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YIELD AND ITS COMPONENTS OF TWO CUCUMBER CULTIVARS AS INFLUENCED BY PLANT DENSITIES AND NITROGEN FERTILIZATION UNDER SOHAG GOVERNORATE CONDITIONS

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ABESTRACT

The present study was carried out at privet Farm at Gerga Sohag Governorate, Egypt during the growing ٢٠٠٧ and ٢٠٠٨ seasons, the to investigate the influence of plant densities (١٢٠٠٠٠, ٦٠٠٠٠, ٤٠٠٠٠, ٣٠٠٠٠, ٢٤٠٠٠ and ٢٠٠٠٠ plants/fed.) and three nitrogen fertilizer rates (٥٠, ١٠٠ and ١٥٠ kg N/fed.) on yield and it's components of two cucumber cultivars (Madena and Prince) under Sohag conditions. The obtained results indicated that cultivars type significantly affected most of studies characteristics. In addition, sex ratio percentage, early and total fruits yield Madena cultivar increased significantly compared to Prince cultivar in both seasons.

Concerning the effect of plant densities, results showed that sowing cucumber plants at the highest plant density (١٢٠٠٠٠ plant/fed.) significantly increased main stem length, sex ratio percentage and total fruits yield compared to other plant densities in both seasons.

Regarding the effect of varying applied rates of nitrogen, results revealed that nitrogen fertilizer rates significantly affected most studies characteristics. Highest nitrogen rate (١٥٠ kg N/fed.) significantly increased main stem length, fruit length, fruit diameter, early fruit yield, total fruits yield and nitrogen percentage in leaves and fruit. On contrary, the lowest nitrogen rate (٥٠ kg N/fed.) significantly decreased earliness of flowering and sex ratio percentage. in the two seasons.

Regarding the effect of different interactions between any two or all studied factors, obtained data showed that all possible interactions significantly influences most studied characteristcs in both seasons. Triple combination among Madena cultivar, ١٢٠٠٠٠ plant/fed. and ١٥٠ kg N/fed. recorded the highest total fruit yield, ٢٣.٧٧ and ٢٤.٢٠ Ton/fed. in the first and second seasons, respectively. However, Triple combination among Madena cultivar, ١٢٠٠٠٠ plant/fed. and ١٠٠ kg N/fed. recorded the highest early fruit yield in both seasons.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of the most popular cucurbitaceae crops in Egypt. It is planted for fresh fruits which are locally consumed or exported to increase national income. The total cultivated area of cucumber in Egypt in ٢٠٠٨ was ٦٧٨١٠ feddan and the total production reached ٥٧٦٧٣٢ tons with an average of ٨.٥٠٥ tons/feddan.

During recent years, intensive efforts have bean made to increase vegetable yields in order to meat the demand of both local consumption and exportation using suitable high yield cultivars and/or improving growth and development of plants by improving agricultural practices especially with selecting suitable cultivars. However, cucumber cultivars differ significantly in their growth, yield and its components and this was reported by many investigators (Wehner and Miller ١٩٩٠; Russo, *et al.* ١٩٩١; Lamparter ١٩٩٢; Jimenez and Radriguez ١٩٩٢; Duffek ١٩٩٣; Al-Harbi, *et al.*, ١٩٩٦;

Martyniak-Przybyszewska ١٩٩٩; Zhang-Meng, *et al*., ١٩٩٩; Selvakumar and Sekar ٢٠٠٠; Saikia, *et al*., ٢٠٠١; Abdul-Hamid, *et al*., ٢٠٠٢; Muhammad-Zamin, *et al*., ٢٠٠٢; Ylimaz and Gebologlu ٢٠٠٢; Hikoska and Sugiyama ٢٠٠٤; Sushir, *et al*., ٢٠٠٥; Moushumi-Sarkar and Sirohi ٢٠٠٦; Nehe *et al*. ٢٠٠٧; Sanchez, *et al*., ٢٠٠٨ and Yadav *et al*., ٢٠٠٨).

Now a days, great efforts are made all over the world for the production of more and better food to meet the needs of the over increasing population of the world, especially, in the developing countries. In that respect, high density sowing showed promising means of reducing the cost of growing by increasing the productivity and better use of input resource per area basis. Many researchers studied the effect of plant density in cucumber growth and yield such (Hanna and Adams, ١٩٩١; and ١٩٩٣; Wanna, ١٩٩٣; Akintoye, *et al*., ٢٠٠٢; Choudhari and More ٢٠٠٢ and Ylmaz and Gebologlu, ٢٠٠٢.

Nitrogen the plays a significant role in growth nutrition and development of plants. It is also considered as indispensable elementary constituent of numerous organic compound of general importance (amino acids, protein, nucleic acids) and formation of protoplasm, new cell as well as encouragement for elongation. The influence of nitrogen on cucumber growth, yield and its components were studied by several authors (Du, *et al*., ١٩٨٩; Shou-Senyan, *et al*., ١٩٩٥; Wollfe, *et al*., ١٩٩٥; Shou-Senyan *et al*., ١٩٩٦; Koota and Osinska ٢٠٠١; Akintoye, *et al*., ٢٠٠٢; Choudhari and More ٢٠٠٢; Zambrano, *et al*., ٢٠٠٢; Ristea ٢٠٠٣; Kashi and Baghbani ٢٠٠٤; Agba and Enya ٢٠٠٥; Khan, *et al*., ٢٠٠٥; Umamaheswarappa, *et al*., ٢٠٠٥ and Soltani, *et al*. ٢٠٠٦).

The interaction among the studied factors were examined by Hanna and Adams (١٩٩١); Bhattarai and Subedi (١٩٩٥); Selvakumar and Sekar (٢٠٠٠); Akintoye, *et al*. (٢٠٠٢); Choudhari and More (٢٠٠٢); Ylmaz and Gebo Loglu (٢٠٠٢); Kashi and Baghbani (٢٠٠٤); Agba and Enya (٢٠٠٥) and Umamaheswarappa, *et al*. (٢٠٠٥). The present investigation aimed to study the influence of plant densities and nitrogen fertilization on yield and it's components of two cucumber cultivars under Sohag Governorate conditions.

MATERIALS AND METHODS

Two field experiments were carried out at privet Farm at Gerga Sohag Governorate, Egypt during the growing ٢٠٠٧ and ٢٠٠٨ seasons to investigate the influence of plant densities and nitrogen fertilization on yield and it's components of two cucumber cultivars under Sohag Governorate conditions. Every field trail included thirty-six treatments represented the combination between two cucumber cultivars (Madena and Prince), six plant densities (١٢٠٠٠٠, ٦٠٠٠٠, ٤٠٠٠٠, ٣٠٠٠٠, ٢٤٠٠٠ and ٢٠٠٠٠ plants/fed) and three nitrogen fertilizer rats (٥٠, ١٠٠ and ١٥٠ kg N/fed).

Inorganic nitrogen fertilizer was used in the form of ammonium nitrate (٣٣.٥ % N), and was added at three equal doses after ١٥, ٣٠ and ٤٥ days from planting. Phosphorus fertilizer, as calcium super phosphate (١٥.٥٪ P_2O_5) was added during soil preparation as recommended at a rate of ٤٥ kg P_2O_5/fed. Potassium fertilizer were applied at two equal patches as potassium sulphate (٤٨% K_2O) the first was with the first irrigation and the second patch at flowering and fruits setting at rate of ٥٠ kg K_2O /fed. Ten soil samples were randomly taken from the experimental farm soil before planting, air dried, crushed, sieved, and used to determine, physical and chemical characteristics of the experimental site, (Table ١).

Split-split plot design with four replicates was used, the two cucumber cultivars were allocated in the main plots, while the six plant densities were distributed in sub plots. While three nitrogen fertilizer rats were randomly distributed in the sub-sub plots. Each plot size was ١٢.٨ m^2 contained two ridges each of them was ٣ m long and ١٤٠ cm in wide. The experimental site was prepared and sowing was made on ١٣th and ١٤th of March in the first and second seasons, respectively by sowing two seeds per hill. Growing plants were thinned to one plant just before first irrigation. All other agricultural practices of cucumber production other than the applied treatments were made as recommend by the Egyptian Ministry of Agriculture.

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Table ١: Some physiochemical characteristics of experimental soil sites.

	Clay %	١٣.٤٤
Physical properties	**Silt %**	٣٩.٠٠
	Sand %	٤٧.٥٦
Texture class		**Loam**
	PH	٨.٥
	EC mmhos/cm at ٢٥°C	٠.٨٠
	Ca^{++}	١.٨٠
Soluble cations and	**Mg^{++}**	٠.٨٠
anions	**Na^{+}**	٣.٥٥
(meq/١٠٠ gm soil)	**K^{+}**	١.٢٨
	CO_3^{-}	--
	$CaCO_3$%	٤
	HCO_3^{-}	٠.٤٠
	Cl^{-}	١.٠٠
	$SO_4^{=}$	٦.٠٣
Concentration of	**N**	١٥
available	**P**	٢٠
nutrients in ppm	**K**	٩٢٤

Ten plants were randomly chosen in each plot to determine the flowing characters:
Main stem length (recorded at the end of growing seasons).
Number of branches/plant (recorded at the end of growing seasons).
Number of leaves/plant.
Plant dry matter weight.
Earliness of flowering: measured as node number to the first opining female flower on main stem.
Sex ratio %. = No. female flowers / No. male flowers. Determinate after ٣٠ days from seed sowing.
Harvesting was made every two days, and twenty fruits were taken from each plot in the fifths picking to determine the following criteria:
Fruit length cm.
Fruit diameter cm.

Also, the following data were recorded:
Early fruits yield Ton/fed. (from the first harvest) and Total fruits yield Ton/fed. (from all the harvests).
The following chemical determinations were determined according to Jakson (١٩٦٧).
Nitrogen percentage in leaves and Nitrogen percentage in fruits.

The obtained data were subjected to the proper statistical analysis of split-split plot design according to Gomez and Gomez (١٩٨٤) using means of "MSTAT-C" computer software package according to Freed *et al*. (١٩٨٩) and least significant differences (L.S.D.) at ٥٪ level of probability was used.

RESULTS AND DISCUSSION

Vegetative growth characteristics:

Data presented in Table ٢ clearly show that both cucumber cultivars (Madena and Prince) significantly effected vegetative growth characteristics expressed as main stem length (cm) and dry matter percentage in the two seasons. Prince cultivar gave the highest values than Madena cultivar, and exceeded it by ٣.٤٧ and ٣.٨٧٪ for main stem length (cm) in the first and second seasons, respectively. The differences among cucumber cultivars in vegetative growth characters were reported by several authors (Jimenez and Radriguez, ١٩٩٢; Al-Harbi, *et al*., ١٩٩٦; Saikia, *et al*., ٢٠٠١;Moushumi-Sarkar and Sirohi, ٢٠٠٦; Nehe *et al*., ٢٠٠٧ and Yadav *et al*., ٢٠٠٨).

Table ٢ also reveals that plant densities significantly increased main stem length in the two experimental seasons. Dry matter percentage was also significantly affected, but the differences were more in the second season Main stem lengths gradually increased with increasing plant density from ٢٠٠٠٠ up to ١٢٠٠٠٠ plant/fed. This result could be possibly dry that to the reduction in light intensity caused by high plant density, encouraged IAA synthesis, which caused cell enlargement and hence plant length. Vise versa, dry matter percentage decreased with higher plant densities, this result may be due to high competition for above and below environmental factors in case of high plant densities.

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These finding are in accordance with those found by Akintoye, *et al*. (٢٠٠٢) and Choudhari and More (٢٠٠٢).

Increasing nitrogen levels significantly increased main stem length in both seasons and plant dry weight only in the second season. The highest values of vegetative growth were recorded on using highest nitrogen rate (١٥٠ kg N/fed.) in the first and second seasons, respectively. These results are in accordance with those found by Akintoye, *et al*. (٢٠٠٢); Zambrano, *et al*. (٢٠٠٢); Kashi and Baghbani (٢٠٠٤) and Umamaheswarappa *et al*. (٢٠٠٥) who found that dry matter percentage increased with increasing N level. This increase was correlated positively with increase in plant height.

Table ٢ shows that all possible interactions between the studied factors significantly affected cucumber main stem length in both seasons. However, the combinations among prince cultivar, ١٢٠٠٠٠ plant/fed. and ١٥٠ kg N/fed. resulted in the highest main stem length i.e., (٢٠٥.٧ and ٢٠٥.٠ cm) in the first and second seasons, respectively. However, the combinations among prince cultivar, ٣٠٠٠٠ plant/fed. and ١٥٠ kg N/fed. produced the highest dry matter percentage i.e., (١٢.٣٥ and ١٢.٢٢ %) in the first and second seasons, These results are in line with the findings of Akintoye, *et al*. (٢٠٠٢); Kashi and Baghbani (٢٠٠٤) and Agba and Enya (٢٠٠٥).

Flowering characteristics:

Data in Table ٣ clearly indicate that the two studied cultivars differed significantly in flowering characteristics expressed as earliness of flowering (nods number, which carry the first opining female flower on main stem) and sex ratio percentage. Madena cultivar was more earliness than Prince cultivar and recorded the highest values of sex ratio percentage in both seasons. Many authors observed the differences in flowering characteristics among different cucumber cultivars (Abdul-Hamid, *et al*., ٢٠٠٢; Hikoska and Sugiyama, ٢٠٠٤; Sushir, *et al*., ٢٠٠٥ and Yadav, *et al*., ٢٠٠٨).

It is clear from Table ٣ that plant densities significantly affected flowering characteristics in the two seasons. Plant density ٢٤٠٠٠ plant/fed. gave the earliest opening female flower. However, plant density (١٢٠٠٠٠ plant/fed.) resulted in the highest sex ratio

percentage values ١٣.٩٩% and ١٣.٦٥٪ in the first and second seasons, respectively. These results are in harmony with those reported by Hanna and Adams (١٩٩١).

Table ٣ also reveals that earliness of flowering (nods number, which carry the first opining female flower on main stem) and sex ratio percentage were significantly affected by varying the applied rates of nitrogen. Cucumber plants which fertilized with ٥٠ kg N/fed. recorded the earliest female flower and the highest values of sex ratio percentage compared to the latest opining female flower and the lowest values of sex ratio percentage produced by ١٥٠ kg N/fed. in the first and second seasons, respectively. These results are in line with those found by Shou-Senyan, *et al*. (١٩٩٦); Kashi and Baghbani (٢٠٠٤) and Khan, *et al*. (٢٠٠٥).

The interactions among the three studied factors did not differ significantly in earliness of flowering. However, all possible combinations significantly affected sex ratio percentage in both seasons. Furthermore, the interaction among both Madena and Prince cultivars with ١٢٠٠٠٠ plant/fed. and ٥٠ kg N/fed. gave the highest values with no significant differences between them in both seasons.

Fruits characteristics:

Data in Table ٤ clearly show that the differences between the two studied cultivars were significant in increasing fruit characteristics values expressed as fruit length and diameter. Prince cultivar recorded higher values than Madena cultivar but, Madena cultivar recorded significant increment in fruit diameter only in the second season. These results are in line with those reported by Duffek (١٩٩٣) and Muhammad-Zamin *et al*. (٢٠٠٢).

It is evident that cucumber plant densities significantly effected both fruit length and diameter (cm.). However, the highest values were obtained when cultivated (٢٤٠٠٠ plant/fed.) in both seasons. These results may be explained by the high competition between plants in higher plant densities for under and above environmental factors. These findings are in total agreement with those reported by Zhang-Meng *et al*. (١٩٩٩) and Akintoye, *et al*. (٢٠٠٢).

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Regarding the effect of applying different rates of nitrogen, the obtained results in Table ٤ reveal that fruit length and diameter increased significantly with increasing nitrogen rates from the lowest to the highest rate in both seasons. These results are in harmony with those reported by Akintoye, *et al*. (٢٠٠٢) and Zambrano, *et al*. (٢٠٠٢).

Concerning the effect of all possible interaction between any two or among the three studied factors, data showed that all possible interactions significantly affected fruit length and diameter (cm.) in both seasons. The highest values were produced by the interaction among Prince cultivar, ٢٤ ٠٠٠ plant/fed. and ١٥٠ kg N/fed. in both seasons for fruit length and in the second season for fruit diameter. These results are in agreement with those reported by Hanna and Adams (١٩٩١) and Akintoye, *et al*. (٢٠٠٢) who found that fruit length and diameter increased with increasing plant densities and N rates.

Early and total fruits yield (Ton/fed.):

.It is clear from the data presented in Table ٥ that early and total fruit yield (Ton/fed.) were significantly affected by cultivars. Madena cultivar gave the highest values in both seasons. Madena cultivar exceeded prince cultivar by ٢٤.٣% and ٢٤.٢٪ and (٤٧.٠٠ % and ٤٩.٠٠ % for early and total fruits yield in the first and second seasons, respectively. The highest fruits yield was obtained from Madena cultivar could be explained in the light of increments induced in earliness of flowering, sex ratio and early fruits yield previously discussed. These results are in general trend with those reported by Martyniak- Przybyszewska (١٩٩٩); Zhang-Meng *et al*. (١٩٩٩); Selvakumar and Sekar (٢٠٠٠) Also, Abdul-Hamid *et al*. (٢٠٠٢) and Ylimaz and Gebologlu (٢٠٠٢).

Concerning the effect of plant densities, data in Table ٥ show that plant densities significantly affected early and total fruit yield in both seasons. The highest cucumber fruits yield i.e., ١٩.٠٣ and ١٩.٣٣ Ton/fed. was resulted from the highest plant density of ١٢٠٠٠٠ plant/fed. in the first and second seasons, respectively. This result may be attributed to that the grater amount of light energy intercepted by foliage in dense sowing than in wide one might in turn resulted in the increase in the amount of metabolites synthesized by plants,

consequently the total yield per unit area became greater in dense sowing than in wide ones. Also, the increase in the highest main stem length and sex ratio percentage led to the highest total yield. Many researchers reported similar findings (Hanna and Adams ١٩٩١; and ١٩٩٣; Wanna, ١٩٩٣; Ylimaz and Gebologlu, ٢٠٠٢ and Hao *et al*., ٢٠٠٧).

Fertilizing cucumber cultivars with nitrogen fertilizer significantly affected early and total fruit yield Ton/fed. in both seasons. The values were significantly increased with increasing nitrogen rates from ١٥٠ kg N/fed. in both seasons. The highest early and total fruit yield were produced by ١٥٠ kg N/fed. in the first and second seasons, respectively. The positive effect of nitrogen rates on plants stem length, dry matter, fruits length and fruits diameter previously discussed surely reflected positively on these characteristics. These results are in agreement with those found by Bhattarai and Subedi (١٩٩٥); Shou-Senyan, *et al*. (١٩٩٥); Shou-Senyan, *et al*. (١٩٩٦); Koota and Osinska (٢٠٠١); Choudhari and More (٢٠٠٢) and Kashi and Baghbani (٢٠٠٤).

Regarding the effect of different interactions between any two or among all of the studied factors, the obtained data showed that all possible interactions significantly influenced early and total fruit yield Ton/fed. in both seasons. Triple combination among Madena cultivar, ١٢٠٠٠٠ plant/fed. and ١٥٠ kg N/fed. recorded the highest total fruit yield (٢٣.٧٧ and ٢٤.٢٠ ton/fed.) in both seasons. These results are in accordance with those reported by Bhattarai and Subedi (١٩٩٥); Selvakumar and Sekar (٢٠٠٠); Choudhari and More (٢٠٠٢) and Ylmaz and Gebo Loglu (٢٠٠٢).

Chemical characteristics:

Data in Table ٦ clearly show that cultivars affected chemical characteristics expressed as nitrogen percentage in leaves and fruits in both seasons. Prince cultivar gave the highest values than Madena cultivar, but the differences were more announced and statistically significant with nitrogen percentage in leaves in both seasons.

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It is evident that as the number of plants per feddan was decreased, the nitrogen percentage in leaves was significantly increased. Nitrogen percentage in fruits increased significantly with decreasing plant densities up to the lowest one in the two experiential seasons. These results held well in the two experiential seasons. Siwek and Capecka (١٩٩٩) obtained similar trend.

Varying applied rates of nitrogen significantly increased values of nitrogen percentage in leaves and fruits gradually from the lowest rate i.e., (٥٠ kg N/fed.) up to the highest one (١٥٠ kg N/fed.) in the first and second season, respectively. These results are reported by several anthers (Wolfe, *et al*., ١٩٩٥; Ristea, ٢٠٠٣; Kashi and Baghbani, ٢٠٠٤ and Soltani, *et al*., ٢٠٠٦).

The interactions between any of two or the three studied factor significantly increased nitrogen percentage in cucumber leaves and fruits in both seasons. Madena cultivar, at ٢٠٠٠٠ plant/fed. and ١٥٠ kg N/fed. gave the highest nitrogen percentage in cucumber leaves and fruits compared to all other possible interactions in both seasons. These results were also reported by Choudhari and More (٢٠٠٢)

RECOMMENDATION

It could be recommended to growers interested in obtaining higher total fruit yield by Madena cultivar they should sow at plant density ١٢٠٠٠٠ plant/fed. and fertilize with١٥٠ kg N/feddan. Inaddition, the growers interested in the highest early fruit yield should sow Madena cultivar at plant density ١٢٠٠٠٠ plant/fed. and fertilizing with١٠٠ kg N/fed.

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المحصول ومكوناته لصنفين من الخيار وتأثرهما بالكثافة النباتية والتسميد النيتروجينى تحت ظروف محافظة سوهاج

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وزارة الزراعة واستصلاح الأراضي.

أجريت هذه الدراسة فى مزرعة خاصة بمركز جرجا محافظة سوهاج – مصر وذلك فى موسمي ٢٠٠٧و ٢٠٠٨. وذلك بهدف دراسة تأثير الكثافة النباتية (١٢٠و ٦٠ و٤٠ و ٣٠ و٢٤ و ٢٠ ألف نبات للفدان) و ثلاثة مستويات من التسميد النيتروجينى

هي (٥٠ و ١٠٠ و ١٥٠ كجم نيتروجين/فدان) على إنتاجية صنفين من الخيار هما (مدينة وبرنس) وذلك تحت ظروف محافظة سوهاج.

دلت النتائج المتحصل عليها أن أصناف الخيار المستخدمة فى الدراسة أثرت معنويا على معظم الصفات موضع الدراسة علاوة على ذلك أعطى مدينة زيادة معنوية فى النسبة الجنسية والمحصول المبكر والكلى مقارنة بالصنف برنس فى كلا موسمى الدراسة.

أوضحت النتائج أن الكثافة النباتية ١٢٠ ألف نبات للفدان أعطت زيادة معنوية فى طول الساق الرئيسية والنسبة الجنسية والمحصول الكلى مقارنة بباقي الكثافات المستخدمة فى الموسمين.

أعطى تسميد نباتات الخيار بجرعات مختلفة من النيتروجين اختلافات معنوية فى معظم الصفات موضع الدراسة وحقق المستوى الأعلى من النيتروجين ١٥٠ كجم نيتروجين للفدان زيادة معنوية فى طول الساق الرئيسية وطول الثمرة وقطر الثمرة والمحصول المبكر والمحصول الكلى والنسبة المئوية للنيتروجين الكلى فى الأوراق والثمار. وعلى العكس من ذلك فان اقل مستوى من النيتروجين ٥٠ كجم نيتروجين للفدان قلل معنويا التبكير فى الإزهار والنسبة الجنسية وكانت هذه النتائج متطابقة فى كلا الموسمين.

أظهرت النتائج أن جميع التفاعلات المختلفة بين عوامل الدراسة كان له تأثير معنوي على معظم الصفات المدروسة فى كلا الموسمين وحقق التفاعل الثلاثي بين الصنف مدينة مع الزراعة بكثافة ١٢٠ ألف نبات للفدان والتسميد بمعدل ١٥٠ كجم نيتروجين للفدان أعلى محصول كلى من الخيار(٢٣.٧٧ و ٢٤.٢٠ طن/فدان) فى الموسم الأول والثاني على التوالي .بينما حقق التفاعل الثلاثي بين الصنف مدينة مع الزراعة بكثافة ١٢٠ ألف نبات للفدان والتسميد بمعدل ١٠٠ كجم نيتروجين للفدان أعلى محصول مبكر من الخيار فى كلا الموسمين. ومن النتائج يمكن التوصية بزراعة الصنف مدينة بكثافة نباتية ١٢٠ ألف نبات للفدان والتسميد بمعدل ١٥٠ كجم للحصول على أعلى محصول كلى من الخيار للفدان أو التسميد ب ١٠٠ كجم نيتروجين للحصول على أعلى محصول مبكر من الخيار للفدان.