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PROSPECTS FOR A MODIFIED CULTURAL SYSTEM FOR STRAWBERRY NURSERIES IN RELATION TO SUBSEQUENT FRUIT PRODUCTION UNDER LOW PLASTIC TUNNELS:
1- NUMBER AND QUALITY OF TRANSPLANTS

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ABSTRACT

This study was carried out at the Strawberry and Non-Traditional Crops Research Station, Nobaria, Behaira Governorate during the two successive seasons 2000 and 2001. The aim of this study was to investigate the effects of cultivar, nursery planting system and mother plant spacing on number and quality of transplants. Results indicate that using Sweet Charlie cultivar resulted in significant increases in number of fresh transplants dug in September as well as dormant ones dug in January. The results of the two studied seasons indicated that planting nursery stock plants (Super Elite) on raised beds was responsible for significant increases in number of total and marketable fresh transplants used for fresh plantations, crown diameter of transplant and number of dormant transplants used for frigo plantations. Increasing plant spacing (low population of nursery stock plants) was responsible for increasing marketable fresh transplants as well as transplant diameter as compared with those of high mother plant population. In this connection, increasing mother plant density resulted in significant increases in total number of fresh and dormant transplants. The lowest plant spacing for Sweet Charlie as well as Camarosa gave the highest number of fresh and dormant transplants. On the other hand, the best treatment combination which produced the highest number of marketable fresh transplants as well as the biggest crown diameter was the widest plant spacing (2m) with Sweet Charlie or Camarosa. As for number of marketable and total fresh transplants, Sweet Charlie planted on raised bed system at the largest plant distance showed the highest values in addition to Camarosa cultivar, planted on raised beds at the largest two plant distances in the second season. Planting nursery stock plants on raised beds caused significant increments in dry weight of leaves, crown and roots and carbohydrate content in roots and crowns of the produced transplants in the two years except carbohydrates content in crowns in the second season.

Keywords: Strawberry, Nursery, Raised beds, Crown diameter, Carbohydrates.

INTRODUCTION

Annual plasticulture strawberries in Egypt has received significant attention in the last few years since this production technique was developed to induce early and high quality fruit production for exportation. Transplant quality can have a major effect on the productivity of strawberry. Bare – root transplants are produced in open nurseries where daughter plants remain attached to the mother plant and allow to root into the soil. Improvement of post-transplant establishment and early growth of bare- root plants would

significantly increase profitability for nurserymen and fruit producers (Stapleton *et al.*, 2001). According to Latimer (1998), the goal of transplants production is to produce plants that 1) adapt rapidly to the field environment, 2) establish and resume active growth soon after transplanting and 3) produce acceptable early and total yield. Several factors may all be contributing factors to the transplant success in the fruiting fields, i.e., transplant size (Chandler *et al.* 1989, Kirschbaum *et al.* 1998; Latimar 1998; NeSmith and Duval, 1998; Ragab *et al.* 2000), transplant age (Vavrina, 1998; Ragab *et al.* 2002), transplant root structure (Nicola, 1998) and root carbohydrate content, (Palha *et al.*, 2002). Reekie *et al.* (2002) found that plant height causes petioles to break during transportation and planting whereas, leaf tissue damage can adversely affect crop earliness and significantly decrease overall strawberry fruit yield.

Turemis *et al.* (1997) mentioned that there was a negative correlation between quality and number of runner plants per unit area. Lisiecka and Pudelski (1997) and khalaf (2003) found significant differences among cultivars in number and diameter of transplants during propagation of mother plants. Raised beds have been shown to improve drainage and decrease soil compaction in strawberry production field (Goulart and Funt, 1985). Schupp and Hennion (1997) found that the carbohydrate content in the roots appeared to be a component of plant quality. However the influence of nursery planting system and mother plant (Super Elite) spacing on subsequent strawberry yields have not been determined. New methods are needed for enhancement of strawberry transplant production systems to provide sustainable good quality fruit production during harvesting season.

Therefore, this study was designed to investigate the effects of cultivar, nursery planting system and mother plant spacing on number and quality of transplants.

MATERIALS AND METHODS

This study was carried out at the Strawberry and Non-Traditional Crops Research Station, Nobaria, Behaira Governorate during the two successive seasons 2000 and 2001. The objectives of this work were to investigate the effects of cultivar, nursery planting system and plant spacing as well as their interaction on number and quality of strawberry transplants in addition to dry weight and carbohydrates content in the produced transplants. The experiment was laid out in a split –split plot design with three replicates. The main plots were assigned to two cultivars (Sweet Charlie and Camarosa). Whereas, the two planting systems (flat and raised bed) were randomly distributed in the sub- plots. The sub- sub plots were allocated to the four mother plant spacing (1.0,1.25,1.50 and 2 meter within the plants). The experiment included all possible 16 treatment combinations among the levels of the three main studied factors. Uniform Super Elite strawberry transplants (first generation from in vitro culture plants) from both Sweet Charlie and Camarosa as predominant cultivars for exportation were planted. In flat rows 10m long and 160 cm width or on raised beds 10 m long and 160 cm width as a single row at plant spacing of 1.0,1.25, 1.50 and 2m within the rows or the

raised bed. Planting dates were April 24, 2000 and May 2, 2001. Each sub-sub-plot consisted of 6 rows or beds.

Flowers were continuously removed until plants stopped flowering and started runnering. All agricultural partices for strawberry nurseries, i.e., irrigation, fertilization and pest control were carried out as recommended. In mid September, all transplants from the inner two rows or beds of each of sub- sub plot were dug out, and data were recorded as follows: -

1- Number of fresh transplants / plant: -

All harvested transplants from the inner two rows or beds were counted and number of transplant /mother plant was calculated

2- Number of marketable fresh transplants:-

All harvested transplants were tested with the vernier caliber and those having crown diameter more than 0.8 cm were counted as marketable transplants and average number / plant was calculated.

3- Crow diameter:

- It was measured in cm by verniar caliber in twenty random transplants.

4- Dry weight of leaves, crown and roots: -

It was determined in ten random fresh transplants from each sub-sub plot and average dry weights of leaves, crown and roots per transplant were calculated.

5- Carbohydrates content: -

Total carbohydrates content in roots and crowns of fresh transplants dug in mid September was determined according the method described by Shaffer and Hartmann (1921).

6- Number of dormant transplants: -

On January 1 dormant transplants from the other two inner rows or beds in each replicate were dug and number of transplants per mother plant was calculated.

Statistical analysis:

The recorded data were statically analyzed according to Duncan's multiple range test (Duncan,1955).

RESULTS AND DISCUSSION

1. **Effects of cultivar, nursery planting system and plant spacing on production and diameter of transplants:**

Data tabulated in Table (1) show the comparisons among the means of the studied treatments within each of the three main factors i.e. between the two cultivars (Sweet Charlie and Camarosa), between the two nursery planting systems (flat and raised bed) as well as among four levels of plant spacing (1.0, 1.25, 1.5, 2.0) in relation to their effects on number of total and marketable fresh transplants, transplant diameter and number of transplants at the end of the season (dormant transplants).

The main effect of the two studied cultivars indicate that using Sweet Charlie cultivar resulted in significant increases in number of total and marketable fresh transplants dug in September as well as dormant ones dug in January. Lisiecka and Pudelski (1997) and Khalaf (2003) who found

significant differences among strawberry cultivars in number of fresh transplants obtained similar results. On the other hand,. Camarosa transplants showed an increment in crown diameter, this increment was significant in the second year.

Table (1): Main effects of cultivar, nursery planting system and mother plant spacing on production and diameter of transplants.

Treatment			2000 Season			
Cultivars	Planting system	Plant spacing	No. of total fresh transplant	No. of marketable fresh transplant	Transplant diameter (cm)	No. of total transplant
SC			63.23a	45.39a	1.09a	117.87a
C			59.07b	42.59b	1.25a	114.88b
	F		53.08b	39.08b	1.08b	106.57b
	Rb		69.21a	48.90a	1.27a	126.18a
		D1	70.66a	39.04d	0.917c	134.21a
		D2	64.98b	42.68c	1.12b	123.87b
		D3	57.71c	46.03b	1.29a	108.57c
		D4	51.24d	48.21a	1.38a	98.85d
			2001 season			
SC			65.74a	46.46a	1.14b	144.93a
C			62.47b	46.35a	1.29a	141.26b
	F		55.88b	40.98b	1.11b	131.03b
	Rb		72.33a	51.83a	1.32a	155.15a
		D1	73.6 b	42.03d	0.96c	183.74a
		D2	68.13a	44.66c	1.18b	151.12b
		D3	60.83c	48.38b	1.32a	122.84c
		D4	53.88d	50.56a	1.40a	114.68d

Any means within column followed by the same letter are not statistically different at 5% level. (Duncan's multiple range test).

SC= Sweet Charlie C = Camarosa F = Flat Rb = Raised bed

D1=1.0 m D2 = 1.25 m D3=1.50 m D4=2.0 m

As for the effect of planting system, the results of the two studied seasons indicated that planting nursery stock plants (Super Elite) on raised beds was responsible for significant increases in number of total and marketable fresh transplants used for fresh plantations, crown diameter of transplant and dormant transplants used for frigo plantations. Increasing number of fresh and number of dormant transplants increase profitability for nurserymen as mentioned by Stapleton *et al.* (2001). Moreover, transplant size may contribute in transplant success in the fruiting fields and increase yield as shown by Chandler *et al.* (1989), Kirschbaum *et al.* (1998), Latimar (1998), NeSmith and Duval (1998), and Ragab *et al.* (2000). Concerning the main effect of mother plant spacing, results of the two seasons illustrated in Table (1) indicate that increasing plant distance (low population of nursery stock plants) was responsible for increasing marketable fresh transplants as well as transplant diameter as compared with those of high mother plant population. In this connection, decreasing plant density resulted in significant increases in number of total fresh and dormant transplants. Similar results were obtained by Turemis *et al.* (1997). Strawberry fresh producers aim to increase early yield for exportation with good quality transplants while those

of frigo producers (for local market) looking for high transplant production with limited crown size because of delaying the transplants digging until December in the nursery to become of more thickness. It is clear from results presented in Table (2) that the interaction between cultivar and planting system did not reflect any significant differences on number of total fresh transplants, transplant diameter and number of dormant transplants in the first season.

Table (2): Effects of interaction between each two factors of cultivar, nursery planting system and mother plant spacing on production and diameter of transplants.

Treatments			2000 season			
Cultivars	Planting system	Plant spacing	No. of total fresh transplants	No. of marketable fresh transplants	Transplant diameter (cm)	No. of dormant transplants
SC	F		54.76a	39.37c	0.98a	97.5a
	Rb		71.69a	51.42a	1.21a	120.8a
C	F		51.41a	38.79c	1.18a	117.5a
	Rb		66.72a	46.38b	1.33a	132.5a
SC		D1	72.05a	40.70d	0.82d	135.2a
		D2	66.4abc	44.12c	1.05c	127ab
		D3	60.23cd	46.90b	1.17bc	108.4cd
		D4	54.22de	49.85a	1.33ab	100.8d
C		D1	69.27ab	37.38e	1.01cd	133.2ab
		D2	63.55bc	41.25d	1.2bc	120.7bc
		D3	55.18de	45.15bc	1.35ab	108.7cd
		D4	48.27e	46.57b	1.43a	96.88d
	F	D1	61.25c	35.25g	0.82c	121.9bc
		D2	56.47cd	38.27f	1.03bc	114.2cd
		D3	50.05de	40.67e	1.22abc	98.93de
		D4	44.57e	42.13de	1.23ab	91.25e
	Rb	D1	80.07a	42.83d	1.02bc	146.6a
		D2	73.48ab	47.10c	1.22abc	133.5ab
		D3	65.37bc	51.38b	1.3ab	118.2bc
		D4	57.92cd	54.28a	1.53a	106.4cde
			2001 season			
SC	F		56.53c	40.83b	1.05b	135.4a
	Rb		74.95c	52.09a	1.23b	154.5a
C	F		55.24b	41.14b	1.17b	126.7a
	Rb		69.72a	51.57a	1.40a	155.8a
SC		D1	74.45a	40.88e	0.85a	184.9a
		D2	69.53b	45.18c	1.117a	155b
		D3	62.7d	48.62b	1.233a	122.8c
		D4	56.28f	51.15a	1.35a	116.9c
C		D1	72.77a	43.18d	1.067a	182.6a
		D2	66.73c	44.13cd	1.233a	147.2b
		D3	58.95e	48.13b	1.4a	122.8c
		D4	51.47g	49.97ab	1.45a	112.4c
	F	D1	64.45d	36.63g	0.8a	166.8b
		D2	59.38e	39.43f	1.1a	139.3bcd
		D3	53.18f	43.28e	1.267a	112.1de
		D4	46.53g	44.58e	1.267a	105.9e
	Rb	D1	82.77a	47.43d	3.817a	200.7a
		D2	76.88b	49.88c	1.25a	162.9bc
		D3	68.47c	53.47b	1.367a	133.6cde
		D4	61.22e	56.53a	1.533a	123.5de

Any means within column followed by the same letter are not statistically different at 5% level. (Duncan 's multiple range test).

SC= Sweet Charlie C = Camarosa F = Flat Rb = Raised bed

D1=1.0 m D2 = 1.25 m 3=1.50 m D4=2.0 m

The interaction between cultivar and plant distance reflected some significant differences in both seasons. The comparison among the means of the eight treatment combinations showed that the narrow plant distances between Sweet Chalie as well as Camarosa tended to the highest increments on number of fresh and dormant transplants. On the other hand, the best treatment combination which produced the highest number of marketable fresh transplants as well as the biggest crown diameter appeared to be the widest plant distance with Sweet Charlie or Camarosa. Cultivars or planting system combined with four planting distances did not significantly differ in their effects on transplant diameter in the second season.

The results concerning the effects of the interaction among the three studied main factors on number of total and fresh transplants, crown diameter and number of dormant transplants are shown in Table (3).

Table (3): Effects of the interaction among cultivar, nursery planting system and mother plant spacing on production and diameter of transplants.

Treatment			2000 season			
Cultivars	Planting system	Plant spacing	No. of total fresh transplant	No. of marketable Fresh transplant	Transplant diameter (cm)	No. of total transplant
SC	F	D1	62.07f	36.27hi	0.7l	123.9bc
		D2	57.57h	38.33gh	0.93k	120.2bc
		D3	52.1j	40.63fg	1.1j	103.9cde
		D4	47.3k	42.23ef	1.17h	92.57de
	Rb	D1	82.03a	45.13d	0.9k	146.5a
		D2	75.23c	49.90c	1.17h	133.9ab
		D3	68.37e	53.17b	1.23g	112.9bcd
		D4	61.13fg	57.47a	1.5b	109.1cde
C	Fl	D1	60.43g	34.23l	0.93k	119.8bc
		D2	55.37l	38.20gh	1.13l	108.2cde
		D3	48k	40.70fg	1.3d	93.97de
		D4	41.83l	42.03ef	1.3e	89.93e
	Rb	D1	78.1b	40.53fg	1.1j	146.6a
		D2	71.73d	44.30de	1.27f	133.2ab
		D3	62.37f	49.60c	1.37c	123.5bc
		D4	54.7i	51.10bc	1.57a	103.8cde
			2001 season			
SC	F	D1	64.83de	37.30fg	0.7c	169.4b
		D2	61.2efg	39.40f	1.07d-f	146.7bcd
		D3	53.4fgh	42.83e	1.2cde	118.1efg
		D4	46.7h	43.77e	1.23cd	107.4fg
	Rb	D1	84.07a	44.47e	1.0ef	200.4a
		D2	77.87ab	50.97cd	1.11 cde	163.3bc
		D3	72bcd	54.40b	1.27bcd	127.6d-g
		D4	65.87cde	58.53a	1.48ab	126.5d-g
C	Fl	D1	64.07def	35.97g	0.9f	164.2bc
		D2	57.57efg	39.47f	1.13cde	132def
		D3	52.97gh	43.73e	1.33bc	106.2g
		D4	46.37h	45.40e	1.30bc	104.3g
	Rb	D1	81.47ab	50.40cd	1.23cd	200.9a
		D2	75.9abc	48.80d	1.33bc	162.5bc
		D3	64.93de	52.53bc	1.47ab	139.5cde
		D4	56.57e-h	54.53b	1.6a	120.5efg

Any means within column followed by the same letter are not statistically different at 5% level. (Duncan 's multiple range test).

SC= Sweet Charlie C = Camarosa F = Flat Rb = Raised bed

D1=1.0 m D2 = 1.25 m D3=1.50 m D4=2.0 m

The best treatment combinations, that gave the highest mean values of total fresh transplants, appeared to be that involving Sweet Charlie cultivars, on raised bed system at the smallest plant spacing in both tested seasons. However, the results of the second season revealed non significant differences among this treatment combination and each of Sweet Charlie or Camarosa planted on raised beds at the first two plant distances (D1 and D2). such high number of total transplants may be not needed because of its poor quality (etulated plants) which may be damaged during transportation and planting as recorded by Reekie *et al.* (2002). As for number of marketable of fresh transplants, Sweet Charlie on raised bed system and the largest plant distance showed the highest values in addition to Camarosa cultivar, on raised bed and the largest two plant distances in the second season.

As for transplant diameter, results in Table (3) indicate that the highest values were obtained from Camarosa or Sweet Charlie cultivars planted on raised beds at the widest plant distance. Concerning the effect of the interaction on number of dormant transplants, it's clear from results arranged in Table (3) that the highest values were recorded from Sweet Charlie or Camarosa planted on raised beds at the narrowest plant spacing in the two tested seasons with non significant difference when compared with those of the two cultivars on raised beds planted at the second plant distance (D2) in the first season. These high values of number of dormant transplants per plant may be attributed to the high population of nursery stock plants (Super Elite) and the raised bed which maximized plant growth and subsequence runner formation and transplants production as found by Goulast and Funt (1985).

2- Effect of cultivar, nursery planting system and plant distance on transplant dry weight and carbohydrates content:

As for cultivar effect, data presented in Table (4) indicated clearly that Camarosa showed higher increments in dry weight of leaves and roots and carbohydrate content in crowns compared to those of Sweet Charlie. These increments were significant only in the second season. No significant differences were detected between the two tested cultivars in dry weight of crown in both seasons. Similar results were obtained by Nicola (1998) and Palha *et al.* (2002). Results in Table (4) demonstrate that planting nursery stock plants on raised beds caused significant increments in dry weight of leaves, crown and roots and carbohydrates content in roots and crowns of the produced transplants in the two years except carbohydrates content in crowns in the second season which was insignificant. The detected positive increment from plants grown on raised beds on the studied characters could be related to the excessive rates of photosynthesis and accumulation of stored carbohydrates in these thicker transplants as shown from Table (1).

As for the effect of plant spacing, results in Table (4) show clearly that distance between plants did not affect significantly dry weight of leaves while it showed some effects on dry weight of crowns and roots. Increasing plant spacing reduced dry weight in crowns and roots. However no significant differences between D3 and D4 in dry weight of roots and crowns were detected in the first and the second seasons, respectively. Plant spacing

showed significant positive effect on carbohydrate content in roots and crowns in both seasons except crown carbohydrate content in the second year. This carbohydrate content is a quality component as found by Schupp and Hennion (1997).

Table (4): Main effects of cultivar, nursery planting system and mother plant spacing on dry weight of leaves, crowns and roots and carbohydrates content of crown and roots.

Treatment			2000 season				
Cultivars	Planting system	Plant spacing	D. W. in leaves	D. W. in crown	D. W. in roots	Carbohydrates content of crown	Carbohydrates content of roots
SC			5.99a	2.81a	3.29a	3.33a	5.03b
C			6.34a	2.97a	3.35a	3.4a	5.54a
	F		5.9b	2.65b	2.93b	3.19b	4.97b
	Rb		6.43a	3.13a	3.70a	3.57a	5.61a
		D1	6.18a	2.5d	2.81c	2.88c	4.42d
		D2	6.14a	2.72c	3.08b	3.29b	5.1c
		D3	6.14a	3.09b	3.6a	3.6a	5.6b
		D4	6.19a	3.24a	3.79a	3.75a	6.02a
			2001 season				
SC			5.96b	2.91a	3.31b	3.27b	4.90b
C			6.45a	3.11a	3.45a	3.48a	5.5a
	F		5.95b	2.72b	3.01b	3.16a	4.91b
	Rb		6.45a	3.31a	3.75a	3.59a	5.49a
		D1	6.13a	2.63b	2.82d	2.91a	4.44d
		D2	6.11a	2.64b	3.14c	3.29a	4.98c
		D3	6.38a	3.28a	3.66b	3.59a	5.42b
		D4	6.19a	3.49a	3.9a	3.72a	5.97a

Any means within column followed by the same letter are not statistically different at 5% level. (Duncan 's multiple range test).
SC= Sweet Charlie C = Camarosa F = Flat Rb = Raised bed
D1=1.0 m D2 = 1.25 m D3=1.50 m D4=2.0 m

Results in Table (5) show that the interaction between cultivar and nursery planting system did not show any significant effects on dry weight and carbohydrates content of transplant in the two tested seasons.

No significant differences among the treatment combination of Sweet Charlie or Camarosa planted on raised beds at the first two plant distances (D1 and D 2).

Results in Table (6) show the comparisons among the means of the various studied treatments on dry weight and carbohydrate content. Results show that the differences were not always significant due to interaction effects. The best treatment combination among the three studied factors in carbohydrate content was Camarosa transplants planted on raised beds at the widest plant spacing followed by Sweet Charlie under the same conditions.

Table (5): Effects of the interaction between each two factors of cultivar, nursery planting system and mother plant spacing on dry weight of leaves, crowns and roots and carbohydrates content of crown and roots.

Treatments			2000 season				
Cultivars	Planting system	Plant spacing	D. W. in leaves (g)	D. W. in crowns (g)	D. W. in roots (g)	Carbo-hydrates content of crown (g)	Carbo-hydrates content of roots (g)
SC	F		5.56a	2.53a	2.93a	3.13a	4.81a
	Rb		6.42a	3.08a	3.66a	3.53a	5.25a
C	F		6.24a	2.76a	2.94a	3.26a	5.13a
	Rb		6.43a	3.18a	3.75a	3.62a	5.94a
SC		D1	5.9a	2.53a	2.83b	2.83d	4.27e
		D2	5.95a	2.7a	3.05b	3.22c	4.9cde
		D3	6.02a	3.02a	3.55a	3.52ab	5.32bcd
		D4	6.08a	2.98a	3.73a	3.73a	5.63abc
C		D1	6.45a	2.47a	2.78b	2.93d	4.57de
		D2	6.33a	2.73a	3.1b	3.37bc	5.3bcd
		D3	6.27a	3.17a	3.65a	3.68a	5.88ab
		D4	6.3a	3.5a	3.85a	3.77a	6.4a
	F	D1	5.8b	2.32b	2.32d	2.67f	4.23e
		D2	5.93ab	2.5b	2.7cd	3.15de	4.77cde
		D3	5.92ab	2.72ab	3.32bc	3.4cd	5.25bcd
		D4	5.95ab	3.05ab	3.4bc	3.55bc	5.63ab
	Rb	D1	6.55a	2.68ab	3.3bc	3.1e	4.6de
		D2	6.35ab	2.93ab	3.45abc	3.43cd	5.43bc
		D3	6.37ab	3.47a	3.88ab	3.8ab	5.95ab
		D4	6.43ab	3.43a	4.18a	3.95a	6.4a
			2000 season				
SC	F		5.63a	2.58a	3.02a	3.04a	4.75a
	Rb		6.29a	3.25a	3.61a	3.5a	5.058a
C	F		6.28a	2.86a	3a	3.28a	5.075a
	Rb		6.62a	3.37a	3.89a	3.68a	5.925a
SC		D1	5.83b	2.55c	2.85b	2.78c	4.433a
		D2	5.87ab	2.6c	2.98ab	3.29abc	4.667a
		D3	6.23ab	3.17b	3.5ab	3.52ab	4.85a
		D4	5.9ab	3.33ab	3.92a	3.52ab	5.667a
C		D1	6.43ab	2.72c	2.78b	3.03bc	4.45a
		D2	6.35ab	2.68c	3.3ab	3.32abc	5.3a
		D3	6.52a	3.4ab	3.82a	3.67ab	5.983a
		D4	6.48ab	3.65a	3.88a	3.92a	6.267a
	F	D1	5.83a	2.3d	2.38e	2.57b	4.267d
		D2	5.73a	2.48cd	2.77de	3.12ab	4.7bcd
		D3	6.15a	2.93bcd	3.38bc	3.48a	5.167bcd
		D4	6.08a	3.15abc	3.5bc	3.48a	5.517abc
	Rb	D1	6.43a	2.97bcd	3.25cd	3.25ab	4.617cd
		D2	6.48a	2.8cd	3.52bc	3.47a	5.267bcd
		D3	6.6a	3.63ab	3.93ab	3.7a	5.667ab
		D4	6.3a	3.83a	4.3a	3.95a	6.417a

Any means within column followed by the same letter are not statistically different at 5% level. (Duncan 's multiple range test).

SC= Sweet Charlie C = Camarosa F = Flat Rb = Raised bed

D1=1.0 m D2 = 1.25 m D3=1.50 m D4=2.0 m

Table(6) : Effects of the interaction among cultivar, nursery planting system and mother plant spacing on dry weight of leaves, crowns and roots and carbohydrates content of crown and roots.

Treatment			2000/2001				
Cultivars	Planting system	Plant spacing	D. W. in leaves (g)	D. W. in crowns (g)	D. W. in roots (g)	Carbo-hydrates content of crown(g)	Carbo-hydrates content of roots(g)
SC	F	D1	5.4d	2.33e	2.3d	2.6l	4.07h
		D2	5.6bcd	2.43e	2.533cd	3.067g	4.73fgh
		D3	5.67bcd	2.7cde	3.37a-d	3.3ef	5.07d-g
		D4	5.57cd	2.67cde	3.5a-d	3.53d	5.37c-f
	Rb	D1	6.4ab	2.73cde	3.37a-d	3.07g	4.47gh
		D2	6.3ab	2.97a-e	3.57abc	3.37e	5.07d-g
		D3	6.37abc	3.33abc	3.73abc	3.73c	5.57cd
		D4	6.6a	3.3a-d	3.97ab	3.93ab	5.9bc
C	F	D1	6.2abc	2.3e	2.33d	2.73h	4.4gh
		D2	6.27abc	2.57e	2.87bcd	3.23f	4.8efg
		D3	6.17abcd	2.73cde	3.27a-d	3.5d	5.43cde
		D4	6.33abc	3.43ab	3.3a-d	3.57d	5.9bc
	Rb	D1	6.7a	2.63de	3.23a-d	3.13g	4.73fgh
		D2	6.4ab	2.9b-e	3.33a-d	3.5d	5.8bc
		D3	6.37ab	3.6a	4.03ab	3.87b	6.33ab
		D4	6.27ab	3.57ab	4.4a	3.97a	6.9a
			2001 season				
SC	F	D1	5.4d	2.23f	2.4e	2.4h	4.3f
		D2	5.6cd	2.43ef	2.57de	3.13g	4.57ef
		D3	5.67bcd	2.77c-f	3.4a-d	3.37d-g	4.77e
		D4	5.57cd	2.87cde	3.7abc	3.27fg	5.37d
	Rb	D1	6.4a	2.87cde	3.3b-e	3.17g	4.57ef
		D2	6.3ab	2.77c-f	3.4a-e	3.4c-g	4.77e
		D3	6.37a	3.57ab	3.6a-d	3.67b-e	4.93e
		D4	6.6a	3.8a	4.13ab	3.77b	5.97c
C	F	D1	6.2abc	2.37ef	2.37e	2.73h	4.23f
		D2	6.27ab	2.53def	2.97cde	3.1g	4.83e
		D3	6.17abc	3.1bc	3.37b-e	3.6b-f	5.57cd
		D4	6.33a	3.43ab	3.3b-e	3.7bcd	5.67cd
	Rb	D1	6.7a	3.07bcd	3.2b-e	3.33efg	4.67ef
		D2	6.4a	2.83cde	3.63a-d	3.53b-f	5.77cd
		D3	6.37a	3.7a	4.27ab	3.73bc	6.4b
		D4	6.27ab	3.87a	4.47a	4.13a	6.87a

Any means within column followed by the same letter are not statistically different at 5% level. (Duncan's multiple range test).

SC= Sweet Charlie C = Camarosa F = Flat Rb = Raised bed

D1=1.0 m D2 = 1.25 m D3=1.50 m D4=2.0 m

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توقعات النجاح لنظام زراعة معدل لمشاتل الفراولة وعلاقته بانتاج الثمار تحت الأقبية البلاستيكية المنخفضة:

١- عدد وجودة الشتلات

محمد إمام رجب

قسم البساتين – كلية الزراعة – جامعة عين شمس – شبرا الخيمة – القاهرة

أجريت هذه الدراسة في مزرعة تجارب مركز تنمية الفراولة بالنوبارية خلال عامي ٢٠٠٠ ، ٢٠٠١ في تربة رملية حديثة الاستزراع بهدف دراسة تأثير كل من الصنف وطريقة زراعة المشتل ومسافات الزراعة بين النباتات علي عدد وجودة الشتلات الناتجة سواء للزراعة مباشرة بعد التقليع (Fresh) أو الزراعة بعد التجميد (Frigo) ولدراسة تأثير العوامل الثلاثة والتفاعل بينها تم تصميم التجربة في تصميم القطع المنشقة مرتين.

أوضحت النتائج زيادة عدد الشتلات الطازجة والشتلات الكلية والساكنة في الصنف سويت شارلي عنه في الصنف كماروزا ولم يكن هناك فرق معنوي في الصنفين في عدد الشتلات الكلية الطازجة خلال موسمي الدراسة وكانت هناك زيادة في قطر الشتلة في الصنف كماروزا عنه في الصنف سويت شارلي ولم تكن هذه الزيادة معنوية في الموسم الأول .

أوضحت النتائج أيضا أن هناك زيادة معنوية في عدد الشتلات الفرش والكلية الساكنة في أخر الموسم وعدد الشتلات القابلة للتسويق وقطر الشتلة عند الزراعة علي مصاطب عنه في حالة زراعة المشتل بالطريقة العادية (المسطحة) خلال موسمي الدراسة .

توضح النتائج أيضا انه بزيادة مسافة الزراعة بين الأمهات في المشتل زاد عدد الشتلات القابلة للتسويق وقطر الشتلة بينما قل عدد الشتلات الطازجة الكلية والساكنة الكلية في أخر الموسم.

بالنسبة للتفاعل أوضحت النتائج زيادة عدد الشتلات الطازجة القابلة للتسويق في كلا الصنفين عند الزراعة بطريقة المصاطب وقد زاد سمك الشتلة في حالة صنف كماروزا عند الزراعة علي المصاطب علي مسافات ٢ متر بين الأمهات .

تظهر النتائج كذلك زيادة الوزن الجاف لاوراق وجذور الشتلات ومحتوى التاج من الكربوهيدرات الكلية في الصنف كماروزا عنه في الصنف سويت شارلي ولم تكن هذه الزيادة معنوية في الموسم الأول وكانت الزيادة في محتوى الجذور من الكربوهيدرات الكلية في الصنف كماروزا عنه في السويت شارلي معنوية خلال موسمي الدراسة. أدت زراعة مشتل الفراولة بطريقة المصاطب إلى زيادة معنوية في الوزن الجاف للأوراق والتاج والجذور للشتلة وكذا محتوى التاج والجذور من الكربوهيدرات الكلية عنه في طريقة الزراعة العادية وقد زاد محتوى الجذور من الكربوهيدرات الكلية والوزن الجاف للجذور بزيادة مسافة الزراعة في المشتل .