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PROPAGATION OF SOME TOMATO HYBRIDS VIA TISSUE CULTURE TECHNIQUE

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ABSTRACT: This investigation was carried out at the Tissue Culture Lab., Hort. Dept., Fac. Agric., Zagazig Univ., Egypt during the two successive seasons of 2014 and 2015 to produce transplants of two tomato hybrids through tissue culture technique. A protocol was developed for shoot multiplication and rooting in two tomato (*Lycopersicon esculentum* Mill.) hybrids *i.e.,* Silla 108 and Farrah. Shoot tips were cultured into Murashige and Skoog media (MS medium) with different concentrations of benzyl adenine (BA) and Kinetin (Kin) 1.5 mg BA/l, 1.5 mg BA/l + 1 mg Kinetin/l, 3 mg Kin/l and 4 mg Kin/l) compared with MS basal medium as a control treatment, the obtained results illustrated that supplementing BA at 1.5 mg/l gave the highest value of number of shoots/explant of Sila 108 hybrid followed by kinetin at 4 mg/l for Farrah hybrid in both seasons. Multiplicated shoots of two tomato hybrids were excised and cultured on MS medium supplemented with different rooting growth regulators including indole acetic acid (IAA) at 0.5 and 1 mg/l, Naphthalene acetic acid (NAA) at 1 mg/l and indole butyric acid (IBA) at 1mg/l compared to the control treatment (without growth regulators). From the foregoing results, it could be concluded that supplementing IAA at 1 mg/l and NAA at 1 mg/l to MS media were the best treatment for rooting stage of Farrah and Sila 108 tomato hybrids. The plantlets were transferred to plastic cups containing peatmoss + sand at 1:1, peatmoos + vermiculite at 1:1 (*V/V*) or peatmoss alone. It could be concluded that the agriculture media for acclimatization of plantlets of Farrah and Sila 108 tomato hybrids produced from tissue culture technique were peatmoss and peatmoss+ vermiculite at 1:1 (*V/V*).

Key words:

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) belongs to the family Solanaceae is the second popular and nutritive vegetable crop after potato (**Mamidala and Nanna, 2011**). It is one of the most protective foods because its nutritive value and it is a rich source of vitamins, minerals and organic acids (**Devi *et al*., 2008**). According to FAO statistics, the top five tomato producers are China, India, USA, Turkey and Egypt, representing about 60% of the world production (**FAO, 2014**). In Egypt, tomato crop plays a major nutritional and economic role in vegetable crops production (**Bediwy and El-Habbaq, 2016**). Tomato is very amenable to tissue culture and highly responsive to *in vitro* cultures (**Himabindu *et al*., 2012**). *In vitro* culture tomato used in different biotechnological applications; *i.e.* production virus free plant (**Moghaieb *et al*., 2004**) and studied about the effect of variety and plant growth regulators on tomato cultivars (**Chaudhary *et al*., 2007**). The response of tomato propagation at tissue culture has been found to depend largely on genotype, explant and plant growth regulators which used in the culture medium (**Praveen and Swamy, 2011**). *In vitro* techniques are important to multiply elite selections, and to develop the suitable cultivars in the minimum time (**Taji *et al*., 2002**).

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In vitro the morphogenetic responses of cultured plants are affected by different components of the culture media and it is important to evaluate their effect on plant propagation (**Gubis *et al*., 2004**).

Various reports of shoot multiplication stage in tomato by using different explants with different plant growth regulators; *i.e.,* 6-benzylaminopurine (BAP), kinetin, N1, 2, 3-Thiadiazol-5-yl-N'-phenylurea (TDZ) and Zeatin alone and also in combinations was reported (**Vikram *et al*., 2012**).In addition, shoot multiplication for several tomato cultivars were induced with 3 mg /l BAP (**Harish *et al*., 2010**). A high shoot multiplication capacity from different tomato lines was obtained when the explants were cultured on medium containing 5 µm BAP (**Arkita *et al*., 2013**).

High tomato shoot number was obtained by MS medium which supplied with 16.8 µm kinetin. For rooting tomato through *in vitro* micro-shoots were transferred on MS medium supplemented with 0.5 mg/l IAA, IBA, and the plantlets were acclimatization in the culture room and maintained in the green house (**Vikram *et al*., 2012**).

Tomato crop production is affected by the economic changes, and climatic conditions, as well as, price of varieties causing price fluctuations **(Bediwy and El-Habbaq, 2016**).

In vitro studies on tomato have been carried out for section of cell lines for biotic and abiotic stresses (**Rahman and Kaul, 1989**) and mass propagation (**Fari *et al*., 1992**).

Tomato is a self-pollinated plant, the process of hybrid seed production involves and hand pollination, whole process of hybrid seed production is done manually under field conditions, and undesirable weather conditions. So all these factors lead to increase cost of tomato hybrid seeds, using tissue culture technique can help reduce the price of hybrid seeds mass propagation of high quality seeds (**Bhatia and Ashwath, 2004)**.

Therefore, the objective of this study was propagation of some tomato with high price hybrid seeds through the tissue culture technique.

MATERIALS AND METHODS

This work was conducted at Plant Tissue Culture Lab., Hort. Dept., Fac. Agric., Zagazig Univ., Egypt during two successive seasons of 2014 and 2015 to produce transplants of two tomato hybrids through tissue culture technique.

The experiment divided into three stages; *i.e.,* multiplication, rooting, and acclimatization. Seeds of two tomato hybrids (Sila 108 and Farrah) were obtained from Alain Seeds Nursery in Abou Hammad, Sharkia Governorate, Egypt. Seeds were washed under running tap water for 1 hour. They were soaked in a soap solution for 5 minutes, then were taken and surface sterilized with 75% aqueous ethanol for 60 seconds, followed by 15-20 minutes sodium hypochlorite of 15% solution ($NaClO_4$) containing 1% (*V/V)* tween 20, as wetting agent, then rinsed four times by sterile distilled water and placed on sterilized filter paper (in culture cabinet) to remove the remained water.

Culture Media

The used basal medium was Murashige and Skoog (**MS**) media (**1962**). The medium was supplemented with 30 g sucrose/l, 0.1 g myo-inistol/l, and solidified with 0.7% agar. The considered medium was supplemented with other tested growth regulators according to the aim of each stage. pH was adjusted to 5.8, the media were then sterilized in autoclave at 121^{o}C for 20 minutes. All cultures at the different stages, were incubated in growth chamber at 25 ± 2^{o}C under 16 hr., photoperiod at an intensity of 2000 from cool white fluorescent lamps. During germination, multiplication and rooting stage and about 3000 Lux during acclimatization stage.

Seeds Germination

Seeds of two tomato hybrids were cultured in jars containing MS basal medium without hormones, (**Cortina and Culiáñez-Macià, 2004**) and two seeds were cultured in each jar and kept for 25 days to get a sterilized seedlings as a source of explants for multiplication stage (Photo 1).

Multiplication Stage

The lateral buds, about 2-3 mm from the previously obtained seedlings were cultured

Seeds germination to produce explants

Photo 1. Seeds germination

on MS basal media supplemented with different concentrations of benzyl adinen (BA) and Kinetin (1.5 mg BA/l, 1.5 mg BA/l + 1 mg Kin /l, 3 mg Kin/l and 4 mg Kin /l) compared to the MS basal medium as a control treatment, the cultures were incubated for two weeks. Number of shoots per explant, shoot length (cm) and number of leaves per shoot were determined.

Rooting Stage

Multiplicated shoots of two tomato hybrids were excised and cultured on MS medium supplemented with different rooting growth regulators, indole acetic acid (IAA) at 0.5 and 1 mg/l, naphthalene acetic acid (NAA) at 1 mg/l and indole butyric acid (IBA) at 1mg/l, compared with control treatment, (without growth regulators addition). Rooting percentage, number of roots per plantlet, root length (cm), shoot length (cm) and number of leaves per plantlet were determined four weeks later culture.

Acclimatization Stage

The aim of this stage was to adapt tomato plantlets before transferring to the open field. Rooted plantlets were taken from vessels and washed with sterile distilled water, then disinfected by immersing roots in Rhizolex solution (1g/l), for 10 minutes. Plantlets were transferred to plastic cups which containing three media, *i.e.,* peatmoss + sand at 1:1, peatmoos + vermiculite at 1:1 (*V/V*) or peatmoss alone. Cups were covered with polyethylene bags to maintain high humidity (70 to 80%) around plantlets. The cups were kept in growth room illuminated with 3000 lux light intensity and 25 ± 2^{o}C temperature after seven dayes each cup was fertilized weekly with equal amout of complete fertilizer, survival percentage, plantlet length and number of leaves/plantlet were determined six weeks later acclimatization stage.

Statistical Analysis

All treatments were arranged in a split plot design with three replicates, each replicate contained three plants, where tomato hybrids were randomly arranged in the main plots and another treatments were randomly distributed in the sub plots.

The obtained data were statistically analyzed according to **Snedecor and Cochran (1980)**. The means were compared using the **Duncan** (**1955**) multiple rang test at 0.05, probably.

RESULTS AND DISCUSSION

Multiplication Stage

Effect of tomato hybrids

Results in Table 1 show that there were no significant differences between Sila 108 and Farrah hybrids with respect to number of leaves/ shoot, shoot length, and number of shoots/ explant except number of shoots/explant in the

Table 1. Effect of tomato hybrids on shoot characteristics during multiplication stage

Hybrid	First season			Second season		
	No. of leaves/shoot	Shoot length (cm)	No. of shoots/explant	No. of leaves/shoot	Shoot length (cm)	No. of shoots/explant
Sila 108	3.77 a	3.02 a	1.38 b	3.70 b	3.07 a	1.73 a
Farrah	4.38 a	3.55 a	1.61 a	4.53 a	3.77 a	1.73 a

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

1st season, and number of leaves/shoot in the 2nd season, as well as, Farrah hybrid was regarded the highest values in this respect.

Effect of BA and Kinetin concentrations

Supplementing BA at 1.5 mg/l, Kin at 1mg/l + BA at 1.5 mg/l and Kin at 3 and 4 mg/l of MS media significantly increased shoot length and number of shoots/explant compared to control (MS without BA and Kin) (Table 2).

There were no significant differences among BA and Kin concentrations and control regarding to number of leaves/shoot in both seasons. Also, there were no significant differences among BA and Kin concentrations in shoot length and number of shoots/explant. **Arkita *et al.* (2013)** came to similar results on tomato, they concluded that the average number of shoot were observed when BA and Kinetin were combined together. However, BA at 1.5 mg/l gave the highest value of shoots number/ explant. In this connection, **Mohamed *et al.* (2010)**, came to similar results. They illustrated that, the BA levels was associated with increase the tomato shoots number and shoot length through tissue culture techuique.

Effect of the interaction between tomato hybrids and BA and kinetin concentrations

Results in Table 3 and Photo 2 show clearly that supplementing Kin at 4 mg/l to MS media recorded the highest value of number of leaves/ shoot of Farrah hybrid, followed by Kin at 3mg/l in the 1st season, whereas kin at 3 mg/l gave the highest value of shoot length of Farrah hybrid in both seasons. As for number of shoots/explant, supplementing BA at 1.5 mg/l gave the highest value of number of shoots/explant of Sila 108 hybrid, followed by Kin at 4 mg/l for Farrah hybrid in both seasons. Same results were obtained by **Jamous and Abu-qaoud (2015)**, they stated that using BA only proved to be more beneficial than the combination of other hormones for shoot number of different tomato cultivars through tissue culture techuique.

From the foregoing results, it could be concluded that, supplementing Kin at 3 or 4 mg/l, and BA at 1.5 mg/l alone were the best treatments for multiplication stage of both tomato hybrids.

Rooting Stage

Effect of tomato hybrids

Farrah hybrid gave high number of leaves/ plantlet, shoot length, number of roots/ plantlet and average root length compered to Sila 108 hybrid, except number of leaves/plantlet and average root length in the 1st season (Table 4). Rooting percentage was 100% for both hybrids in the two seasons.

Effect of IAA, IBA and NAA concentrations

Results presented in Table 5 show that supplementing MS media with IAA at 0.5 and 1 mg/l, IBA at 1 mg/l and NAA at 1 mg/l increased number of leaves/shoot and number of roots/plantlet compared to control (MS media without hormons). These results could be explained by the promotive effect of auxins on

Table 2. Effect of growth regulators on shoot characteristics of tomato hybrids during multiplication stage

Treatment	First season			Second season		
	No. of leaves/shoot	Shoot length (cm)	No. of shoots/explant	No. of leaves/shoot	Shoot length (cm)	No. of shoots/explant
MS (control)	3.50 a	2.03 b	1.00 c	3.75 a	2.25 b	1.00 b
1.5 mg BA/L	4.22 a	3.33 a	1.89 a	4.42 a	3.62 a	2.17 a
1 mg Kin/L + 1.5 mg BA/L	3.81 a	3.47 a	1.68 ab	4.08 a	3.75 a	1.92 a
3 mg Kin/L	4.35 a	3.91 a	1.36 bc	4.00 a	3.79 a	1.75 a
4 mg Kin/L	4.50 a	3.69 a	1.55 ab	4.33 a	3.67 a	1.83 a

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

Table 3. Effect of the interaction between tomato hybrids and growth regulators on shoot characteristics during multiplication stage

Hybrid	Treatment	First season			Second season		
		No. of leaves/shoot	Shoot length (cm)	No. of shoots/explant	No. of leaves/shoot	Shoot length (cm)	No. of shoots/explant
Sila 108	**MS (control)**	3.00 b	1.61 c	1.00 c	3.17 c	1.75 c	1.00 d
	1.5 mg BA/L	4.11 ab	3.33 abc	2.00 a	4.00 abc	3.58 ab	2.50 a
	1 mg Kin/L + 1.5 mg BA/L	4.17 ab	3.21 abc	1.58 ab	4.17 abc	3.50 ab	2.00 abc
	3 mg Kin/L	3.78 ab	3.44 ab	1.22 bc	3.67 bc	3.17 ab	1.67 bc
	4 mg Kin/L	3.78 ab	3.50 ab	1.11 bc	3.50 bc	3.33 ab	1.50 cd
Farrah	**MS (control)**	4.00 ab	2.45 bc	1.00 c	4.33 abc	2.75 bc	1.00 d
	1.5 mg BA/L	4.33 ab	3.33 abc	1.78 a	4.83 ab	3.67 ab	1.83 bc
	1 mg Kin/L + 1.5 mg BA/L	3.45 b	3.72 ab	1.78 a	4.00 abc	4.00 ab	1.83 bc
	3 mg Kin/L	4.92 a	4.38 a	1.50 abc	4.33 abc	4.42 a	1.83 bc
	4 mg Kin/L	5.22 a	3.89 ab	2.00 a	5.17 a	4.00 ab	2.17 ab

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

BA **4 Kin** **3 Kin** **Control**

Photo 2. Effect of the interaction between tomato hybrids and BA and Kinetin concentrations during multiplication stage

Table 4. Effect of tomato hybrids on growth characteristic and rooting (%) of plantlet during rooting stage

Hybrid	First season					Second season				
	No. of leaves/ plantlet	Shoot length (cm)	No. of roots/ plantlet	Root length (cm)	Rooting (%)	No. of leaves/ plantlet	Shoot length (cm)	No. of roots/ plantlet	Root length (cm)	Rooting (%)
Sila 108	7.00 a	7.42 b	5.96 b	6.50 a	100	6.37 b	7.45 b	5.57 b	6.97 b	100
Farrah	7.64 a	9.13 a	9.32 a	8.05 a	100	7.87 a	9.30 a	10.17 a	9.42 a	100

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

Table 5. Effect of growth regulators on growth characteristic and rooting (%) of tomato hybrids during rooting stage

Treatment	First season					Second season				
	No. of leaves/ plantlet	Shoot length (cm)	No. of roots/ plantlet	Root length (cm)	Rooting (%)	No. of leaves/ plantlet	Shoot length (cm)	No. of roots/ plantlet	Root length (cm)	Rooting (%)
MS (control)	6.06 c	8.89 a	3.50 c	9.95 a	100	5.58 cc	8.87 a	3.50 c	9.80 a	100
0.5 mg IAA /L	7.67 ab	7.78 a	7.17 b	5.94 b	100	7.75 ab	8.50 a	6.83 b	6.87 b	100
1 mg IBA /L	6.72 bc	7.53 a	7.28 b	4.92 b	100	6.83 bc	7.83 a	7.67 b	6.71 b	100
1 mg IAA /L	9.17 a	9.33 a	7.58 b	9.92 a	100	8.67 a	8.67 a	7.25 b	10.42 a	100
1 mg NAA /L	6.99 bc	7.86 a	12.65 a	5.64 b	100	6.75 bc	8.00 a	14.08 a	7.17 b	100

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

rooting initials, as noticed by **Deklerk *et al.* (1999)**. Whereas, IAA, IBA and NAA at the same concentrations did not show any effect on shoot length, IAA at 1 mg/l increased number of leaves/plantlet and root length with no significant differences with MS media (control) with respect to root length, NAA at 1 mg/l increased number of roots/plantlet. These results are in agreement with those reported by **Isag *et al*. (2009).** They concluded that NAA at 0.5 mg/l recorded the higher values of number of roots/ plantlet compared to IBA and IAA. All treatments gave 100% rooting percentage in both seasons.

Effect of the interaction between tomato hybrids and growth regulators concentrations

The obtained results in Table 6 and Photo 3 indicate that supplementing IAA at 1 mg/l to MS media gave the highest value for each of number of leaves/plantlet, shoot length and average root length for Sila 108 hybrid in both seasons. In addition, Farrah hybrid recorded the maximum value of number of roots/plantlet when it cultured on MS medium supplied with NAA at 1 mg/l. 100% rooting in both seasons was obtained by all interaction treatments.

From the foregoing results, it could be concluded that supplementing IAA at 1 mg/l and NAA at 1 mg/l to MS media were the best treatments for rooting stage of Farrah and Sila 108 tomato hybrids.

Acclimatization Stage

Effect of tomato hybrids

Farrah hybrid gave the highest value for each of survival (%), plantlet length and number of leaves/plantlet compared to Sila 108 hybrid in both seasons (Table 7).

Effect of substrate and its mixtures

There were no significant differences among peatmoss, peatmoss + vermiculite at 1:1(*V/V*) and peatmoss + sand at 1:1 (*V/V*) in plantlet length and number of leaves/plantlet, except number of leaves/plantlet in the 2nd season only (Table 8). Peat moss media increased survival (%) compared to the two other media in both seasons. Survival (%) were about 75 and 74.72% for peatmoss, 68.05 and 67.78% for peatmoss+ vermiculite at 1:1 (*V/V*) and 61.67 and 61.39% for peatmoss + sand at 1:1 (*V/V*) in the 1st and 2nd seasons, respectively. These results are in harmony with those found by **Amer *et al.* (2013)**. They concluded that 96.66% of strawberry transplants were acclimatized on peatmoss alone.

Effect of the interaction between tomato hybrids and substrate

Results in Table 9 and Photo 4 demonstrate that peatmoss and peatmoss + vermiculite at 1:1 (*V/V*) increased survival (%), plantlet length and number of leaves/plantlet for Farrah hybrid, whereas peatmoss increased survival (%) in both seasons and number of leaves/ plantlet in the 2nd season for Sila 108 hybrid.

From the foregoing results, it could be concluded that the agriculture media for acclimatization of plantlets of Farrah and Sila 108 tomato hybrids produced from tissue culture technique were peatmoss and peatmoss + vermiculite at 1:1 (*V/V*).

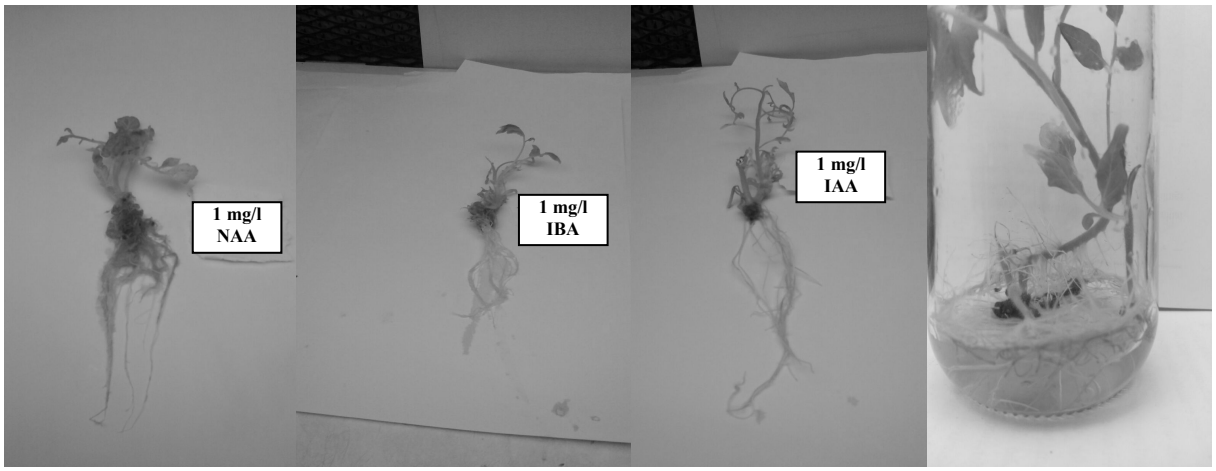
Conclusively

It could be concluded that supplementing BA at 1.5 mg/l to MS media gave the highest value of number of shoots/explant of Sila 108 hybrid, followed by Kin at 4 mg/l for Farrah hybrid in both seasons. On the other hand, supplementing IAA at 1 mg/l, and NAA at 1 mg/l to MS media were the best treatments for rooting stage of Farrah and Sila 108 tomato hybrids. Finally, the best agriculture media for acclimatization of plantlets of Farrah and Sila 108 tomato hybrids produced from tissue culture technique were peatmoss and peatmoss + vermiculite at 1 : 1.

Table 6. Effect of the interaction between tomato hybrids and growth regulators on growth characteristic and rooting (%) of plantlet during rooting stage

Tomato hybrid	Treat.	First season					Second season				
		No. of leaves/ plantlet	Shoot length (cm)	No. of roots/ plantlet	Root length (cm)	Rooting (%)	No. of leaves/ plantlet	Shoot length (cm)	No. of roots/ plantlet	Root length (cm)	Rooting (%)
Sila 108	**MS (control)**	5.56 d	7.89 bc	3.11 d	8.11 cd	100	5.33 d	7.92 bcd	2.83 e	8.11 cd	100
	0.5 mg IAA /L	6.67 bcd	6.11 c	3.78 d	2.50 f	100	6.17 bcd	6.50 d	3.50 e	3.00 f	100
	1 mg IBA /L	5.89 cd	5.72 c	3.33 d	2.61 f	100	5.50 d	6.33 d	3.17 e	2.75 f	100
	1 mg IAA /L	10.50 a	10.83 a	9.17 bc	14.33 a	100	9.00 a	10.00 ab	8.67 cd	14.83 a	100
	1 mg NAA /L	6.39 cd	6.56 c	10.39 b	4.94 ef	100	5.83 cd	6.50 d	9.67 bc	6.17 de	100
Farrah	**MS (control)**	6.56 bcd	9.89 ab	3.89 d	11.80 ab	100	5.83 cd	9.83 ab	4.17 e	11.50 b	100
	0.5 mg IAA /L	8.67 ab	9.44 ab	10.56 b	9.39 bc	100	9.33 a	10.50 a	10.17 bc	10.75 b	100
	1 mg IBA /L	7.56 bcd	9.33 ab	11.22 b	7.22 cde	100	8.17 ab	9.33 abc	12.17 b	10.67 b	100
	1 mg IAA /L	7.83 bc	7.83 bc	6.00 cd	5.50 de	100	8.33 a	7.33 cd	5.83 de	6.00 e	100
	1 mg NAA /L	7.58 bcd	9.17 ab	14.92 a	6.34 de	100	7.67 abc	9.50 ab	18.50 a	8.17 c	100

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.



NAA **IBA** **IAA** **Control**

Photo 3. Effect of the interaction between tomato hybrids and growth regulators concentrations on rooting

Table 7. Effect of tomato hybrids on morphological characters plantlet during acclimatization stage

Hybrid	First season			Second season		
	Survival (%)	Plantlet length (cm)	No. of leaves/plantlet	Survival (%)	Plantlet length (cm)	No. of leaves/plantlet
Sila 108	66.48 b	14.33 b	4.89 b	66.11 b	13.63 b	5.44 a
Farrah	70.00 a	28.48 a	6.33 a	69.82 a	28.67 a	5.85 a

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

Table 8. Effect of different substrates on morphological characters of plantlet tomato hybrids during acclimatization stage

Treatment (*V/V*)	First season			Second season		
	Survival (%)	Plantlet length (cm)	No. of leaves/ plantlet	Survival (%)	Plantlet length (cm)	No. of leaves/ plantlet
Peatmoss	75.00 a	22.78 a	5.83 a	74.72 a	21.72 a	6.39 a
Peatmoss + Vermiculite 1:1 (*V/V*)	68.05 b	21.22 a	5.72 a	67.78 b	20.83 a	5.66 ab
Peatmoss + Sand 1:1 (*V/V*)	61.67 c	20.22 a	5.28 a	61.39 c	20.89 a	4.89 b

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

Table 9. Effect of the interaction between tomato hybrids and different substrates on morphological characters of plantlet during acclimatization stage

Hybrids	Treatments (*V/V*)	First season			Second season		
		Survival (%)	Plantlet length (cm)	No. of leaves	Survival (%)	Plantlet length (cm)	No. of leaves
Sila 108	**Peatmoss**	75.00 a	15.00 b	5.22 cd	73.89 a	13.22 c	6.33 ab
	Peatmoss + Vermiculite 1:1 (*V/V*)	63.89 b	14.33 b	4.67 d	62.78 b	14.11 c	5.11 bc
	Peatmoss + Sand 1:1 (*V/V*)	60.56 b	13.67 b	4.78 d	61.67 b	13.56 c	4.89 c
Farrah	**Peatmoss**	75.00 a	30.56 a	6.44 ab	75.56 a	30.22 a	6.45 a
	Peatmoss + Vermiculite 1:1 (*V/V*)	72.22 a	28.11 a	6.78 a	72.78 a	27.56 b	6.22 ab
	Peatmoss + Sand 1:1 (*V/V*)	62.78 b	26.78 a	5.78 bc	61.11 b	28.22 ab	4.89 c

Means having the same letters within each column are not significantly differed at 0.05 level, according to Duncan multiple range.

Peatmoss + vermiculite **Peatmoss + sand** **Peatmoss**

Photo 4. Effect of the interaction between tomato hybrids and substrates on acclimatization

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استخدام تقنية زراعة الأنسجة في إكثار بعض هجن الطماطم

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أجرى هذا البحث في معمل زراعة الأنسجة، قسم البساتين كلية الزراعة، جامعة الزقازيق، مصر خلال موسمين متتاليين عامي ٢٠١٤، ٢٠١٥ لإنتاج شتلات هجينين من الطماطم من خلال تقنية زراعة الأنسجة، وقد وضع بروتوكول لزيادة عدد الأفرع والتجذير لإثنين من هجينين الطماطم (سيلا ١٠٨وفرح) تم زراعة القمم النامية للأفرع على بيئة مضاف إليها تركيزات مختلفة من البنزيل أدنين١,٥ ملجم/لتر، الكينيتن (١ ملجم/لتر، ٣ ملجم/لتر، ٤ ملجم/لتر)، مع المقارنة ببيئة مورشيج وسكوج بدون منظمات النمو كبيئة كنترول، أظهرت البيانات التي تم الحصول عليها أن إضافة بنزيل أدنين ١,٥ ملجم/لتر قد أعطى أعلى القيم لعدد الأفرع/للجزء النباتي من هجين سيلا ١٠٨ يليها الكينيتين ٤ ملجم/لتر مع هجين فرح في كلا الموسمين، تم استئصال البراعم المضاعفة من اثنين من هجن الطماطم واستزراعها على بيئة مورشيج وسكوج مع إضافة منظمات نمو مختلفة لتجذيرها، بما في ذلك إندول حامض الخليك عند ٠,٥ و ١ ملجم/لتر، نفثالين حامض الخليك عند ١ ملجم/لتر، اندول حامض البيوتريك ١ملجم/لتر مع المقارنة ببيئة مورشيج وسكوج بدون منظمات النمو، من النتائج وجد أن إضافة إندول حامض الخليك ١ ملجم/لتر ونفثالين حامض الخليك عند ١ ملجم/لتر إلى بيئة مورشيج وسكوج كانت أفضل المعاملات لتجذير هجن الطماطم فرح وسيلا ١٠٨، تم نقل النبيتات إلى أكواب بلاستيكية تحتوي على مخاليط مختلفة (بيت موس + رمل بنسبه حجمية١: ١، بيت موس + فيرميكوليت بنسبه حجمية ١: ١، بيت موس منفردا)، ووجد أن أفضل بيئة لأقلمة نبيتات هجن الطماطم فرح وسيلا ١٠٨ المنتجة من تقنية زراعة الأنسجة هي البيت موس منفردا، والبيت موس + الفيرميكوليت بنسبه حجميه ١: ١.

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