

GARLIC PRODUCTION IN CALCAREOUS SOIL AS AFFECTED BY GENOTYPES AND POPULATION DENSITY

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ABSTRACT

This experiment was conducted at the private farm of Mr. Mohamed El-Soony 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 calcareous sandy soil of the new reclaimed area in west Beni - Suef conditions under a drip irrigation system. The objective of this study was to determine the effect of plant density on growth, yield and yield components of four garlic genotypes. Genotypes were grown in the field at two plant densities (60 and 90 plants / m²). As plant density increased, total fresh and cured yield increased from 7.99 to 10.37 ton per Fed., and from 4.52 to 5.66 ton per Fed., respectively. Fresh weight of individual plants, bulb fresh weight, bulb dry matter percentage, and cured bulb weight and bulb diameter characteristics was decreased significantly as population density increased. No significant differences among the tested treatments for number of cloves per bulb. Eggaseed 1 had the highest total yield, whereas the Egyptian cultivar had the lowest. In addition, there were significant interactions between plant density and genotypes for the total fresh and cured yield. Based on the obtained results it could be concluded that for maximizing garlic yield, clone St 133 should be grown at 90 plants m² under fertigation system in the calcareous soil in the west of Beni Suef and similar conditions.

Keywords: Garlic (*Allium sativum* L.), genotypes, plant density, yield, sandy soil, drip irrigation.

INTRODUCTION

Garlic is one of the most cash generating crops for Egyptian farmers. The overall production and the garlic area in the valley land are not great enough; consequently, the Egyptian government is pressing hard to increase the area and production through reclaimed land and applying new culture technology. However, one of the major production problems is improper agronomic practice used by farmers. Appropriate agronomic management has an undoubted contribution in increasing garlic yield. The optimum level of any agronomic practice such as plant population varies with environment, purpose of production 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 information is required (England, 1991).

Plant density is one of this packages 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 (El-Beheidi *et al.*, 1983; Abd El - Hameid *et al.*, 1991; and 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 right population density that improves garlic yield quantity and quality may help garlic producer's extent their cultivars 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). However, 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 genotypes varied significantly and then fresh yield across three growing seasons ranged from 5.923 for Egyptian to 10.083 ton/ fed., for Egaseed 1.

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

The present study aimed to find out the optimum plantation density of different garlic genotypes to achieve maximum yield under new reclaimed calcareous soil conditions using the fertigation system.

MATERIALS AND METHODS

The present experiment was conducted at the private farm of Mr. Mohamed El-Soony 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 calcareous sandy soil. The source and bulb visual color of the used genotypes are shown in Table 1.

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
Egaseed 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	Sandy	8.2	1.2	9.5
Second season	90.5	2.9	6.6	Sandy	8.0	1.4	10.4

The experimental field was ploughed and pulverized. Twenty m³ farmyard manure, ammonium sulphate (20.5% N) at the rate of 100 kg/fed., super phosphate (15.5%) at the rate of 300 kg/feddan, sulphur at the rate of 100 kg/fed., respectively, were added during the soil 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 density was assigned as the main plots and cultivars in the

sub-plots. Area occupied by a subplot was 10x1m. Two plant densities viz 60 and 90 plants per square meter were tried on four garlic cultivars 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 /m³ 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 Horticulture 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 C° – oven dry weight of the plant vegetative growth without bulb, 70 C° - 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 determined. Also, fresh yield and total cured yield for grade A (> 4.0 cm diameter) of bulbs were estimated according to the European standards.

Statistical analyses.

Analysis of variance and Duncan means separation tests using MSTST C Ver. 4 software were used to compare the collected data (MSTATC, 1985).

RESULTS AND DISCUSSION

1- Plant height.

Cultivars varied significantly from each other with respect to plant height in both seasons. The highest values were recorded in clone St133 followed by cv. Egyptian without significant differences. The shortest plants were recorded in cv. Sids-40 and Eggaseed-1, respectively. Both cultivars attained statistically similar plant height but differed significantly from the other two cultivars. Significant variations were observed in plant height as reported by Tantawy (2010).

Significant values in plant height were observed with increased plant population. High plant density (90 plants m²) had significantly taller plants

during both years plants 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.

Table 3: Plant height (cm) of four garlic cultivars 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
Cultivars		
1-Eggaseed-1	83.96C	86.80C
2-Sids- 40	77.80D	81.57D
3-St 133	95.14A	102.56A
4-Egyptian	92.45AB	100.51AB
Plant density		
1-60 plants/m ²	88.25B	86.43B
2-90 plants/m ²	93.12A	92.61A
Interaction		
1x1	84.85f	87.30e
1x2	86.80e	86.80f
2x1	78.37h	77.22g
2x2	81.30g	81.86h
3x1	96.04c	94.22c
3x2	102.67a	102.45a
4x1	93.73d	91.17d
4x2	101.69ab	99.32ab

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

2- Number of leaves per plant.

No significant differences in this trait were noticed among cultivars during both years. Plant densities insignificantly influenced leaves number in both seasons. The interaction among the studied factor was insignificant. Variation in number of leaves is due to genetic variations. But 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).

Table 4: Leaves number/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
Cultivars		
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
Plant density		
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 levels (Duncan's range test).

3-Fresh weight of whole plant (g).

Growing temperature, day length and solar reaction differ from year to year. Thus some traits remain consistent and others may change when garlic is replanted in similar conditions (Waterer and Schmitz, 1994). The effects of growing cultivars were significant. The highest value of fresh weight was obtained from growing the purple cv. Eggaseed - 1 in both years followed by the white clone St133. Heavier plants were produced from lower population plots when compared with that of higher population. The impact of plant density on the plant growth should be considered in the degree of competition under which evaluation for performance of entries should be applied. Low planting density (60 plants/m²) produced high values of plant weight (154.00 g) against the lighter weight (137.87g) from high density planted plots (90 plants/m²). Plants size variability is directly related to neighborhood 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 effect of cultivars and plant densities in both years, plants of maximum height 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 cultivars as affected by plant density and their interactions under new reclaimed soil in two winter successive seasons

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

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

4- Bulb cured weight percentage (g).

Bulb dry weight percentage was significantly affected by cultivars and population density (Table 6). The interaction cultivars x plant density showed significant effects. This may reflect the good adaptability of the tested genotypes. Also these results indicated that differences in bulb dry weight percentage were consistent from cultivar to cultivar.

Waterer and Schmite, (1994) and Gvozdenovic- Varga *et al.* (2002) stated that bulb mass is highly correlated with environmental factors.

In conclusion, bulb dry weight percentage differences among genotypes changed by plants density. 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 cultivars 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
Cultivars		
1-Eggaseed1	26.62 A	27.49A
2-Sids 40	25.20B	25.97B
3- St 133	22.69C	22.41C
4-Egyptian	21.30D	21.22D
Plant density		
1-60 plants/m ²	24.92A	25.37A
2-90 plants/m ²	22.99B	23.18B
Interaction		
1x1	27.75a	29.17a
1x2	25.50c	25.80c
2x1	26.32b	27.65b
2x2	24.07d	24.30d
3x1	23.47e	23.17e
3x2	21.90g	21.65f
4x1	22.12f	21.47 fg
4x2	20.47h	20.97h

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

5- Bulbing ratio.

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

With regard to the effect of the studied plant density on bulbing ratio, there are significant differences in both seasons. (90 plants / m²) gave the earlier plants, with insignificant differences (60 plants / m²) in the second season only.

In addition, there are insignificant differences between the mean values of the interactions of cultivars and plant density in both seasons.

6- Cured bulb diameter.

One challenge of garlic production in the Upper Egypt especially for exporting to foreign markets is to mature the crop within a relatively short season. In this region, garlic producers seek the shifting from vegetative to bulbing stage in the right time to assure adequate time for developing larger bulbs. However, the genetics background of the cultivated genotypes shifts nutrients resources to developing larger bulbs. Growing season influenced bulb - diameter significantly. Also the effects of genotypes and plant density were significant in this study. Increasing bulb diameter is observed in the genotype Eggaseed- 1 with planting density of 60 plants per square meter in both seasons Table 8.

Table 7: Bulbing ratio of four garlic cultivars 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
Cultivars		
1-Eggaseed-1	0.29 A	0.29 A
2-Sids -40	0.28B	0.25 B
3- St 133	0.25C	0.24BC
4-Egyptian	0.24C	0.23 C
Plant density		
1-60 plants/m ²	0.24B	0.25 A
2-90 plants/m ²	0.28A	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).

Table 8: Cured bulb diameter of four garlic cultivars 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
Cultivars		
1-Eggaseed-1	6.09 A	5.80A
2-Sids- 40	5.02B	4.90B
3- St 133	4.61C	4.35C
4-Egyptian	4.20CD	3.85D
Plant density		
1-60 plants/m ²	5.47A	4.99A
2-90 plants/m ²	4.49B	4.46B
Interaction		
1x1	6.65a	6.20a
1x2	5.52b	5.40b
2x1	5.62b	5.12bc
2x2	4.42c	4.67d
3x1	5.07b	4.62de
3x2	4.15c	4.07def
4x1	4.52bcd	4.00def
4x2	3.87e	3.70g

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.

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 respectively. Further more there were significant differences among the studied plant density. The highest values were obtained from (60 plants /m²) density in both seasons.

Concerning effect of cultivars and plant densities interaction, the effect was significant in both seasons; plants of maximum highest values were recorded in cv. Egaseed -1 when grown in plots with lower population.

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

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

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

8-Clove number per bulb.

The analysis of the main effect of this characteristic indicated that the cultivars, plant density and all types of interactions were different insignificantly. Insignificant interactions indicate 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 cultivars. From the results of both years, Egyptian gave the highest number (41.40 cloves/bulb) followed by clone St133 (37.57 cloves/bulb). Eggaseed-1 gave the lowest number (15.19 cloves/bulb) followed by Sids-40 (16.64 cloves/bulb)as shown in Table (10). Garlic market are focusing on low number and big size cloves in the bulb (Gad El Hak and Abd El- Mageed, 2000).

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
Cultivars		
1-Eggaseed-1	15.09B	15.30B
2-Sids- 40	16.36B	16.92B
3- St 133	37.05A	38.10A
4-Egyptian	40.90A	41.90A
Plant density		
1-60 plants/m ²	27.47A	28.37A
2-90 plants/m ²	27.22A	27.74A
Interaction		
1x1	15.12b	15.45b
1x2	15.05b	15.15b
2x1	16.37b	16.92b
2x2	16.35b	16.92b
3x1	37.20a	38.62a
3x2	36.90a	37.57a
4x1	41.20a	42.50a
4x2	40.60a	41.30a

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

9- Clove weight.

Genotypes and population density 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). Cultivar 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 was obtained at density of 60 plants/m². Genotype x plant density interactions had significant effect on clove weight. The genotypes responded to increasing planting densities. However, the increases in some cultivars were superior to 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. 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 number per bulb.

Table 11: Clove weight (g) of four garlic cultivars 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
Cultivars		
1-Eggaseed-1	5.50A	4.86A
2-Sids- 40	4.39A	4.05A
3- St 133	1.31B	1.09B
4-Egyptian	0.94B	0.81B
Plant density		
1-60 plants/m ²	3.16A	2.82A
2-90 plants/m ²	2.90B	2.58B
Interaction		
1x1	5.67a	5.12a
1x2	5.32a	4.60a
2x1	4.62a	4.15a
2x2	4.15a	3.95a
3x1	1.37b	1.17b
3x2	1.25b	1.00b
4x1	0.97b	1.17b
4x2	0.90b	1.00b

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 per fed. increased significantly by increasing population density of different growing cultivars. The effect of cultivars x population density interactions also verified for fresh yield (Table 12). In this case, all cultivars were responded significantly to 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). 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 fresh yield ranged from 10.96 to 12.12 Ton/fed. with Egyptian and from 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 Egyptian cultivar in this 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. Similar observations with different garlic genotypes were reported by Kilgori *et al.* (2007).

11- Cured yield.

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. Cured bulb yield increased significantly with increased plant density in both seasons. However, the bulb size decreased with increasing plant density (Table 13). Garlic bulbs were smaller in high density cultivation (90 plants / m²).

Table 12: Fresh yield (Ton/fed) of four garlic cultivars 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
Cultivars		
1-Eggaseed-1	10.80A	10.52A
2-Sids- 40	8.82B	8.77B
3- St 133	9.09C	9.37C
4-Egyptian	7.84D	8.21D
Plant density		
1-60 plants/m ²	7.84B	7.99B
2-90 plants/m ²	10.34A	10.37A
Interaction		
1x1	9.7abc	9.47abc
1x2	11.85a	11.57a
2x1	7.60cdef	7.52cdefg
2x2	10.05ab	10.02ab
3x1	7.57abcde	7.95cdef
3x2	10.6ab	10.80ab
4x1	6.82cdefg	7.22cdefgh
4x2	8.85bcd	9.20abcde

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

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 middle Egypt.

Table 13 : Cured yield (Ton/fed) of four garlic cultivars 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
Cultivars		
1-Eggaseed-1	6.49A	6.24A
2-Sids- 40	5.27B	5.20B
3- St 133	4.54C	4.74C
4-Egyptian	3.91D	4.19D
Plant density		
1-60 plants/m ²	4.41B	4.52B
2-90 plants/m ²	5.70A	5.66A
Interdiction		
1x1	5.85b	5.70b
1x2	7.12a	6.77a
2x1	4.57c	4.50d
2x2	5.97ab	5.90bc
3x1	3.72ef	4.07f
3x2	5.35fg	5.40de
4x1	3.47fgh	3.82g
4x2	4.35d	4.55de

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, clone St133 should be grown at 90 plants / m² under fertigation system in calcareous soil.

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إنتاج الثوم فى الأراضى الجيرية تحت تأثير الأصناف وكثافة الزراعة

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أجريت التجربة فى مزرعة خاصة ملك المزارع محمد السننى بإشراف من كلية الزراعة - جامعة المنيا ومحنة بحوث البساتين بسدس -مركز للبحوث الزراعية - الجيزة - مصر خلال موسمين متتاليين ٢٠٠٧/ ٢٠٠٨ و ٢٠٠٨/ ٢٠٠٩ فى الاراضى الجيرية الرملية فى مناطق الاستصلاح الجديدة تحت ظروف غرب بنى سوف تحت نظام الري بالتنقيط. الغرض من الدراسة تحديد تأثير كثافة الزراعة على النمو والمحصول ومكونات المحصول على أربع تراكيب وراثية من الثوم وهى (الصنف البلدى-والسلالة ST133 -أيجاسيد-١ وسدس-٤٠) . كل التراكيب الوراثية زرعت فى الحقل المستديم على كثافتين من الزراعة (٦٠ و ٩٠ نبات لكل متر مربع) فوجد الاتى : أنه كلما زادت كثافة الزراعة زاد المحصول الكلى الطازج والجاف فزاد المحصول الطازج من ٧.٩٩ حتى ١٠.٣٣ طن للفدان بينما زاد المحصول الكلى الجاف من ٤.٥٢ حتى ٥.٦٦ طن للفدان. صفات وزن النبات الكلى ووزن البصلة الطازج والنسبة المؤية للمادة الجافة ووزن البصلة الجاف وقطر البصلة هذه الصفات كانت منخفضة المعنوية بزيادة كثافة الزراعة. ووجد أنه لا توجد فروق معنوية بين المعاملات المختبرة فى عدد الفصوص. ووجد ان الصنف أيجاسيد -١ كان أعلى محصولا بينما الصنف البلدى كان اقل محصولا . بالإضافة الى ذلك وجدت فروقا معنوية فى التداخل بين كثافة الزراعة والأصناف لصفات المحصول الطازج والجاف. ومن النتائج المتحصل عليها يمكن نوصى بزراعة الصنف أيجاسيد-١ والصنف سدس -٤٠ على كثافة زراعية ٩٠ نبات لكل متر مربع تحت نظام الري بالتنقيط فى الاراضى الجيرية تحت ظروف غرب بنى سوف.

قام بتحكيم البحث

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