to application both 30 kg N/fad., and 30 kg P_2O_5/ fad., in mono eared plants. But increasing N level up to 120 kg N/fad., tended to produce longer ears with different p application therefore, the longest ear length was obtained by 15 kg P_2O_5 + phosphorien when 120 kg N/fad., was applied in two ears/plant.

Number of grains/ row

Results presented in Table 3 show the influence of N fertilizer levels and addition of P levels and phosphorien on number of grains/ row of three yellow maize hybrids when maize plants carried one or two ears/plant.

Maize hybrid differences

Maize hybrids varried significantly in number of grains/row when maize plants carried one or two ears/ plant in both seasons and their combined, while SC 167 and SC 168 had higher number of grains/ row and TWC 352 gave lower values for this character in the two seasons and their combined when maize plant carried one ear/plant. Concerning the number of grains/row when maize plants carried two ears/plant, SC 167 produced higher grain number followed by SC 168, whereas TWC 352 gave the lowest grain number in the two seasons and their combined. These results are in line with those reported by **Sharifi *et al.* (2009), Golezani and Tiajbakhsh (2012), Radma and Dagash (2013), Kandil (2013) and Modhej *et al.* (2014)**.

Nitrogen levels effect

Significant differences in number of grains/ row due to nitrogen fertilization treatments were observed in both seasons and their combined analysis when maize plants carried one or two ears/plant, in the two cases 90 kg N/fad., was a quite enough to produce the largest average of number of grains/row (Table 3).

Table 2-c. Effect of interaction between N fertilizer levels and phosphorus fertilization regimes on ear length (combined data)

Phosphorus fertilization regimes	N levels (kg N/fad.)			
	30	60	90	120
		Mono eared plants		
	C	B	A	A
30kg P_2O_5/ fad.	22.29b	22.57b	22.83c	22.82c
	C	A	A	B
Phosphorien	22.54a	23.32a	23.31b	23.10b
	C	C	A	B
15 kg P_2O_5 /fad. + phosphorien	22.53a	22.68b	23.87a	23.57a
		Douple eared plants		
	D	C	B	A
30 kg P_2O_5/fad.	20.23c	21.09b	21.71b	21.80b
	B	D	C	A
Phosphorien	20.64b	19.78c	20.46c	21.82b
	D	C	C	A
15 kg P_2O_5/fad. + phosphorien	21.27a	21.81a	22.02a	22.17a

Table 3. Number of grains/ row of maize as influenced by the different treatments during 2013 and 2014 seasons

Main effects and interactions	Mono eared plants			Douple eared plants		
	2013	2014	Combined	2013	2014	Combined
Maize hybrids (H)						
SC 168	48.64a	48.39a	48.51a	44.33b	45.33b	44.83b
SC 167	48.83a	48.47a	48.65a	45.06a	46.28a	45.67a
TWC 352	39.72b	39.47b	39.60b	37.75c	39.69c	38.72c
F. test	**	**	**	**	**	**
Nitrogen level (kg N/fad.) (N)						
30	45.33c	44.54b	44.96c	42.33b	43.78b	43.06b
60	44.96d	45.0ab	44.98c	41.52c	42.63b	42.08c
90	46.89a	46.52ab	46.70a	43.59a	45.19a	44.39a
120	45.74b	45.67a	45.70b	40.07b	43.48b	42.78b
F. test	**	**	**	**	**	**
Phosphorus fertilization regimes (p)						
30 kg P_2O_5/ fad.	45.53b	44.47c	45.25c	41.97b	42.11b	42.04c
Phosphorien	46.11a	45.86a	45.99a	41.92b	44.39a	43.15b
15kg P_2O_5/fad. + phosphorien	45.56b	45.5b	45.53b	43.25a	44.81a	44.03a
F. test	**	**	**	**	**	**
Interactions						
H×N	**	**	**	**	**	**
H×P	**	**	**	**	**	**
N×P	**	**	**	**	**	**

In the literature, several authors found that addition of nitrogen was effective to increase number of grains/row **(El-Sobky, 2014; Sorkhi and Fateh, 2014; El-Kholy, 2015; Ikramullah *et al.*, 2015)**.

Phosphorus fertilizer and phosphorien

An appreciable variation in number of grains/ row when maize plants carried one or two ears/ plant due to phosphorus fertilizer and phosphorien was detected in both seasons and the combined analysis (Table 3). Acquriment of the enlargement this numbers was the amenability of the application of phosphorien only when maize plants carried one ear/plant in the two seasons and their combined. But, when maize plant carried two ears/plant dualist application of 15 kg P_2O_5/fad., and phosphorien produced higher number of grains/row in the first season and combined data. The significant positive impact of chemical phosphorus fertilizer on number on grains/row was affirmed by **Iqbal and Chauhan (2003) and Khan *et al.* (2005)**.

The stimulant effect of phosphoru, bio-fertilizers on number of grains/row was recorded by many workers such as **Chabot *et al.* (1993)**.

Interaction effect

SC 167 hybrid appeared to produce higher number of grains/row when maize plants carried one or two ears/ plant under different N Levels with exception under 90 Kg N/fad., in mono eared plants followed by SC 168 while TWC 352 showed lower number of grains/row. while, under 90 kg N/fad., on one hand, number of grains/row of SC 167 and TWC 352 were higher when plants carried one or two ears/plant followed by 120 Kg N/fad., for TWC 352 in this connection (Table 3-a).

Regarding maize plants carried one ear/plant, in general, under both phosphorien alone or 15 kg P_2O_5/fad., + phosphorien, the superior hybrid was SC 168 and followed by SC 167 and meantime TWC 352 showed the lowest number, while under, 30 Kg P_2O_5/fad., SC 167 was the superior hybrid in this number followed by SC 168 and TWC 352, when maize plants carried two ears/plant, the superior hybrid was SC 167 under the three phosphorus treatments, meantime TWC 352 showed the lowest number (Table 3-b).

Results exhibited significant interaction effect (Table 3-c) between N fertilizer and phosphorus levels and phosphorien, the application of 90 Kg N/fad., under any phosphorus fertilizer regime used, produced the largest number of grains/row when maize plant carried one or two ears/plant. The uppermost number of gains/row (47.06 g) was obtained under addition of 90 kg N/fad., and 15 Kg P_2O_5/fad., + phosphorien, while the lowest number of grains/row (44.17 g) was attained due to addition both 60 kg N/fad and 15 kg P_2O_5 + phosphorien in mono eared plants, this was also true when maize plant carried two ears/plant.

Number of Rows Ear

Results pertaining to number of rows/ear of three yellow maize when carried one or two ears/plant as influenced by both N and P fertilization as well as addition of phosphorien are presented in Table 4.

Maize hybrid differences

As shown in Table 4, maize hybrids show significant difference in number of rows/ear in maize mono eared plants, but without significant difference among the three yellow maize on this number in douple eared plants in the two seasons, and their combined, TWC 352 gave the highest values for number of grains/row, whereas the other two hubrids were equal in this number. These results are in line with those reported by **Hejazi and Soleymain (2014) and Sorkhi and Fateh (2014)**.

Nitrogen level effect

Significant differences in number of rows/ear due to nitrogen fertilization treatments were observed in both seasons and their combined analysis when maize plants carried one or two ears/plant. But this addition was without significant effect in the first season on the douple eared plants/plant. In mono eared plants, the first and second nitrogen increment failed to increase number of rows lear, while this character responded to 120 kg N/fad., which recorded the highest number of rows/ear. But, in maize douple eared plants, 90 kg N/fad., was quite enough to produce the largest averages of number of rows/ear in the second season and the combined (Table 4). the obtained data, also confirm the idea that applied by **Abd El-Maksoud and Sarhan (2008), Atiaa *et al.* (2009), Abdou *et al.* (2012), Mukhtar *et al.* (2012) and El-Sobky (2014)**.

Table 3-a. Effect of interaction between N fertilizer levels and maize hybrids on number of grains/row (combined data)

Maize hybrid (H)	N level (kg N/fad.)			
	30	**60**	**90**	**120**
		Mono eared plants		
	D	C	A	B
SC 168	46.89b	48.28a	49.83a	49.06b
	C	B	A	A
SC 167	47.33a	48.56a	49.22b	49.5a
	B	D	A	C
TWC 352	40.67c	38.11b	41.05c	38.56c
		Douple eared plants		
	30	60	90	120
	B	A	A	A
SC 168	43.83b	44.94a	45.06b	45.5a
	BC	C	A	B
SC 167	45.22a	44.89a	46.89a	45.67a
	B	D	A	C
TWC 352	40.11c	36.39b	41.22c	37.17b

Table 3-b. Effect of interaction between maize hybrids and phosphorus fertilization regimes on number of grains/ row (combined data)

Maize hybrids (H)	Phosphorus fertilization regimes		
	30 kg P_2O_5/fad.	**Phosphorien**	**15 kg P_2O_5/fad. + phosphorien**
		Mono eared plants	
	C	**B**	**A**
SC 168	47.95b	48.54a	49.04a
	B	A	A
SC 167	48.25a	48.75a	48.96a
	B	A	C
TWC 352	39.54c	40.67b	38.58b
		Douple eared plants	
	C	B	A
SC 168	43.67a	44.67b	46.17b
	C	B	A
SC 167	43.63a	45.92a	47.46a
	A	A	A
TWC 352	38.83b	38.88c	38.46c

Table 3-c. Effect of interaction between N fertilizer levels and phosphorus fertilization regimes on number of grains/row (combined data)

Phosphorus fertilization regimes	N levels (kg N/fad.)			
	30	60	90	120
		Mono eared plants		
30 kg P_2O_5/fad.	D	c	A	B
	44.56c	44.83b	46.11b	45.5b
Phosphorien	C	BC	A	B
	44.89b	45.94a	46.94a	46.17a
15kg P_2O_5/fad. + phosphorien	B	C	A	B
	45.44a	44.17c	47.06a	45.44b
		Douple eared plants		
	A	A	A	B
30 kg P_2O_5/fad.	42.5b	42.17 ab	42.61c	40.89c
	C	BC	A	B
Phosphorien	42.33b	42.61a	44.56b	43.17b
	B	C	A	B
15 kg P_2O_5 + phosphorien	44.33a	41.44b	46.06a	44.28a

Table 4. Number of rows/ear of maize as influenced by the different treatments during 2013 and 2014 seasons

Main effects and interactions	Mono eared plants			Douple eared plants		
	2013	2014	Combined	2013	2014	Combined
Maize hybrid (H)						
SC 168	15.78b	16.00b	19.89b	19.89	16.33	16.11
SC 167	15.89b	15.89b	19.89b	19.83	16.39	16.11
TWC 352	16.61a	16.61a	16.61a	16.11	16.39	16.25
F. test	**	**	**	NS	NS	NS
Nitrogen level (kg N/fad.) (N)						
30	15.85b	16.00b	15.93	15.93	16b	15.96b
60	15.93b	16.07b	16b	16.00	15.93b	15.96b
90	16.07b	16b	16.04b	16.00	16.81a	16.41a
120	16.52a	16.59a	16.56a	15.85	16.74a	16.30a
F. test	**	**	**	NS	**	**
Phosphorus fertilization regimes (p)						
30 kg P_2O_5/fad.	16.11ab	16.11b	16.11b	15.94	15.94b	15.94b
phosphorien	15.89b	15.89b	15.89C	16.00	16.67a	16.33a
15 kg P_2O_5 /fad.+ phosphorien	16.28a	16.50a	16.39a	15.89	16.5a	16.19a
F. test	**	**	**	NS	**	**
Interactions						
H×N	NS	**	**	NS	**	*
H×P	*	NS	**	NS	**	**
N×P	**	**	**	NS	**	**

Phosphorus fertilizer and phosphorien

Significant differences in number of rows/ear due to phosphorus fertilizer and addition of phosphorien were observed in the two seasons and their combined when maize plants carried one or two ears/plant with the exception of the first season in douple eared plants. Treated plants with 15kg P_2O_5/fad., + phosphorien ranked first in this number and addition of 30 kg P_2O_5/fad., came in the second rank, but addition of phosphorien only came in the third rank in mono eared plants. But when maize plant carried two ears/plant, the plants, that received phosphorien only or 15 kg P_2O_5/fad., + phosphorien recorded the highest number of rows/ear without significant differences between them in the second season and the combined. The obtained results, also confirm the idea that applied by **Ahmad *et al.* (2007), Hussain *et al.* (2007) and Mukhtar *et al.* (2012)**.

Interaction effect

Under 30 kg N/fad., in maize mono eared plants and under 30 or 90 kg N/fad., in douple eared plants, each of SC 168, SC 167 and TWC 352 had equal number of rows/ear. But under 90 or 120 kg N/fad., in mono eared plants and 60 Kg N/fad., in douple eared plants. TWC 352 had higher number of rows/ear than each of SC 168 and SC 167. For the three yellow maize hubrids in mono eared plants, 120 kg N/fad., gave higher number of rows/ear than the other N treatment, but in douple eared plants 90 kg N/fad., was quite enough to produce the highest averages of this number in the three yellow moize hybrids (Table 4-a).

Under 30 kg P_2O_5/fad., in maize mono eared plants and under each of phosphorien or 15 kg P_2O_5/fad., + phosphorien in douple eared plants, the three yellow maize had equal number of rows/ear. But under each of phosphorien and 15 kg P_2O_5/fad., + phosphorien in mono eared plants and under 30 kg P_2O_5/fad., in douple eared plants, TWC 352 had higher number of rows/ear than each of SC 168 and SC 167 but, for TWC 352 the largest number of rows/ear was obtained from applying 15 kg P_2O_5/fad., + phosphorien and the other two phosphorus treatments gave the highest value under phosphorien treatment in douple eared plants (Table 4-b).

Under 30 kg N/fad., in mono eared plants and under both 30 and 90 Kg N/fad., in douple eared plants, the three phosphorus treatments had, equal number of rows/ear. But under 60 and 120 kg N/fad., in mono eared plants and 120 kg N/fad., in douple eared plants, maize plant fertilized by 15 kg P_2O_5/fad., + phosphorien produced higher number of rows/ear. When maize plants fertilized by 30 kg P_2O_5/fad., in mono eared plants, 90 kg N/fad., was quite enough to produce the highest averages of this number, but when fertilized by phosphorien only in douple eared plants, 60 kg N/fad., was quite in this respect (Table 4-c).

Hundred Grain Weight (g)

Maize hybrids differences

Results in Table 5 confirm high significant differences among the three hybrids in hundred grain weight when maize plants carried one or two ears/plant. The combined analysis results indicated that SC 167 produced the heaviest hundred grain weight followed by SC 168 while, TWC 352 gave the lighter hundred grain weight. This picture is clearly true in the first season and combined in mono eared plants and also the two seasons beside their combined when maize plants carried two ears/ plant. These results are in line with those reported by **Sharifi *et al.* (2009), Golezani and Tiajbakhsh (2012), Radma and Dagash (2013), Kandil (2013) and Modhej *et al.* (2014)**.

Nitrogen level effect

Statistical analysis revealed highly significant differences among nitrogen fertilizer levels in both seasons and their combined when maize plants carried one or two ears/plant. Meanwhile, appliance of 30 or 120kg N/fad., produced the heaviest weight of 100 grains followed by both 60 and 90 kg N/fad., in mono eared plants, whereas in maize douple eared plants, appliance of 30 kg N/fad., produced the heaviest 100 grain weight followed by both 90 and 120 kg N/fad., but the lowest weight was obtained from applying 60 kg N/fad., (combined data).

The positive effect of N feltilizer on hundred grain weight was reported by **El-Sobky (2014), Sorkhi and Fateh (2014), El-Kholy (2015) and Ikramullah *et al.* (2015)**.

Table 4-a. Effect of interaction between N fertilizer levels and maize hybrids on number of rows/ear (combined data)

Maize hybrid (H)	N levels (kg N/fad.)			
	30	60	90	120
		Mono eared plants		
	B	B	B	A
SC 168	15.89a	15.78b	15.67b	16.22b
	AB	B	B	A
SC 167	15.89a	15.78a	15.78b	16.11b
	C	B	B	A
TWC 352	16.00a	16.44a	16.67a	17.33a
		Douple eared plants		
	B	B	A	A
SC 168	15.89a	15.78b	16.33a	16.44a
	B	B	A	A
SC 167	15.89a	15.78b	16.33a	16.44a
	B	AB	A	B
TWC 352	16.11a	16.33a	16.56a	16.00b

Table 4-b. Effect of interaction between maize hybrids and phosphorus fertilization regimes on number of rows/ ear (combined data)

Maize hybrid (H)	Phosphorus fertilization regimes		
	30 kg P_2O_5/ fad.	Phosphorien	15 kg P_2O_5/fad. + phosphorien
		Mono eared plants	
	A	A	A
SC 168	16.00a	15.67b	16.00b
	AB	B	A
SC 167	16.00a	15.50b	16.17b
	B	B	A
TWC 352	16.00a	16.50a	17.00a
		Douple eared plants	
	A	B	B
SC 168	15.75b	16.33a	16.25a
	B	A	A
SC 167	15.75b	16.25a	16.33a
	AB	A	B
TWC 352	16.33a	16.42a	16.00a

Table 5. Hundred grain weight (g) of maize as influenced by the different treatments during 2013 and 2014 seasons

Main effects and interactions	Hundred grain weight (g)					
	Mono eared plants			Douple eared plants		
	2013	2014	Combined	2013	2014	Combined
Moize hybrid (H)						
SC 168	38.47b	39.85a	39.16b	36.4b	37.10b	36.70b
SC 167	39.69a	40.39a	40.04a	37.86a	38.80a	38.30a
TWC 352	37.59c	37.31b	37.45c	35.20c	36.10c	35.70c
F. test	**	**	**	**	**	**
Nitrogen level (kg N/fad.) (N)						
30	40.08a	39.48ab	39.78a	38.00a	38.70a	38.30a
60	36.59d	37.31b	36.95b	35.20d	35.70c	35.50c
90	38.16c	38.77ab	38.46b	36.50b	37.40b	36.90b
120	39.74b	41.17a	40.46a	36.20c	37.60b	36.90b
F.test	**	**	**	**	**	**
Phosphorus fertilization regimes (p)						
30 kg P_2O_5/fad.	36.88b	38.34b	37.61b	37.50b	38.10b	37.80b
phosphorien	36.79b	37.65b	37.22b	33.20c	34.30c	33.70c
15 kg P_2O_5/fad. + phosphorien	42.26a	41.26a	41.91a	38.80a	39.60a	39.20a
F. test	**	**	**	**	**	**
Interactions						
H×N	**	NS	**	**	**	**
H×P	**	**	**	**	**	**
N×P	**	**	**	**	**	**

Phosphorus fertilizer and phosphorien

An appreciable variation in hundred grain weight when maize plants carried one or two eared/plant due to phosphorus fertilizer and phosphorien was detected in both seasons and their combined (Table 5). Acquirement of the heaviest grains was *via* the application of 15 kg P_2O_5/fad., + phosphoien, while the lowest hundred grain weight was given by each of 30 kg P_2O_5/fad., or phosphorien only in both seasons and their combined when maize plants carried one ear/plant. This picture is true also in the douple eared plants, but addition of phosphorien only gave the lowest hundred weight in the two seasons and their combined.

The significant positive impact of chemical phosphorus fertilizer on 100 grain weight was affirmed by **Ahmad *et al.* (2007) and Omar (2011)**.

Interaction effect

Under 30and 90 kg N/fad., in maize mono eared plants and also, under 60 kg N/fad., in douple eared plants, each of SC 168 and SC 167 had the heaveiest hundred grain weight. But under the same level of N (30 and 90) in mono eared plants and under 60kg N/fad., in douple eared plants, TWC 352 gave the lightest hundred grain weight. No clear trend could be detected for this character in this respect (Table 5-a).

Concerning mono eared plants, under 30 kg P_2O_5/fad., both SC 168 and TWC 352 had the heaviest 100 grain weight while SC 167 gave the lightest weight, but under each of sole phosphorien

Table 5-a. Effect of interaction between N fertilizer levels and maize hybrids on hundred grain weight (combined data)

Maize hybrid (H)	N levels Kg N/fad.			
	30	60	90	120
	Mono eared plants			
SC 168	A 40.57 a	B 35.46 b	A 39.54 a	A 41.07 a
SC 167	A 40.81 a	A 38.08 a	A 40.02a	B 35.69 b
TWC 352	A 37.96b	AB 37.32ab	B 35.83 b	A 39.07 a
	Douple eared plants			
SC 168	A 37.05b	A 37.07a	AB 36.51b	B 36.23b
SC 167	A 40.37a	C 37.64a	D 36.69b	B 38.69a
TWC 352	A 37.54b	C 31.65b	A 37.63a	B 35.91b

application or 15 kg P_2O_5/fad., + phosphorien, SC 168 and 167 had the heaviest, whereas TWC 352 recorded the lightest weight. For SC 168 and 167, the heaviest grains was achieved by 15kg P_2O_5/fad., + phosphorien, while the lowest weight was given by 30kg P_2O_5/fad.

Regarding douple eared plants under the three phosphorus treatments, SC 167 had the heaviest hundred grain weight, while the lowest weight was given by each of SC 168 and TWC 352. For SC 168 and SC 167, the heaviest grains recorded by applying 15 kg P_2O_5/fad., + phosphorien and the lowest weight was given by phosphorien only (Table 5-b).

When maize plants carried one ear/plant and under 30 kg N/fad., the three phosphorus treatments had equal hundred grain weight, while the heaviest hundred grain weight was achived by addition of 15kg P_2O_5 + phosphorien under the other N levels (60, 90 and 120 kg N/fad.). In addition, when maize plants fertilized by 30 Kg P_2O_5/fad., or phosphorien, 30 kg N/ fad., was quite enough to produce the heaviest hundred grain weight, but when fertilized by 15 kg P_2O_5/fad., + phosphorien, the heaviest weight was obtained by applying 120 kg N/fad., (Table 5-c).

Regarding douple eared plants, under 30 and 60 kg N/fad., the heaviest hundred grain weight was given by addition of 15 kg P_2O_5 + phosphorien. Then, the heaviest grains was recorded by 30kg P_2O_5/fad., under each of 90 and 120 kg N/fad.,. While when maize fertilized by phosphorien only or 15 kg P_2O_5/fad., + phosphorien, 30 kg N/fad., was quite enough to produce the heaviest weight (Table 5-c)

Ear Grain Weight (g)

Results concerning the hybrids differences and the effect of N levels and phosphorus fertilizer as well as phosphorien on ear grain weight are given in Table 6.

Maize hybrid differences

Maize hybrids revealed highly significant differences in ear weight, where SC 167 hybrid appeared to produce the heaviest ear grain weight throughout the second season and their

Table 5-b. Effect of interaction between maize hybrids and phosphorus fertilization regimes on hundred grain weight (g) (Combined data)

Maize hybrid (H)	Phosphorus fertilization regimes		
	30 Kg P_2O_5/fad.,	Phosphorien	15 kg P_2O_5/fad.+ phosphorien
	Mono eared plants		
SC 168	B 36.95a	B 34.21ab	A 43.32a
SC 167	C 33.48b	B 38.45a	A 44.30a
TWC 352	A 38.23a	B 36.00b	A 38.38b
	Douple eared plants		
SC 168	B 37.53b	C 32.85b	A 39.76b
SC 167	B 38.43a	C 35.11a	A 41.51a
TWC 352	A 37.41b	C 33.27b	B 36.36c

Table 5-c. Effect of interaction between N fertilizer levels and phosphorus fertilization regimes on hundred grain weight (g)

Phosphorus fertilization regimes	N levels (kg/fad.)			
	30	60	90	120
	Mono eared plants			
30 kg P_2O_5/fad.	A 39.61a	B 33.49c	A 37.72b	B 34.06b
Phosphorien	A 40.15a	B 37.12b	B 35.88b	B 35.73b
15 kg P_2O_5/fad. + phosphorien	C 39.58a	BC 40.24a	B 41.79a	A 46.03a
	Douple eared plants			
30 kg P_2O_5/fad.	C 36.20b	B 37.86b	A 39.06a	B 38.03a
phosphorien	A 36.53b	C 29.97c	B 34.16c	B 34.31b
15 kg P_2O_5/fad. + phosphorien	A 42.22a	B 38.53a	C 37.60b	B 38.49a

Table 6. Ear grain weight (mono eared plants) of maize as influenced by the different treatments during 2013 and 2014 seasons

Main effects and interactions	2013	2014	Combined
Maize hybrid (H)			
SC 168	266.6a	245.4b	256.0b
SC 167	257.4b	267.3a	262.3a
TWC 352	205.bc	205.6c	205.7c
F. test	**	**	**
Nitrogen level (kg N/fad.) (N)			
30	220.6d	242.1b	231.4d
60	240.bc	246.3a	243.4b
90	243.2b	239.6c	241.4c
120	268.6a	229.8d	249.2a
F. test	**	**	**
Phosphorus fertilization regimes (p)			
30 kg P_2O_5/fad.	235.5b	245.0b	240.3b
Phosphorien	247.5a	222.4c	234.9c
15 kg P_2O_5/fad. + phosphorien	246.7a	250.9a	248.8a
F. test	**	**	**
Interactions			
H×N	**	**	**
H×P	**	**	**
N×P	**	**	**

combined. Otherwise, TWC 352 hybrid gave the lowest ear grain weight in this respect. This result almost followed the same patterns of hundred grain weight. The differences in ear grain weight among the there maize hybrids might be attributed to the genetically variation. Similar maize hybrids change in ear weight was obtained by **Abdou *et al.* (2012)**.

Nitrogen levels effect

Nitrogen fertilization results revealed highly significant differences throughout the two seasons and their combined. Meanwhile, appliance of 120 kg N/fad., produced the heaviest ear grain weight followed by 60 and 90 kg N/fad., whereas the lowest weight of ear grain weight was obtained from 30 kg N/fad., (combined data). (Table 6) Several investigators came to the same conclusion such as **El-Moursy (2013), Kandil (2013), Hejazi and Soleymain (2014) and Khan *et al.* (2014)**.

Phosphorus fertilizer and phosphorien effect

Significant differences in ear grain weight due to phosphorus fertilizer and addition of phosphorien were observed in the two seasons and their combined. Treated plants with 15 kg P_2O_5/fad., + phosphorien ranked first in this weight and addition of 30kg P_2O_5/fad., came in the second rank, but addition of phosphorien only came in the last rank, this was true in the second season and the combined (Table 6). Several authors came to the same conclusion of

them **Yosefi *et al.* (2011), Zafar *et al.* (2011) and Khan *et al.* (2014)**. In addition **Karimian (2000) and Jat and Shaktawat (2003)** confirmed satisfactory results from the use of phosphate biological fertilizer.

Interaction effect

Under 30 and 120kg N/fad., SC 167 had the heaviest ear grain weight followed by SC 168, where under 60 and 90 kg N/fad., SC 168 recorded the heaviest ear grain weight, while TWC 352 gave the lowest weight under the four N level. Therefore, the highest ear grain weight (287 g) was achieved by SC 167 hybrid when 120 kg N/fad., was applied. Otherwise, TWC 352 hybrid gave the lowest ear grain weight (201 g) under applying 90 kg N/fad., (Table 6-a).

Under 60 and 120 kg N/fad., the heaviest ear grain weight was recorded when maize plants fertilized by 15 kg P_2O_5 + phosphorien, but recoded by 90 kg N/fad., when fertilized by 30 kg P_2O_5/fad. When maize plants fertilized with phosphorien only, 30kg N/fad., was quite enough to produce the heaviest ear grain weight, but when fertilized by 30 kg P_2O_5/fad., or 15 kg P_2O_5 + phosphorien they were needed 90 and 120 kg N/fad., respectively. Then, the highest ear grain weight (264.5) was recorded when maize plants fertilized by each of 15 kg P_2O_5/fad., + phosphorien and 120 kg N/fad, where the lower ear grain weight (223.1) was recorded when fertilized by each of 30 kg P_2O_5/fad., and 30 kg N/fad., (Table 6-b).

Under 30 kg P_2O_5/fad., and 15 kg P_2O_5/fad., + phosphorien, SC 167 recorded the highest ear grain weight, while, SC 168 gave the heaviest weight when maize plants were fertilized by phosphorien only, then the lowest ear grain weight was achieved by TWC 352 in all phosphorus fertilizer. Therefore, the heaviest ear grain weight of 277.8 was obtained by SC 167 hybrid when 15 kg P_2O_5/fad., + phosphorien were applied. Otherwise, TWC 352 gave the lowest ear grain weight (203 g) under phosphorien only applied (Table 6-c).

Grain Yield (ardab/fad.)

The average effects of nitrogen fertilizer levels and addition of phosphorus and phosphorien on grain yield of the three yellow maize hybrids are shown in Table 7.

Maize hybrid differences

Significant differences could be detected between the three yellow maize hybrids in the two seasons and their combined, where SC 167 hybrid had greater grain yield/fad., than the other maize hybrids. Otherwise, TWC 352 hybrid gave the lowest grain yield/fad., in this respect. This result almost followed the same patterns of hundred grain weight and ear grain weight. This inclination was fairly virtual in both growing seasons and affirmed when their data were statistically combined. The hybrid differences in such trait could be explained by the fact that photosynthetic translocate from the source to the sink were great enough to fill all the grains of SC 167 hybrid or to increase the final grain yield/fad., relative to TWC 352 or SC 168. These results are in conformity with those given by **Abd El-Maksoud and Sarhan (2008), Atiaa *et al.* (2009), Abdou *et al.* (2012) and Mukhtar *et al.* (2012)**.

Nitrogen levels effect

It is evident from Table 7 that each N increment up to 120 kg N/fad, produced a significant increase in grain yield (arda/fad.), in both seasons and their combined. The response of grain yield to the increase of N level reflected that observed in each of ear length, number of grains/row, number of rows/ear and ear grain weight (Tables 2, 3, 4 and 6) several authors reported significant increase in grain yield due to the increase of N level (**Sharifi *et al.*, 2009; Golezani and Tiajbakhsh, 2012; Kandil, 2013;Radma and Dagash, 2013; Modhej *et al.*, 2014)**.

Phosphorus fertilizer and phosphorien effect

Significant differences in grain yield/fad., due to phosphorus fertilizer and addition of phosphorien were observed in the two seasons and their combined. Acquirement of the heaviest grain yield/fad., was by application of 30 kg P_2O_5/fad., or phosphorien only, while the lowest grain yield/fad., was given by addition 15 kg P_2O_5/fad., + phosphorien in both seasons and their combined (Table 7).

Table 6-a. Effect of interaction between N fertilizer levels and maize hybrids on ear grain weight (g) in mono eared plants (combined data)

Maize hybrid (H)	N levels (kg N/fad.)			
	30	**60**	**90**	**120**
	D	B	A	C
SC 168	239.9b	261.5a	267.0a	255.7b
	D	B	C	A
SC 167	246.3a	259.9b	256.0b	287.0a
	A	A	C	B
TWC 352	207.9c	208.0c	201.1c	204.9c

Table 6-b. Effect of interaction between N fertilizer levels and phosphorus fertilization regimes on ear grain weight (g) in mono eared plants (combined data)

Phosphorus fertilization regimes	N levels (kg N/fad.)			
	30	**60**	**90**	**120**
	D	C	A	B
30kg P_2O_5/fad.	223.1c	241.9b	251.0a	244.9b
	A	C	D	B
Phosphorien	240.5a	233.0c	228.1c	238.2c
	D	B	C	A
15 kg P_2O_5 / fad., + phosphorien	230.5	255.2a	245.0b	264.5a

Table 6-c. Effect of interaction between maize hybrids and phosphorus fertilization regimes on ear grain weight (g) in mono eared plants (combined data)

Maize hybrids (H)	30 kg P_2O_5/fad.,	Phosphorien	15 kg P_2O_5/fad. + phosphorien
	B	C	A
SC 168	254.3b	252.2a	261.6b
	B	C	A
SC 167	259.4a	249.7b	277.8a
	A	B	A
TWC 352	207.1c	203.0c	206.9c

Table 7. Grain yield (ardab/faddan) of maize as influenced by the different treatments during 2013 and 2014 seasons

Main effects and interactions	2013	2014	Combined
Maize hybrid (H)			
SC 168	38.31b	40.54b	39.42b
SC 167	39.45a	41.26a	40.36a
TWC 352	31.64c	32.63c	32.13c
F. test	**	**	**
Nitrogen level (kg N/fad.) (N)			
30	34.22d	36.01d	35.12d
60	35.80c	37.00c	36.58c
90	36.81b	38.40b	37.61b
120	39.02a	40.81a	39.91a
F. test	**	**	**
Phosphorus fertilization regimes (p)			
30 kg P_2O_5/fad.	37.72a	38.93a	38.32a
Phosphorien	37.54a	39.10a	38.32a
15kg P_2O_5/fad., + phosphorien	34.13b	36.40b	35.26b
F. test	**	**	**
Interactions			
H×N	**	**	**
H×P	**	**	**
N×P	**	**	**

The significant positive impact of chemical phosphorus fertilizer on grain yield/fad., was reported by (**Iqbal *et al.,* 2003; Salih *et al.,* 2007; Olusegun, 2015**). Some authors reported that, application of biofertilizer of phosphorus increased growth and yield (**Glaa, 1989; Sundara *et al.,* 2002; Bolan and Duraisamy, 2003; Behbahani and Khayyam, 2004; Pradhan and Sukla, 2005; Xiao *et al.,* 2011**).

Interaction effect

Under the four N levels, SC 167 had the heaviest grain yield/fad., followed by SC 168 and TWC 352. Therefore, the highest grain yield/fad., of (44.26 ardab) was achieved by SC 167 hybrid when fertilized by 120kg /fad. Otherwise, TWC 352 hybrid gave the lowest grain yield (29.24) when fertilized by 30 kg N/fad., (Table 7-a).

Under 30 and 60 kg N/fad., the highest grain yield recorded when maize plants were fertilized by 30 kg P_2O_5/fad., but recorded by 90 and 120 kg N/fad., when fertilized by phosphorien only. When maize plants fertilized by 30 kg P_2O_5/fad., observed that 30kg N/fad., was quiet enough to produce the heaviest grain yield, but when fertilized by phosphorien only they needed 120 kg N/fad., and 60 kg N /fad., when fertilized by 15 kg P_2O_5/fad., + phosphorien, receptively. Then the higher grain yield (47.06) was recorded when maize plants, fertilized by each of phosphorien and 120 kg N/fad., where the lowest grain yield (32.98) was recorded when plants were fertilized by 30 kg N/fad., and 15 kg P_2O_5/fad., + phosphorien (Table 7-b).

Under all phosphorus treatments, SC 167 recorded the highest grain yield, then the lowest grain yield was achieved by TWC 352 in this respect. Therefore, the heaviest grain yield (42.82) was obtained when SC 167 hybrid fertilized by phosphorien only.

Otherwise, the lowest grain yield (30.77) recorded by TWC 352 when fertilized by phosphorien only (Table 7-c).

Table 7-a. Effect of interaction between N fertilizer levels and maize hybrids on grain yield (ardab/fad.) (combined data)

Maize hybrid (H)	N levels (kg N/fad.)			
	30	**60**	**90**	**120**
	D	C	B	A
SC 168	37.02b	38.07b	39.71a	42.89b
	B	C	B	A
SC 167	39.08a	38.66a	39.43a	44.26a
	D	B	A	C
TWC 352	29.24c	33.02c	33.68b	32.59c

Table 7-b. Effect of interaction between N fertilizer levels and phosphorus fertilization regimes on grain yield (ardab/ fad.) (combined data)

Phosphorus fertilization regimes	N levels (kg N/fad.)			
	30	**60**	**90**	**120**
	A	A	B	C
30 kg P_2O_5/fad.	39.61a	39.24a	38.31b	36.59b
	C	C	B	A
Phosphorien	33.21b	33.21c	39.82a	47.06a
	D	A	C	B
15 kg P_2O_5/fad.+ phosphorien	32.98b	37.29b	34.69c	36.09c

Table 7-c. Effect of interaction between maize hybrids and phosphorus fertilization regimes on grain yield (ardab/fad.) (combined data)

	Phosphorus fertilization regimes		
Maize hybrids (H)	**30kg P_2O_5/fad.,**	**Phosphorien**	**15 kg P_2O_5+ phosphorien**
	B	A	C
SC 168	40.22b	41.39b	36.66a
	B	A	C
SC 167	41.71a	42.82a	36.55a
	A	B	A
TWC 352	33.05c	30.77c	32.58b

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تأثيـر بعـض المعـاملات الـزراعية علـى المحصول ومساهماته لبعض هجن الذرة الشـــامية الصفـراء

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أقيمت تجربتان حقليتان بقرية شيط الهوى، مركز كفر صقر، محافظة الشرقية، مصر خلال موسمي الزراعة ٢٠١٣، ٢٠١٤ وذلك لدراسة تأثير أربعة مستويات من التسميد النيتروجين (٣٠، ٦٠، ٩٠، ١٢٠كجم ن/فدان) والتسميد الفوسفاتي (٣٠كجم فو٢أ٥، فوسفورين، ١٥كجم فو٢أ٥+ فوسفورين) على القدرة الإنتاجية لثلاثة هجن صفراء من الذرة الشامية عندما تحمل النباتات كوز واحد أو كوزين، كان التصميم المستخدم هو نظام القطع المنشفة مرتين في ٣مكررت حيث وضعت الهجن في القطع الرئيسية ومستويات التسميد النيتروجين في القطع المنشقة من الدرجة الأولي، ووضع التسميد الفوسفاتي والفوسفورين في القطع المنشقة من الدرجة الثانية ويمكن تلخيص النتائج كما يلي: أولا: في حالة النباتات الحاملة لكوزين، كان تأثير الهجن معنوياً على مستوى الصفات المدروسة حيث تفوق الهجين الفردي ١٦٧في معظم صفات ومساهمات المحصول تلاه الهجين الفردي ١٦٨ثم الهجين الثلاثي ٣٥٢، حيث تفوق الهجين ١٦٧في طول الكوز، عدد الحبوب بالسطر، وزن ١٠٠حبة، أوضحت نتائج التحليل التجميعي للموسمين أن كل زيادة في معدل التسميد النيتروجيني حتى ١٢٠ كجم ن/فدان أدت لزيادة في طول الكوز في حين كانت الاستجابة حتى ٩٠كجم ن/فدان في كل من عدد الحبوب بالسطر وعدد السطور بالكوز وحتى ٣٠كجم ن/فدان في وزن ١٠٠حبة، ولوحظ من التحليل للموسمين أن إضافة ١٥كجم فو٢أ٥ + فوسفورين أدي للحصول علي أعلي القيم لكل من طول الكوز، عدد الحبوب بالسطر، عدد السطور بالكوز، وزن ١٠٠حبة، ثانيا: في حالة النباتات الحاملة لكوز واحد، كان تأثير الهجن معنويا على معظم الصفات المدروسة حيث تفوق الهجين الفردي ١٦٧ تلاه الهجين الفردي ١٦٨ ثم الهجين الثلاثي ٣٥٢ في معظم مساهمات المحصول ومحصول الحبوب للفدان وكان تفوق الهجين ١٦٧ بسبب تفوقه في كل من طول الكوز، عدد الحبوب بالسطر، وزن ١٠٠حبة، وزن حبوب الكوز ومحصول الحبوب للفدان في حين تفوق محصول الهجين الثلاثي الأصفر ٣٥٢ في عدد السطور بالكوز، أوضحت نتائج التحليل التجميعي للموسمين أن كل زيادة في معدل التسميد النينروجيني حتى ٩٠كجم ن/فدان أدت لزيادة كل من طول الكوز، عدد الحبوب بالسطر في حين كانت الاستجابة حتى ١٢٠كجم ن/فدان بالنسبة لكل من عدد السطور بالكوز ووزن حبوب الكوز ومحصول الحبوب للفدان، لوحظ من التحليل التجميعي للموسمين أن إضافة ١٥كجم فو٢أ٥ + فوسفورين أدى إلى الحصول على أعلى القيم لكل من طول الكوز، عدد السطور بالكوز، ووزن ١٠٠حبة ووزن حبوب الكوز في حين تم الحصول على أعلى محصول حبوب للفدان باستخدام أي من ٣٠كجم فو٢أ٥ أو فوسفورين فقط، أوضحت نتائج التحليل التجميعي للموسمين وجود تداخل فعل معنوي بين هجن الذرة الشامية من ناحية وبين كل من معاملات النيتروجين ومعاملات الفوسفور المختلفة من ناحية أخري حيث تفوق الهجين الفردي ١٦٧في محصول الحبوب للفدان تحت معظم مستويات النيتروجين وكانت استجابته حتى ١٢٠كجم ن/فدان في حين سجل الهجين الثلاثي ٣٥٢ أقل محصول حبوب عند ٣٠كجم ن/فدان واستخدام الفوسفورين فقط ومن هنا تم الحصول على أعلى محصول حبوب للفدان (٤٢,٨٢ أردب للفدان) عند تسميد الهجين الفردي الأصفر ١٦٧ بمستوى ١٢٠ كجم ن/فدان والفوسفورين.

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