Effect of Different Genotypes and Plant Population on Garlic Productivly in New Reclaimed Sand Soil Using Drip Irrigation System

S.I. Ahmed
Vegetable Res., Dept., Hort. Res. Inst., Agric. Res. Center, Giza, Egypt.

Abstract:

This research was carried out at private farm under the official supervision of Faculty of Agriculture, Minia University and Sids Horticulture Research Station, Agricultural Research Center, Giza, Egypt, during the two successive winter seasons of 2007/2008 and 2008/2009 in sandy soil of the new reclaimed area in west Beni - Suef conditions using a drip irrigation system. The objective of this study was to determine the effect of plant population on growth, yield and yield components of four garlic genotypes. Genotypes Eggaseed-1, Sids-40, clone St133 and Egyptian were cultivated to study two plant populations (60 and 90 plants / m^2). As plant density increased, the total fresh and cured yield increased from 7.99 to 10.37ton per Fed., and from 4.52 to 5.66 ton per fed., respectively. This increase in fresh weight of individual plants, bulb fresh weight, bulb dry matter percentage, cured bulb weight and bulb size characteristics decreased significantly as plant population increased. No significant differences were found among the tested treatments for number of cloves per bulb. Eggaseed - 1 had the highest total yield, whereas the Egyptian cultivar had the lowest values. In addition, there were significant interactions between plant population and genotypes for the total fresh and cured yield. Referring to the obtained results, it could be concluded that for to achieve the maxinime garlic yield, cultivar Eggaseed-1 should be grown at 90 plants m^2 under garlic fertigation system in this type of soil in the west of Beni Suef and similar conditions.

Keywords: garlic (*Allium sativum* L.), genotypes, plant population, yield, sandy soil, drip irrigation system.

Received on: 8 / 5 /2013 **Accepted for publication on:** 3/ 9 /2013
Referees: Prof. Sayed A. Abdel-Aal **Prof**. Mohamed A. Elshal

Introduction:

Garlic is one of the most cash crops for Egyptian farmers. The overall production and the garlic area in the valley land are not great enough; consequently, to increase the area and production through reclaimed land, applying new culture technologies should be done.. However, one of the major problems to into production is improper agronomic practice used by farmers. Appropriate agronomic management has an undoubted contribution in increasing garlic yield. The optimum level of any agronomic practices such as plant population depended on with environment condition, purpose of the crop and cultivar. Thus, it is very difficult to give general recommendations that can be applied to the different soil characteristics of the new reclaimed area where major growing area of vegetables are existing. So that, to optimize garlic productivity in specific conditions, full package of informations are required (England, 1991).

Plant density is one of this package that need to be optimized. It is a vulnerable way of controlling bulb size, shape and yield in garlic. Higher yield and better control over bulb size could be obtained of cloves planted at optimum density (Kilgori *et al* 2007). The demand for high quality fresh market garlic continues to increase as foreign market and local consumers seek to purchase the Egyptian garlic (Gad El Hak and Abd El- Mageed, 2000).

The identification of the suitable plant densities that improves garlic yield quantity and quality may help garlic producers extent their cultivated area in the new reclaimed land. Choosing cultivars and management technique will help growers to maximize garlic production under the fertigation systems as reported by Nassar *et al.* (1972); Maksoud *et al.*(1983); El-Sawah (1990); Hussein *et al.*(1995). Furthermore, Aly (2010) showed that garlic yield under Assiut conditions of 12 garlic ecotypes ranged from 4.26 to 12.03 ton /fed. Also, Tantawy (2010) reported that the six studied genotypes varied significantly and also the fresh yield across three growing seasons ranged from 5.923 ton/ fed. for Egyptian to 10.083 ton/ fed., for Egaseed 1.

In Egypt, the effect of genotypes on garlic productivity was studied in most of the Egyptian governorates under furrow irrigation systems.

The present study was designed to study the effect of different garlic genotypes and plant density. achieve maximum yield under new reclaimed sand soil conditions using the fertigation system.

Materials and Methods:

The present experiment was carried out at the private farm under the official supervision of Faculty of Agriculture, Minia University and Sids Research Station, Agricultural Research Center, Giza, Egypt, during the two successive winter seasons of 2007/2008 and 2008/2009 in sandy soil. The source and bulb visual color of the used genotypes are shown in Table 1 and the physical and chemical properties of this soil are presented in Table 2.

Table 1: Source and bulb visual color of the used genotypes.

Genotypes	Source	Bulb skin Color
Eggaseed 1	Egyptian Agriculture Company for seed Production (EGAS)	Purple
Clone St 133	Egyptian Agriculture Company for seed Production (EGAS)	White
Egyptian	Egyptian landrace from Sids Research Station	White
Sids 40	Sids Research Station, Agric.Res. Center, Giza, Egypt.	Purple

Table 2: Physical and chemical properties of the soil used for growing garlic varieties before using any fertilizers.

Component	Sand %	Silt %	Clay %	Soil Texture	PH	E.C. ds/m	Total CaCo3 %
First season	92.3	3.1	4.6	Sand	8.2	1.2	9.5
Second season	90.5	2.9	6.6	Sand	8.0	1.4	10.4

The experimental field was ploughed and pulverized. Twenty m^2 farmyard manure, ammonium sulphate (20.5% N) at the rate of 100 kg/fed., super phosphate (15.5%) at the rate of 300 kg/fed., Agriculture Sulpher at the rate of 100 kg/fed., respectively were added to the soil during preparation. Then, the soil was formed into beds (50 meters long and one meter wide). The bed surface was carefully leveled as possible. Irrigation pipes were hand–laid on beds to the end of the experiment. The experiment was conducted in split plots using a Randomized Complete Block Design (RCBD) with four replications. Plant population was assigned as the main plots and cultivars as the sub-plots. Area occupied by a subplot was 10x1m. Two plant densities vie 60 and 90 plants per square meter were tried on four garlic genotypes namely Eggaseed-1, Sids-40, clone St133 and Egyptian. Drip irrigation and fertigation were adopted uniformly as recommended by the Egyptian Ministry of Agriculture for garlic production (Year book 1999).

Pregerminated cloves of the four cultivars were planted on the 10th and 16th of October in the first and second seasons respectively. The total amount of irrigation water which were added to the experimental plots along the growing season is shown in the following table by (the Egyptian Ministry of Agriculture for garlic production (year book 1999).

Months	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Amount of water (m^3/fed. /day)	9.45	8.40	5.04	6.30	10.50	12.60

Also, the following amounts of fertilizers g /m^3 were added.

Fertilizers \ Months	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Ammonium nitrate	400	400	350	300	300	250
Phosphoric acid	100	100	100	120	120	120
Potassium sulphate	700	700	700	700	650	650
Magnesium sulphate	250	250	250	250	250	250
Nitric acid	100	100	75	75	75	75

Other Horticultural practices recommended for garlic production were followed. Data were recorded at harvesting for plant height, leaves number, fresh weight of whole plant, bulb fresh weight, 70 Co – oven dry weight of the plant vegetative growth without bulb, 70 Co - oven dry weight of bulbs and bulbing ratio. After curing for 21 days from harvesting, bulb diameter, bulb weight, clove number/bulb and single clove weight, were recorded. Also, fresh yield and total cured yield for grade A (> 4.0 cm diameter) of bulbs were estimated.

Statistical Analyses:

Data from both years were combined in a single analysis. Analysis of variance and Duncan means separation tests using MSTST C Ver. 4 software were used to compare means of the collected data.

Results and Discussion:

1-Plant height (cm)

Genotypes varied significantly from each other with respect to plant height in both seasons. The highest values were recorded to clone St133 followed by cv. Egyptian with significant differences. The shortest plants were recorded to cv. Sids-40 and Eggaseed-1, respectively. Both cultivars showed statistically similar plant heigh but differed significantly from the other two cultivars (Table 3) Such significant variations in garlic varieties were observed in plant height by Tantawy (2010).

Significant values at plant height were observed with increasing plant population. High population (90 plants m2) gave taller plants in the two years than that of wider plant densities (60 plants/m2). Cumulative effect of cultivars and plant densities was significant in both years, plants of maximum height values were recorded in clone St133 followed by Balady without significant differences when grown in plots with higher population.

2-Number of leaves per plant

No significant differences in this trait were noticed among gentypes during both years. Plant densities insignificantly influenced number of leaves/plant in both seasons. The interaction among the studied factor was insignificant. However, slight increase in number of leaves was observed in wider spacing in the first season (10.84 vs 10.59 leaves) and in narrower spacing in the second season (10.82 vs. 10.77 leaves) as shown in Table 4.

Table 3: Plant height (cm) of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Plant height (cm.)	
	First season	Second season
Genotypes		
1-Eggaseed-1	83.96 C	86. 80 C
2-Sids- 40	77.80 D	81.57 D
3-St 133	95.14 A	102. 56 A
4-Egyptian	92.45 AB	100. 51 AB
Population		
1-60 plants/m^2	88.25 B	86.43 B
2-90 plants/m^2	93.12 A	92.61 A
Interaction		
1x1	84.85 f	87.30 e
1x2	86.80 e	86.80 f
2x1	78.37 h	77.22 g
2x2	81.30 g	81.86 h
3x1	96.04 c	94.22 c
3x2	102.67 a	102.45 a
4x1	93.73 d	91.17 d
4x2	101.69 ab	99.32 ab

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

Table 4: Number of leaves/plant of four garlic cultivars as affected by plant density and their interactions under new reclaimed soil in two winter successive seasons.

Main effect	Number of leaves per plant	
	First season	Second season
Genotypes		
1-Eggaseed-1	10.87 A	10.97 A
2-Sids- 40	10.86 A	10.96 A
3-St 133	10.76 A	10.52 A
4-Egyptian	10.71 A	10.36 A
Population		
1-60 plants/m^2	10.84 A	10.77 A
2-90 plants/m^2	10.59 A	10.82 A
Interaction		
1x1	10.87 a	10.87 a
1x2	10.85 a	11.10 a
2x1	10.92 a	10.79 a
2x2	10.80 a	11.12 a
3x1	10.75 a	10.77 a
3x2	10.50 a	10.55 a
4x1	10.80 a	10.62 a
4x2	10.22 a	10.50 a

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

3-Fresh weight of whole plant (g)

Waterer and Schmitz, 1994 said that growing temperature, day length and solar reaction differ from year to year. Thus some traits remain consistent and others may change when garlic are replant in similar conditions. Results in Table 5 showed that the effects of growing cultivars were significant. The highest value of fresh weight was obtained from growing the purple cv. Eggaeed - 1 in both years followed by the white clone St133 (Table 5). Heavier plants were produced from lower population plots when compared with that of the higher population. The impact of plant density on the plant growth should be considered the degree of competition under different evaluations. Low population (60 plants/m2) produced high values of plant weight (154.00 g) against the lighter weight (137.87g) from density planted plots (90 plants/m2). Plants size variability is directly related to neighbor-hood competition in which the growth of an individual depends on the number, size and proximity of neighbors. Generally, there is a negative relationship between plant density and plant–to–plant uniformity (Kilgori *et al.* 2007). Concerning the effect of genotypes and plant densities in both years, plants of maximum high fresh weight of whole plant (g) values were recorded in cv. Eggaseed -1 followed by clone St133 when grown in plots with lower population.

Table 5: Fresh weight of whole plant (g) of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two winter successive seasons.

Main effect	Fresh weight of whole plant	
	First season	Second season
Genotypes		
1-Eggaseed-1	154.37 A	151.75 A
2-Sids- 40	138.37 C	141.00 C
3- St 133	150.37 B	144.87 B
4-Egyptian	140.63 D	134.37 D
Population		
1-60 plants/m^2	154.00 A	149.12 A
2-90 plants/m^2	137.87 B	136.87 B
Interaction		
1x1	164.00 a	160.75 a
1x2	144.75 d	142.75 de
2x1	141.50 e	143.00 cd
2x2	135.25 f	139.00 ef
3x1	157.00 b	148.75 b
3x2	143.75 de	141.00 de
4x1	153.50 c	144.00 c
4x2	127.75 g	124.75 g

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

1-Bulb dry weight percentage

Bulb dry weight percentage was significantly affected by genotypes and plant population density (Table 6). The interaction of cultivars x plant density showed significant effects. This may reflects the good adaptability of the tested genotypes. Also these results indicated that differences in bulb dry weight percentage varied from among the tested genotypes. Waterer and Schmite, 1994 and Gvozdenovic- Varga *et al.* (2002) stated that bulb mass is highly correlated with environmental factors.

Bulb dry weight differences among genotypes were changed with plant population. The genotypes produced relatively above – average weight in low – population environments. The order of their bulb dry weight was Eggaseed –1> Sids- 40> clone St133> Egyptian. Therefore, Eggaseed–1 produced relatively bulb dry weight heavier percentage and was not sensitive to environments These results disagreed with those of Aly (2010) who reported that bulb dry weight was increased with increasing plant density.

Table 6:Bulb dry weight percentage of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Bulb dry weight percentage	
	First season	Second season
Genotypes		
1-Eggaseed1	26.62 A	27.49 A
2-Sids 40	25.20 B	25.97 B
3- St 133	22.69 C	22.41 C
4-Egyptian	21.30 D	21.22 D
Population		
1-60 plants/m^2	24.92 A	25.37 A
2-90 plants/m^2	22.99 B	23.18 B
Interaction		
1x1	27.75 a	29.17 a
1x2	25.50 c	25.80 c
2x1	26.32 b	27.65 b
2x2	24.07 d	24.30 d
3x1	23.47 e	23.17 e
3x2	21.90 g	21.65 f
4x1	22.12 f	21.47 fg
4x2	20.47 h	20.97 h

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

5- Bulbing ratio

Data presented in Table (7) indicated significant differences between cultivars in bulbing ratio. The Egyptian cv. has the lower bulbing ratio than that of clone St133, Sids-40 and Egseed-1 in both seasons respectively. This indicated that Egaseed-1 cv. was earlier in maturity than the other genotypes in both seasons. The photoperiods, temperature and light are the factors which control bulbing in garlic (Brewester, 2008).

Regarding the effect of the studied plant population on bulbing ratio, there were significant differences in both seasons. The plant density (90 plants / m2) gave the earlier yield, with insignificant differences (60 plants / m2) in the second season only (Table 7).

In addition, insignificant differences between the mean values of the interactions of genotypes and plant density were found in both seasons.

Table 7:Bulbing ratio of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Bulbing ratio	
	First season	Second season
Genotypes		
1-Eggaseed-1	0.29 A	0.29 A
2-Sids -40	0.28 AB	0.25 B
3- St 133	0.25 C	0.24 BC
4-Egyptian	0.24 C	0.23 C
Population		
1-60 plants/m^2	0.24 B	0.25 A
2-90 plants/m^2	0.28 A	0.25 A
Interaction		
1x1	0.26 a	0.29 a
1x2	0.33 a	0.30 a
2x1	0.25 a	0.26 a
2x2	0.30 a	0.24 a
3x1	0.24 a	0.24 a
3x2	0.25 a	0.24 a
4x1	0.22 a	0.22 a
4x2	0.25 a	0.23 a

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

6- Cured bulb diameter

The effects of genotypes and plant density on this trait were significant in this study. Interestingly, higher bulb diameter is observed in the genotype Eggaseed- 1 with planting density of 60 plants per square meter in both seasons (Table 8).

Table 8:Cured bulb diameter of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Cured bulb diameter(cm)	
	First season	Second season
Genotypes		
1-Eggaseed-1	6.09 A	5.80 A
2-Sids- 40	5.02 B	4.90 B
3- St 133	4.61 C	4.35 C
4-Egyptian	4.20 CD	3.85 D
Population		
1-60 plants/m^2	5.47 A	4.99 A
2-90 plants/m^2	4.49 B	4.46 B
Interaction		
1x1	6.65 a	6.20 a
1x2	5.52 b	5.40 b
2x1	5.62 b	5.12 bc
2x2	4.42 c	4.67 d
3x1	5.07 b	4.62 de
3x2	4.15 c	4.07 def
4x1	4.52 bcd	4.00 def
4x2	3.87 e	3.70 g

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

7-Cured bulb weight(g)

Data presented in Table (9) indicated that the cured bulb weight (g) of cultivar Egaseed -1 significantly surpassed those of cultivars Sids-40, clone St133 and Egyptian in both seasons, at the two plant densities. Furthermore, there were significant differences among the studied two plant densities. The highest values were obtained from (60 plants /m^2) treatment in both seasons.

Concerning the effect of genotypes and plant densities interaction, the effect was significant in both years, plants of maximum higher values were recorded in cv. Eggaseed -1 when grown in plots at higher population numbers.

8-Clove number per bulb

The analysis of the main effect of this characteristic indicated that the genotypes, plant density and their of interactions were differed insignificantly. Insignificant interactions indicates a high degree of adaptation of garlic genotypes (Yan and Hunt, 1998 and Gvozdanovic *et al.* 2002). The average number of cloves per bulb ranged from 15.05(Eggaseed-1 at 90 plants/m2) to 42.00(Egyptian at 60 plants/m2). Clove number shows significant differences among genotypes. From the results of both years, the Egyptian cultivar gave the highest number (41.40 cloves/bulb).

Table 9:Cured bulb weight (g) of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Cured bulb weight	
	First season	Second season
Genotypes		
1-Eggaseed-1	75.92 A	73.47 A
2-Sids- 40	66.35 B	61.96 B
3- St 133	50.01 C	46.36 C
4-Egyptian	41.17 D	38.32 D
Populatio		
1-60 plants/m^2	65.75 A	61.77 A
2-90 plants/m^2	50.08 B	48.29 B
Interaction		
1x1	82.97 a	79.90 a
1x2	68.87 c	67.05 c
2x1	76.67 b	71.10 b
2x2	56.02 d	52.82 d
3x1	57.25 de	52.69 d
3x2	42.77 efg	40.02 ef
4x1	46.10 defg	43.40 fg
4x2	36.25 h	33.25 efgh

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

Table 10:Clove number/bulb of four garlic cultivars as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Clove number per bulb	
	First season	Second season
Gentypes		
1-Eggaseed-1	15.09 B	15.30 B
2-Sids- 40	16.36 B	16.92 B
3- St 133	37.05 A	38.10 A
4-Egyptian	40.90 A	41.90 A
Population		
1-60 plants/m^2	27.47 A	28.37 A
2-90 plants/m^2	27.22 A	27.74 A
Interaction		
1x1	15.12 b	15.45 b
1x2	15.05 b	15.15 b
2x1	16.37 b	16.92 b
2x2	16.35 b	16.92 b
3x1	37.20 a	38.62 a
3x2	36.90 a	37.57 a
4x1	41.20 a	42.50 a
4x2	40.60 a	41.30 a

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

9-Clove weight (g)

Genotypes and plant population had significant effects on this quality character. Clove weight ranged from 0.90 g (Egyptian at 90 plants/m2 in the first season) to 5.67 g for Eggaseed -1 at 60 plants/m2 in the first season). Cloves of Eggaseed-1 with (5.50 g) in average, was superior to the other tested genotypes followed by cultivar Sids-40 (4.39g) Table (11). However, the maximum clove weight for both cultivars obtained at density of 60 plants/m2. Genotype x plant density interactions had significant effect on clove weight and the genotypes responded to increasing planting densities. However, the increases in some cultivars were superior to the increases in others which explain why the interactions effects occurred. Eggaseed-1 had heavier cloves in both years at lower planting density and this cultivar gave an average of 5.67 g in the first season and 5.12 g in the second season. Increasing plant population decreased the clove weight (Abd El-Hameid *et al.,* 1991). The high stability of this character among the tested genotypes indicated that the environmental fluctuations as well as plant density did not play a key role in clove weight per bulb.

Table 11:Clove weight (g) of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Clove weight (g)	
	First season	Second season
Genotypes		
1-Eggaseed-1	5.50 A	4.86 A
2-Sids- 40	4.39 A	4.05 A
3- St 133	1.31 B	1.09 B
4-Egyptian	0.94 B	0.81 B
Population		
1-60 plants/m^2	3.16 A	2.82 A
2-90 plants/m^2	2.90 B	2.58 B
Interaction		
1x1	5.67 a	5.12 a
1x2	5.32 a	4.60 a
2x1	4.62 a	4.15 a
2x2	4.15 a	3.95 a
3x1	1.37 b	1.17 b
3x2	1.25 b	1.00 b
4x1	0.97 b	1.17 b
4x2	0.90 b	1.00 b

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

10-Fresh yield (ton/fed)

Total fresh yield increased significantly by increasing plant population of the different growing genotypes. The effect of genotypes x plant population interactions were also varied for fresh yield (Table 12) .In this case, all cultivars were responded significantly to the increased population densities. However, the research on managing garlic in row spacing has focused on modeling the response of crop yield and bulb size in response to crop density (Aliudin, 1980; Cardenas Valdovinos: 1986:Abdel-Hameid *et al*.1991; Ismail *et al*, 1996 and Kilgori *et al.* 2007). It is known that the total yield per unit area depends not only on the performance of individual plants but also on the growing cultivars and the total number of plants per unit area. Ismail *et al*.(1996) reported that garlic fresh yield was ranged from 10.96 to 12.12 ton/fed. with Egyptian.Also, at ranged 8.37 to 9.92 ton/fed with the Chinese cultivars in alluvial soil conditions at Sids Horticulture Research Station, Beni Sweif governorate. However, the fresh yield of the Egyptian cultivar in these sandy soil conditions ranged from 6.82 ton/fed (low population density) to 9.20 ton/fed.(high population density). Eggaseed-1 cultivar gave the highest yield which ranged from 9.47 to 11.57 ton/ fed. The highest values were given by the growing cultivar Eggaseed-1 at 90 plants per square meter in the first season. Yield differences among different garlic genotypes were reported by Kilgori *et al.* (2007).

Table 12: Fresh yield (Ton/fed.) of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	Fresh yield (Ton/ fed.)	
	First season	Second season
Genotypes		
1-Eggaseed-1	10.80 A	10.52 A
2-Sids- 40	8.82 B	8.77 B
3- St 133	9.09 C	9.37 C
4-Egyptian	7.84 D	8.21 D
Population		
1-60 plants/m^2	7.84 B	7.99 B
2-90 plants/m^2	10.34 A	10.37 A
Interaction		
1x1	9.7 abc	9.47 abc
1x2	11.85 a	11.57 a
2x1	7.60 cdef	7.52 cdefg
2x2	10.05 ab	10.02 ab
3x1	7.57 abcde	7.95 cdef
3x2	10.6 ab	10.80 ab
4x1	6.82 cdefg	7.22 cdefgh
4x2	8.85 bcd	9.20 abcde

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

11-Cured yield (ton/fed)

Selecting the suitable genotypes for specific area and understanding the climatic and other environmental factors that affect the genotype performance is extremely important for garlic growers. In this study, cured bulb yield increased significantly with increasing plant density in both seasons. However, the yield increased with increasing plant density (Table 13) but the garlic bulbs were smaller in density cultivation (90 plants / m^2) as showed in Table (9).

It is know that garlic is commonly priced according to bulb sizes. The results of this study may help choose the best genotypes most important for maximizing the profitability of garlic production under the new reclaimed soil conditions in the west desert of the Middle Egypt.

Table 13: Cured yield (Ton/fed.) of four garlic genotypes as affected by plant density and their interactions under new reclaimed soil in two successive winter seasons.

Main effect	**Cured yield** (ton/ fed)	
	First season	**Second season**
Genotypes		
1-Eggaseed-1	6.49 A	6.24 A
2-Sids- 40	5.27 B	5.20 B
3- St 133	4.54 C	4.74 C
4-Egyptian	3.91 D	4.19 D
Population		
1-60 plants/m^2	4.41 B	4.52 B
2-90 plants/m^2	5.70 A	5.66 A
Interdiction		
1x1	5.85 b	5.70 b
1x2	7.12 a	6.77 a
2x1	4.57 c	4.50 d
2x2	5.97 ab	5.90 bc
3x1	3.72 ef	4.07 f
3x2	5.35 fg	5.40 de
4x1	3.47 fgh	3.82 g
4x2	4.35 d	4.55 de

Means within each column followed by the same letter are not statistically different at 0.05 level (Duncan's range test).

Conclusion:

Based on the results obtained, it could be concluded that, for maximizing garlic yield Eggseed -1 could be grown at 90 plants / m^2 under fertigation system in sandy soil.

Refernces:

Abdel-Hameid, A. M.; M. Z. Abdel-Hak and A.Z. Osman *(1991)*: Effect of plant density and nitrogen level on growth and yield of garlic plant. Egypt. J.Appl.Sci.,6(1):69-81.

Agriculture Research Center Giza, Egypt. Year Book (1999): Production and plantation of garlic in new reclaimed desert land. P.P 7 :10

Aliudin *(1980)*: The effect of seed size and plant spacing on garlic production. Bulletin Penelition Hortikultura, Vol. 8: 3-11 (c.f. Hort. Abst., 52: 736).

Aly, Shreen, *H. (2010)*: Growth and yield of some garlic (*Allium sativum* L.) ecotype as affected by different culture practices under Assiut condition. Ph.D .Thesis, Fac. Agric. Assiut Univ. Egypt.

Cardenas Valdoinos, J.H. (1986): Nitrogen fertilization planting layout in garlic. Proceedings of the Tropical Region, American Society for Horticultural Science 23, 182-186.

Brewester, J.L.(2008):Crop production science in horticulture onions and other vegetable *Aliums*. CABI is a trading name of CAB international CABI North American office 875 massachusetts avenue 7th floor.

El - Sawah, M. H.*(1990)*: Study of the effect of ether on growth and yield of two garlic cultivars. Zagazig J. Agric. Res. Vol. 17 (2): 403-410.

England, R. L. (1991): Growing great garlic: The definitive guide for organic gardeners and small farmers. Filaree Farms, Okanogan, WA.226 p. ISBN# 0-9630850 -1-8.

Gad El – Hak, S.H. and Y.T. Abd El – Mageed (2000*):* Effect of nitrogen source on growth, yield, nitrate content and storage ability of two garlic cultivars. Minia J. .Res. & Dev. Vol. 20 (1) :115 – 139.

Gvozdanovic- Varga. J., J.M.Vasic, and J. Cervenski(2002): Variability of characteristics of garlic (*Allium sativum* L.) ecotype ISHS Acta Horticulture 579: 171-175.

Hussein, M. S.; H. M. E l- Saeid and E.A. Omer (1995): Development of growth and yield of some lines of Chinese garlic. Egypt J. Hort 22(1): 19-30.

Ismail, S.A.; A.Z.Osman; A.M. Abd El-Hameid and D.S.Darwish (1996): Effect of ammonia gas in alluvial soil with different rates, population and their interaction on garlic plants *(Allium sativum L.)* Egyptian J. Appl. Sci.; 11(1) 151-160.

Kilgori, M.J., M.D. Magaji and A.I. Yakubu (2007): Effect of plant spacing and date of planting on yield of two garlic (*Allium sativum* L.) cultivars in Sokoto, Nigeria. Am. Euras. J. Agric.&Environ. Sci. 2: 143-157.

Maksoud, M.A.; Sherifa Foda; A. El-Gizawi and M.T. El-Sayed (1983): Response of garlic plants to fertilization treatments. Egypt. J. Hort., 10(2): 159-165.

MSTAT-C (1985): A software program for the design management, and analysis of agronomic research experiments (Version 4)Michigan State University, USA.

Nassar, S. H.; S. Moustapha; Sh. Foda; M. Gheta and S. Ghebrial (1972): A better garlic variety for export. Agric. Res. 50(4) 47-58.

Tantawy, I.A.A. (2010): Studies on improving quantitative and qualitative garlic productivity. M. Sc, Dept. Hort., Fac. Agric., Minia University , El-Minia , Egypt.

Waterer, D. and D. Schmitz (1994): Influence of variety and cultural practices on garlic yields in Saktchewan. Canadian J.P. Scineca. Vol.74: 611-614.

Yan,W. and L.A. Hunt (1998):Genotype by environment interaction and crop yield. Plant Breeding Reviews 16: 135-178.

تأثير التراكيب الوراثية المختلفة وكثافة الزراعة على أنتاج الثوم فى الاراضى الرملية حديثة الاستصلاح باستخدام نظام الرى بالتنقيط

سعيد ابراهيم احمد
بحوث الخضر- معهد بحوث البساتين – مركز البحوث الزراعية

أجريت التجربة فى مزرعة خاصة بإشراف من كلية الزراعة –جامعة المنيا و محطة بحوث البساتين بسدس –مركز البحوث الزراعية – الجيزة –مصر خلال موسمين متتاليين 2007 /2008 و 2009/2008 فى الاراضى الرملية فى مناطق الاستصلاح الجديدة تحت ظروف غرب بنى سويف باستخدام نظام الرى بالتنقيط .وكان الغرض من الدراسة هو تحديد تأثير التراكيب الوراثية المختلفة و كثافة الزراعة على النمو والمحصول ومكونات المحصول وكانت التراكيب الوراثية المنزرعة من الثوم هى (الصنف البلدى–والسلالة ST133 – ايجاسيد–1 وسدس–40) .

كل التراكيب الوراثية زرعت فى الحقل المستديم على كثافتين من الزراعة (60 و90 نبات لكل متر مربع) فوجد الاتى أنة كلما زادت كثافة الزراعة زاد المحصول الكلى الطازج والجاف فزاد المحصول الطازج من 7.99 حتى 10.33 طن للفدان بينما زاد المحصول الكلى الجاف من 4.52 حتى 5.66 طن للفدان. صفات وزن النبات الكلى ووزن البصلة الطازج والنسبة المئوية للمادة الجافة ووزن البصلة الجاف وقطر البصلة صفات كانت منخفضة المعنوية بزيادة كثافة الزراعة. ووجد أنه لا توجد فروق معنوية بين المعاملات المختبرة فى عدد الفصوص. ووجد أن الصنف أيجا سيد –1 كان أعلى محصولا بينما الصنف البلدى كان اقل محصولا . بالإضافة إلى ذلك وجد معنوية فى التداخل بين كثافة الزراعة والأصناف لصفات المحصول الطازج والجاف.

ومن النتائج المتحصل عليها يمكن التوصية بزراعة الصنف ايجاسيد–1 على كثافة زراعية 90 نبات لكل متر مربع باستخدام نظام الرى بالتنقيط فى الاراضى الرملية تحت ظروف غرب بنى سويف والظروف المماثلة.