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RESPONSE OF SOME MAIZE HYBRIDS TO NITROGEN FERTILIZER LEVELS UNDER CULTIVATED SANDY SOILS.

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ABSTRACT

Tow field experiments were carried out at a private Farm at Wadi El-Mollak, Abo-Hammad District, Sharkia Governorate, Egypt during 2006 and 2007 summer seasons. The aim of this work was to study the response of three maize hybrids i.e. single cross 18, three way cross 310 and three way cross 320 to N fertilizer levels (50, 75, 100 and 125 kg N/fad). A split-plot design with three replicates was followed, the three maize hybrids were arranged at random in the main plots whereas, nitrogen fertilizer levels were occupied the sub-plots. The obtained results of the combined analysis of the two growing seasons could be summarized as follows:

Highly significant differences were detected among the three tested maize hybrids in most the growth and yield characteristics. SC18 maize hybrid surpassed the other two hybrids in grain yield/fad as a result of its superiority in yield components i.e. ear length, number of grains/row, number of grains/ear and 100-grain weight. TWC 310 plants were superior in plant and ear heights. Both TWC 310 and TWC 320 had the largest leaf area/plant. The plants of both SC18 and TWC 320 gave the highest shelling percentage. The studied maize hybrids did not significantly differed in number of rows/ear.

Each increment of N level up to 125 kg/fad resulted in a continuous and significant increase in plant height, leaf area/plant, ear length, number of grains/row, number of grains/ear, shelling percentage and grain yield/fad. Ear height, number of rows/ear and 100-grain weight were gradually increased with increasing N level up to 100 kg N/fad.

The interaction between the two studied factors significantly affected leaf area/plant and grain yield/fad. Planting TWC 320 with application of 125 kg N/fad is the best to obtain the largest leaf area/plant whereas, planting SC18 with 100 or 125 kg N/fad is the best to obtain the highest grain yield/fad.

Positive and significant correlation coefficients between maize grain yield on one hand and each ear length, number of grains/row and number of grains/ear on the other hand were observed, while positive and insignificant correlations were found between grain yield and other studied characters. The direct effect of ear length was 49.5% being higher than those of number of grains/ear and 100-grain weight which were 2.85 and 4.40% of grain yield variation, respectively.

INTRODUCTION

Maize (*Zea mays*, L.) is one of most important cereal crops in the world and it ranks the third after wheat and rice according to its area, distribution and its important in human and animal feeding as well as in industrial products. In Egypt, the local production of maize is not sufficient to meet the increase in consumption. Therefore, more attempts for raising maize production are considered a matter of most importance. Thus, efforts should be directed towards two objectives. First, the development of high yielding single and three way cross hybrids and second, the improvement of proper agronomic practices for maximum and efficient production.

Maize hybrids differ in their growth and yielding abilities due to the difference in their genetic make up and environmental conditions. Many investigators found significant differences among studied maize hybrids, of them El-Bana (2001), El-Metwally *et al.* (2001), Ahmed and El-Sheikh (2002), Oraby and Sarhan (2002), Mahfouz (2003), Mowafy (2003), Oraby *et al.* (2003), Oraby *et al.* (2005), Hans (2006), Abd El-Maksoud and Sarhan (2008) and Thiraporn *et al.* (2008).

It is well known that nitrogen is a key element in maize nutrition. So, an adequate supply of nitrogen, is essential to maximize yield. Under sandy soil conditions, Oraby and Sarhan (2002) found that maize growth, yield and yield components were significantly increased by each increment of N fertilizer up to 120 kg N/fad in a reclaimed sandy soil. Moreover, Oraby *et al.* (2005) found that increasing nitrogen levels up to 150 kgN/fad increased significantly maize growth, grain yield and yield attributes, in the newly reclaimed soils. Similar results were observed by El-Bana and Gomaa (2000), El-Bana (2001), El-Metwally *et al.* (2001), Ahmed and El-Sheikh (2002), Zohry and Farghaly (2003), Badr *et al.* (2003), Khamis *et al.* (2005), Hans (2006), Abd El-Maksoud and Sarhan (2008) and Thiraporn *et al.* (2008).

This work was performed to investigate the effect of nitrogen fertilization on growth, yield, yield components and yield analysis of three maize hybrids under cultivated sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were carried out in a private Farm at Wadi El-Mollak, Abo-Hammad District, Sharkia Governorate, Egypt. During 2007 and 2008 summer seasons. The aim of this work was to study the effect of nitrogen fertilizer levels (50, 75, 100 and 125 kg N/fad) on growth, yield and its attributes and yield analysis of three maize hybrids namely SC18, TWC 310 and TWC 320.

A split plot design with three replicates was used. Maize hybrids were randomly arranged in the main plots whereas; nitrogen fertilizer levels were assigned at random in the sub-plots. Each sub-plot area was 16.8m2 and contained 6 ridges, 4 meters in length and 70cm in width.

The preceding crop was lupin in the first season mean while, it was wheat in the second one.

The mechanical and chemical analysis of the soil in both seasons are presented in table (1).

Planting took place on 21st and 23rd of May in the two growing seasons, respectively.

Calcium super phosphate (15.5% P_2O_5) at the rate of 100kg /fad and potassium sulphate (48% K_2O) at the rate of 50kg/fad were added just before sowing as a basal fertilization. The nitrogen fertilizer used was added as ammonium sulphate (20.5% N) at three equal doses just before the first three irrigations at 15, 25 and 35 days after sowing.

Maize plants were thinned to one plant/hill after 15 days from sowing. The other recommended agronomic practices in the region were followed.

Table (1): Soil mechanical and chemical analysis of the experimental field (upper 30cm of soil surface).

Soil properties	1st season	2nd season
Mechanical analysis:		
Coarse sand %	36.15	35.47
Fine sand %	30.45	29.85
Silt %	19.32	18.15
Clay %	14.08	16.53
Soil texture	Sandy	Sandy
Chemical analysis:		
Organic matter %	1.01	0.97
Available N ppm	19.64	18.81
Available P ppm	6.54	7.11
Available K ppm	191.41	185.36
pH.	7.5	7.6

Recorded data :

The two outer ridges (1st and 6th) were left as borders. The second two inner ridges were used for recording growth characters and to determine yield components. The remain central ridges were harvested for determine grain yield/fad.

a) Growth characters:

After 75 days from sowing a sample of tagged five plants were taken to measure the following characters i.e. plant height, ear height and leaf area (dm^2/plant).

b) Yield and yield components:

At harvest, ten guarded plants were taken from the 2nd and 5th ridges in each sub-plot, then ear length (cm), number of rows/ear, grain number /row, number of grains/ear, 100- grain weight (gm) and shelling percentage were recorded. Grain yield (ardab/fad) at 15.5% moisture content was determined from the two central ridges.

Statistical analysis:

The obtained data of both seasons were subjected to the statistical analysis according to Snedecor and Cochran (1980). For comparison of means, Duncan's multiple range test was used (Duncan, 1955). In interaction Tables, capital and small letters were used to compare means in rows and columns, respectively. The combined data of yield and its components used to calculate the simple correlations and path coefficient analysis according to Svab (1973).

RESULTS AND DISCUSSIONS

I. Growth:

a-Maize hybrids differences:

Data in Table (2) indicate that the differences among the tested maize varieties were significant regarding plant height, ear height and leaf area/ plant and this was true in both growing seasons as well as their combined.

Table (2): Plant height (cm), Ear height (cm) and Leaf area (dm^2/plant) of tested maize hybrids as affected by N fertilizer levels in the two seasons and their combined.

Main effects and interaction	Plant height (cm)			Ear height (cm)			Leaf area (dm^2/plant)		
	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined
Maize hybrids (H) :									
SC18	273.8a	248.7b	261.3b	142.7b	135.4b	139.1b	75.5c	74.5b	75.0b
TWC310	274.2a	265.5a	269.9a	147.1a	141.8a	144.5a	77.5b	80.0a	78.8a
TWC320	255.1b	260.4c	257.8c	136.5c	130.2c	133.4c	84.9a	74.3b	79.6a
F. test	**	**	**	*	*	*	*	**	**
N fertilizer levels (N) :									
50 kg N/fad.	255.7d	236.3d	246.0d	135.9c	126.4c	131.2c	62.4d	66.4c	64.4d
75 kg N/fad.	268.6c	255.6c	262.1c	142.2b	131.1b	136.7b	79.5c	76.9b	75.2c
100 kg N/fad.	270.3b	269.3b	269.8b	145.2a	142.7a	143.9a	85.1b	80.7a	82.9b
125 kg N/fad.	276.2a	271.6a	273.9a	145.1a	143.0a	144.1a	90.2a	81.1a	85.7a
F. test	**	**	**	**	**	**	**	**	**
Interaction :									
V X N	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**	*

The combined data revealed that TWC 310 hybrid was superior than the other two varieties in both plant and ear heights followed by SC18, while TWC320 was in the third order. Both TWC310 and TWC320 maize hybrids had the larger leaf area/plant compared to SC18 variety. The superiority of TWC310 in plant and ear heights and the superiority of TWC310 and TWC 320 in leaf area/plant may be due to the broad genetic base of these hybrids that make them more responsive to agriculture practices and environmental conditions. These results are in accordance with the findings of El-Metwally *et al.* (2001), Ahmed and El-Sheikh (2002), Oraby *et al.* (2003) and Abd El-Maksoud and Sarhan (2008).

b-Nitrogen effect:

As shown in Table (2), the favourable effect of nitrogen fertilizer on plant height, ear height and leaf area/ plant was detected either in the two growing seasons or in the combined.

Both plant height and leaf area/plant was continuously and significantly increased by each increment of nitrogen fertilizer up to 125 kg N/fad and this was true in the combined analysis. Ear height was responded up to 100 kg N/fad only and this was the trend in both growing seasons and their combined. Similar results were obtained by El-Metwally *et al.* (2001), Oraby and Sarhan (2002), Oraby *et al.* (2003), Khamis *et al.* (2005), Oraby *et al.* (2005) and Abd El –Maksoud and Sarhan (2008).

c-The interaction effect:

The combined analysis of the two growing seasons revealed that the interaction effect between maize hybrids and nitrogen fertilizer levels on leaf area/plant was significant as shown in Table (3).

Table (3): Leaf area (dm^2) per plant as affected by the interaction between maize hybrids and nitrogen levels (combined).

Maize hybrids	Nitrogen fertilizer level (kg /fad)			
	50	75	100	125
SC18	64.8b D	75.9b C	78.1c B	81.2c A
TWC310	69.3a C	79.9a B	82.1b A	83.9b A
TWC320	59.2c D	78.8a C	88.5a B	91.9a A

Leaf area of TWC320 and SC18 plants was continuously and significantly increased by each increase of nitrogen up to 125 kg N/ fad whereas, leaf area of TWC 310 plants was positively responded up to only 100kg N/ fad. TWC 320 recorded the largest leaf area/ plant under the two higher levels of N fertilizer. Whereas, the last hybrid gave the lowest leaf area/plant when plants were received 50 kg N/ fad.

II-Yield and yield components:

Data presented in Tables (4), (5) and (6) show the effect of maize hybrid and nitrogen fertilizer levels on grain yield of maize and its components in both growing seasons and their combined.

Table (4): Ear length (cm), Number of rows/ear and Number of grains/row of tested maize hybrids as affected by N fertilizer levels in the two seasons and their combined.

Main effects and interaction	Ear length (cm)			Number of rows/ear			Number of grains/row		
	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined
Maize hybrids (H) :									
SC18	21.35a	19.72a	20.54a	13.95	12.89	13.42	41.35a	40.75a	41.05a
TWC310	20.07b	18.57b	19.32b	13.74	13.13	13.44	39.85b	39.25b	39.55b
TWC320	19.97b	17.86c	18.92b	13.79	13.24	13.52	39.65b	39.15b	39.40b
F. test	**	**	**	N.S	N.S	N.S	**	**	**
N fertilizer levels (N) :									
50 kg N/fad.	16.64d	16.28d	16.46d	13.85	12.57c	13.21c	38.45d	37.84d	38.15d
75 kg N/fad.	19.95c	18.95c	19.45c	13.50	13.15b	13.33b	39.95c	39.45c	39.70c
100 kg N/fad.	21.45b	19.21b	20.33b	13.97	13.42a	13.70a	40.75b	40.17b	40.46b
125 kg N/fad.	23.81a	20.43a	22.12a	13.99	13.21b	13.60a	41.98a	41.41a	41.70a
F. test	**	**	**	N.S	*	*	**	**	**
Interaction :									
V X N	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

Table (5): Number of grains/ear, 100-grain weight (gm) and shelling percentage of tested maize hybrids as affected by N fertilizer levels in the two seasons and their combined.

Main effects and interaction	Number of grains/ear			100-grain weight (gm)			shelling percentage		
	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined
Maize hybrids (H) :									
SC18	576.83a	525.27a	551.05a	31.95a	29.55a	30.75a	84.15a	84.66a	84.41a
TWC310	547.54b	515.35b	531.45b	30.15c	28.05b	29.10b	83.27b	83.35b	83.31b
TWC320	546.77b	518.35b	532.56b	30.97b	29.45a	30.71a	84.29a	84.71a	84.50a
F. test	**	*	**	*	**	**	*	*	*
N fertilizer levels (N) :									
50 kg N/fad.	532.53d	475.65d	504.09d	28.45c	26.36d	27.41c	82.96c	82.10d	82.53d
75 kg N/fad.	539.33c	518.77c	529.05c	30.65b	28.29c	29.47b	83.91b	83.83c	83.87c
100 kg N/fad.	569.28b	539.08b	554.18b	32.42a	30.15b	31.29a	84.56a	84.96b	84.76b
125 kg N/fad.	587.30a	547.03a	567.17a	32.57a	31.27a	31.29a	84.18a	86.07a	85.13a
F. test	**	**	**	**	**	**	**	**	**
Interaction :									
H X N	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

a-Maize hybrids differences:

Significant differences in each of ear length, number of grains/row, number of grains/ear, 100-grain weight, shelling percentage and grain yield/fad among the three tested maize hybrids were detected and this was true either in the two growing seasons or in the combined. SC18 maize hybrid on one hand surpassed TWC310 and TWC320 in ear length, number of grains/row, number of grains/ear and grain yield/fad. Whereas, SC18 and TWC320 hybrids gave heavier 100-grain weight and higher shelling percentage comparing those of TWC310. The differences among maize hybrids under this study in number of rows/ear did not reach the 5% level of significance. This might be due to the differences among maize hybrids in their genetic constitution and its interaction with the environmental conditions. Significant differences among maize hybrids were reported by Ahmed and El-Sheikh (2002), Oraby and Sharhan (2002), Mahfouz (2003), Oraby *et al.* (2003), Oraby *et al.* (2005) and Abd El Maksoud and Sharhan (2008).

Table (6): Grain yield (ardab/fad) of maize varieties as affected by fertilizer levels in the two seasons and their combined.

Main effects and interaction	Grain yield (ardab/fad)		
	1st season	2nd season	Combined
Maize hybrids (H):			
SC18	22.48a	21.85a	22.17a
TWC310	20.65b	18.45b	19.55b
TWC320	19.12c	17.25c	18.19c
F. test	**	**	**
N fertilizer levels (N):			
50 kg N/fad.	14.95d	13.11d	14.03d
75 kg N/fad.	20.25c	18.67c	19.46c
100 kg N/fad.	22.95b	21.34b	22.15b
125 kg N/fad.	24.85a	23.61a	24.23a
F. test	**	**	**
Interaction :			
H X N	*	*	*

b-Nitrogen effect:

The combined analysis of the two growing seasons indicated that ear length, number of grains/row, number of grains/ear, shelling percentage and grain yield/fad were significantly and continuously increased by increasing N levels up to 125 kg N/fed. While, both number of rows/ear and 100- grain weight positively responded up to 100 kg N/fad only. The increases in grain yield due to increasing N levels from 50 to 75, to 100 and up to 125 kg N/fad were 5.43, 8.12 and 10.20 ardab/fad i.e. the yield increase was about 27.90, 57.79 and 72.70%, respectively. These increases in grain yield might be due to the significant effect of nitrogen on growth characters especially leaf area as mentioned before (Table 2) as well as yield components (Tables 4 and 5). These results are oftenly in accordance with those of Ahmed and El- Sheikh (2002), Oraby and Sarhan (2002), Oraby *et al.* (2003), Mohamed (2004), Khamis *et al.* (2005), Oraby *et al.* (2005) and Abd El-Maksoud and Sarhan (2008).

c-The interaction effect:

The effect of the interaction between maize hybrids and nitrogen fertilizer levels on grain yield (ardab/fad) was significant as shown in Table (7)

Table (7) : Grain yield (ardab/fad) as affected by the interaction between maize hybrids and nitrogen levels (combined).

Maize hybrids	Nitrogen fertilizer level (kg /fad)			
	50	75	100	125
SC18	15.70a C	21.62a B	25.16a A	26.20a A
TWC310	13.60b D	19.67b C	21.90b B	23.03b A
TWC320	12.79c D	17.09c C	19.40c B	23.48b A

Grain yield of the two three way crosses 310 and 320 was continuously and significantly increased by increasing N fertilizer levels up to 125 kg N/fad, while yield was highest when SC18 plants were received 100 or 125 kg N/fad. Thus, the highest grain yield/ fad could be attained by adding 100kgN/fad to SC18 plants.

III-Yield analysis:

a-Correlation studies:

The association between maize grain yield in ardab/fad on one hand and each of the other characters from 1 to 6 of the combined is shown in Table (8).

Table (8): Simple correlation between maize grain yield (ardab/fad) and yield attributes of combined.

Character	1	2	3	4	5	6
Y- Grain yield (ardab /fad.)	0.9410**	0.3123	0.5333*	0.5801*	0.3927	0.4793
1- Ear length (cm)		0.3380	0.6059**	0.6053**	0.4099	0.3808
2- No. of rows/ear			0.4978	0.9066**	0.4409	0.5211
3- No. of grains/row				0.9131**	0.4978	0..2974
4- No. of grains/ear					0.1556	0.5463
5- 1000-grain weight (g)						0.3142
6- Shelling percentage (%)						-

Combined data revealed that there were positive and significant correlation coefficients between grain yield on one hand and ear length, number of grains/row and number of grains/ear on the other hand. However, positive and insignificant correlations were found between the same character and the other studied characters.

Highly significant positive correlations were observed between ear length and both number of grain/row and number of grains/ear, whereas it was positively and insignificantly correlated with number of rows/ear, 100-grain weight and shelling percentage.

Number of rows/ear had a highly significant positive correlation with number of grains/ear and insignificant positive correlations with number of grain row, 100-grain weight and shelling percentage.

Number of grains/row had a highly significant positive correlation with number of grains/ear and insignificant positive correlations with either 100-grain weight or shelling percentage.

Significant positive correlation was detected between number of grains/ear and shelling percentage, while insignificant positive correlation was found between the same character and 1000- grain weight. 100-grain weight had insignificant positive correlation with shelling percentage.

b-Path analysis:

The method of path coefficient included the yield components i.e. ear length, number of grains/ear and 100-grain weigh. Path analysis was practiced in order to find out the relative importance of these characters in contributing maize grain yield.

The effect of direct and indirect path coefficients of ear length, number of grains/ear and 100 grain weight on maize grain yield are shown in Table (9). These effects were computed by partitioning the total correlation coefficient into its components ear length proved to have a high direct effect on grain yield compared with that of number of grains/ear or 100-grain weight. Again, as mentioned before (Table 8) total correlation coefficient was most pronounced in ear length (r = 0.9410) than in number of grains/ ear (r = 0.5801) or in 100-grain weight (r = 0.3927).

Table (9) : Partitioning of simple correlation coefficient between maize grain yield and its components (combined).

Source	Value
Ear length :	
Direct effect	0.9287
indirect effect via number of grains/ear	0.1490
Indirect effect via 1000-grain weight	-0.1365
Total (ry_1)	0.9410
Number of grains/ear :	
Direct effect	0.2229
Indirect effect via ear length	0.6212
Indirect effect via 1000-grain weight	-0.2636
Total (ry_2)	0.5801
Thousand-grain weight :	
Direct effect	-0.2770
Indirect effect via ear length	0.4578
Indirect effect via number of grains/ear	0.2121
Total (ry_3)	0.3927

The relative importance in contributing maize grain yield as recorded in percentage of variation for ear length, number of grains/ear, 100-grain weight and their interactions is presented in Table (10). The path analysis revealed that the direct effect of ear length was 49.5% being higher than that of number of grains/ear and 100-grain weight which was 2.85 and 4.40% of grain yield variation, respectively. The joint effect of ear length with number of grains/ ear and with 100-grain weight; number of grains/ear with 100-grain weight as 15.89, 14.55 and 6.74% of grain yield variation, respectively. Here, it is worthy to note that those characters i.e. ear length, number of grains/ ear and 100-grain weight could contributed much in maize grain yield since R^2 was 93.93% of the total variation in grain yield. Also, it is interesting to observe that the residual effects contributing to grain yield in this study was low in magnitude being 6.07%.

Table (10) : Direct and joint effects of yield components as percentage of grain yield variation of maize.

Variables	C.D.	%
Ear length	0.4950	49.50
Number of grains/ear	0.0285	2.85
Thousand grain weight	0.0440	4.40
Ear length x number of grains/ear	0.1589	15.89
Ear length x 1000- grain weight	0.1455	14.55
Number of grains/ear x 1000- grain weight	0.0674	6.74
R^2	0.9393	93.93
Residual	0.0607	6.07
Total	1.0000	100.00

C.D = Coefficient of determination % = percentage contributed

In conclusion, under cultivated sandy soil, planting SC18 maize cultivar with application of 100 kg N/fad is recommended

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استجابة بعض هجن الذرة لمستويات من السماد النيتروجيني تحت ظروف الأراضي الرملية المنزرعة.

عبد الغني عبد المعطي منصور و مجدي فتحي عبد المقصود
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أقيمت تجربتان حقليتان بمزرعة خاصة بوادي الملاك -مركز أبو حماد -محافظة الشرقية خلال الموسمين الصيفيين ٢٠٠٧ و ٢٠٠٨ لدراسة استجابة ثلاث هجن من الذرة (هجين فردي ١٨، هجين ثلاثي ٣١٠ وهجين ثلاثي ٣٢٠) لأربعة مستويات من التسميد النيتروجيني (٥٠، ٧٥، ١٠٠و ١٢٥ كجم ن/فدان) علي صفات النمو والمحصول ومكوناته. استخدم تصميم القطع المنشقة مرة واحدة في ثلاث مكررات حيث احتوت القطع الرئيسية على هجن الذرة بينما احتوت القطع المنشقة على مستويات التسميد النيتروجيني.

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي:

اختلفت هجن الذرة تحت الدراسة في معظم صفات النمو والمحصول ومكوناته ماعدا عدد السطور/الكوز وقد تفوق الهجين الفردي ١٨ على الصنفين الآخرين في محصول الحبوب للفدان كنتيجة لتفوقه على نفس الصنفين في طول الكوز، عدد الحبوب/السطر، عدد الحبوب/الكوز ووزن الـ ١٠٠ حبه من ناحية أخرى أظهر الهجين الثلاثي ٣١٠ تفوقا في ارتفاع النبات وارتفاع الكوز وكان كل من الهجين الثلاثي ٣١٠، الهجين الثلاثي ٣٢٠ الأعلى في مساحة الأوراق/نبات. وأخيرا أعطي كل من الهجين الفردي ١٨، الهجين الثلاثي ٣١٠ أعلي نسبة تفريط.

كان للتسميد النيتروجيني تأثير معنوي على كل الصفات المدروسة فقد أدى إضافة النيتروجين حتى اعلي معدل ١٢٥كجم ن/فدان إلى زيادة معنوية في ارتفاع النبات، مساحة أوراق النبات، طول الكوز، عدد الحبوب/ السطر، عدد الحبوب /الكوز، نسبة التفريط ومحصول الحبوب/فدان بينما أدى زيادة النيتروجين حتى معدل ١٠٠كجم ن/فدان إلى زيادة معنوية في ارتفاع الكوز، عدد السطور/الكوز ووزن الـ ١٠٠ حبة.

كان للتفاعل بين عاملي الدراسة تأثير معنوي على مساحة أوراق النبات وكذلك محصول الحبوب/فدان حيث نتج عن زراعة الهجين الثلاثي ٣٢٠ والتسميد بمعدل ١٢٥ كجم ن/فدان أعلى مساحة ورقية للنبات بينما أعطى الهجين الفردي ١٨ المسمد بمعدل ١٠٠ أو ١٢٥ كجم ن/فدان أعلى محصول حبوب/فدان.

وجد ارتباط موجب ومعنوي بين محصول الحبوب/فدان من ناحية وطول الكوز، عدد الحبوب/السطر وعدد الحبوب/الكوز من ناحية أخرى. أما الارتباط بين محصول الحبوب/فدان وباقي الصفات فكان موجبا وغير معنويا. يشير تحليل معامل المرور إلى أن التأثير المباشر لطول الكوز كان ٤٩,٥% ومرتفعا عن ذلك التأثير بالنسبة لعدد الحبوب/ الكوز ووزن المائة حبة حيث بلغ ٢,٨٥ و ٤,٤٠% من تباين محصول الحبوب، على التوالي، وقد ساهمت التأثيرات المباشرة وغير المباشرة بمقدار ٩٣,٩٣% من تباين المحصول.

توصي الدراسة من خلال النتائج المتحصل عليها بإضافة السماد النيتروجيني بمعدل ١٠٠ كجم ن/ف للهجن الفردية وإضافة ١٢٥ كجم ن/ف للهجن الثلاثية وذلك تحت ظروف الأراضي الرملية المنزرعة بمركز أبو حماد بمحافظة الشرقية.