

4- RESULTS AND DISCUSSION

4.1. Peach Rootstocks

- 4.1.I. Micro-propagation
- 4.1.I.A. Indirect regeneration
- 4.1.I.A.1. Callus production and development

4.1.I.A.1.1. Effect of explant type

Data of Table (1) and Fig. (1) show the effect of different explant types on explant development and growth parameters of peach rootstocks (Nemagaurd & Okinawa). Table (1-A) states that statistical differences were lacking between Nemagaurd and Okinawa rootstocks when necrosis, explant development and callus production parameters were concerned. This means that rootstock type had no effect on different parameters under study.

Moreover, Table (1-B) shows that shoot tip was significant superior than either leaf discs and stem segments explant in reducing necrosis with increased explant development parameters. Meanwhile, leaf discs significantly surpassed shoot tips and stem segments in maximizing callus production.

Regarding, the effect of interaction between rootstock type and explant type, it is noticed from Table (1-C) that culturing of leaf discs explant of two peach rootstocks induced a significant reduce in necrosis and increased callus production parameters. However, culturing of shoot tip explant of Nemagaurd rootstock induced a significant increase in explant development as compared with the other interactions.

The abovementioned results reflect the best effect of leaf discs explants on callus production and lack the role of rootstock. These results are somewhat go in line with the findings of **Zaied** (1997) on stone fruit plants and **Channuntapipat** *et al.* (2000) on almond. They declared that shoot tip showed a good results in callus production.

Table (1) Effect of different explant type on explant development and growth parameters of peach rootstocks (Nemagaurd & Okinawa)

Table (1-A) Effect of rootstock type

Parameters Rootstock type	Necrosis	Explant development	Callus production	
Nemagaurd	1.19 A	3.39 A	2.47 A	
Okinawa	1.29 A	3.36 A	2.44 A	

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

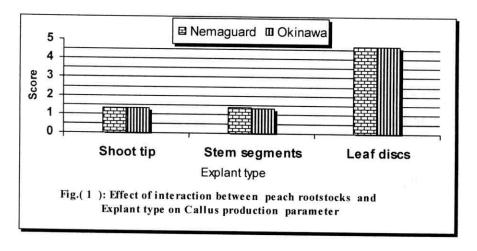
Table (1-B) Effect of explant type

Parameters Explant types	Necrosis	Explant development	Callus production
Shoot tip	1.15 B	4.58 A	1.33 B
stem segments	1.33 A	4.20 B	1.37 B
Leaf discs	1.23 AB	1.33 C	4.67 A

Table (1-C) Effect of interaction between peach rootstocks and explant type

Parameters	Necrosis		-	olant opment	Callus production	
Rootstock type Explant types	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Shoot tip	4.67	4.50	4.67	4.50	1.33	1.33
	A	AB	A	AB	B	B
stem segments	4.17	4.23	4.17	4.23	1.40	1.33
	B	AB	B	AB	B	B
Leaf discs	1.33	1.33	1.33	1.33	4.67	4.67
	C	C	C	C	A	A

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.



4.1.I.A.1.2. Effect of cold pre-treatment

Data of Table (2) explain the effect of cold pretreatment on explant development and callus production parameters of peach rootstocks (Nemagaurd & Okinawa). Table (2-A) clarifies that Nemagaurd significantly surpassed Okinawa rootstock in increasing explant development. On the other hand, both Nemagaurd and Okinawa rootstocks failed to induce any significant difference when necrosis, browning and callus production were considered.

Moreover, Table (2-B) shows that keeping of the explant for 3 days in refrigerator at 5°C enhanced a significant improvement of the explant which reduced necrosis and browning while increased callus production in relation to the other periods and the control. Meanwhile, explant development was significantly maximized as the explant stayed in the refrigerator for 3 or 5 days.

Regarding the interaction between peach rootstocks and cold pretreatments. It appears from Table (2-C) that keeping of the Nemagaurd rootstock explant for 3 days in refrigerator at 5°C induced the best results as it significantly reduced browning and significantly maximized explant development parameter as compared with the other combinations. However, callus production was significantly improved when either Nemagaurd or Okinawa rootstock explant were used in combination with keeping period of the explant for 3 days in refrigerator at 5°C. On the other hand, different combinations between peach

rootstocks and cold pretreatments failed to induce significant differences as necrosis parameter was concerned.

The above results demonstrate that cold pretreatment of the explant for 3 days encouraged the best responses in the explant. This may be due to the ability of the cold pretreatment to reduce free phenolic compounds through converting it to combined phenolic compound which resulted in reducing their toxicity and in turn improved the tissue culture parameters. These results are in harmony with the findings of EL-Hadidy (2005) found that cold treatment of Marianna plum rootstock for 3 days was very effective in reducing phenolic compounds accumulation and encouraging in increasing explant development and reducing necrosis and browning.

Table (2) Effect of cold pre-treatment on callus development and growth parameters of peach rootstocks (Nemagaurd & Okinawa)

Table (2-A) Effect of rootstock type

Parameters Rootstock type	Necrosis	Browning	explant development	Callus production
Nemagaurd	1.47 A	1.63 A	4.34 A	4.03 A
Okinawa	1.58 A	1.73 A	4.11 B	3.92 A

Table (2-B) Effect of cold pre-treatment

Parameters cold Pre-treatment (days)		Browning	explant development	Callus production
Control (0.00)	1.50 AB	1.83 A	3.93 B	3.88 B
3	1.33 B	1.42 B	4.50 A	4.33 A
5	1.73 A	1.80 A	4.25 A	3.72 B

Means of cold pretreatment followed by the same letter(s) within each column are not significantly different at 1% level.

Table (2-C) Effect of interaction between peach rootstocks and cold pre-treatment

Parameters	Necr	osis	Brow	ming	exp develo		Call produ	
Rootstock type cold Pre- treatment(days)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control	1.33	1.67	1.70	1.97	3.93	3.93	3.93	3.83
	A	A	BC	A	C	C	B	BC
3	1.33	1.33	1.33	1.50	4.67	4.33	4.33	4.33
	A	A	D	CD	A	AB	A	A
5	1.73	1.73	1.87	1.73	4.43	4.07	3.83	3.60
	A	A	AB	ABC	AB	BC	BC	C

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.I.A.1.3. Effect of auxin type

The data in Table (3) and photo (1) show that the effect of auxin type on necrosis, explant development and callus production parameters of two peach rootstocks. It is clear from Table (3-A) state that statistical differences were lacking between Nemagaurd and Okinawa rootstocks when necrosis,

explant development and callus production parameters were concerned. This means that rootstock type had no effect on different parameters under study. Meanwhile, Table (3-B) shows that Indole-3-butyric acid (IBA) significantly surpassed both NAA and 2,4-D in increasing callus production and reduced necrosis. On the other hand, both IBA and NAA were significantly increased explant development compared with 2,4-D.

Regarding the interaction between peach rootstocks and auxin type. It is clear from Table (3-C) that IBA supplementation to the culture medium in combination with Nemagaurd peach rootstock explant succeeded in reducing necrosis and significantly increase callus production as compared with the other combinations. Meanwhile, either IBA or NAA in combination with either peach rootstocks explant enhanced explant development parameter.

Table (3) Effect of Auxin type on explant development and callus production parameters of peach rootstocks (Nemagaurd & Okinawa)

Table (3-A) Effect of rootstock type

Parameters Rootstock type	Necrosis	Explant development	Callus production	
Nemagaurd	2.48 A	3.04 A	3.67 A	
Okinawa	2.56 A	2.82 A	3.11 A	

Table (3-B) Effect of Auxin type treatments

Parameters Auxin type	Necrosis	Explant development	Callus production	
IBA	1.72 C	3.77 A	5.00 A	
NAA	1.95 B	3.62 A	3.33 B	
2,4-D	3.88 A	1.42 B	1.83 C	

Means of auxin type followed by the same letter(s) within each column are not significantly different at 1% level.

Table (3-C) Effect of interaction between peach rootstocks and Auxin type

Parameters	Necrosis			lant pment	Callus production		
Rootstock type Auxin type	73	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	
IBA	1.70 D	1.73CD	3.80 A	3.73 A	5.67 A	4.33 AB	
NAA	1.93 BC	1.97 B	3.67 A	3.57 A	3.33 BC	3.33 BC	
2,4-D	3.80 A	3.97 A	1.67 B	1.17 C	2.00 CD	1.67 D	

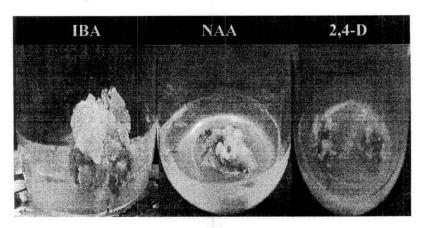


Photo (1) Effect of auxin type on callus production parameter of peach rootstocks (Nemagaurd & Okinawa)

4.1.I.A.1.4. Effect of auxin concentration

Table (4) and Fig (2) verifies the effect of different IBA concentrations on necrosis, explant development and callus production of two peach rootstocks. It is clear from Table (4-A) that statistical differences were lacking between Nemagaurd and Okinawa rootstocks when necrosis, explant development and callus production parameters were concerned. This means that rootstock type has no effect on different parameters under study.

Meanwhile, Table (4-B) verifies that supplementation of culture medium with 3.0 mg/L IBA caused a significant increase of callus production. While addition of either 2.0 or 3.0 mg/L IBA concentration significantly increased explant development in relation to the others.

Regarding the interaction between peach rootstocks and IBA concentrations. It is clear from Table (4-C) that inclusion of IBA at 3.0 mg/L level to the culture medium in combination with Nemagaurd peach rootstock explant resulted in a reduction of necrosis. However, using of 3.0 mg/L IBA combined with either one of the two peach rootstocks had significantly maximized explant development and callus production as compared with the other combinations.

Table (4) Effect of different concentration of IBA on explant development and callus production parameters of peach rootstocks (Nemagaurd & Okinawa)

Table (4-A) Effect of rootstock type

Parameters Rootstock type	Necrosis	Explant development	Callus production	
Nemagaurd	1.497 A	3.483 A	3.100 A	
Okinawa	1.592 A	3.475 A	2.967 A	

Means of rootstocks followed by the same letter(s) within each column are not Significantly different at 1% level.

Table (4-B) Effect of IBA concentrations

Parameters IBA Conc. (mg/L)	Necrosis	Explant development	Callus production	
Control (00.00)	1.962 A	2.650 C	1.283 D	
1.00	1.467 B	3.533 B	2.350 C	
2.00	1.433 B	3.817 A	3.933 B	
3.00	1.317 B	3.917 A	4.567 A	

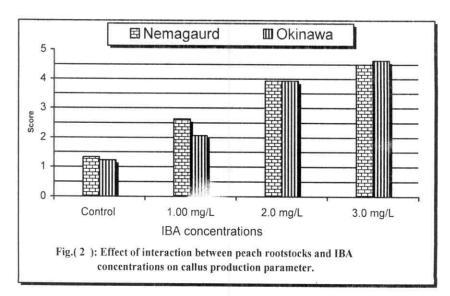


Table (4-C) Effect of interaction between peach rootstocks and IBA concentrations

Parameters	Necrosis			lant pment	Callus production	
Rootstock type IBA Conc. (mg/L)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control (00.00)	1.89	2.03	2.70	2.60	1.33	1.23
	A	A	D	D	E	E
1.00	1.50	1.43	3.47	3.60	2.63	2.07
	B	BC	C	BC	C	D
2.00	1.37	1.50	3.83	3.80	3.93	3.93
	BC	B	AB	AB	B	B
3.00	1.23	1.40	3.93	3.90	4.50	4.63
	C	BC	A	A	A	A

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.I.A.1.5. Effect of additives.

Data in Table (5) and photo (2) point out the effect of different additives on explant development and growth parameters of peach rootstocks. It is clear from Table (5-A) that statistical differences disappeared between Nemagaurd and Okinawa rootstocks when necrosis, explant development and callus production parameters were concerned.

Meanwhile, Table (5-B) clarify that both adenine sulphate (80 mg/L) and yeast extract (300 mg/L) treatments encouraged a significant increase in callus production parameter and statistically reduced necrosis as compared with the other additive

treatments. Meanwhile, explant development was significantly increased when Asparagine (200 mg/L) was added to the culture medium as compared with the other treatments.

Regarding the interaction between peach rootstocks and additives. Table (5-C) indicates that culturing of either peach rootstocks on a medium containing Asparagine (200 mg/L) encouraged a significant increase in explant development as compared with the other combinations. Meanwhile, culturing of either Nemagaurd or Okinawa rootstock on the medium supplemented with adenine sulphate (80 mg/L) or yeast extract(300 mg/L) enhanced the highest significant increase in callus production and statistically reduced necrosis as compared with the other interactions.

The aforementioned results clarify that either addition of adenine sulphate or yeast extract was more effective in improving callus production of both peach rootstocks. Also, culturing of either Nemagaurd or Okinawa rootstock explant on medium supplemented with Asparagine encouraged the highest explant development.

Table (5) Effect of different additives on explant development and callus production parameters of peach rootstocks (Nemagaurd & Okinawa)

Table (5-A) Effect of rootstock type

Parameters Rootstock type	Necrosis	Explant development	Callus production
Nemagaurd	1.81 A	3.04 A	2.56 A
Okinawa	1.89 A	2.97 A	2.53 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

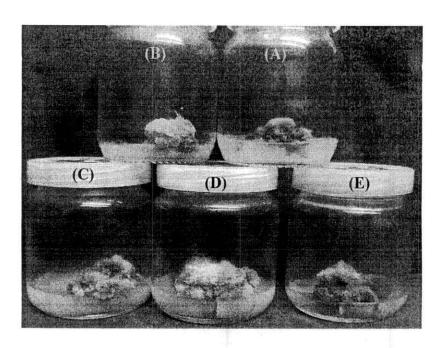
Table (5-B) Effect of additives treatments

Parame Additives (mg/L)	ters Necrosis	Explant development	Callus production
Control (0.00)	1.85 C	4.10 B	1.50 B
Glutamine (200)	2.07 B	3.83 C	1.65 B
Asparagine (200)	1.67 CD	4.63 A	1.43 B
Adenine sulphate (80)	1.58 D	1.82 E	4.65 A
Yeast extract (300)	1.57 D	2.23 D	4.58 A
Casin hydrolysate (100)	2.38 A	1.40 F	1.45 B

Means of additives followed by the same letter(s) within each column are not significantly different at 1% level.

Table (5-C) Effect of interaction between peach rootstocks and additives

Parameters	Necr	rosis	Explant de	velopment	Cal produ	
Rootstock type Additives (mg/L)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control (0.00)	1.80 CD	1.90 BC	4.13 B	4.07 B	1.50 B	1.50 B
Glutamine (200)	2.00 BC	2.13 AB	3.83 B	3.83 B	1.67 B	1.63 B
Asparagine (200)	1.53 D	1.80 CD	4.67 A	4.60 A	1.47 B	1.40 B
Adenine sulphate (80)	1.60 D	1.57 D	1.90 DE	1.73 EF	4.70 A	4.60 A
Yeast extract (300)	1.53 D	1.60 D	2.37 C	2.10 CD	4.70 A	4.47 A
Casin hydrolysate (100)	2.40 A	2.37 A	1.33 G	1.47 FG	1.33 B	1.57 B



A= Control (00.00 mg/L) B= Asparagine (200 mg/L)

C= Adenine sulphat (80 mg/L)
D= Yeast extract (300 mg/L)

E= Casin hydrolysate (100 mg/L)

Photo(2):Effect of different additives on explant development and callus production parameters of peach rootstocks (Nemagaurd & Okinawa)

4.1.I.A.1.6. Effect of callus storage.

Data in Table (6) and photo (3) explain the effect of storing callus to different periods on necrosis, callus type, regeneration, callus size, colour and No. of globules. It appears from Table (6-A) that statistical differences between Nemagaurd and Okinawa rootstocks were nil with regard to all parameters under study (i.e. necrosis, callus type, regeneration, No. of

globules, size and color). However, Table (6-B) verifies that there were a direct relationship between storage periods and necrosis, smooth callus and regeneration parameters that these parameters were increased by increasing storage periods. However, the reverse was true with regard to globular callus, number of globules/callus as well as size and colour of callus produced. Besides, Table (6-C) indicates that storing of Nemagaurd callus or Okinawa callus for 4 or 6 months showed a significant increase in necrosis, smooth callus and regeneration ability. On the other hand, combinations of either Nemagaurd or Okinawa rootstock with 2 month storage period resulted in increasing globular callus, number of globules, callus size and callus colour as compared with the other combinations.

Table (6):Effect of storage callus on callus characteristics of some peach rootstock plantlets.

Table (6-A) Effect of rootstock

Parameters		Callus	type		No. of	Size	Colour
Rootstock type	Necrosis	Globular	smooth	Regeneration	Globules		BONT SPECE
Nemagaurd	2.44 A	3.62 A	1.49 A	3.00 A	4.25 A	3.25 A	2.67 A
Okinawa	2.51 A	3.56 A	1.53 A	3.00 A	4.25 A	3.08 A	2.67 A

Table (6-B) Effect of storage periods.

Parameters		Callus	type		No. of	Size	Colour
Storage periods (month)	Necrosis	Globular	smooth	Regeneration	Globules	L. CHOCKE	
Control (fresh callus)	1.15 D	4.80 A	1.32 C	1.83 B	7.00 A	4.67 A	4.33 A
2	1.48 C	3.92 B	1.47 B	2.17 B	4.17 B	3.17 B	2.83 B
4	2.97 B	2.97 C	1.62 A	3.67 A	3.33 BC	2.50 B	2.00 C
6	4.30 A	2.67 D	1.63 A	4.33 A	2.50 C	2.33 B	1.50 C

Means of storage periods followed by the same letter(s) within each column are not significantly different at 1% level.

Table (6-C) Effect of interaction between rootstocks and storage periods.

Parameters	Nec	rosis		SHOWING NO. 1	s type		Reger	neration	N 2002/05	o. of	S	ize	Co	lour
			Glob	oular	sm	ooth			Glo	bules	(sc	ore)	(sc	ore)
Rootstock type Storage periods (month)		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control	1.13	1.17	4.83	4.77	1.30	1.33	1.67	2.00	7.00	7.00	4.67	4.67	4.33	4.33
(fresh callus)	D	D	A	A	C	C	B	B	A	A	A	A	A	A
2	1.47	1.50	3.93	3.90	1.43	1.50	2.33	2.00	4.33	4.00	3.33	3.00	2.67	3.00
	C	C	B	B	BC	ABC	B	B	B	BC	B	B	BC	B
4	2.90	3.03	3.00	2.93	1.63	1.60	3.67	3.67	3.33	3.33	2.67	2.33	2.00	2.00
	B	B	C	C	AB	AB	A	A	BCD	BCD	B	B	BCD	BCD
6	4.27	4.33	2.70	2.63	1.60	1.67	4.33	4.33	2.33	2.67	2.33	2.33	1.67	1.33
	A	A	D	D	AB	A	A	A	D	CD	B	B	CD	D

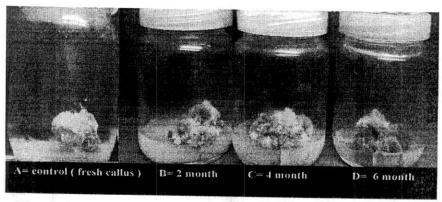


Photo (3): Effect of storing callus on callus characteristics of some peach rootstock plantlets

4.1.I.A.2. Plantlet regeneration (Hormonal balance).

Data of Table (7) and Photo (4) reflect the effect of hormonal balance on No. of regenerated plantlet, and growth parameters of some peach rootstocks (Nemagaurd &Okinawa). It is clear from Table (7-A) that the significant differences among the two peach rootstocks were nil when necrosis, growth, No. of regenerated plantlets and greening parameters were concerned. Moreover, Table (7-B) shows the effect of IBA concentrations, the growth and greening significantly were increased when 0.0 mg/L (control) or 3.0 mg/L IBA was added to cultured medium in relation to the other IBA concentrations. Meanwhile, No. of regenerated plantlets was significantly increased when the medium was supplemented with 2.0 mg/L IBA. On the other hand, necrosis parameter was not statistically affected by different concentrations of IBA.

Table (7-C) shows the Effect of 6-Benzylaminopurine (BAP) concentrations on growth and number of regenerated plantlets of some peach rootstocks. It is clear that supplement of the culture medium with BAP at 1.0 mg/L maximized growth and greening significantly while only 3.0 mg/L level significantly increased number of regenerated plantlets in relation to the other concentrations under study. On the other hand, supplemented culture medium with 4.0 mg/L BAP maximized necrosis significantly.

Dealing with the interaction between peach rootstocks and different concentrations of IBA, Table (7-D) reflect that culturing of two peach rootstocks on culture medium supplemented with 0.0 mg/L or 3.0 mg/L IBA encouraged a significant increase in growth and greening parameters as compared with the other interactions. However, the lowest significant necrosis was noticed when combination of Nemagaurd explant and 0.5 or 2.0 mg/L IBA were used in comparison with the other combinations. Also, No. of regenerated plantlets was significantly increased when the two explants peach rootstocks were cultured on medium supplemented with 2.0 mg/L IBA.

Thus, the previous results indicate that IBA at low and high concentrations (0.0 and 3.0 mg/L) improved growth and greening. While, 2.0 mg/L IBA enhanced No. of regenerated plantlets.

Moreover, Table (7-E) pointed out the effect of the interaction between the two peach rootstocks and BAP concentration. It is quite evident that growth and greening parameters recorded a significant increase when both Nemagaurd and Okinawa rootstocks were cultured in combination with 1.0 mg/L BAP concentration. Meanwhile, using BAP (3.0 mg/L) for both Nemagaurd and Okinawa rootstocks resulted in significantly maximizing in No. of

regenerated plantlets in relation to the other combinations. However, Necrosis was statistically increased when Okinawa explant was used in combination with BAP at (4.0 mg/L or 4.0 mg/L) in the medium.

These results verified that both peach rootstocks (Nemagaurd and Okinawa) are preferred when cultured on medium received 3.0 mg/L BAP concentration. and maximize No. of regenerated plantlets parameter.

Dealing with the interaction between IBA and BAP concentrations, Table (7-F) reveals that supplementation of the culture medium with a combination of 1.0 mg/L cytokinin (BAP) and either 0.0, 0.5 or 1.0 mg/L auxin encouraged a significant increase in growth and greening parameters. However, No. of regenerated plantlet parameter was maximized significantly by using either 3.0 mg/L cytokinin (BAP) or 0.0, 0.5 and 1.0 mg/L auxin in the culture medium. On the other hand, significant differences between auxin and cytokinin concentrations were nil when necrosis parameter was concerned.

Regarding to the interaction between IBA, BAP and peach rootstocks, it appears from Table (7-G) that either Nemagaurd or Okinawa peach rootstocks combined with 3.0 mg/L BAP and either 0.0, 0.5 or 2.0 mg/L IBA concentrations encouraged a significant increase in growth and greening

parameters. However, No. of regenerated plantlet parameter was maximized significantly by using either 2.0 mg/L cytokinin (BAP) or 0.0, 0.5 and 1.0 mg/L auxin in the culture medium combined with the two peach rootstocks. On the other hand, statistical differences between auxin, cytokinin concentrations and peach rootstocks were nil when Necrosis parameter was concerned

Table (7) Effect of hormonal balance on No. of regenerated plantlet and growth parameters of some peach rootstocks

Table (7-A) Effect of rootstock type

Parameter Rootstock type	Necrosis	Growth	No. Of regenerated plantlet	Greening
Nemagaurd	1.54 A	3.91A	2.38 A	3.64 A
Okinawa	1.69 A	3.85 A	2.53 A	3.62 A

Means of rootstocks followed by the same letter(s) within each column are not Significantly different at 1% level.

Table (7-B) Effect of IBA concentrations

Parameters IBA conc. (mg/L)	Necrosis	Growth	No. Of regenerated plantlet	Greening
Control (0.00)	1.55 A	4.57 A	1.40 D	4.40 A
0.5	1.52 A	4.05 B	1.92 C	3.92 B
1.00	1.68 A	3.47 C	1.15 B	3.17 C
2.00	1.55 A	2.63 D	4.52 A	2.22 D
3.00	1.77 A	4.67 A	1.28 D	4.45 A

Table (7-C) Effect of BAP concentrations

Parameter BAP conc. (mg/b)	C)	Growth	No. Of regenerated plantlet	Greening
Control (00.00)	1.75 C	4.10 B	1.63 C	3.98 B
1.00	1.55 C	4.75 A	1.60 CD	4.52 A
2.00	1.55 C	4.20 B	1.40 D	4.20 B
3.00	2.65 B	1.38 D	2.97 A	2.32 D
4.00	3.45 A	1.20 D	1.63 C	1.23 E

Means of BAP followed by the same letter(s) within each column are not significantly different at 1% level.

Table (7-D) Effect of interaction between peach rootstocks and IBA concentrations

Parameters	Necr	osis	Gro	wth	regen	. Of erated ntlet	Gree	ning
Rootstock type IBA conc.(mg/D)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control (0.00)	1.50	1.60	4.63	4.50	1.33	1.47	4.50	4.49
	AB	AB	A	A	E	E	A	A
0.5	1.43	1.60	4.07	4.03	1.90	1.93	3.97	3.87
	B	AB	B	B	D	D	BC	C
1.00	1.67	1.70	3.50	3.43	3.03	3.27	3.17	3.17
	AB	AB	C	C	C	C	D	D
2.00	1.40	1.83	2.70	2.57	4.65	4.70	2.07	2.37
	B	A	D	D	A	A	E	E
3.00	1.70	1.70	4.63	4.70	1.30	1.27	4.50	4.48
	AB	AB	A	A	E	E	A	A

Table (7-E) Effect of interaction between peach rootstocks and BAP concentrations

Parameters	Necr	osis	Gro	wth	Regen	. Of erated ntlet	Gree	ning
Rootstock type BAP conc. (mg/L)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control (00.00)	1.70	1.80	4.07	4.13	1.70	1.57	4.03	3.93
	D	D	B	B	C	CD	BC	C
1.00	1.50	1.60	4.80	4.70	1.50	1.70	4.53	4.50
	D	D	A	A	CD	C	A	A
2.00	1.60	1.50	4.30	4.10	1.30	1.50	4.13	4.27
	D	D	B	B	D	CD	BC	AB
3.00	2.70	2.60	1.50	1.27	2.87	3.07	2.13	2.50
	C	C	D	DE	A	A	F	E
4.00	3.20	3.70	1.07	1.33	1.71	1.30	1.23	1.23
	B	A	E	DE	C	D	G	G

Table (7-F) Effect of interaction between IBA and BAP concentrations

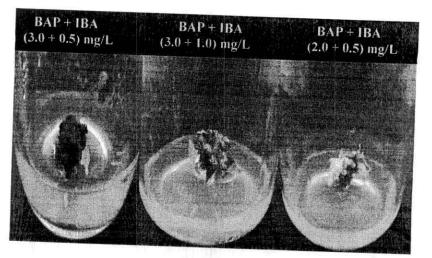
	۱				-					\vdash		٤	90							
Parameters		ě	Necrosis				J	Growth			윤	on elements	no. on Regenerated plantlet	ıntlet			5	Greening	4 000	
nc (mg/L)	0000	50	961	200	3.00 00.0	2 0	0.5	8	1.00 2.00 3.00	3.00	0000	0.5	1.00 2.00 3.00 00.00	2.00	300 0	000	92	1.00	2.00	300
0000 0000	155	₹ 4	155 154 157 1.66 1.60 1.23 2.45	99. ⊲	1.60 A	12 H	_	233 E	236 E	153 F	128 F	138 F	82 4	1.43 1.43 4.46 F F A	1.43 F	4.46 A	1.43 F	123 F	123 F	143 F
130	c 🖺 🔻	1 2 V	1.66	1.70 A		4.46 A	~~	100	233 E	<u>ج</u> ہے	1.43 F	233 E	234 E	224 E	1.43 F	4.46 A	453 A	453 A	433 AB	224 E
200	G 88 4	1.65 A	1.75	: SI		1.45 F		233 E	224 E	1.45 F	425 AB	38 B	3% B	234 E	E T	423 AB	4.10 B	233 E	224 E	표 표
330	152 A	: 2 4	1.77 A	1.68 A	E3 4	٣뇨	430 AB	224 E	389 B	2.07 E	4.46 A	4.46 A	453 A	ш %	430 AB	430 2.45 AB D	2.45 D	2.45 D	E 33	233
4.00	1.75 A	LS:	1.63 A	## W	2 . ★	130 F	323 C	389 B	425 AB	234 E	423 AB	425 AB	435 AB	224 E	123 F	ᄦᅼ	F. F.	₩. ₩.	45. F	F 139

Table (7-G-a) Effect of interaction between peach rootstocks, IBA and BAP

Parameters					Nec	Necrosis					L				2			l		
r.	L	1		1			1				1				5	Growth				
Kootstock Type		Ž	Nemagaurd				_	Okinawa	1/3			~	Nemagaurd	nm				Okinawa	173	
BA conc (mg/L)																L				
ava	000	0.5	1,00	2.00	300	000	0.5	1.00	200	3.00	000	0.5	1,00	2.00	300	900	0.5	1.00	200	300
DAT CORC. (Mg/L)																				
0000	153	m	1.77	0	157	-	27.	1.57		1.60	130	2.26	1.29	133	223	1.23	2.45	2.23	3.26	1.30
	ď	ď	ď	eC.	⊲C	Æ	Æ	ď	Ą	₹	ĽĽ,	(±)	[Z-j	Ex.		[I,	D	(T)	(F)	i tr
1.00	152	2 <	1.73	89.4	2.	1.77	1.78	1.66	1.70	1.70	138	233	133	1.45	233	13	4.10	233	233	- 3
	q S	c i	c :	aC,	ď	ď	≪C	₩.	≪.	≪;	Ez,	ഥ	124	ĽŦ.	[1]	[24	щ	(±)	E	124
2.00			1.65 A	₹3 ×	1.75	1.68	1.65	1.75	<u>5</u>	· 55	1.43	2.24	1.45	423	130	1.43	423	423	2.24	145
	: :	-	c	¢	c	c	«;	a;	eC;	⋖	_	(1)	124	AB	[X4	[II.	AB	AB	[11]	[±,
3.00	132	_	를 -	.68	1.77	152	욹.	1.77	1.68	2	138	90	4.33	4.46	1.43		4.46	453	446	2012
		oC	-	aC.	⊲C	-	-QC	≪	⋖	Ą	Lr.	⊲C	Ą	-4ζ	[14	[II.	⊲ C	⊸C	2: ⊲C	ें मा
4.00	1.75	23	-	173	1.63	40	155	1.63	1.77				-	3.23		1	3.73	33	301	224
		4;	Ą	<.	√C	~ C	⊸c	-aC	⊲5	₩.	Ez.	AB	[T]	ی	fr.	į įz.	10	3 12	4 d	707

Table (7-G-b) Cont.

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Parameters		A	2	5	No. UI Regenerateu piaturei	aica p	ignine:			+		2		7		1	2	Okinawa		Γ
Rontstock Type		Nem	Nemagaurd	P	-		ð	Okinawa	gi			e l	Nemagauru	₌	1		5		t	T
3	000	0.5	81	200	300	000	9	1.00	2.00	3.00 0) 00'0	50	81	2.00	3.00	00.0	90	901	2.00	3.00
BAP conc. (mg/D)										1	1	1	1		-	3	-	\$	Ş	4 43
0000	£45	430	423	1.20	138	82 12	1.43 F	1.43 F	1.43 F	표 표	E 33	224 E	표 표	233 E	1.43 F	F	Н	. 다	3 m	£ 124
			2 5	. 5	. 22	134	274	1.43	425	133	423	4.10	233	1.43	1.29	1.43	423	224	233	23
100]. 143	450 D	₹ r=	£ 12	<u>ქ</u> т.	<u>ұ</u> т	4 6 대	<u>.</u>	W H			Д	ĹΞĴ	ഥ	[II.	[Z.	AB B	121	.	ച .
		2		-	1			3	3	_	39 0	3,45	31/6	177	410	233	224	1.43	2.45	2.45
2.M	456	~~	4.46	425	138	450	₹ 7	4. 4. ⊲	2 . ⊲	4.30 AB	6 .7	f; 0	f o	品品		ഥ	E	[I.	Ω.	Ω.
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3.00	1.43	-	233	410	423	453	4.53	£ 4	4.23 A.B.	3 4	442 AB	9. ℃	ç 45	₹ <	ĝ o	<u>,</u> 0	. ⊲C	.≪C	Ą	ഥ
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!	133	133	433	423	425	425	2.24	•	133	-	143	1.25	2 1	Ž 1	3 12	<u>, r</u>	£ 12	वें प्र	<u> </u>	ഥ
4.00	[14	[34	AB BB	AB	AB	AB B	ŒÌ	. I.	퐈	ᆈ	14		4	-	•	4	-1			1



Photo(4): Effect of hormonal balance on No. of regenerated plantlet and growth parameters of some peach rootstocks

4.1.II.Salinity stress:

4.1.II.a.Direct regeneration:-

4.1.II.a.1. Evaluation of salt tolerance levels.

Table (8) and Photo (5) show the evaluation of *in vitro* growth parameters as affected by different salinity levels tolerated by some peach rootstock. Table (8-A) shows that Nemagaurd rootstock statistically surpassed Okinawa rootstock in maximizing No. of shoots, shoot length, root length and No. of roots. However, statistical differences were nil between Nemagaurd and Okinawa when necrosis, growth, shoot thickness and No. of leaves/plant were concerned. Meanwhile, Table (8-B) reflects that increasing NaCl & CaCl₂ levels induced

negative effect on most studied tissue culture parameters i.e. shoot length, number of shoots, number of leaves/plant, root length and number of roots where they were significantly reduced by increasing salinity in the culture medium. However, the reverse was true in case of both necrosis and shoot thickness parameters. Besides, NaCl had a great adverse effect than CaCl₂ concentration. It is clear that either 1000 ppm from NaCl or 1500 ppm of CaCl₂ in the culture medium tolerated by both rootstocks under study.

Table (8-C) and Fig (3) reflect the effect of interaction between rootstocks and salinity treatments on tissue culture parameters. It is clear that using of 500 ppm CaCl₂ in combination with Nemagaurd significantly showed less harmful effect on the most studied tissue culture parameters i.e. growth, shoot length, number of shoots, number of leaves/plant and root length in comparison with the other combinations. However, shoot thickness was increased significantly when CaCl₂ at 2000 ppm was used with Okinawa rootstock. The effect of different levels of CaCl₂ with both peach rootstocks were less toxic to the plants as compared with the similar levels of NaCl. Meanwhile, combination NaCl with CaCl₂ with both peach rootstocks reduced NaCl toxicity.

Table (8): Evaluation of *in vitro* growth parameters as affected by different salinity levels tolerated by some peach rootstock.

Table (8-A) Effect of rootstocks

Parameters Rootstock type	Necrosis	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of
Nemagaurd	2.88 A	2.69 A	3.49 A	2.87 A	0.22 A	3.51	2.06	4.67
Okinawa	2.92 A	2.64 A	3.13 B	2.71 B	0.24 A	3.36 A	1.94 B	4.10 B

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (8-B) Effect of salinity treatments

Parameters Salinity treatments (ppm)	Necrosis	Growth	No. of shoots	Shoot	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Control (0.00)	1.35	4.62 A	6.50 A	4.28 A	0.12 D	5.17 A	0.75 4	-
NaCI (500)	1.87 G	3.03 CD	5.00 B	3.77 B	0.15 CD	4.50 AB	2.75 A	9.50 A
NaCI (1000)	2.38 F	2.88 E	3.17 CD	2.92 D	0.13 GB		2.65 AB	7.50 B
NaCI (1500)	4.90 A	1.13	1.07 G	2.60 E	0.20 AB	3.50 CD 1.67 F	2.32 C	5.83 C
NaCI (2000)	4.97 A	1.00	1.00 G	1.65 G	0.20 AB	1.67 F	1.12 H	1.17
CaCl ₂ (500)	1.52 H	3.67 B	4.67 B	3.68 B	0.15 CD	4.17 BC	1.15 H	1.17
CaCl ₂ (1000)	1.95 G	3.08 C	3.33 C	3.07 C	0.217 BC		2.55 B	2.00 H
CaCl ₂ (1500)	3.45 C	2.38 F	2.50 DEF	2.68 E	0.27 AB	4.17 BC	2.32 C	2.50 GF
CaCl ₂ (2000)	3.83 B	2.15 G	2.17 EF	2.05 F	0.27 AB	3.17 D	1.93 E	5.67 C
laCl + CaCl ₂ 250 + 250)	2.75 E	3.07 C	5.17 B	2.98CD	0.517 A	3.17 D 4.17 BC	1.63 F 1.78 EF	4.00 DE
aCI + CaCI ₂ 500 + 500)	1.92 G	2.88 E	3.50 C	2.58 E	0.22 BC	3.17 D	1.72 F	3.83 DEI
aCI + CaCI ₂ '50 + 750)	2.92 D	2.90 DE	2.83 CDE	2.02 F	0.30 AB	2.83 DE	1.72 F	3.50 EFG
aCI + CaCI ₂ 000 + 1000)	3.97 B	1.62 H	2.00 F	1.78 G	0.33 A	2.17 EF	1.38 G	2.83 FGF

Table (8-C) Effect of interaction between rootstocks and salinity treatments

	155	cath								_				-		
Parameters	Necr	oses	Grov	wth	No. sho	W 100	Sho		Sho		No. leave pla	es/	Roo	5.576	No. roo	
Rootstock type Salinity Conc. (ppm)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
Control (0.00)	1.30 J	1.40 IJ	4.73 A	4.50 B	7.00 A	6.00 AB	4.33 A	4.23 A	0.13 DE	0.10 E	Α	5.00 AB	2.73 AB	Α	10.00 A	9.00 AB
NaCI (500)	1.93 H	1.80 H	3.13 D	2.93 DEF	5.33 BC	4.67 CDE	В	3.63 C	0.13 DE	0.17 CDE	BCD	4.67 ABC	2.73 AB	2.57 ABC	8.33 B	6.67 C
NaCI (1000)	2.20 G	2.57 F	2.93 DEF	2.83 F	3.33 FGH	3.00 FGHI	Е		0.20 BCDE		DEF	3.33 EFG	2.43 CD	2.20 DE	6.33 C	5.33 CDE
NaCI (1500)	4.90 A	4.93 A	1.11 J	1.14 J	1.00 K	1.00 K	2.70 GH	2.50 I	0.27 ABC	0.300 AB	2.00 IJ	2.22 HI	2.10 EF	2.13 EF	4.33 DEFG 1.00	3.33 FGHIJ 1.33
NaCI (2000)	4.93 A	4.97 A	1.10 J	1.07 J	1.00 K	1.00 K	JK	1.70 L	0.30 AB	0.27 ABC	2.00 IJ	1.33 J	1.17 M	1.13 M	L	KL
CaCl ₂ (500)	1.50 IJ	1.53 I	3.60 C	3.73 C	5.33 BC	4.00 DEF	3.80 B	3.57 C	0.17 CDE	0.133 DE	4.00 CDE	BCD	2.60 ABC	2.50 BC	2.00 JKL	2.00 JKL
CaCl ₂ (1000)	1.93 H	1.97 H	3.07 DE	3.10 D	3.33 FGH	3.33 FGH	3.17 D	2.97 EF	0.20 BCDE	0.23 ABCD		CDE	2.43 CD	2.20 DE	2.67 HIJK	2.33 IJKL
CaCl ₂ (1500)	3.40 C	3.50 C	2.30 GH	2.47 G	2.67 GHI	2.33 HIJ	2.77 G	2.60 HI	0.27 ABC	0.27 ABC	3.33 EFG	_	1.97 EFG	1.90 FGH	5.67 CD	5.67 CD
CaCl ₂ (2000)	3.80 B	3.87 B	2.17 H	2.13 H	2.33 HIJ	2.00 IJK	2.07 J	2.03 J	0.300 AB	0.33 A	3.00 FGH		1.73 GHIJK	1.53 JK	4.67 DEF	3.33 FGHIJ
NaCl + CaCl ₂ (250 + 250)	2.80 DE	2.70 EF	3.13 D	3.00 DEF	5.00 BCD	5.33 BC	3.03 DE	EF	0.133 DE	CDE	_	3.67 DEF	1.83 GHI	1.73 GHIJK	5.33 CDE	4.33 DEFG
NaCl + CaCl ₂ (500 + 500)	1.93 H	1.90 H	2.93 DEF		3.67 EFG	3.33 FGH	2.70 GH	1	0.20 BCDE	_	_	EFG		1.63 IJK	3.67 FGHI	4.00 EFGH
NaCl + CaCl ₂ (750 + 750)	2.93 D	2.90 DE	2.93 DEF	2.87 EF	3.00 FGH	2.67 GHI	2.07 J	J	0.27 ABC	0.333 A	GHI	-	_	1.67 HIJK	3.67 FGHI	_
NaCI + CaCI ₂ (1000 + 1000	11000	4.00 B	1.67 I	7 1.57 I	2.00 IJK	2.00 IJK	1.80 KL	1.77 L	0.33 A	0.33 A	2.33 HI	2.00 IJ	1.50 KL	1.27 LM	3.00 GHIJ	2.67 HIJK

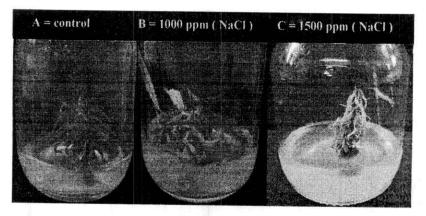
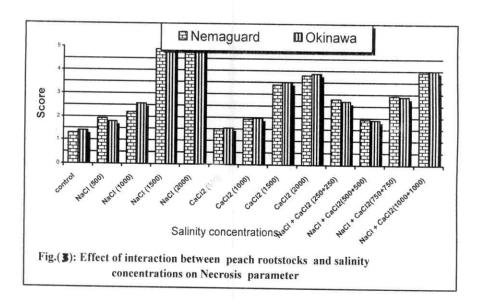


Photo (5): Evaluation of *in vitro* growth parameters as affected by different salinity levels tolerated by some peach rootstocks.



4.1.II.a.2. Induction of salt tolerance.

4.1.II.a.2.1. Tissue culture parameters.

It appears from Table (9-A) that values of shoot length, root length and number of roots of Nemagaurd were significantly

higher than those of Okinawa rootstock. However, both peach rootstocks exhibit significantly similar values when growth, number of shoots, number of leaves/plant and shoot thickness parameters were considered.

Table (9-B) clarifies that cultured explants were slightly affected without significance when NaCl concentrations increased from 1000 to 1500 ppm in the culture medium when most of tissue culture parameters (necrosis, growth, number of shoots, shoot length, shoot thickness and number of leaves/plant) were considered. However, continuous increase of NaCl concentrations up to 2500 ppm induced the worst effect as necrosis dominated most of explants and considered as lethal dose of NaCl in the culture medium.

Table (9-C), Photo (6) and Fig (4) reveal that Nemagaurd rootstock combined with NaCl concentrations significantly surpassed Okinawa rootstock combined with the same NaCl concentrations in tolerating the adverse effect of NaCl and this appeared in improving all parameters except necrosis which decreased. Meanwhile, the interaction between peach rootstocks and 2500 ppm of NaCl failed to show statistical increase in necrosis and dominated most of explants.

The above mentioned results concluded that salinity inserted a worthy results on most studied tissue culture

parameters. This is true as a result of the bad effect of salinity on free water and nutritional status available to the *in vitro* plantlets and in turn induced a negative response on tissue culture parameters. These negative effects were increased with increasing salt concentration in the medium. These results are in general agreement with the findings of (Tewary, et. al., 2000) On mulberry and (Abd EL-Rahman, et. al., 2007) on pear. They found that salinity affected shoot number, shoot length, leaf number and survival percentage.

Table (9): Effect of gradual increase of NaCl levels on growth parameters of direct regenerated some peach rootstock plantlets.

Table (9-A) Effect of rootstocks

Parameters Rootstock type	Necrosis	Growth	No. of shoots	Shoot length	Shoo thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.35	2.17	2.13	2.19	0.29	2.53	1.77	3.80
	B	A	A	A	A	A	A	A
Okinawa	3.48	2.08	2.00	2.09	0.25	2.40	1.68	3.20
	A	A	A	B	A	A	B	B

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (9-B) Effect of salinity treatments

Parameters NaCI Conc. (ppm)	Necrosis	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
1000	2.38 C	2.87 A	3.17 A	2.92 A	0.22 B	3.50 A	2.32 A	5.83 A
1500	2.42 C	2.87 A	2.67 AB	2.85 A	0.25 AB	3.17 A	2.17 B	4.83 B
2000	2.65 B	2.35 B	2.33 B	2.65 B	0.28 AB	2.17 B	1.92 C	3.67 C
2500	4.98 A	1.03 D	1.00 C	1.03 C	0.25 AB	1.20 B	0.53 D	1.07 D

Table (9-C) Effect of interaction between rootstocks and NaCl treatments

Parameters	Necr	osis	Grov	vth	No. shoc	(C)(XX 1)	Sho leng		Sho thickn		No. leave pla	es /	Roo		No.	3/2 m
Rootstock type NaCl Conc. (ppm)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
1000	2.20 D	2.57 BC	2.90 A	2.83 A	3.33 A	3.00 AB	3.00 A	2.83 BC	0.23 AB	0.20 B	3.67 A	3.33 AB	2.43 A	В	6.33 A	AB
1500		2.43 BCD	2.93 A	2.80 A	2.67 AB	2.67 AB	2.93 AB	2.77 C	0.27 AB	0.23 AB	3.33 AB	3.00 ABC	2.17 B	2.17 B	5.33 AB	BC
2000	2.60 BC		2.40 B	2.30 B	2.33 B	2.33 B	2.70 CD	2.60 D	AB	AB	2.33 BCD	2.00 CD	1.93 C	С	С	С
2500	4.97 A	4.95 A	1.03 D	1.03 D	1.00 C	1.00 C	1.02 F	1.10 EF	0.23 AB	0.24 AB	1.33 D	1. 33 D	0.83 E	0.87 E	1.00 D	1.00 D

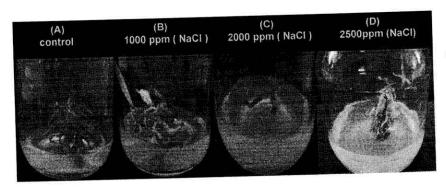
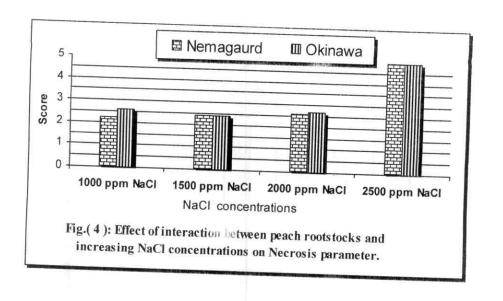


Photo (6): Effect of gradual increase of NaCl levels on growth parameters of direct regenerated some peach rootstock plantlets.



4.1.II.a.2.2. Chemical parameters.

Table (10-A) indicates that Okinawa rootstock statistically surpassed Nemagaurd rootstock in total sugars contents. However, statistical differences were nil between Nemagaurd and Okinawa rootstocks when chlorophyll (A), chlorophyll (B), total indoles, total phenols and proline were considered.

Meanwhile, Table (10-B) shows that there were an indirect relationship between increase of NaCl concentrations and increase in different parameters under study except total phenol and proline contents, It appears that chlorophyll (A), chlorophyll (B), total sugars and total indoles were statistically increased when lower levels of NaCl (1000 ppm) was added to the medium. However, supplementation of the culture medium

with higher concentrations up to 3000 NaCl ppm caused a significant increase in total phenols and proline in relation to the other NaCl concentrations.

Moreover, the interaction between peach rootstocks and NaCl concentrations are tabulated in Table (10-C). It is clear that culturing of either Nemagaurd or Okinawa rootstock on medium containing 1000 ppm NaCl encouraged the highest significant increase of chlorophyll (A)&(B), total indoles and total sugars parameters compared with other combinations under study. However, increasing the NaCl concentration up to 3000 ppm significantly induced higher total phenols and proline levels in relation to the other combinations.

In general, the before mentioned results indicate that increasing NaCl concentrations had an adverse effect on chlorophyll (A) & (B), total indoles and total sugars while both total phenols and proline contents were maximized. These may be due to the effective role of these components in increasing tolerance to salinity and these confirm the findings of **Bondok,et al (1996)**. They stated that irrigation of Florida prince peach with saline water contained NaCl, CaCl₂, and MgCl at concentrations from 1000 to 4000 ppm induced an increase in proline contents. Also, The findings of **Abo EL- khashab** (1997) showed that a decrease in chlorophyll (A) & (B) and

carotene occurred in olive and peach seedlings when irrigated with saline water.

Table (10): Effect of gradual increase of NaCl levels on chemical parameters of direct regenerated some peach rootstock plantlets.

Table (10-A) Effect of rootstock

Parameters Rootstock type	Chlorophyll (A)	Chlorophyll (B)	Total sugars	Total indoles	Total phenol	Proline
Nemagaurd	2.58 A	3.17 A	9.41 B	1 70 A	10.15	-
Okinawa	2.58 A	3.17 A			13.17 A	1.63 A
feans of rootstocks for			9.62 A	1.75 A	13.19 A	1.65 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (10-B) Effect of salinity treatments

Parameters NaCl Conc. (ppm)	Chlorophyll (A)	Chlorophyll (B)	Total sugars	Total indoles	Total phenol	Proline
1000	6.24 A	7.29 A	12.00			
1500	4.38 B		12.09 A			0.155 E
2000	2.27 C	3.28 C		2.22 B	11.29 D	0.80 D
2500	0.01 D		9.39 C	1.91 C	12.25 C	1.58 C
eans of NaCl conc		0.01 D	7.26 E	0.88 E	17.25 A	3.32 A

Means of NaCl concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (10-C) Effect of interaction between rootstocks and NaCl treatments

Parameters	Chloro (A		Chloro (B)		Total s	ugars	Tot indo		Total p	henol	Prol	ine
Rootstock type NaCl Conc. (ppm)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
1000	6.24 A	6.25 A	7.29 A	7.30 A	12.03 A	12.15 A	2.56 A	2.50 A	10.29 E 11.3	10.29 E 11.2	0.16 E 0.78	0.15 E 0.82
1500	4.40 B	4.35 B	5.29 B	5.25 B	10.41 B	10.4 B	2.25 B	2.20 B 1.91	11.3 D 12.2	D 12.2	D 1.55	D 1.60
2000	2.25 C	2.30 C	3.28 C	3.29 C	С	9.50 C 7.29	1.90 C 0.91	C 0.87	C 17.18	C 17.31	C 3.32	3.3
2500	0.01 D	0.01 D	0.01 D	0.01 D	7.23 F	7.29 F	0.91 E	E	A	Α	Α	Α

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.II.b. Indirect regeneration

4.1.II.b.1. Evaluation of salt tolerance levels.

Table (11) and Photo (7) show the evaluation of growth parameters of *in vitro* regenerated plantlets from stored callus as affected by different salinity levels tolerated by some peach rootstock. It is clear from Table (11-A) that peach rootstocks (Nemagaurd & Okinawa) failed to induce significant differences when necrosis, growth, number of shoots, shoot length, shoot thickness, number of leaves/plant and number of roots were considered. Also, Nemagaurd rootstock statistically surpassed Okinawa rootstock in maximizing root length. Moreover, Table (11-B) clarifies that increasing levels of salinity induced a statistical negative effect on most tissue culture parameters.

Meanwhile, CaCl₂ treatments gave less adverse effect than NaCl treatments at the same salinity levels. It is clear from Table (11-C) and Fig (5) that the highest shoot thickness was obtained when Okinawa explants was cultured on a medium containing 1000 ppm of NaCl + 1000 ppm of CaCl₂. However, the best root length was appeared when combination of Nemagaurd rootstock and 500 ppm CaCl₂ was used compared with the other concentrations under study.

Table (11):Evaluation of growth parameters of *in vitro* regenerated plantlets from stored callus as affected by different salinity levels tolerated by some peach rootstock.

Table (11-A) Effect of rootstocks

Parameters Rootstock type	Necrosis		No. of shoots		Shoot thickness	No. of leaves / plant	Root length	
Nemagaurd	2.54 A	2.98 A	3 95 A	3 13 A	0.30 A	2.40.4	2 0 4 4	
Okinawa	2.55 A	2.95 A	3.80 A	3.13 A	0.30 A 0.33 A	3.49 A 3.59 A	2.04 A 1.99 B	

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

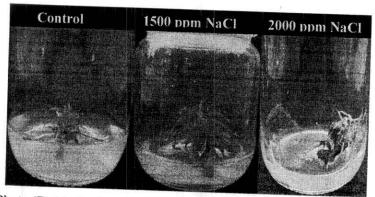


Photo (7): Evaluation of growth parameters of *in vitro* regenerated plantlets from stored callus as affected by different salinity levels tolerated by some peach rootstock.

Table (11-B) Effect of salinity treatments

) Elle	ct of se	anning					
		No. of	Shoot	Shoot	No. of leaves / plant	Root length	No. of roots
	4 70 A	7.67 A	4 37 A	0.15 H	6.00 A	2.35 B	8.00 A
			413000000000000000000000000000000000000		5.00 BC	2.20 C	6.83 B
		C/ / C/ D/C				1.98 DE	5.50 C
						1.72 G	4.00 DE
			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				2.83 FG
0.02200.000		1. Andrones sour				2.57 A	2.50 FGH
						2.32 BC	1.83 HIJ
1.83 H	5.822						1.17 J
2.45 E			_			Compression control	1.17 J
3.18 C	1.92	1.83 F	2.05	0.40 DC			4 00 D
2.50 E	2.57 G	4.50 D	3.27 E	0.18 GH	5.50 AB	2.42 B	4.33 D
2.83 D	2.12 H	3.00 E	2.75	0.30 DEF	2.67 EF	2.03 D	3.33 EF
3.13 C	1.88	2.17 F	2.08	0.38 BCI	2.00 FC	1.77 FC	2.17 GH
3.77 B	1.68	1.00 G	1.85	J 0.500 A	1.50 G	1.35	1.50 IJ
	1.20 J 1.80 H 2.03 G 2.22 F 4.50 A 1.62 I 1.83 H 2.45 E 3.18 C 2.50 E 2.83 D	1.20 J 4.78 A 1.80 H 4.18 B 2.03 G 3.92 C 2.22 F 3.67 D 4.50 A 1.38 K 1.62 I 3.95 C 1.83 H 3.43 E 2.45 E 3.08 F 3.18 C 1.92 I 2.50 E 2.57 G 2.83 D 2.12 H 3.13 C 1.88 I 3.77 B 1.68 S	Necrosis Growth shoots No. of shoots 1.20 J 4.78 A 7.67 A 1.80 H 4.18 B 6.00 B 2.03 G 3.92 C 5.00 D 2.22 F 3.67 D 3.50 E 4.50 A 1.38 K 1.00 G 1.62 I 3.95 C 5.83 BC 1.83 H 3.43 E 5.17 CD 2.45 E 3.08 F 3.67 E 3.18 C 1.92 I 1.83 F 2.50 E 2.57 G 4.50 D 2.83 D 2.12 H 3.00 E 3.13 C 1.88 I 2.17 F 3.77 B 1.68 J 1.00 G	Necrosis Growth shoots No. of shoots Shoot length 1.20 J 4.78 A 7.67 A 4.37 A 1.80 H 4.18 B 6.00 B 4.08 B 2.03 G 3.92 C 5.00 D 3.90 C 2.22 F 3.67 D 3.50 E 3.57 D 4.50 A 1.38 K 1.00 G 2.42 H 1.62 I 3.95 C 5.83 BC 3.82 C 1.83 H 3.43 E 5.17 CD 3.52 D 2.45 E 3.08 F 3.67 E 3.00 F 3.18 C 1.92 I 1.83 F 2.05 I 2.50 E 2.57 G 4.50 D 3.27 E 2.83 D 2.12 H 3.00 E 2.75 G 3.13 C 1.88 I 2.17 F 2.08 3.77 B 1.68 J 1.00 G 1.85	Necrosis Growth shoots length thickness 1.20 J 4.78 A 7.67 A 4.37 A 0.15 H 1.80 H 4.18 B 6.00 B 4.08 B 0.217 FGH 2.03 G 3.92 C 5.00 D 3.90 C 0.27 EFG 2.22 F 3.67 D 3.50 E 3.57 D 0.38 BCD 4.50 A 1.38 K 1.00 G 2.42 H 0.47 AB 1.62 I 3.95 C 5.83 BC 3.82 C 0.23 FGH 1.83 H 3.43 E 5.17 CD 3.52 D 0.28 EF 2.45 E 3.08 F 3.67 E 3.00 F 0.35 CDE 3.18 C 1.92 I 1.83 F 2.05 I 0.40 BC 2.50 E 2.57 G 4.50 D 3.27 E 0.18 GH 2.83 D 2.12 H 3.00 E 2.75 G 0.30 DEF 3.13 C 1.88 I 2.17 F 2.08 I 0.38 BCD 3.77 B 1.68 J 1.00 G 1.85 J 0.500 A	Necrosis Growth Recrosis No. of shoots Shoot length Shoot shickness No. of leaves / plant 1.20 J 4.78 A 7.67 A 4.37 A 0.15 H 6.00 A 1.80 H 4.18 B 6.00 B 4.08 B 0.217 FGH 5.00 BC 2.03 G 3.92 C 5.00 D 3.90 C 0.27 EFG 3.33 DE 2.22 F 3.67 D 3.50 E 3.57 D 0.38 BCD 3.33 DE 4.50 A 1.38 K 1.00 G 2.42 H 0.47 AB 2.00 FG 1.62 I 3.95 C 5.83 BC 3.82 C 0.23 FGH 4.83 BC 1.83 H 3.43 E 5.17 CD 3.52 D 0.28 EF 4.17 CD 2.45 E 3.08 F 3.67 E 3.00 F 0.35 CDE 3.33 DE 3.18 C 1.92 I 1.83 F 2.05 I 0.40 BC 2.33 FG 2.50 E 2.57 G 4.50 D 3.27 E 0.18 GH 5.50 AB 2.83 D 2.12 H 3.00 E 2.75 G 0.30 DEF 2.67 EF	Necrosis Growth Roots No. of shoots Shoot length Shoot length No. of leaves / plant Root length 1.20 J 4.78 A 7.67 A 4.37 A 0.15 H 6.00 A 2.35 B 1.80 H 4.18 B 6.00 B 4.08 B 0.217 FGH 5.00 BC 2.20 C 2.03 G 3.92 C 5.00 D 3.90 C 0.27 EFG 3.33 DE 1.98 DE 2.22 F 3.67 D 3.50 E 3.57 D 0.38 BCD 3.33 DE 1.72 G 4.50 A 1.38 K 1.00 G 2.42 H 0.47 AB 2.00 FG 1.53 H 1.62 I 3.95 C 5.83 BC 3.82 C 0.23 FGH 4.83 BC 2.57 A 1.83 H 3.43 E 5.17 CD 3.52 D 0.28 EF 4.17 CD 2.32 BC 2.45 E 3.08 F 3.67 E 3.00 F 0.35 CDE 3.33 DE 2.05 D 3.18 C 1.92 I 1.83 F 2.05 I 0.40 BC 2.33 FG 1.87 EF 2.50 E 2.57 G 4.50 D 3.27 E<

Means of salinity concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

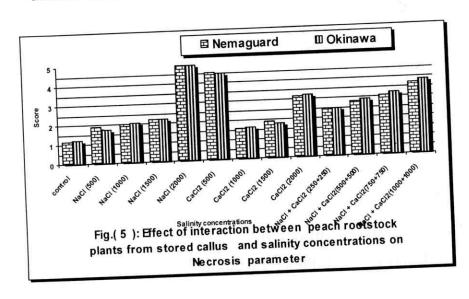


Table (11-C) Effect of interaction between rootstocks and salinity treatments

Parameter		ecros	es (Grow		lo. of noots		hoot ength	thi	Shoot ckness	le	No. of aves / plant		Root ength		o. of
Rootsto tyl Salinity Conc. (ppm	De paricona	Okinagana	Nomina	Melliayauru	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	7	Nemagaurd	Okinawa	Nemagaurd	Okinawa
(0.00)	1.1 N			30 4.7	77 7.67 A A	7.6 A	7 4.30 A	0 4.4 A	3 0.167 HI	0.13	5.67 AB	6.33 A		7 2.33 DBCDI		
NaCI (500)	IJ	JKI	_ B(В	В	BCE	1	4.07 B	7 0.20 GHI	0.23 FGHI	4.67 BCD	5.33	2.23	2.17	7.33 AB	6.33 BC
NaCI (1000)	Н	GH		D	BCDE	DEF		3.87 C	0.267 EFGH	0.267 EFGH	3.33 EF	3.33 EF	2.00 GHI	1.97	5.67 C	5.33
NaCI (1500)	G	FG	E	E	0 3.33 GHI	3.67 FGH	3.63 DE	3.50 E		0.43	3.33	3.33 EF	1.77 KL	1.67 LM	4.33 DE	3.67
NaCI (2000)	4.53 A	A	М			1.00 K	2.40 J	2.43 J	0.43 ABCD	0.50 AB	2.00 GH	2.00 GH	1.53 MN	1.53 MN	2.67	3.00
CaCl ₂ (500)	1.60 L	1.63 KL	3.90 D	3.97 CD		5.67 BCD	3.80 CD	3.83 C		0.23 FGHI	4.67 BCD	5.00 BCD	2.63	2.50	FGHI 2.33	2.67
CaCl ₂ (1000)	1.87 IJ	1.80 JK	3.43 F	3.43 F	5.33 BCDE	5.00 CDE	3.50 E	3.53 E	0.30 DEFGH	0.27	4.33 CDE	4.00 DE	2.30	2.33	1000	2.00
CaCl ₂ (1500)	2.50 E	2.40 EF	3.07 G	3.10 G		3.67 FGH	3.03 G	2.97 GH	0.33	0.37 BCDEF	3.33	3.33	2.10	BCDE 2.00	1.33	HIJK 1.00
CaCl ₂ (2000)	3.17 C	3.20 C	1.93 JK	1.90 K	_	2.00 JK	2.00 KL	2.10	0.37 BCDEF	0.43	2.33	2.33	FGH 1.93	GHI 1.80	JK 1.00	1.33
NaCI +CaCI ₂ (250 + 250)	2.50 E	2.50 E	2.60 H	-	4.33 EFG	4.67 DEF	3.23 F	3.30 F	0.17	0.20	FGH 5.33	FGH 5.67	HIJK 2.40	JKL 2.43		JK 4.33
NaCI +CaCI ₂ (500 + 500)	2.80 D	2.87 D	2.13		3.33 GHI	2.67 HIJ	2.80 HI	2.70	0.27	0.33	ABC 2.67	AB 2.67				DE 3.33
NaCI +CaCI₂ (750 + 750)	3.07 C	3.20 C	1.97 IJK	1.80 K		2.00 JK		2.07	0.37 BCDEF	0.40 ABCDE	FG 2.00 GH	2.00 GH	1.83	1.70	2.33	2.00
NaCI +CaCI₂ 1000 +1000)	3.70 B	3.83 B	1.80 K	1.57 L	1.00 K	1.00 K	1.87 L	1.83 L	0.47 ABC	0.53 A	1.67 GH	1.33	JKL 1.40 NO	1.30		1.33 JK

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.II.b.2.Induction of salt tolerance.

4.1.II.b.2.1. Tissue culture parameters.

Table(12) and Photo (8) show the effect of gradual increase of NaCl levels on growth parameters of indirect

regenerated of some peach rootstock plantlets. It is clear from Table (12-A) that the two peach rootstocks were statistically similar in all studied parameters (i.e. necrosis, growth, No. of shoots, shoot length, shoot thickness, No. of leaves/plant, root length and No. of roots). Moreover, Table (12-B) illustrates that using low concentration (1500 ppm) of NaCl enhanced a significant increase in growth, number of shoots, shoot length, number of leaves/plant, root length and number of roots. While necrosis was significantly reduced in relation to the other concentrations. However, the highest NaCl concentration induced the highest shoot thickness. Furthermore, Table (12-C) and Fig (6) verify that using low NaCl concentration i.e. 1500 ppm combined with both peach rootstocks encouraged the best tissue culture parameters i.e. growth, No. of shoots, shoot length, shoot thickness, No. of leaves/plant, root length and No. of roots in relation to the other NaCl concentrations. However, continuous increase in NaCl levels induced a detrimental effect on all studied parameters. The lethal concentration was 3000 ppm as it caused death of all the in vitro plantlets of both peach rootstocks. The results showed an increase in salt tolerance up to 2500 ppm of NaCl which reflected the positive effect of callus storage and probability of somaclonal variation may be the reason.

Table (12): Effect of gradual increase of NaCl levels on growth parameters of indirect regenerated some peach rootstock plantlets.

Table (12-A) Effect of rootstocks

Parameters cootstock type	Necrosis	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves/	Root length	No. of
Nemagaurd	3.36 A	2.44 A	2 33 A	2744	0.51 A	Della Property	4.05.4	-
Okinawa	3.40 A		2.53 A			2.33 A 2.33 A		

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (12-B) Effect of salinity treatments

Parameters NaCl Conc. (ppm)	Necrosis		snoots	length	thickness	No. of leaves /	Root length	No. of roots
1500	2.22 E	3.67 A	3.50 A	3 57 A	0.38 C	-	4.70 4	1.00
2000	2.62 D	3.08 B	3 17 AR	3 28 P	0.45 BC	3.33 A	1.72 A	4.00 A
2500	2.82 C	2.77 C	2.67 D	3.20 D	0.45 BC	3.00 AB	1.52 B	2.83 B
3000	4.95 A	1.00 5	2.07 B	3.00 C	0.52 ABC	2.50 B	1.32 C	2.00 C
eans of salinity	4.00 A	1.UZ E	THE D	1.05 E	0.57 A	1.07 C	1.00 D	1.00 D

Means of salinity concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (12-C) Effect of interaction between rootstocks and NaCl treatments

Parameters		rosis	Gr	rowth		o. of loots	100	hoot ngth		hoot kness	lea	of ves/ ant		oot gth		o. of
Rootstock type Salinity Conc. ppm)		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
1500	2.20 D	2.23 D	3.63 A	3.70 A	3.33 A	3.67 A	3.63 A	3.50 A	0.33 C	0.43 BC	3.33	3.33		1.67	4.33	3.67
2000	C	2.63 C	В	В	3.00 AB	3.33 A	3.30 B		0.47 ABC	0.43 BC	3.00 A	3.00 A	1.53 BC	AB 1.50	A 2.67 CD	3.00
	C	C	2.80 C	2.73 C	2.7 ABC	2.7 ABC	3.00 C	3.00 C	0.53 AB	0.50 ABC	2.33 ABC	2.67 AB	1.30		2.00	BC 2.00
3000	4.80 A	4.80 A	1.20 E	1.17 E	1.00 D	1.00 D	1.17 E	1.13 E	-	0.57 AB	1.33 CD	1.00 D	1.03 ·	D 1.07 E	DE 1.00	1.00 F

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

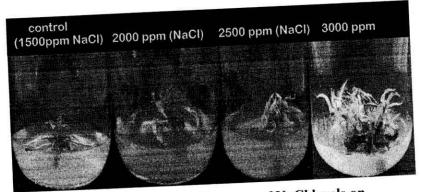
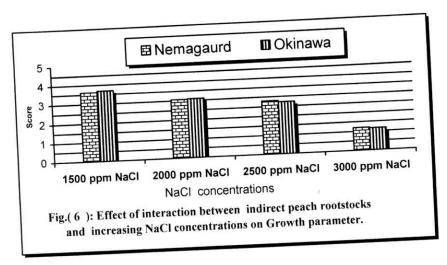


Photo (8): Effect of gradual increase of NaCl levels on growth parameters of indirect regenerated some peach rootstock plantlets



4.1.II.b.2.2. Chemical parameters.

Data in Table (13-A) indicate that statistical differences between the two peach rootstocks were lacking when all parameters (chlorophyll (A), chlorophyll (B), total sugars, total indoles, total phenols and proline) under study were concerned. Meanwhile, Table (13-B) clarifies that the lowest concentration

of NaCl (1500 ppm) succeeded in keeping chlorophyll (A), chlorophyll (B), total sugars and total indoles in higher levels while total phenols and proline were showed a significant increase when the highest concentration (3000 ppm) was used. Moreover, Table (13-C) shows that culturing of either Nemagaurd or Okinawa rootstocks on medium containing 1500 ppm NaCl encouraged the highest significant contents of chlorophyll (A), chlorophyll (B), total sugars and total indoles parameters compared with other combinations under study. Meanwhile, increasing the concentration up to 3000 ppm in combination with either peach rootstocks significantly maximized total phenols and proline levels in relation to the other combinations.

Table (13): Effect of gradual increase of NaCl levels on chemical parameters of indirect regenerated some peach rootstock plantlets.

Table (13-A) Effect of rootstock

Parameters otstock type	Chlorophyll (A)	Chlorophyll (B)	Total sugars	Total indoles	Total phenol	Proline
Nemagaurd	2.54 A	3.19 A	9.88 A	Name and Address of the Owner, where	THE PERSON NAMED IN	
Okinawa	2.53 A				13.22 A	
ans of rootstocks fo		3.33 A	9.88 A	1.79 A	13.09 A	1.80 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (13-B) Effect of NaCl concentrations treatments

Rarameters NaCl Conc.	Chlorophyll (A)	Chlorophyll (B)	Total sugars	Total indoles	Total phenol	Proline
(ppm) 1500 2000 2500 3000	6.18 A 4.27 B 2.23 C 0.01 D	7.35 A 5.32 B 3.62 C 0.01 D	13.26 A 11.27 B 9.90 C 7.16 E	2.60 A 2.26 B 1.91 C 0.90 E	10.97 D 11.71 D 12.97 C 15.95 A	0.158 E 0.83 D 1.72 C 3.59 A

Means of salinity concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (13-C) Effect of interaction between rootstocks and NaCl treatments

Parameters	Chloro (A		Chloro (B		Total su	igars	Total ins	soles	Total pl	nenoi	Proli	
Rootstock type	-	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
1500 2000	6.17 A 4.29 B	6.19 A 4.24 B	7.36 A 5.29 B	7.35 A 5.35 B	13.24 A 11.29 B	13.29 A 11.25 B 9.91	2.59 A 2.31 B 1.92	2.62 A 2.20 C 1.90	10.97 F 11.65 F 13.11	10.97 F 11.76 EF 12.83	0.16 E 0.80 D 1.65	0.16 E 0.87 D
2500 3000	2.22 C 0.01	2.23 C 0.01	3.29 C 0.01	3.95 C 0.01	9.89 C 7.16 E	7.16 E	D	0.90 F	16.22 A	DE 15.69 A	3.55 A	3.6 A

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.III.Drought stress:

- 4.1.III.a.Direct regeneration.
- 4.1.III.a.1.Effect of Mannitol.
- 4.1.III.a.1.1.Evaluation of Mannitol levels.

Data of Table (14) and Photo (9) reflect the effect of different Mannitol concentrations on tissue culture parameters of

in vitro peach rootstocks (Nemagaurd & Okinawa) plants. It is quite evident from Table (14-A) that statistical differences were lacking between Nemagaurd and Okinawa rootstocks when necrosis, growth, number of shoots, shoot length, shoot thickness, number of leaves/plant, root length and number of roots parameters were concerned. This means that rootstock type had no effect on different parameters under study. Meanwhile, Table (14-B) notice that supplementation the culture medium with 20 g/L Mannitol encouraged a significant increase of growth, number of shoots, shoot length, number of leaves/plant, root length and number of roots as compared with the other concentrations used. However, the reverse was true when necrosis was taken in consideration. Meanwhile, shoot thickness was statistically higher when 60, 80 and 100 g/L Mannitol were used.

Regarding the interaction between peach rootstocks and Mannitol concentrations, Table (14-C) and Fig (7) indicate that both Nemagaurd and Okinawa peach rootstock in combination with 20g/L Mannitol induced a significant reduction in necrosis and significantly maximized shoot length and number of roots as compared with the other combinations. However, culturing of Nemagaurd plants on the medium supplemented with 20 g/L Mannitol enhanced the highest significant growth, number of shoots, number of leaves / plant and shoot length as compared

with the other interactions. On the other hand, different combinations between peach rootstocks and different Mannitol concentrations failed to induce significant differences as shoot thickness parameters was concerned.

Table (14): Evaluation of different Mannitol levels on tissue culture in vitro peach rootstock plants. parameters of

Table (14-A) Effect of peach rootstocks

Table (1	4-A) E	ffect of	f peach	roots	tocks		Y V	
Darameters			No of	Shoot	Shoot	No. of leaves /plant	Root length	No. of roots
Rootstock type	1000	0004	2.27 A	1.90 A	0.140 A	2.73 A	1.33 A	2.27 A
Nemagaurd	3.57 A	2.38 A	2.20 A	1.86 A	0.147 A	2.73 A	1.25 A	2.08 A
Okinawa	3.61 A	2.32 A	2.20 A	1.00 /	ithin and	n column are	not signi	ficantl

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (14-B) Effect of Mannitol treatments

Parameters Mannitol	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Conc. (g/L)				0.07 A	0.13 AB	5.17 A	1.93 A	4.33A
20	1.42 C	4.27 A	4.50 A	2.97 A		3.83 B	1.73 B	2.50 B
40	1.92 B	4.00 B	3.67 B	2.67 B		1.43 C	0.88 C	1.50 C
60	4.92 A	1.02 C	1.00 C	1.04 C		1.33 C	0.92 C	1.33 (
80	4.92 A	1.02 C	1.00 C	1.02 D		1.33C	0.98 C	1.20 0
100	4.98 A	1.00 C	1.00 C	1.02 D	0.18 A	within each col		

Means of mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (14-C) Effect of interaction between peach rootstocks and Mannitol treatments

Parameters		roses	Gr	owth		o. of oots	100	noot ngth		hoot kness	lea	o. of ives / lant	1.4	oot ngth		o. of
Rootstock type Mannitol Conc. (9/L		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
20	1.33 C	1.50 C	4.33 A	4.20 AB	4.67 A	4.33 AB	2.97 A	2.97 A	0.13 A	0.13 A	5.33 A	5.00 AB	2.00	1.87	4.33	4.33
40	1.93 B	1.90 B	4.07 BC	3.93 C	3.67 B	3.67 B	2.70 AB		_	11.15	3.67 C	4.00 BC	1.77 B	1.70 B	2.67	
60	4.90 A	4.90 A	1.10 E	1.10 E	1.00 C	1.00 C	1.10 D	1.10 D	0.17 A	0.20 A	1.67 D	2.00 D	0.93 C	0.83 C	1.67 BC	1.30
80	Α	4.92 A	1.10 E	Ε	1.00 C	1.00 C	1.10 D	1.00 D	0.13 A	0.13 A	1.33 D	1.33 D	1.00 C	0.97 C	1.33 BC	1.33 BC
100	4.95 A	4.96 A	1.10 E	1.13 DE	1.00 C	1.00 C	1.03 D	1.07 D	0.17 A	0.17 A	1.67 D	1.33 D	0.97 C	0.87	1.33	1.33 BC

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

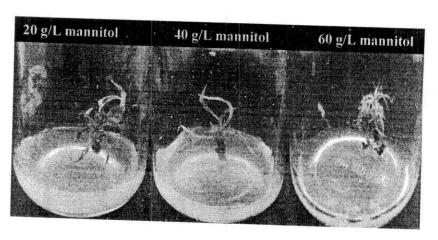
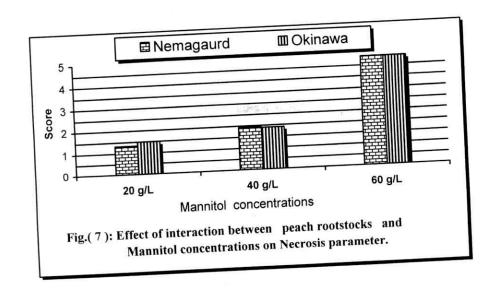


Photo (9): Evaluation of different Mannitol levels on tissue culture parameters of in vitro peach rootstock plants.



4.1.III.a.1.2.Induction of Mannitol tolerance.

The effect of gradual exposure of *in vitro* plants to different Mannitol levels on the tissue culture parameters were tabulated in Table (15). It is clear from Table (15-A) that statistical differences among rootstocks plants were nil for all parameters under study i.e. necrosis, growth, No. of shoots, shoot length, shoot thickness, No. of leaves/plant, root length and No. of roots were considered. On the contrary Table (15-B) reflects that addition of low Mannitol concentration (40 or 50g/L) to the culture medium enhanced a statistical improvement as reducing Necrosis and maximized growth, No. of shoots, shoot length, No. of leaves/plant, root length and No. of roots parameters. On the other hand, the shoot thickness parameter

was not statistically affected by different Mannitol concentrations under study.

Regarding the interaction between peach rootstocks and Mannitol concentrations, Table (15-C) and Fig (8) indicate that both peach rootstocks in combination with 40 g/L Mannitol induced a significant reduction in necrosis and maximized growth, shoot length, number of leaves/plant, root length and number of roots as compared with the other combinations. However, culturing of Okinawa plants on medium supplemented with (40 or 50 g/L) Mannitol as well as culturing of Nemagaurd plants on medium supplemented with (40 g/L) Mannitol enhanced the highest significant number of shoots as compared with the other interactions. On the other hand, different combinations between peach rootstocks and Mannitol concentrations failed to induce significant differences as shoot thickness parameter was concerned.

Table (15) Effect of gradual exposure of Mannitol levels on tissue cultural parameters of *in vitro* Peach rootstock plants.

Table (15-A) Effect of peach rootstocks.

Parameters Rootstock type	Necroses	Growth	No. of shoots		Shoot thickness	No. of leaves / plant	Root length	No. of
Nemagaurd	3.39 A	2.59 A	2 20 A	1 70 A	0.11 A		4.05.4	4.704
Okinawa	3.43A		2.27 A			2.40 A 2.33 A	1.25 A 1.18 A	

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (15-B) Effect of Mannitol treatments

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
40	1.92 D	4.00 A	3.67 A	2.67 A	0.10 A	3.83 A	1.73 A	2.50 A
50	2.25 C	3.78 B	3.17 A	2.28 B	0.13 A	3.17 A	1.40 B	2.00 AB
60	3.12 B	2.82 C	2.33 B	1.82 C	0.13 A	2.17 B	1.22 C	1.83 B
70	4.95 A	1.05 D	1.00 C	0.80 E	0.10 A	1.07 C	0.88 D	1.00 C

Means of mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (15-C) Effect of interaction between peach rootstocks and Mannitol treatments

Parameters	Necr	oses	Gro	wth	No. sho	1900	1.000	oot gth	Sho thick		No. leav pla	es /	Roo		No.	
Rootstock type Mannitol Conc. (o/L		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
40	1.93	1.90	4.07	3.93	3.67	3.67	2.70	2.63	0.100	0.100	3.67	4.00	1.77	1.70	2.67	2.33
	E	E	A	AB	A	A	A	A	A	A	A	A	A	A	A	AB
50	2.17	2.33	3.83	3.73	3.00	3.33	2.27	2.30	0.133	0.133	3.00	3.33	1.47	1.33	2.00	2.00
	D	C	BC	C	AB	A	B	B	A	A	ABC	AB	B	BC	AB	AB
60	3.07	3.17	2.80	2.83	2.33	2.33	1.90	1.73	0.133	0.133	2.33	2.00	1.23	1.20	2.00	1.67
	B	B	D	D	B	B	C	C	A	A	BCD	CDE	C	C	AB	BC
70	4.87	4.87	1.17	1.13	1.00	1.00	1.23	1.20	0.100	0.100	1.67	1.33	0.93	0.83	1.00	1.00
	A	A	E	E	C	C	D	D	A	A	DE	DE	D	D	C	C

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

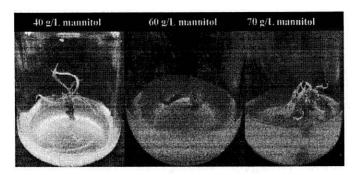
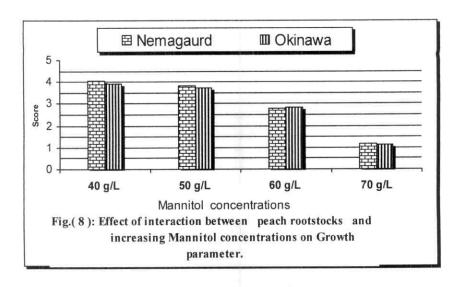


Photo (10): Effect of gradual exposure of Mannitol levels on tissue cultural parameters of *in vitro* Peach rootstock



4.1.III.a.2. Effect of Polyethylene glycol.

4.1.III.a.2.1. Evaluation of Polyethylene glycol levels.

Table (16) and Photo (11) show evaluation of different PEG levels on tissue cultural parameters of *in vitro* peach rootstock plants. It appears from Table (16-A) that studied rootstocks failed to induce any statistical differences when all parameters under study were considered. Dealing with the effect of PEG concentrations, It is clear from Table (16-B) that supplementation of the cultural medium with 2% PEG induced the best results and significantly reduced necrosis and increased growth, number of roots, shoot length, shoot thickness, number of leaves/plant and root length in relation to the other concentrations. However, number of roots was significantly

increased when subjected to the lower concentration (2 or 4 %) of PEG.

Table (16-C) and Fig (9) reflects that necrosis was significantly decreased when Nemagaurd rootstock was used in combination with 2 % PEG. However, growth and root length were significantly maximized when both Nemagaurd and Okinawa rootstock in combination with 2% PEG. Meanwhile, using 2 or 4% PEG in combination with both Nemagaurd and Okinawa rootstock induced a significant improvement in shoot length in comparison with the other combinations. Moreover, shoot thickness and number of leaves/plant were significantly increased by using Okinawa in combination with 2 % PEG. On the other hand, number of shoots was showed a significant increase when Nemagaurd rootstock was used in combination with either 2 or 4 % PEG as well as Okinawa rootstock in combination with 2 % PEG. Beside, 2% PEG in combination with both Nemagaurd and Okinawa rootstock as well as 4 % PEG in combination with Okinawa rootstock encouraged a significant increase in number of roots in comparison with the other combinations.

Table (16): Evaluation of different PEG levels on tissue culture parameters of *in vitro* peach rootstock plants.

Table (16-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.53 A	2.47 A	2.80 A	2.35 A	0.22 A	3.07 A	1.82 A	
Okinawa	3.560 A	2.44 A	2.60 A	2.30 A	0.21 A	3.07 A	1.76 A	2.07 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (16-B) Effect of PEG treatments

Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
2	1.48 C	4.70 A	5.67 A	3.10 A	0.37 A	5.17 A	2.33 A	3.33 A
4	1.63 B	4.05 B	4.83 B	2.92 B	0.25 B	4.17 B	2.03 B	2.83 A
6	4.88 A	1.27 C	1.00 C	1.98 C	0.18 B	2.00 C	1.75 C	1.33 B
8	4.90 A	1.15 CD	1.00 C	1.90 C	0.18 B	2.00 C	1.50 D	1.50 B
10	4.95 A	1.00 D	1.00 C	1.73 D	0.10 C	2.00 C	1.33 E	1.17 B

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (16-C) Effect of interaction between peach rootstocks and PEG treatments

Parameters	Necro	ses	Grov	wth	No.	2000	Sho		Sho		No. leave pla	es /	Ro lenç	CCCC	No. o	200
Rootstock type PEG Conc. (%)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
2	1.37	1.60	4.77	4.63	5.67	5.67	3.10	3.10	0.33	0.40	5.00	5.33	2.33	2.33	3.33	3.33
	C	B	A	A	A	A	A	A	AB	A	AB	A	A	A	A	A
4	1.63	1.63	4.03	4.07	5.33	4.33	2.93	2.90	0.27	0.23	4.33	4.00	2.10	1.97	2.67	3.00
	B	B	B	B	A	B	A	A	BC	BC	BC	C	B	B	AB	A
6	4.89	4.89	1.30	1.23	1.00	1.00	2.03	1.93	0.20	0.17	2.00	2.00	1.77	1.73	1.33	1.33
	A	A	C	CD	C	C	B	BC	CD	CD	D	D	C	C	C	C
8	4.90	4.90	1.10	1.10	1.00	1.00	1.93	1.87	0.20	0.17	2.00	2.00	1.53	1.47	1.33	1.67
	A	A	D	D	C	C	BC	BCD	CD	CD	D	D	D	DE	C	BC
10	4.96 A	_	1.10 D	1.10	1.00	1.00	1.77 CD	1.70	0.10 D	0.10 D	2.00 D	2.00 D	1.37 DE	1.30 E	1.33 C	1.00 C

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

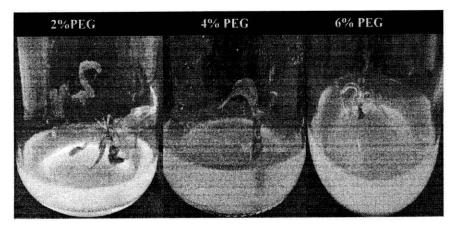
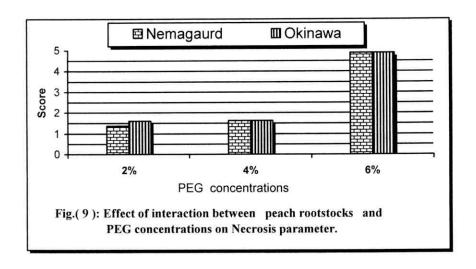


Photo (11): Evaluation of different PEG levels on tissue culture parameters of *in vitro* peach rootstock plants.



4.1.III.a.2.2.Induction of polyethylene glycol tolerance.

Data of Table (17) show the effect of gradual exposure of PEG levels on tissue cultural parameters of *in vitro* peach rootstock plants under study. It is clear from Table (17-A) that both Nemagaurd and Okinawa rootstocks used failed to induce

statistical differences when all parameters under study were indicates that considered. However, Table (17-B)supplementation of cultural medium with 4 or 5 % PEG resulted in best results as well as significantly reduced necrosis and increased growth, No. of shoots and No. of roots in relation to the other concentrations. Meanwhile, No. of leaves/plant was significantly maximized when subjected to stress by increasing PEG up to 6 %/L in relation to the higher concentrations (7 %). On the other side, shoot length and root length were significantly increased when subjected to the lower concentration (4 %) of PEG. On the other hand, statistical differences among PEG concentrations were lacking when shoot thickness was concerned.

Dealing with the interaction between PEG concentrations and peach rootstocks, it is clear from Table (17-C) and Fig (10) that necrosis was significantly decreased when both Nemagaurd and Okinawa peach rootstocks were used in combination with either 4 or 5 % PEG. However, growth was significantly maximized when Nemagaurd rootstock in combination with 4, 5 and 6% or Okinawa in combination with 4 and 5 %. Meanwhile, number of shoots was significantly increased by using Nemagaurd in combinations with 4 or 5% of PEG. Moreover, using 4% PEG in combination with both Nemagaurd and Okinawa peach rootstocks enhanced a significant

development in shoot length in combination with the other combinations. On the contrary, No. of leaves/plant was showed a significant increase when both Nemagaurd and Okinawa peach rootstocks in combination with either 4, 5 and 6 % PEG.

On the contrast, 4% PEG in combination with Nemagaurd encouraged a significant increase in root length. Beside, number of roots was significantly increased as the Okinawa plants in combination with 4 % PEG. On the other hand, different combinations between peach rootstocks and PEG concentrations failed to induce significant differences as shoot thickness was concerned.

Table (17) Effect of gradual exposure of PEG levels on tissue cultural parameters of *in vitro* Peach rootstock plants.

Table (17-A) Effect of peach rootstocks.

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.03 A	2.82 A	3.33 A	2.14 A	0.24 A	3.00 A	1.57 A	2.00 A
Okinawa	3.03 A	2.76 A	3.20 A	2.07 A	0.23 A	2.80 A	1.53 A	2.07 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (17-B) Effect of PEG treatments

Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
4	1.63 C	4.05 A	4.83 A	2.92 A	0.25 A	4.17 A	2.03 A	2.83 A
5	1.60 C	4.03 A	4.83 A	2.63 B	0.27 A	3.83 A	1.88 B	2.50 A
6	2.22 B	3.55 B	4.00 B	2.53 B	0.20 A	3.33 A	1.58 C	2.00 AB
7	4.90 A	1.13 C	1.00 C	1.15 C	0.20 A	1.50 B	1.07 D	1.33 B

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (17-C) Effect of interaction between peach rootstocks and PEG treatments

Parameters	Necr	oses	Gro	wth	No.			oot gth		oot	No. leav /pla	/es		oot ngth	No.	
Rootstock type PEG Conc. (%)	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
4	1.63	1.63	4.03	4.07	5.33	4.33	2.93	2.90	0.27	0.23	4.33	4.00	2.10	1.97	2.67	3.00
	C	C	A	A	A	AB	A	A	A	A	A	A	A	AB	AB	A
5	1.60	1.60	4.00	4.07	5.00	4.67	2.67	2.60	0.27	0.27	4.00	3.67	1.93	1.83	2.33	2.67
	C	C	A	A	A	AB	AB	B	A	A	A	A	AB	BC	ABC	AB
6	2.20	2.23	3.80	3.30	3.67	4.33	2.60	2.47	0.20	0.20	3.33	3.33	1.67	1.50	2.00	2.00
	B	B	A	B	B	AB	B	B	A	A	A	A	CD	D	ABC	ABC
7	4.90	4.90	1.10	1.17	1.00	1.00	1.17	1.13	0.20	0.20	1.67	1.33	1.00	1.13	1.33	1.33
	A	A	C	C	C	C	C	C	A	A	B	B	F	EF	C	C

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

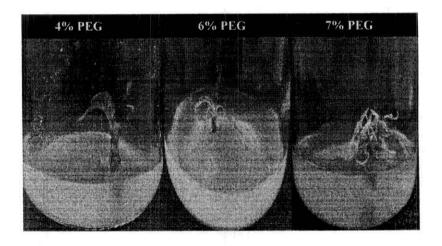
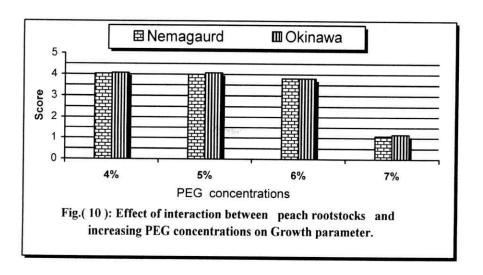


Photo (12): Effect of gradual exposure of PEG levels on tissue cultural parameters of in vitro Peach rootstock plants.



4.1.III.a.3. Effect of agar.

4.1.III.a.3.1. Evaluation of agar levels.

Table (18) and Photo (13) show the evaluation of different agar levels on tissue culture parameters of *in vitro* peach rootstock plants. Data in Table (18-A) reveal that statistical differences among rootstocks plants were lacking when all parameters under study were considered. However, Table (18-B) clarifies that addition of agar at the rate of 6 g/L induced a significant reduction of necrosis and significantly maximized growth, No. of shoots, shoot thickness, root length and No. of roots. Meanwhile, increasing agar concentration in culture medium from 6 up to 8 g/L encouraged a significant increase of shoot length and number of leaves/plant in comparison with the other concentrations.

Dealing with the interaction between peach rootstocks and agar concentrations, it is quite evident from Table (18-C) and Fig (11) that necrosis was the lowest level when combination between Okinawa rootstock and 6 g/L agar was used as well as Nemagaurd rootstock in combination with 6 or 8 g/L agar. However, growth and root length were significantly maximized when either Nemagaurd or Okinawa rootstock was used in combination with 6 g/L agar. Meanwhile, No. of shoots was significantly increased using Nemagaurd in combinations with 6 g/L agar . Beside, shoot length and No. of leaves/plant showed a significant increase when both Nemagaurd and Okinawa peach rootstocks were in combination with either 6 and 8 g/L agar. On the contrast, using of 6 g/L agar in combination of Okinawa encouraged a significant increase in shoot thickness and No. of roots.

Table (18): Evaluation of different Agar levels on tissue culture parameters of *in vitro* peach rootstock plants.

Table (18-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots		Shoot thickness	No. of leaves / plant	Contract Con	No. of roots
Nemagaurd	3.45 A	2.37 A	2.80 A	2.80 A	2.17 A	0.35 A	2.12 A	2.73A
Okinawa	3.51 A	2.30 A	-	2.67 A		0.37 A	2.05 A	2.80 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (18-B) Effect of agar treatments

Parameters Agar Conc. (g/L	Necroses	Growth		Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
6	1.32 C	4.35 A	5.50 A	2.97 A	0.48 A	5.50 A	2.58 A	4.50 A
8	1.50 B	3.88 B	4.83 B	2.93 A	0.42 AB	5.33 A	2.28 B	3.33 B
10	4.89 A	1.18 C	1.33 C	1.77 B	0.33 BC	2.00 B	1.97 C	2.50 BC
12	4.90 A	1.12 C	1.00 C	1.50 D	0.27 C	2.00 B	1.92 C	2.17 CD
14	4.92 A	1.13 C	1.00 C	1.63 C	0.28 C	2.00 B	1.67 D	1.33 D

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

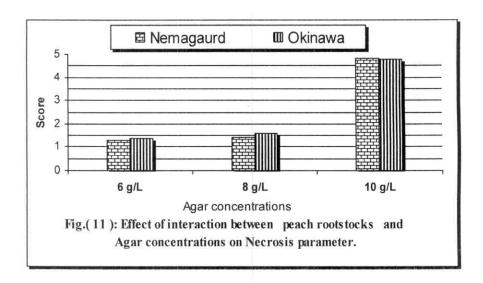
Table (18-C) Effect of interaction between peach rootstocks and agar treatments

		agai treatments														
Parameters	Necr	oses	Gro	wth		No. of shoots		Shoot length		oot ness	No. leav /pla	es .	Root length		No. of roots	
Rootstock type Agar Conc. (g/L)		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
6	1.27	1.37	4.40	4.30	5.67	5.33	2.97	2.97	0.43	0.53	5.67	5.33	2.57	2.60	4.33	4.67
	C	C	A	A	A	AB	A	A	AB	A	A	A	A	A	AB	A
8	1.40	1.60	4.03	3.73	5.00	4.67	2.93	2.93	0.43	0.40	5.33	5.33	2.30	2.27	3.33	2.33
	C	B	B	C	B	B	A	A	AB	BC	A	A	B	B	BC	BC
10	4.83 A	4.80 A	1.17 D	1.20 D	1.33 C	1.33 C	1.83 B			0.33 BCD	2.00 B	2.00 B	2.13 BC	1.80 DEF	2.33 CD	2.67 CD
12	4.87	4.87	1.10	1.13	1.00	1.00	1.53	1.47	0.27	0.27	2.00	2.00	1.90	1.93	2.00	2.33
	A	A	D	D	C	C	D	D	D	D	B	B	DE	CD	DE	CD
14	4.90	4.90	1.13	1.13	1.00	1.00	1.57	1.70	0.27	0.30	2.00	2.00	1.70	1.63	1.67	1.00
	A	A	B	D	C	C	CD	BC	D	CD	B	B	EF	F	CD	E

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.



Photo (13): Evaluation of different Agar levels on tissue culture parameters of *in vitro* peach rootstock plants.



4.1.III.a.3.2. Induction of agar tolerance.

Data of Table (19) and Photo (14) reflect the effect of gradual exposure of agar levels on tissue culture parameters of *in vitro* peach rootstock plants. It is quite evident from Table (19-A) that statistical differences were lack between Nemagaurd and Okinawa rootstocks when all parameters under study were

concerned. On the contrary, Table (19-B) reflects that addition of low agar concentration (8 or 9 g/L) to culture medium enhanced a statistical improvement in reducing necrosis and maximized growth, No. of shoots, shoot length, No. of leaves/plant and root length compared with the other treatments used. Moreover, Shoot thickness was statistically higher when 8 g/L agar was used. Meanwhile, No. of roots was significantly maximized when subjected to stress by increasing agar up to 8 g/L in relation to the higher concentrations (9 or 10 g/L).

Regarding the interaction between peach rootstocks and different agar concentrations, Table (19-C) and Fig (12) indicate that using Nemagaurd rootstock in combination with 8 g/L agar induced a significant reduction in Necrosis and significantly maximized growth and shoot thickness as compared with the other combinations. Meanwhile, culturing Nemagaurd plants on medium supplemented with 8 or 9 g/L agar as well as Okinawa plants on medium supplemented with 8 g/L agar enhanced the highest significant number of Shoots as compared with the other interactions. However, Shoot length was significantly maximized when either Nemagaurd or Okinawa rootstock was used in combination with 8 g/L agar. On the contrary, No. of leaves/plant and root length were showed a significant increase when Okinawa rootstock in combination with 8 or 9 g/L agar as well as Nemagaurd rootstock in combination with 8 g/L agar

were used in comparison with the other combination. Beside, 9 g/L agar in combination with Nemagaurd rootstock as well as 10 g/L agar in combination with Okinawa rootstock encouraged a significant increase in No. of roots in comparison with the other combinations.

Table (19) Effect of gradual exposure of Agar levels on tissue cultural parameters of *in vitro* Peach rootstock plants.

Table (19-A) Effect of peach rootstocks.

Parameters Rootstock type	Necroses	Growth	No. of shoots		Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	2.94 A	2.69 A	3.07 A	2.30 A	0.31 A	3.67 A	1.96 A	
Okinawa	2.02 A	2.64 A	2.87 A	2.30 A	0.31 A	3.73 A	1.98 A	2.87 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (19-B) Effect of Agar treatments

Rarameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
8	1.50 C	3.88 A	4.83 A	2.93 A	0.417 A	5.33 A	2.28 A	3.33 A
9	1.58 C	3.92 A	4.50 A	2.88 A	0.35 AB	5.17 A	2.30 A	3.33 A
10	2.12 B	3.23 B	3.50 B	2.63 B	0.32 BC		1.97 B	
11	4.90 A	1.02C	1.00 C	1.13 D	0.20 D	2.00 C	1.33 D	2.00 B

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (19-C) Effect of interaction between peach rootstocks and Agar treatments

Parameters	Necr	oses	Gro	wth		. of oots		oot gth	A	oot iness	leav	. of /es / ant	1000	oot ngth	5555	o. of ots
Rootstock type Agar Conc. (g/L)	11	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
8	1.40	1.60	4.03	3.73	5.00	4.67	2.93	2.93	0.43	0.40	5.33	5.33	2.30	2.27	3.33	3.33
	D	CD	A	B	A	A	A	A	A	AB	A	A	A	A	AB	AB
9	1.50	1.67	3.87	3.97	4.67	4.33	2.90	2.87	0.37	0.33	5.00	5.33	2.20	2.40	3.67	3.00
	CD	C	AB	AB	A	AB	AB	AB	AB	ABC	AB	A	AB	A	A	ABC
10	2.07 B	2.17 B	3.30 C	3.17 C	3.67 BC	3.33 C	2.67 BC	2.60 C	0.33 ABC		4.00 B	4.00 B	1.97 BC	1.97 BC	3.33 AB	3.67 A
11	4.90	4.90	1.10	1.13	1.00	1.00	1.40	1.47	0.20	0.20	2.00	2.00	1.53	1.53	2.00	2.00
	A	A	D	D	D	D	D	D	D	D	C	C	D	D	C	C

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

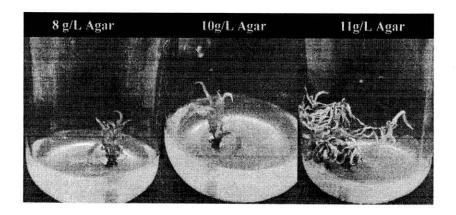
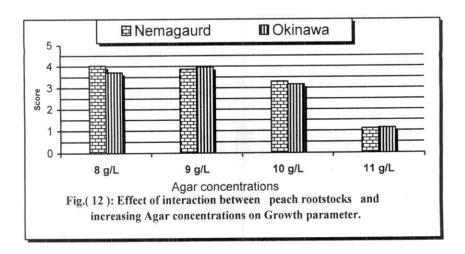


Photo (14): Effect of gradual exposure of Agar levels on tissue cultural parameters of *in vitro* Peach



4.1.III.b.Indirect regeneration .

4.1.III.b.1. Effect of Mannitol.

4.1.III.b.1.1. Evaluation of Mannitol levels.

Data in Table (20) reflect the evaluation of tissue culture parameters of *in vitro* regenerated plantlets from stored callus as affected by different mannitol tolerated levels by some peach rootstock (Nemagaurd & Okinawa) plants. It is quite evident from Table (20-A) that both Nemagaurd and Okinawa peach rootstocks used failed to induce statistical differences when all parameters under study were considered i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/ plant, root length and No. of roots.

Dealing with the effect of mannitol concentrations, it is appeared from Table (20-B) that supplementation of cultural

medium with 20 g/L mannitol improved significantly the most parameters i.e. reduced Necrosis and increased Growth, No. of shoot, Shoot length, No. of leaves/plant and No. of roots in relation to the other concentrations. Meanwhile, Shoot thickness was significantly maximized when subjected to stress with increasing mannitol up to 60 g/L and 100 g/L in relation to lower concentration (20 g/L). However, root length was significantly increased when subjected to the lower concentration (20 or 40 g/L) of mannitol.

Regarding the interaction between peach rootstocks and mannitol concentrations, Table (20-C) and Fig (13) indicate that both peach rootstocks in combination with 20 g/L mannitol induced a significant reduction in Necrosis as compared with the other combinations. However, culturing of Okinawa plantlets on medium supplemented with 20 g/L mannitol enhanced the highest significant Growth, Shoot length and No. of leaves/plant as compared with the other interactions. However, No. of shoot, Root length and No. of roots were significant response when combination of two peach (Nemagaurd & Okinawa) plants and 20 or 40 g/L mannitol were used in relation to the other interactions. On contrary, Shoot thickness was showed a significant increase when Okinawa rootstock in combination with either 60 or 100 g/L mannitol.

Table (20): Evaluation of tissue culture parameters of *in vitro* regenerated plantlets from stored callas as affected by different mannitol levels tolerated by some peach rootstock.

Table (20-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.57 A	2.38 A	2.33 A	2.29 A	0.20 A	3.40 A	1.47 A	2.67 A
Okinawa	3.57 A	2.40 A	2.27 A	2.31 A	0.23 A	3.53 A	1.39 A	

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (20-B) Effect of mannitol treatments

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots		Shoot thickness	No. of leaves / plant	Root length	No. of roots
20	1.35 C	4.38 A	4.50 A	3.22 A	0.150 C	6.83 A	2.13 A	5.33 A
40	1.97 B	4.08 B	3.67 B	3.00 B	0.23 AB	5.50 B	2.02A	4.33 B
60	4.90 A	1.03 C	1.03 C	2.00 C	0.28 A	2.33 C	1.17 B	1.67 C
80	4.91 A	1.03 C	1.00 C	1.85 D	0.17 BC	1.33 C	0.90 C	1.00 C
100	4.93A	1.02 C	1.00 C	1.45 E	0.25 A	1.33 C	0.78 C	1.00 C

Means of mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

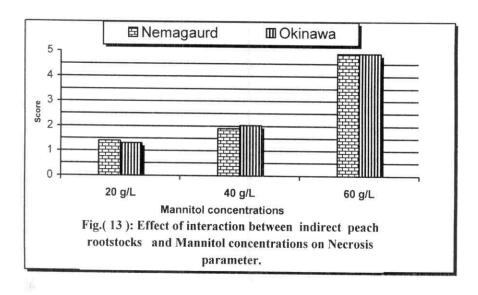


Table (20-C) Effect of interaction between peach rootstocks and Mannitol treatments

Parameters	Necr	oses	Gro	wth	No sho	of ots	Sho	oot gth	She thick	oot ness	leav	of ves / ant	1,355	oot gth	No.	
Rootstock type Mannitol Conc. (gVL		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
20	1.40	1.30	4.30	4.47	4.67	4.33	3.20	3.23	0.13	0.17	6.67	7.00	2.17	2.10	5.33	5.33
	C	C	AB	A	A	A	AB	A	C	BC	AB	A	A	A	A	A
40	1.90 B	2.03 B	4.10 B	4.07 B	3.67 A	3.67 A	3.00 B	3.00 B	0.23 ABC	0.23 ABC	5.33 B	5.67 AB	2.03 A	2.00 A	4.33 A	Α
60	4.90	4.90	1.27	1.20	1.33	1.33	2.00	2.00	0.27	0.30	2.33	2.33	1.20	1.13	1.67	1.67
	A	A	C	C	B	B	C	C	AB	A	C	C	B	B	B	B
80	4.92	4.91	1.13	1.13	1.00	1.00	1.87	1.83	0.17	0.17	1.33	1.33	0.87	0.93	1.00	1.00
	A	A	C	C	B	B	C	C	BC	BC	C	C	C	C	B	B
100	4.95	4.96	1.10	1.13	1.00	1.00	1.40	1.50	0.20	0.30	1.33	1.33	0.77	0.80	1.00	1.00
	A	A	C	C	B	B	D	D	ABC	A	C	C	C	C	B	B

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.III.b.1.2.Induction of Mannitol tolerance.

Data in Table (21) show the effect of gradual exposure of mannitol levels on the tissue cultural parameters of indirect regenerated peach rootstock plants. It is clear from Table (21-A) that root length was significantly increased when Nemagaurd peach rootstock was used compared with Okinawa peach rootstock. On the other hand, both Nemagaurd and Okinawa rootstock failed to induce statistical differences when Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant and No. of roots parameters were taken in consideration. Meanwhile, data in Table (21-B) show that

supplementation the medium with 40 g/L of mannitol was significantly improved Growth, No. of shoots, Shoot length, No. of leaves/ plant, Root length and No. of roots parameters in relation to the other concentrations. However, addition of 40 or 50 g/L mannitol to the culture medium caused significantly a reduction in necrosis. Meanwhile, either 40 or 60 g/L mannitol induced a significant increase in shoot thickness compared with 70 g/L mannitol.

Table (21-C) and Fig (14) reflect that Necrosis was significantly decreased when Nemagaurd peach rootstock was used in combination with 40 g/L mannitol. However, No. of shoots was significantly maximized when either Nemagaurd or Okinawa peach rootstock was used in combination with 40, 50 and 60 g/L mannitol. Meanwhile, culturing of two peach rootstocks (Nemagaurd and Okinawa) plants on the medium supplemented with 40 g/L mannitol enhanced the highest significantly Growth, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots as compared with the other interactions.

Table (21): Effect of gradual exposure of mannitol levels on the tissue cultural parameters of indirect regenerated some peach rootstock plantlets.

Table (21-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.22 A	2.57 A	2.40 A	2.32 A	0.17 A	3.07 A	1.54 A	2.33 A
Okinawa	3.24A	2.54 A	2.33 A	2.31 A	0.19 A	3.27 A	1.47 B	2.27 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (21-B) Effect of Mannitol treatments

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
40	1.97 D	4.08 A	3.67 A	3.00 A	0.23 A	5.50 A	2.02 A	4.33 A
50	2.07 D	3.93 B	3.17 AB	2.85 B	0.17 AB	3.50 B	1.88 B	3.17 B
60	2.45 C	2.40 C	2.67 B	2.50 C	0.20 A	2.83 C	1.45 C	2.00 C
70	4.90 A	1.10 E	1.00 C	1.22 E	0.12 B	2.00 D	0.97 E	1.00 D

Means of mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

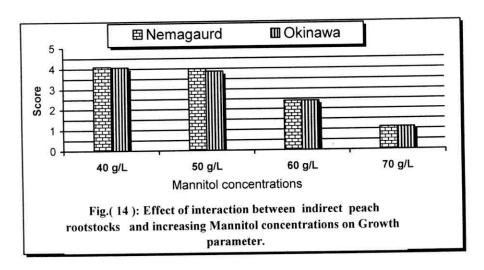


Table (21-C) Effect of interaction between peach rootstocks and Mannitol treatments

Parameters	_	roses	Gro	wth	100	o. of oots		noot ngth		oot kness	leav	. of ves / ant		oot ngth	2000	o. of oots
Rootstock type Mannitol Conc. (94L		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
40	1.90 D	2.03 CD	4.10 A	4.07 A	3.67 A	3.67 A	3.00 A	3.00 A	0.23 A	0.23 A	5.33 A	5.67 A	2.03 A	2.00 A	4.33 A	4.33 A
50	2.00 CD	2.13 C	4.00 AB	3.87 B	3.33 A	3.00 A	2.87 AB	2.83 B	0.17 AB	0.17 AB	3.33 BC	3.67 B	1.93 AB	1.83 B	_	3.00 B
60	2.50 B	2.40 B	2.40 C	2.40 C	2.67 A	2.67 A	2.50 C	2.50 C	0.20 AB	0.20 AB	2.67 CD		1.50 C	1.40 C		
70	4.90 A	4.90 A	1.10 D	1.10 D	1.00 B	1.00 B	1.27 E	1.17 E	0.10 B	0.13 AB	2.00 D	2.00 D	1.00 E	0.93 E	1.00 D	1.00 D

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.III.b.2. Effect of Polyethylene glycol.

4.1.III.b.2.1.Evaluation of Polyethylene glycol levels.

Table (22) shows evaluation of the effect of different PEG levels on tissue cultural parameters of *in vitro* peach rootstock plants. It is appear from Table (22-A) that statistical differences between rootstocks plants were lacked when Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots parameters were considered. Meanwhile, Table (22-B) indicates that supplementation of the cultural medium with 2 % PEG resulted in a significant improving of all parameters and reduced Necrosis and increased

Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of root in relation to other concentrations. Respecting the effect of the interaction between peach rootstocks and PEG concentrations. It is appear from Table (22-C) and Fig (15) that Necrosis was significantly decreased when Nemagaurd peach rootstock was used in combination with 2 % PEG. However, Growth, No. of shoots, Shoot length, No. of leaves/plant and Root length were significantly maximized when either Nemagaurd or Okinawa peach rootstock in combination with 2% PEG were used. Meanwhile, using 2% PEG in combination with Nemagaurd peach rootstock enhanced a significant increase in Shoot thickness in comparison with the other combinations. On the other hand, No. of roots was showed a significant increase when Okinawa in combination with 2 % PEG.

Table (22): Evaluation of tissue culture parameters of *in vitro* regenerated plantlets from stored callas as affected by different PEG levels tolerated by some peach rootstock.

Table (22-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.49 A	2.53 A	2.73 A	1.98 A	0.267 A	3.20 A	1.83 A	2.13 A
Okinawa	3.54 A	2.50 A	2.60 A	1.98 A	0.280 A	2.07 A	1.78 A	2.27 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (22-B) Effect of PEG treatments

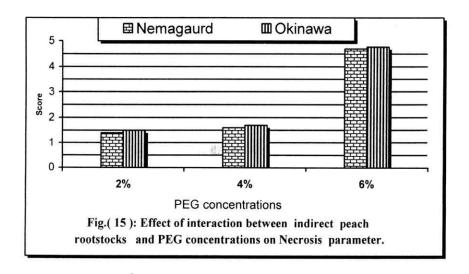
Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
2	1.45 D	4.75 A	5.50 A	3.22A	0.35 A	5.67 A	2.23 A	3.83 A
4	1.65 C	4.30 B	4.17 B	2.98 B	0.33 AB	4.17 B	2.03 B	3.17 B
6	4.73 B	1.27 C	1.67 C	1.38 C	0.27 BC	2.33 C	1.97 B	2.00 C
8	4.83 AB	1.15 CD	1.00 D	1.22 D	0.22 C	2.00 CD	1.60 C	1.00 D
10	4.90 A	1.10 D	1.00 D	1.10 D	0.20 C	1.50 D	1.18 D	1.00 D

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (22-C) Effect of interaction between peach rootstocks and PEG treatments

Parameters		roses	Gro	wth		o. of oots	0.000	oot ngth	Concrete Concrete	oot kness	lea	o. of ves / ant		oot ngth		o. of ots
Rootstock type PEG Conc. (%	-	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
2	1.40 E	1.50 DE	4.80 A	4.70 A	5.67 A	5.33 A	3.20 A	3.23 A	0.37 A	0.33 AB	5.67 A	5.67 A	2.23 A	2.23 A	3.67 AB	4.00 A
4	1.60 CD	1.70 C	4.30 B	4.30 B	4.33 B	4.00 B	3.00 B	2.97 B	0.33 AB	0.33 AB	4.33 B	4.00 B	2.07 AB	2.00 B	_	3.33 BC
6	4.70 B	4.77 AB	1.30 C	1.23 CD	1.67 C	1. 67 C	1.37 CD	1.40 C	0.23 BC	0.30 ABC	2.67 C	2.00 CD	1.93 B	-	2.00 D	-
8	4.83 AB	4.83 AB	1.13 CD	1.17 CD	1.00 C	1.00 C	1.23 CDE	1.20 DE	0.20 C	0.23 BC	2.00 CD	2.00 CD	1.70 C	1.50 C	1.00 E	
10	4.90 A	4.90 A	1.10 D	1.10 D	1.00 C	1.00 C	1.10 E	1.10 E	0.20 C	0.20 C	1.33 D	1.67 CD	1.20 D	1.17 D	1.00 E	_

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.



4.1.III.b.2.2.Induction of PEG tolerance.

Data of Table (23) reflect the effect of gradual exposure of PEG levels on the tissue cultural parameters of indirect regenerated some peach rootstock plants. It is quite evident from Table (23-A) that root length parameter was significantly increased when Nemagaurd peach rootstock was used. Meanwhile, both Nemagaurd and Okinawa peach rootstocks were failed to show significantly when Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves / plant and No. of roots parameters were considered.

Dealing with the effect of PEG concentrations, it is appeared from Table (23-B) that supplementation of the cultural medium with 4 or 5 % PEG induced the best results as significantly reduced Necrosis and increased Growth, No. of

shoots, Root length and No. of roots parameters in relation to the other concentrations. However, Shoot length and No. of leaves/plant were significantly maximized when cultured on medium contained 4 g/L PEG in relation to the other PEG concentrations. On the other hand, statistical differences were nil among the PEG concentrations when Shoot thickness was considered.

Regarding the interaction between peach rootstocks and PEG concentrations, Table (23-C) and Fig (16) indicate that both Nemagaurd and Okinawa peach rootstocks in combination with 4 or 5% PEG significantly reduced Necrosis and increased Growth parameter as compared with other combinations. Meanwhile, No. of shoots was significantly increased by using Nemagaurd in combinations with 4% PEG and Okinawa in combinations with 5% PEG. Moreover, using of 4% PEG in combination with Nemagaurd enhanced a significant increase in Shoot length in comparison with the other concentrations. On contrary, No. of leaves/plant was showed a significant increase when either one of the two peach rootstocks in combination with 4% PEG were used. Beside, 4% PEG in combination with Okinawa encouraged a significant increase in No. of root. However, using 4 or 5 % PEG in combination with Nemagaurd and 5% PEG with Okinawa enhanced a significant increase in Root length in comparison with the other combinations. On the

other hand, the studied of the interaction between peach rootstocks and PEG concentrations failed to induce any statistical differences when shoot thickness was considered.

Table (23): Effect of gradual exposure of PEG levels on the tissue cultural parameters of indirect regenerated some peach rootstock plantlets.

Table (23-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	2.98 A	2.96 A	2.87 A	2.43 A	0.30 A	2.93 A	1.75A	2.00 A
Okinawa	2.01 A	2.96 A	2.87 A	2.37 A	0.29A	2.80 A	1.67 B	2.07 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (23-B) Effect of PEG treatments

Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
4	1.65 D	4.30 A	4.17 A	2.98 A	0.33 A	4.17 A	2.03 A	3.17 A
5	1.63 D	4.22A	4.17 A	2.80 B	0.28 A	3.67 AB	2.03 A	2.83 A
6	2.10 C	3.88 B	3.17 B	2.58 C	0.27 A	3.00 B	1.80 B	2.17 B
7	4.90 A	1.10 D	1.00 D	1.70 E	0.30 A	1.50 C	1.13 D	1.00 C

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

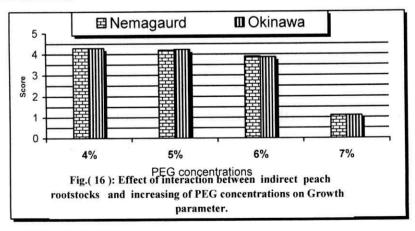


Table (23-C) Effect of interaction between peach rootstocks and PEG treatments

Parameters	Necr	oses	Gro	wth	100000	. of oots		oot	3740	oot kness	leav	. of /es / ant	Ro len			o. of ots
PEG Conc. (%)		Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
4	1.60	1.70	4.30	4.30	4.33	4.00	3.00	2.97	0.33	0.33	4.33	4.00	2.07	2.00	3.00	3.33
	D	D	A	A	A	AB	A	AB	A	A	A	A	A	AB	AB	A
5	1.63 D	1.63 D	4.20 A	4.23 A	4.00 AB	4.33 A	2.83 AB	2.77 BC	0.30 A	0.27 A	3.67 AB	3.67 AB	2.03 A	_		3.00 AB
6	2.07	2.13	3.90	3.87	3.33	3.00	2.60	2.57	0.27	0.27	3.00	3.00	1.87	1.73	2.33	2.00
	C	C	B	B	BC	C	C	C	A	A	B	B	BC	CD	BC	C
7	4.90	4.90	1.10	1.10	1.00	1.00	1.80	1.60	0.33	0.27	1.67	1.33	1.17	1.10	1.00	1.00
	A	A	D	D	E	E	DE	E	A	A	C	C	F	F	D	D

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.III.b.3. Effect of Agar.

4.1.III.b.3.1.Evaluation of Agar levels.

Data of Table (24) explain the effect of tissue cultural parameters of *in vitro* regenerated plants from stored callus as affected by different agar tolerated levels by some peach rootstock. It is clear from Table(24-A) that both Nemagaurd and Okinawa peach rootstocks used failed to induce statistical differences when all parameters under study were considered i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots.

Referring to the effect of agar concentrations it is appear from Table (24-B) that Necrosis was the lower most significant

level while Growth , No. of shoots, Shoot thickness, No. of leaves/plant, Root length and No. of roots were at the higher most significant level when agar was added to the culture medium at 6 g/L. However, addition agar to the culture medium at 6 or 8 g/L encouraged the best significant shoot length as compared with the other agar concentrations.

Dealing with the interaction between peach rootstocks and agar concentrations, It is quite evident from Table (24-C) and Fig (17) that Nemagaurd rootstock in combination with 6 g/L agar resulted in the best results and significantly reduced Necrosis and increased Growth and No. of shoots in relation to the other combinations. Meanwhile, Shoot length and No. of leaves/plant were statistically increased when 6 or 8 g/L agar was added to the medium and either Nemagaurd or Okinawa peach rootstock was used as compared to the other combinations. However, combination of Nemagaurd or Okinawa peach rootstocks and 6 g/L agar enhanced a significant increase in Shoot thickness and No. of roots in relation to the other combinations. Also, Root length was significantly increased as combination of Okinawa peach rootstock and 6 g/L agar was used.

Table (24): Evaluation of tissue culture parameters of *in vitro* regenerated plantlets from stored callas as affected by different agar levels tolerated by some peach rootstock.

Table (24-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	3.43 A	2.46 A	3.13 A	2.14 A	0.28 A	4.07 A	1.87 A	2.93 A
Okinawa	3.44 A	2.42 A	3.00 A	2.16 A	0.27 A	4.07 A	1.89 A	2.80 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (24-B) Effect of agar treatments

Parameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
6	1.27 D	4.62A	6.00 A	3.05 A	0.43 A	8.00 A	2.65 A	5.67 A
8	1.40 C	4.08 B	6.55 B	2.90 A	0.32 B	6.67 B	2.42 B	4.17 B
10	4.70 B	1.30 C	2.00 C	2.00 B	0.22 C	2.33 C	1.85 C	2.33 C
12	4.87 A	1.13 D	1.00 D	1.60 C	0.20 C	1.67 C	1.42D	1.17 D
14	4.93 A	1.07 D	1.00 D	1.20 D	0.20 C	1.67 C	1.05 E	1.00 D

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

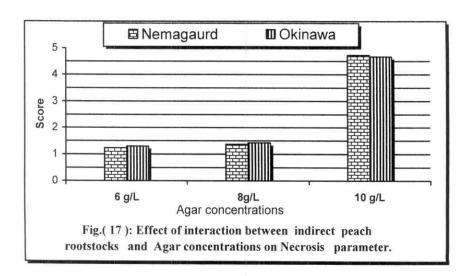


Table (24-C) Effect of interaction between peach rootstocks and agar treatments

Parameters	Nec	roses	Gro	wth		. of oots		oot gth	Sho thick		No. leav pla	200	Roo leng	- 1550 m	Arocae	. of ots
Rootstock type Agar Conc. (g/L)	m I	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
6	1.23 E	1.30 DE	4.70 A	4.53 B	6.33 A	5.67 AB	3.00 A	3.10 A	0.433 A	0.43 A	8.00 A	8.00 A	2.60 AB	2.70 A	5.67 A	5.67 A
8	1.37 DE	1.43 D	4.13 C	4.03 C	5.33 B	5.33 B	2.87 A	2.93 A	0.43 B	0.30 BC	6.67 A	6.67 A	2.47 BC	2.37 C	4.33 B	В
10	4.73 BC	4.67 C	1.27 DE	1.33 D	2.00 C	2.00 C	2.00 B	2.00 B	0.23 CD	0.20 D	2.33 B	2.33 B	1.87 D	1.83 D	2.33 C	С
12	4.87 AB	4.87 AB	1.13 EF	1.13 EF	1.00 D	1.00 D	1.60 C	1.60 C	0.20 D	0.20 D	1.67 B	1.67 B	1.33 E	1.50 E	1.33 CD	1.00 D
14	4.93 A	4.93 A	1.07 F	1.07 F	1.00 D	1.00 D	1.23 D	1.17 D	0.20 D	0.20 D	1.67 B	1.67 B	1.07 F	1.03 F	1.00 D	1.00 D

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.

4.1.III.b.3.2.Induction of agar tolerance.

Data in Table (25) reflect the effect of gradual exposure of agar levels on the tissue cultural parameters of indirect regenerated some peach rootstock plants. It is quite evident from Table (25-A) that both Nemagaurd and Okinawa peach rootstocks failed to induce significant differences when all parameters under study were considered.

Dealing with the effect of agar concentrations, it is appeared from Table (25-B) that supplementation of the cultural medium with 8 or 9 g/L agar induced the best results as significantly reduced Necrosis as well as increased Growth and

Shoot thickness in relation to the other concentrations. However, supplementation the cultural medium with 8g/Lsignificantly improved No. of shoots, Shoot length, No. of leaves/plant, root length and No. of roots parameters in relation to the other concentrations. Regarding the interaction between peach rootstocks and agar concentrations, Table (25-C) and Fig (18) indicate that Necrosis was significantly decreased when Nemagaurd peach rootstock was used in combination with 8 g/L agar. However, culturing of Nemagaurd plants on the medium supplemented with 8, 9 and 10 g/L agar and Okinawa plants on the medium supplemented with 8 g/L agar enhanced the highest significant Growth as compared with the other interactions. Meanwhile, number of shoots, shoot thickness, No. of leaves/plant and No. of roots were significantly responded when combination of either Nemagaurd or Okinawa peach rootstock and 8 g/L agar were used in relation to the other interactions. However, Shoot length was showed a significant increase when Okinawa plants in combination with 8 g/L agar were used. On contrary, using 8 g/L agar in combination with Nemagaurd peach rootstock enhanced a significant increase in root length in comparison with the other combinations.

Table (25): Effect of gradual exposure of agar levels on the tissue cultural parameters of indirect regenerated some peach rootstock plantlets.

Table (25-A) Effect of peach rootstocks

Parameters Rootstock type	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Nemagaurd	2.87 A	2.87 A	3.27 A	2.28 A	0.23 A	4.07 A	1.87 A	2.53 A
Okinawa	2.87 A	2.83 A	3.27 A	2.27 A	0.23 A	4.07 A	1.83 A	2.47 A

Means of rootstocks followed by the same letter(s) within each column are not significantly different at 1% level.

Table (25-B) Effect of Agar treatments

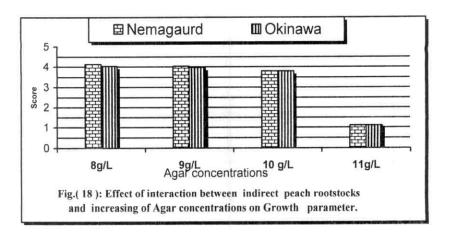
Parameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
8	1.40 D	4.08 A	5.33 A	2.90 A	0.317 A	6.67 A	2.42A	4.17 A
9	1.47 D	4.00 A	4.33 B	2.70 B	0.27 A	5.67 B	2.22 B	3.33 B
10	1.62 C	3.80 B	3.67 B	2.47 C	0.20 B	4.67 C	2.03 C	2.67 B
11	4.90 A	1.10 C	1.00 D	1.37 E	0.17 B	1.33 D	1.13 E	1.00 C

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

Table (25-C) Effect of interaction between peach rootstocks and agar treatments

Parameters	Necr	oses	Gro	wth	1107,000	o of oots	1000	oot gth	Sho thick	0.000	leav	. of res / ant		oot gth	No.	arcara.
Rootstock type Agar Conc. (g/L)	8	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa	Nemagaurd	Okinawa
8	1.37	1.43	4.13	4.03	5.33	5.33	2.87	2.93	0.33	0.30	6.67	6.67	2.47	2.37	4.33	4.00
	F	EF	A	A	A	A	AB	A	A	A	A	A	A	AB	A	A
9	1.43	1.50	4.03	3.97	4.33	4.33	2.70	2.70	0.27	0.27	5.67	5.67	2.20	2.23	3.33	3.33
	EF	DE	A	AB	AB	AB	B	B	AB	AB	AB	AB	CD	BC	AB	AB
10	1.60	1.63	3.80	3.80	3.67	3.67	2.50	2.43	0.20	0.20	4.67	4.67	2.07	2.00	2.67	2.67
	CD	C	A	B	B	B	C	C	BC	BC	B	B	DE	E	B	B
11	4.90	4.90	1.10	1.10	1.00	1.00	1.40	1.33	0.17	0.17	1.33	1.33	1.13	1.13	1.00	1.00
	A	A	C	C	C	C	E	E	C	C	C	C	G	G	C	C

Means of interactions followed by the same letter(s) within each column are not significantly different at 1% level.



4.1.IV. DNA finger printing using RAPD-PCR technique:

RAPD assay, for randomly amplified polymorphic DNA, was developed independently by two different laboratories (Welsh and McClelland, 1990; Williams et al., 1990). It detects nucleotide sequence polymorphism in a DNA amplification assay using only a single primer of arbitrary nucleotide sequence, RAPD assay was used as a tool to identify molecular markers linked to trait of interest.

For primer; OP-A-16 (**Photo**, **15**), the band with molecular weight 1 K bp appeared in both two peach rootstocks (Nemagaurd and Okinawa) (lane 3 & 4) while this band disappeared from the control sample (lane 2), while in primer OP-B6; the band with molecular weight 500 bp which found in both control and Nemagaurd rootstock (lane 2 & 3) disappeared from the Okinawa rootstock (lane 4) (**Photo 16**).

The same results were obtained with primer OP-B7 (**Photo** 17). In this figure we found that the band with molecular size 600 bp found in both control and Nemagaurd rootstock (lanes 2 & 3) while this band was not found in the other rootstock; Okinawa rootstock (lane 4).

Also, with primer OP-E7; the Okinawa rootstock led to avoidance of band with molecular weight 500 bp (lane 4) while this band appeared in both control and Nemagaurd rootstock (Photo 18, lane 2 & 3).

For primer OP-E6 (**Photo 19**), no differences found among the three samples; control and two peach rootstocks (Nemagaurd and Okinawa).

From all above results, RAPD analysis can detect differences which occurred from tolerated rootstocks.

The detection of RAPD markers on the genomic map of different plants is beneficiate to improve breeding programs for these plants. It offers the simplest and fastest methods for detecting a great number of genomic markers in the shortest period of time (Welsh and McClelland, 1990; Williams et al., 1990; Novy and Vorsa, 1996; Autio et al., 1998 and Al-Tiraif et al., 1998).

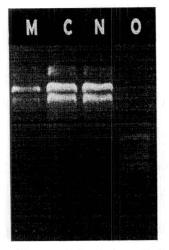


Photo (16): Primer B6

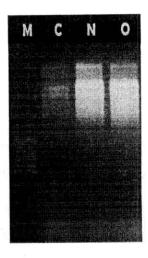


Photo (15): Primer A-16

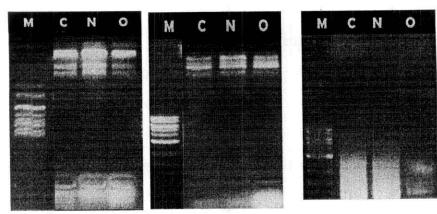


Photo (19): Primer E6 Photo (18): Primer E7 Photo (17): Primer B7

M = Marker

C = Control

N = Nemagaurd rootstock

O = Okinawa rootstock

4.2. Apricot Rootstocks

4.2.I. Micro-propagation

4.2.I.A. Indirect regeneration

4.2.I.A.1. Callus production and development

4.2.I.A.1.1. Effect of explant type

Data of Table (26) reflect the effect of different explant type on explant development and callus production parameters of Amar apricot rootstock (Balady). It is obvious that shoot tip resulted in a significant reduction of Necrosis and significantly maximized explant development as compared with stem segments under study. Meanwhile, stem segments showed a significant increase in callus production as compared with shoot tip and leaf discs explants.

Table (26) Effect of different explant type on explant development and callus production parameters of Amar apricot rootstocks (Balady)

Parameters Explant types	Necrosis	Explant development	Callus production
Shoot tip	1.13 B	4.83 A	1.13 B
Leaf discs	1.40 B	4.53 A	1.17 B
Stem segments	1.77 A	3.90 B	3.83 A

Means of explant type followed by the same letter(s) within each column are not significantly different at 1% level.

4.2.I.A.1.2. Effect of cold pre-treatment

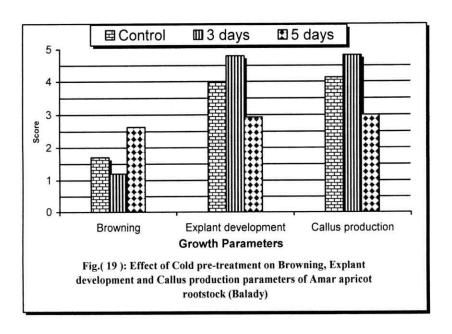
Data of Table (27) and Fig. (19) explain the effect of different cold pretreatment periods on Necrosis, Browning, Explant development and Callus production parameters of Amar apricot rootstock (Balady). It is appear that keeping of the explant for 3 days in refrigerator at 5°C enhanced a significant improvement of the explant which reduced Necrosis and Browning and increased Explant development and Callus production parameters In relation to the other periods and the control.

The above results demonstrate that cold pretreatment of the explant for 3 days encouraged the best responses of the explant. This may be due to the ability of the cold treatment to reduce free phenolic compounds through converting it to combined phenolic compound which resulted in reducing their toxicity and in turn improved the tissue parameters.

Table (27) Effect of cold pretreatment on explant development and callus production parameters of Amar apricot rootstocks (Balady)

Parameters cold Pre- treatment(days)		Browning	Explant development	Callus production	
Control	1.50 B	1.70 B	3.97 B	4.13 B	
3	1.13 C	1.20 C	4.80 A	4.83 A	
5	1.83 A	2.63 A	2.93 C	3.00 C	

Means of cold pretreatment followed by the same letter(s) within each column are not significantly different at 1% level



4.2.I.A.1.3. Effect of auxin type

The data in Table (28) and Photo (20) show that the effect of auxin type on explant development and callus production parameters of Amar apricot rootstock (Balady). It is obvious that Indole-3-butyric acid (IBA) significantly surpassed both NAA and 2,4-D in increasing Explant development and callus production parameters while reduced Necrosis. The aforementioned results conclude that IBA was superior in enhancing explant development parameter.

Table (28) Effect of Auxin type on explant development and callus production parameters of Amar apricot rootstocks (Balady)

Parameters Auxin type	Necrosis	Explant development	Callus production
IBA	1.50 C	3.73 A	6.00 A
NAA	2.30 B	3.13 B	4.33 AB
2,4-D	3.93 A	1.53 C	2.00 B

Means of Auxin type followed by the same letter(s) within each column are not significantly different at 1% level.

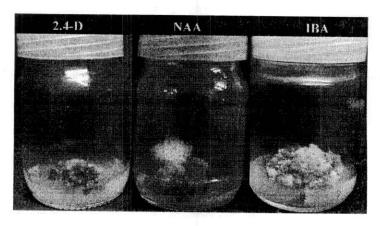


Photo (20): Effect of Auxin type on explant development and callus production parameters of Amar apricot rootstocks (Balady)

4.2.I.A.1.5. Effect of auxin concentrations

Table (29) verifies the effect of different IBA concentrations on necrosis, explant development, callus production and greening parameters of Amar apricot rootstocks (Balady). It is quite evident that supplementation of culture medium with 3.0 mg/L IBA caused a significant decrease of

necrosis and significantly increased explant development, callus production and greening parameters.

The aforementioned results summarized that addition of IBA at 3.0 mg/L to culture medium recommended for realizing the best results.

Table (29) Effect of IBA concentrations on explant development and callus production parameters of Amar apricot rootstocks (Balady)

Parameters IBA Conc. (mg/L)	Necrosis	Explant development	Callus production
Control (00.00)	1.97 A	1.87 D	1.00 C
1.00	1.93 A	2.90 C	1.67 BC
2.00	1.43 B	3.20 B	3.00 B
3.00	1.13 C	3.97 A	6.00 A

Means of auxin concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

4.2.I.A.1.6. Effect of additives.

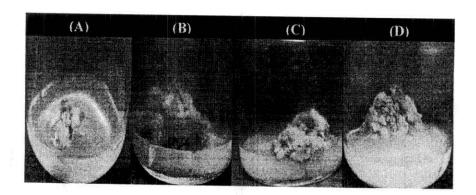
Data in Table (30) and Photo (21) verify the effect of different additives on explant development and growth parameters of Amar apricot rootstock (Balady). It is noticed that supplementing culture medium with adenine sulphate (80 mg/L) significantly reduced Necrosis and significantly improved and Explant development followed by glutamine as compared with the other additives. Moreover, adding of yeast extract (300 mg/L) to the culture medium significantly succeeded in maximized callus production in comparison with different additives under study.

The aforementioned results clarify that either addition of adenine sulphate or yeast extract was more effective in improving all parameters under study.

Table (30) Effect of different additives on explant development and callus production parameters of Amar apricot rootstocks (Balady)

Parameters Additives (mg/L)	Necrosis	Explant development	Callus production
Control (0.00)	2.43 A	1.50 D	1.80 B
Glutamine (200)	1.77 C	4.47 B	1.20 D
Asparagine (200)	2.10 B	3.07 C	1.53 C
Adenine sulphate (80)	1.07 D	4.93 A	1.03 D
Yeast extract (300)	2.07 B	2.87 C	3.03 A

Means of additives followed by the same letter(s) within each column are not significantly different at 1% level.



A= Control (00.00 mg/L) C= Adenine sulphat (80 mg/L)

B= Asparagine (200 mg/L) D= Yeast extract (300 mg/L)

Photo (21): Effect of different additives on explant development and callus production parameters of Amar apricot rootstocks (Balady)

4.2.I.A.1.7. Effect of callus storage (Somaclonal variations).

Table (31) and Photo (22) show the effect of callus storage on callus characteristics of Amar apricot rootstock (Balady)plants. It is clear that there were a direct relationship between storage periods and Necrosis, Smooth callus and Regeneration parameters that increased by increasing storage periods. On the other hand, the reverse was true with regard to globular callus, No. of globules/callus as well as size and colour of the callus produced. Generally, Callus was produced increasing when storage periods at 6 month under study.

Table (31): Effect of callus storage on callus characteristics of Amar apricot rootstocks (Balady)plantlets

Parameters		Callus	type		No. of	Size	Color
Storage periods (month)	Necroses	Globular	smooth	Regeneration	Globules	(score)	(score)
Control (fresh callus)	1.23 C	4.87 A	1.23 C	2.00 C	6.33 A	4.67 A	4.67 A
2	1.57 C	4.13 B	1.53 B	3.00 C	4.33 B	3.67 AB	3.33 B
4	2.33 B	3.80 C	1.63 B	4.67 B	3.33 B	3.00 B	2.33 BC
6	3.33 A	3.03 D	1.93 A	6.33 A	2.67 B	2.67 B	1.67 C

Means of storage periods followed by the same letter(s) within each column are not significantly different at 1% level.

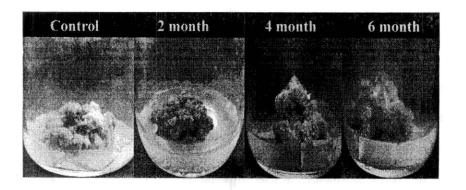


Photo (22): Effect of callus storage on callus characteristics of Amar apricot rootstocks (Balady)plantlets

4.2.I.A.2. Plantlet regeneration (Hormonal balance).

Data of Table (32) and Photo (23) reflect the effect of hormonal balance on growth and number of regenerated plantlets parameters of Amar apricot rootstocks (Balady). Data of Table (32-A) show that effect of different concentrations of Indol-3-butyric acid (IBA). It is clear that supplementation the medium with 1.0 mg/L of IBA caused a significant decrease of necrosis and significantly increased growth, No. of regenerated plantlets and greening parameters. Meanwhile, addition of 2.0 or 3.0 mg/L IBA to culture medium reduced significantly growth as compared with the other concentrations.

The above mentioned results concluded that supplementation of medium with 1.0 mg/L IBA encouraged growth, No. of regenerated plantlets and greening and reduced necrosis. On the other hand, Data in Table (32-B) show the

effect of different BAP concentrations on necrosis, growth, number of regenerated plantlets and greening parameters of Amar apricot rootstocks (Balady). It is quite evident that supplemented of the culture medium with BAP at 3.0 mg/L level was effective in maximizing growth and No. of regenerated plantlets in relation to the other concentrations. Meanwhile, addition either 2.0 or 3.0 mg/L BAP enhanced a significant improvement of greening as compared with the other concentrations. However, Necrosis was significantly decreased as 2.0 or 3.0 mg/L BAP was tested in comparison with the other combinations.

The above results reflect the importance of using 3.0 mg/L BAP to maximize growth and no. of regenerated plantlets parameters.

Data in Table (32-C) show the effect of interaction between IBA and BAP concentrations on necrosis, growth, No. of regenerated plantlets and greening parameters of Amar apricot rootstocks (Balady). It is clear that supplementation of the culture medium with 1.0 mg/L IBA and 3.0 mg/L BAP encouraged growth, No. of regenerated plantlets and greening while reduced necrosis.

Table (32) Effect of hormonal balance on growth and number of regenerated plantlets parameters of Amar apricot rootstocks (Balady)

Table (32-A) Effect of IBA concentrations

Parameters	Necrosis	Growth	No. Of regenerated plantlet	Greening	
Control (0.00)	1.63 BC	4.40 B	1.27 C	3.93 A	
1.00	1.10 C	4.77 A	4.27 A	4.83 A	
2.00	1.33 CD	3.97 C	3.17 B	4.03 B	
3.00	2.07 AB	3.30 D	1.57 C	1.80 C	

Means of IBA followed by the same letter(s) within each column are not significantly different at 1% level.

Table (32-B) Effect of different BAP concentrations

Parameters BAP conc. (mg/L)	Necrosis	Growth	No. Of regenerated plantlet	Greening
Control (00.00)	2.13 A	2.93 D	4.00 C	2.97 B
1.00	1.87 B	3.07 C	7.00 BC	3.07 B
2.00	1.17 C	4.60 B	10.00 B	4.47 A
3.00	1.07 C	4.87 A	15.00 A	4.70 A

Means of BAP followed by the same letter (s) within each column are not significantly different at 1% level.

Table (32-C) Effect of interaction between IBA and BAP concentrations

Parameters	Necrosis		Growth		No. Of Regenerated plantlet		Greening	
Hormone Type conc. (mg/L)	IBA	ВАР	IBA	ВАР	IBA	ВАР	IBA	BAP
Control (00.00)	1.63 BC	2.13 A	4.40 B	2.93 D	1.27 C	4.00 C	3.93 B	2.97 B
1.00	1.10 C	1.87 B	4.77 A	3.07 C	4.27 A	7.00 BC	4.83 A	3.07 B
2.00	1.33 CD	1.17 C	3.97 C	4.60 B	3.17 B	10.00 B	4.03 B	4.47 A
3.00	2.07 AB	1.07 C	3.30 D	4.87 A	1.57 C	15.00 A	1.80 C	4.70 A

Means of interaction followed by the same letter(s) within each column are not significantly different at 1% level.

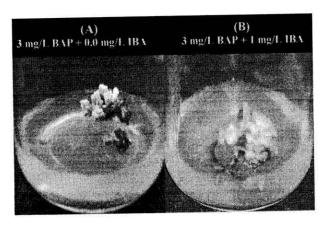


Photo (23): Effect of hormonal balance on growth and No. of regenerated plantlets parameters of Amar apricot rootstocks (Balady)

4.2.II.Salinity stress:

4.2.II.a.Direct regeneration:-

4.2.II.a.1. Evaluation of salt tolerance levels.

The tabulated data of Table (33), Photo (24) and Fig (20) clarify the effect of different salinity concentrations on the tissue cultural parameters i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots of *in vitro* Amar apricot rootstock plants. It is clear that increasing levels of salinity induced a harmful effect on most tissue culture parameters as Growth, No. of Shoots, Shoot length, No. of leaves/plant and No. of roots were significantly reduced by increasing salinity in the culture medium. However, the refers was true in case of Necrosis, Shoot thickness and Root length parameters. Increasing salinity concentrations more than

1000 ppm NaCl had a detrimental effect on most parameters under study up to the lethal concentration 2000 ppm NaCl which caused almost death of *in vitro* plants.

The above mentioned results concluded that salinity inserted a worth results on most tissue culture parameters. This is true a result of the bad effect of salinity on free water and nutritional status available to the plants and in turn induced a negative effect increased with increasing salt concentration in the medium.

Table (33) Evaluation of *in vitro* growth parameters as affected by different salinity levels tolerated by Amar apricot rootstock (Balady) plantlets.

Parameters Salinity Conc. (ppm)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Control (0.00)	1.13 H	4.80 A	7.67 A	4.33 A	0.17 B	10.33 A	2.23 AB	9.00 A
NaCl (500)	1.97 F	3.27 C	5.00 BC	3.90 B	0.17 B	7.00 BC	2.07 BC	6.00 BC
NaCl (1000)	2.87 DE	2.90 D	3.33 DE	3.60 CD	0.23 AB	5.33 D	2.40 A	5.67 BC
NaCI (1500)	4.07 B	1.53 G	1.33 GH	2.67 F	0.30 A	2.67 E	2.10 BC	3.33 EF
NaCI (2000)	4.90 A	1.03 H	1.00 H	1.53	0.27 AB	2.00 E	1.80 DE	1.33 G
CaCl ₂ (500)	1.53 G	3.70 B	5.67 B	3.80 BC	0.20 AB	7.67 B	2.03 BC	7.00 B
CaCl ₂ (1000)	1.97 F	3.17 C	4.33 CD	3.30 E	0.27 AB	7.00 BC	2.17 B	5.00 CD
CaCl ₂ (1500)	3.30 C	2.17 F	2.67 EF	2.80 F	0.30 A	5.33 D	2.17 B	3.67 DEF
CaCl ₂ (2000)	3.93 B	2.07 F	2.00 FGH	2.43 G	0.30 A	4.33 D	2.40 A	2.67 FG
NaCl + CaCl ₂ (250 + 250)	2.77 E	3.30 C	5.67 B	3.50 DE	0.20 AB	7.67 B	1.93 CD	5.33 C
NaCl + CaCl ₂ (500 + 500)	2.97 D	2.73 DE	3.00 EF	2.43 G	0.23 AB	5.67 CD	1.900 CD	5.33 C
NaCl + CaCl ₂ (750 + 750)	3.27 C	2.53 E	2.33 EFG	2.40 G	0.30 A	5.33 D	1.63 EF	4.67 CDE
NaCI + CaCI ₂ (1000 + 1000)	4.00 B	1.50 G	2.00 FGH	1.80 H	0.30 A	4.33 D	1.53 F	3.00 F

Means of salinity concentrations followed by the same letter(s) within each column are not significantly different at 1% level

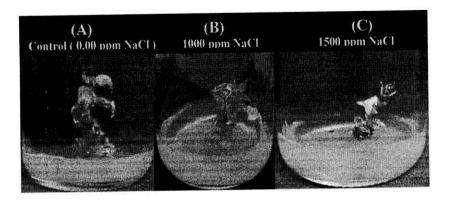
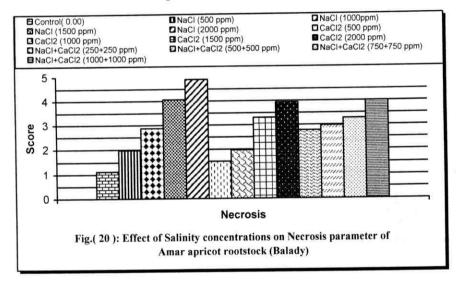


Photo (24):Evaluation of *in vitro* growth parameters as affected by different salinity levels tolerated by Amar apricot rootstock (Balady) plantlets.



4.2.II.a.2. Induction of salt tolerance.

4.2.II.a.2.1.Tissue culture parameters.

Table (34) and Fig (21) and Photo (25) show the effect of gradual increase of NaCl levels on growth parameters of direct regenerated Amar apricot rootstock (Balady) plants. It is appear that adding of higher NaCl concentration (2500 ppm) induced

a significant increase in necrosis and had the lowest Growth, No. of shoots, Shoot length, No. of leaves/plant, Root length and No. of roots parameters. On the other hand, different concentrations of NaCl failed to induce any statistical differences when shoot thickness parameter was taken in consideration.

Generally increasing NaCl concentration more than 1500 ppm induced a bad effect on all parameters under study up to the lethal concentration caused by 2500 ppm which caused almost death of *in vitro* plants.

Table(34) Effect of gradual increase of NaCl levels on growth parameters of direct regenerated Amar apricot rootstock (Balady) plantlets.

Parameters NaCl Conc. (ppm)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
1000	2.87 C	2.90 A	3.33 A	3.60 A	0.23 A	5.33 A	2.40 A	5.67 A
1500	2.87 C	2.93 A	3.67 A	3.47 A	0.30 A	5.00 AB	2.20 AB	
2000	3.17 B	2.23 B				4.00 B	2.03 BC	3.33 BC
2500	4.99 A	1.01 C	1.00 C	1.00 C	-	2.00 C	1.07 C	1.02 D

Means of NaCl concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

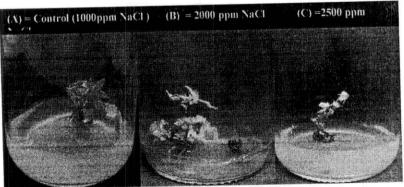
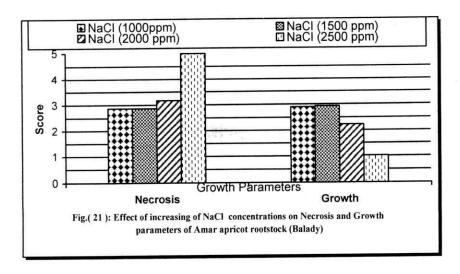


Photo (25): Effect of gradual increase of NaCl levels on growth parameters of direct regenerated Amar apricot rootstock (Balady) plantlets.



4.2.II.a.2.2.Chemical parameters.

Table (35) deals with the effect of gradual increase of NaCl levels on chemical parameters of direct regenerated Amar apricot rootstock (Balady) plants. It is appear that chlorophyll (A), chlorophyll (B), total sugars and total indoles were a statistical increased when lower levels of NaCl (1000 ppm) was added to the medium as compared with the higher levels of NaCl (2500 ppm). On the other hand, supplementation of the culture medium with high concentrations up to 2500 ppm enhanced a significant increase in total phenol and proline in relation to the other NaCl concentrations.

In general, the before mention results summarized that increasing NaCl concentrations had an adverse effect on chlorophyll (A), chlorophyll (B), total sugars and total indoles while both total phenol and proline contents were maximized.

Table (35) Effect of gradual increase of NaCl levels on chemical parameters of direct regenerated Amar apricot rootstock (Balady)plantlets

Parameters NaCl Conc. (ppm)	Chlorophyll A	Chlorophyll B	Total sugars	Total indoles	Total phenol	Proline	
1000	6.23 A					0.16 E	
1500	4.39 B	5.27 B	10.52 B	2.23 B	11.40 D	0.77 D	
2000	2.26 C	3.20 C	9.55 C		12.25 C	1.54 C	
2500	0.0013 D	0.0017 D	7.46 E	0.91 E	16.95 A	3.36 A	

Means of NaCl concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

4.2.II.b. Indirect regeneration

4.2.II.b.1. Evaluation of salt tolerance levels.

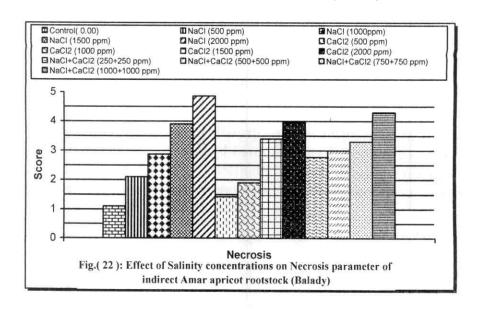
Results in Table (36) and Fig (22) clarify the effect of salinity on tissue culture parameters i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots of *in vitro* Amar apricot rootstock plants. It is clear that different NaCl concentrations had a harmful effect on tissue culture parameters as compared with CaCl₂ and the combinations of NaCl + CaCl₂ when Shoot length, Shoot thickness and Root length were concerned. Meanwhile, increasing NaCl concentration more than 1500 ppm had a detrimental effect on all parameters under study up to the lethal concentration 2000 ppm NaCl which caused almost death of the *in vitro* plants. Generally, increasing NaCl concentrations more than 1500 ppm induced a bad effect on all parameters under study up to the lethal concentration with 2000 ppm NaCl in

which caused almost death of *in vitro* plants. However, the effect of CaCl₂ with different levels was less toxic to the plants compared with the similar levels of NaCl.

Table (36) Evaluation of *in vitro* growth parameters as affected by different salinity levels tolerated by indirect regenerated Amar apricot rootstock (Balady) plantlets.

Parameters Salinity Conc. (ppm)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
Control (0.00)	1.10 J	4.87 A	8.67 A	4.50 A	0.20 D	11.67 A	2.37 A	8.33 A
NaCI (500)	2.10 G	3.50 B	5.67 BCD	4.30 B	0.20 D	7.67 B	2.17 B	6.00 B
NaCl (1000)	2.87 EF	2.83 D	4.67 D	3.90 C	0.33 AB	5.33 DE	1.93 DE	4.67 C
NaCl (1500)	3.90 C	2.23 FG	2.67 E	2.93 F	0.40 A	3.00 G	2.00 CDE	3.33 DEF
NaCl (2000)	4.87 A	1.131	1.00 F	1.50	0.30 BC	1.67 H	1.73 FG	1.33 G
CaCl ₂ (500)	1.431	3.70 B	6.67 B	3.70 D	0.33 AB	7.67 B	2.10 BC	7.00 B
CaCl ₂ (1000)	1.90 H	3.00 CD	5.33 CD	3.43 E	0.20 D	6.33 C	1.93 DE	4.67 C
CaCl ₂ (1500)	3.40 D	2.30 EF	2.67 E	2.80 F	0.23 CD	5.33 DE	1.87 EF	3.67 CDE
CaCl ₂ (2000)	4.00 C	2.03 G	2.00 EF	2.50 G	0.20 D	4.67 EF	1.60 G	2.33 FG
NaCl + CaCl ₂ (250 + 250)	2.77 F	3.20 C	6.00 BC	3.50 E	0.30 BC	7.67 B	2.07 BCD	4.67 C
NaCl + CaCl ₂ (500 + 500)	3.00 E	2.80 D	3.00 E	2.37 G	0.23 CD	5.67 CD	2.00 CDE	4.67 C
NaCl + CaCl ₂ (750 + 750)	3.30 D	2.50 E	2.33 E	2.43 G	0.23 CD	5.00 DE	1.70 G	4.00 CD
NaCl + CaCl ₂ (1000 + 1000)	4.30 B	1.50 H	2.00 EF	1.80 H	0.30 BC	4.00 F	1.43 H	2.67 EF

Means of salinity concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.II.b.2. Induction of salt tolerance.

4.2.II.b.2.1. Tissue culture parameters.

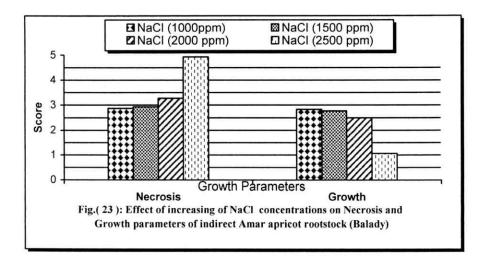
Table (37) and Fig (23) verifies the effect of gradual increase of NaCl levels on growth parameters (i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots) of indirect regenerated Amar apricot rootstock (Balady) plants. It is quite evident that adding lower NaC1 concentrations (1000 and 1500 ppm) induced a significant decrease Necrosis and had the highest Growth, No. of leaves/plant and Root length parameters. However, addition on1000 ppm NaCl enhanced a significant improvement of No. of roots as compared with the other concentrations.

The above results reflect the importance of using 1000 ppm NaCl to maximize all parameters under study.

Table(37) Effect of gradual increase of NaCl levels on growth parameters of indirect regenerated Amar apricot rootstock (Balady) plantlets.

Parameters NaCl Conc. (ppm)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
1000	2.87 D	2.83 A	4.67 A	3.90A	0.33 A	5.33 A	1.93 A	4.67 A
1500	2.93 D	2.77 A	4.00 AB	3.60 B	0.30 AB	4.67 A	1.87 A	3.67 AB
2000	3.27 C	2.50 B	3.00 B	3.40 B	0.33 A	4.00 AB	1.50 B	2.33 BC
2500	4.93 A	1.07 D	1.00 C	1.23 D	0.20 B	1.33 C	1.13 C	1.00 C

Means of NaCl concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.II.b.2.2 Chemical parameters.

Table (38) reflects the effect of gradual increase of NaCl levels on chemical parameters of indirect regenerated Amar apricot rootstock (Balady) plants. It is obvious that chlorophyll

(A&B), total sugars and total indoles levels were significantly increased with 1000 ppm NaCl which added to the culture medium followed by 1500 ppm then 2000 ppm NaCl as compared with higher concentration (2500 ppm NaCl) in descending order. Meanwhile, increasing NaCl concentrations enhanced a significant increase of total phenol and proline up to the highest level at 2500 ppm NaCl.

Table (38):Effect of gradual increase of NaCl levels on chemical parameters of indirect regenerated Amar apricot rootstock (Balady)plantlets.

Parameters NaCl Conc. (ppm)	Δ .	Chlorophyll B	Total sugars	Total indoles	Total phenol	Proline	
1000	6.14 A	7.24 A	13.12 A	2.81 A	10.19 E	0.16 E	
1500	4.20 B	5.23 B	11.78 B	2.54 B	11.55 D	0.78 D	
2000	2.20 C	3.19 C	10.66 C	1.88 C	12.35 C	1.58 C	
2500	0.0013 D	0.0017 D	8.47 E	0.97 E	15.38 A	3.39 A	

Means of NaCl concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

4.2.III.Drought stress:

4.2.III.a.Direct regeneration .

4.2.III.a.1.Effect of Mannitol.

4.2.III.a.1.1.Evaluation of Mannitol levels.

Data of Table (39), Photo (26) and Fig (24) reflect the effect of different Mannitol concentrations on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plants. It is noticed that supplementation culture medium with

20 g/L Mannitol encouraged a significant increase in Growth, No. of shoots, Shoot length, No. of leaves/plant and Root length compared with the other concentrations used. The reverse was true when necrosis was taken in consideration. Meanwhile, statistically higher when both of was No. roots 20 or 40 g/L Mannitol was used. On the other hand, Shoot thickness was significantly increased as concentration of Mannitol which increased up to the highest level used (40, 60 and 80g/L) as compared with the lowest level (20 g/L). Generally, growth parameters i.e. Growth, No. of shoots, Shoot length, No. of leaves/plant, Root length and No. of roots were responded positively with lowest Mannitol concentration.

Table (39): Evaluation of different Mannitol levels on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
20	1.27 D	4.53 A	4.33 A	3.07 A	0.10 B	8.00 A	1.73 A	5.00 A
40	2.10 C	3.97 B	3.33 AB	2.77 AB	0.23 A	5.00 B	1.53 B	4.00 A
60	2.93 B	3.10 C	2.67 B	2.50 B	0.30 A	4.00 BC	1.30 C	2.33 B
80	4.93 A	1.07 E	1.00 C	1.30 D	0.30 A	2.00 D	1.00 D	1.00 B

Means of Mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.

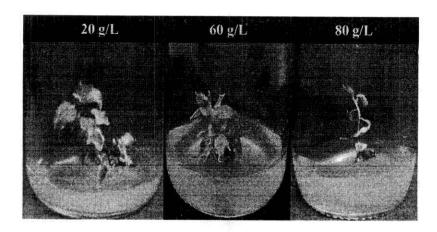
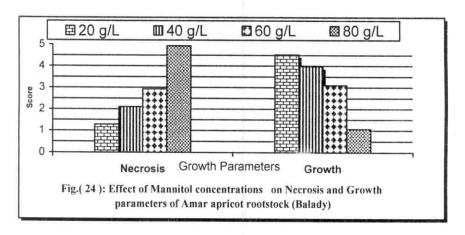


Photo (26): Evaluation of different Mannitol levels on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.



4.2.III.a.1.2.Induction of Mannitol tolerance.

The effect of gradual exposure of Mannitol levels on the tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plants. was tabulated in Table(40).and show in Fig (25). It is appeared that supplementation of the culture medium with (60 and 70 g/L) Mannitol induced the best results and significantly reduced Necrosis as well as increased Growth and

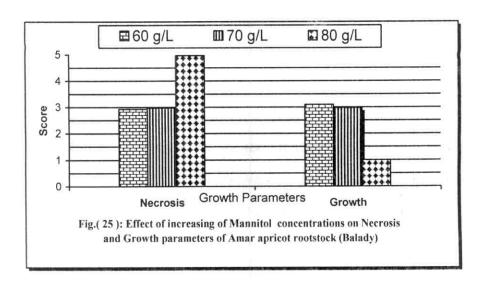
No. of shoots in relation to the other concentrations. Meanwhile, Shoot length, No. of leaves/plant and Root length were significantly maximized when subjected to stress by 60 g/L Mannitol in relation to the higher concentration (80 g/L) of Mannitol. However, shoot thickness was significantly increased when subjected to the higher concentration (80 g/L) of Mannitol. On the other hand, no statistical differences were noticed among different concentrations of Mannitol when No. of roots was evaluated.

Generally, increasing Mannitol concentrations had an adverse effect on Growth, No. of shoots, Shoot length, No. of leaves/plant and Root length and gave the best results with Shoot thickness. The harmful effect appeared on the most parameters under study may be resulted from high osmotic potentials of culture medium and in turn a great reduction of free water occurred. This mean that these plants showed an increase in tolerance to drought stress.

Table (40) Effect of gradual exposure of Mannitol levels on the tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
60	2.93 C	3.10 A	2.67 A	2.50 A	0.30 B	4.00 A	1.30 A	2.33 A
70	2.97 C	2.97 A	2.33 A	2.13 B	0.33 AB	3.33 AB	1.20 AB	2.00 A
80	4.97 A	1.00 C	1.00 B	1.10 E	0.40 A	1.00 D	0.97 C	1.00 A

Means of Mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.a.2. Effect of Polyethylene glycol (PEG) .

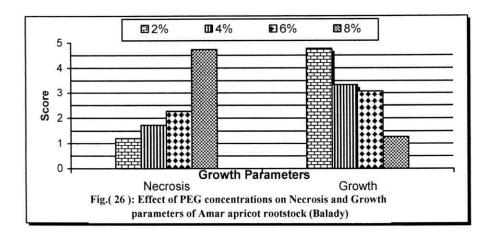
4.2.III.a.2.1. Evaluation of Polyethylene glycol levels.

Table (41) and Fig (26) show evaluation of different PEG levels on tissue cultural parameters of *in vitro* Amar apricot rootstock (Balady) plants. It is clear that addition of 2 % PEG to culture medium encouraged a significant increase of Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant and Root length parameters in comparison with the other PEG concentrations. However, the reverse was true when Necrosis was considered. Meanwhile, No. of roots was significantly increased when either 2, 4 and 6% PEG was added to the medium.

Table (41): Evaluation of different PEG levels on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.

Parameters PEG Conc. (%/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
2	1.20 D	4.77A	6.67 A	3.27 A	0.53 A	9.67 A	2.33 A	4.33 A
4	1.73 C	3.33 B	5.00 B	3.03 B	0.40 AB	7.33 B	2.03 B	4.33 A
6	2.27 B	3.07 C	3.67 C	2.80 C	0.33 AB	5.33 C	1.93 B	3.67 A
8	4.73 A	1.27 D	1.67 D	1.80 D	0.33 AB	3.67 D	1.50 C	2.67 AB
10	4.93 A	1.17 D	1.00 D	1.27 E	0.23 B	2.33 D	1.10 D	1.33 B

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.a.2.2. Induction of polyethylene glycol tolerance.

A glance to Table (42) and Fig (27) shows the effect of gradual exposure of PEG levels on tissue cultural parameters of in vitro Amar apricot rootstock (Balady) plants. indicated that No. of shoots, Shoot length, Shoot thickness and Root length were adverse affected by increasing PEG concentrations. The lowest level (6%) showed the best parameters in this concern.

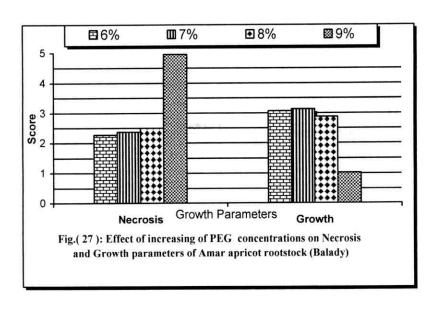
However, the reverse was true in case of Necrosis. Meanwhile, Growth had a positive response with increasing PEG concentrations up to 7 %. Besides, both No. of leaves/plant and No. of roots were significantly maximized when 6 % was used.

The aforementioned results indicate that increasing PEG concentrations resulted in harmful effect on most tissue culture parameters. This may be due to the osmotic effect as increasing PEG concentrations increased the osmotic pressure of the culture medium and in turn reduced free water suitable for absorption which resulted in reducing cell division and elongation. These led to induce a bad effect on most tissue culture parameters of cultured plantlets.

Table (42) Effect of gradual exposure of PEG levels on tissue cultural parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.

Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots		Shoot thickness	No. of leaves / plant		No. of roots
6	2.27 D	3.07 AB	3.67 A	2.80 A	0.33 A	5.33 A	1.93 A	3.67 A
7	2.37 D				0.37 A			
8	2.50 C				0.30 AB			
9	4.96 A	1.03 C			0.10 C			

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.a.3. Effect of Agar.

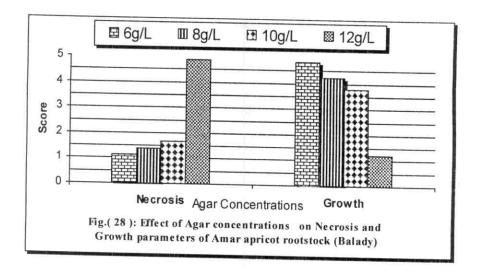
4.2.III.a.3.1. Evaluation of agar levels.

Table (43) and Fig (28) reflect the evaluation of different agar concentrations on tissue culture parameters. i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots of *in vitro* Amar apricot rootstock (Balady) plants. It is quite evident that addition of agar at the rate of 6 g/L induce significant reduction of Necrosis while significantly maximized all other parameters under study followed by 8 g/L then 10 g/L as compared with both 12 g/L and 14 g/L agar concentrations in a descending order.

Table (43): Evaluation of different Agar levels on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.

Parameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
6	1.13 E	4.83 A	5.67 A	2.37 A	0.47 A	7.00 A	1.20 A	4.67 A
8	1.40 D	4.23 B	5.00 AB	2.07 B	0.37 AB	5.00 B	1.07 AB	3.33 AB
10	1.67 C	3.80 C	4.00 B	1.87 C	0.30 BC	4.00 BC	1.03 AB	2.67 AB
12	4.89 B	1.20 D	1.00 C	1.13 D	0.23 C	3.00 CD	0.97 BC	1.33 B
14	4.93 A	1.10 D	1.00 C	0.97 D	0.20 C	2.00 D	0.83 C	1.33 B

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.a.3.2. Induction of agar tolerance.

Data of Table (44) and Fig (29) reflects the effect of gradual exposure of agar levels on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plants. It appears that supplementation of culture medium with 10 g/L agar enhanced a significant increase Growth, No. of shoots, Shoot length, Shoot

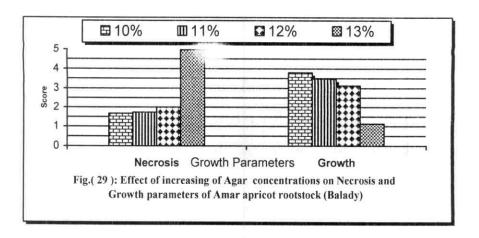
thickness and No. of leaves/plant as compared with the other concentrations. However, increasing agar concentration in culture medium from 10 g/L up to 12 g/L encouraged a significant increase of Root length and No. of roots. Also, supplementation of culture medium with either 10 g/L or 11g/L agar resulted in a significant decrease of Necrosis parameter in comparison with the other agar concentrations.

The aforementioned results concluded that the lowest agar concentration induced the best Growth, No. of shoots, Shoot length, Shoot thickness and No. of leaves/plant while Root length and No. of roots increased by increasing agar concentration to 12 g/L.

Table (44): Effect of gradual exposure of agar levels on tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plantlets.

Parameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant		No. of roots
10	1.67 D	3.80 A	4.00 A	1.87 A	0.30 A	4.00 A	1.03 A	2.67 A
11	1.73 D	3.47 B	3.00 B	1.63 B	0.27 AB	3.33 AB	1.00 A	2.33 A
12	2.00 C	3.13 C	2.33 B	1.20 C	0.20 AB	2.67 BC	0.97 A	2.00 A
13	4.97 A	1.13 E	1.00 C	0.93 D	0.17 B	1.33 D	0.70 B	1.00 B

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.b.Indirect regeneration.

4.2.III.b.1.Effect of Mannitol.

4.2.III.b.1.1.Evaluation of Mannitol levels.

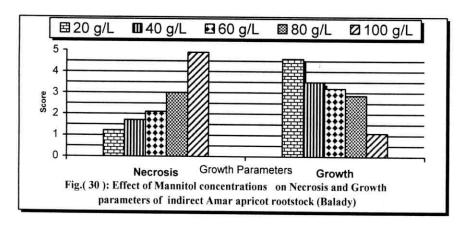
Data in Table (45) and Fig. (30) shows the evaluation of tissue culture parameters of *in vitro* regenerated plants from stored callus as affected by different mannitol levels tolerated by Amar apricot rootstock (Balady) plants. It is clear that Necrosis was the lower most significant level while Growth, No. of shoots, Shoot length, No. of leaves/plant and Root length were had the higher most significant level when mannitol was added to the culture medium at 20 g/L. However, increasing the concentrations of mannitol up to 60, 80 and 100 g/L did not affect significantly Shoot thickness in relation to the lower concentrations of mannitol (20 and 40 g/L). Meanwhile, addition mannitol to the culture medium at 20 or 40 g/L encouraged

a significant increase in No. of roots as compared with the other mannitol concentrations.

Table (45): Evaluation of tissue culture parameters of *in vitro* regenerated plantlets from stored callas as affected by different mannitol levels tolerated by Amar apricot rootstock (Balady) plantlets.

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
20	1.23 E	4.60 A	5.00 A	3.30 A	0.17 B	10.00 A	1.80 A	6.00 A
40	1.70 D	3.50 B	4.33 AB	2.70 B	0.23 AB	9.00 AB	1.60 AB	4.67 A
60	2.10 C	3.20 C	2.67 BC	2.57 BC	0.30 A	6.33 BC	1.40 BC	3.00 B
80	3.00 B	2.87 D	2.33 C	2.43 C	0.30 A	4.67 CD	1.33 C	1.67 BC
100	4.90 A	1.10 E	1.00 C	1.30 D	0.30 A	1.67 D	1.17 C	1.00 C

Means of mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.b.1.2.Induction of Mannitol tolerance.

Data in Table (46) and Fig. (31) dealing with the effect of gradual exposure to increase in concentrations of mannitol on the tissue culture parameters of *in vitro* Amar apricot rootstock (Balady) plants, it is appeared that supplementation of culture

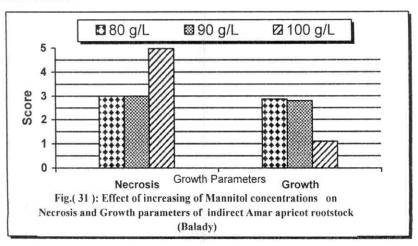
medium with 80 or 90 g/L mannitol induced the best results and significantly reduced Necrosis as well as increased Growth, No. of shoots, Shoot length, No. of leaves/plant and Root length in relation to the other concentrations. On the other hand, statistical differences were disappeared between different concentrations of mannitol as Shoot thickness and No. of roots were concerned.

The aforementioned results indicate that increasing mannitol concentration resulted in harmful effect on most tissue culture parameters.

Table (46) Effect of gradual exposure of mannitol levels on the tissue cultural parameters of indirect regenerated Amar apricot rootstock (Balady) plantlets.

Parameters Mannitol Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
80	3.00 B	2.87 A	2.33 A	2.43 A	0.30 A	4.67 A	1.33 A	1.67 A
90	3.00 B	2.80 A	2.33 A	2.40 A	0.33 A	5.33 A	1.30 A	1.67 A
100	4.97 A	1.10 C	1.00 B	1.03 D	0.30 A	1.00 C	0.43 C	1.00 A

Means of mannitol concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.b.2. Effect of Polyethylene glycol.

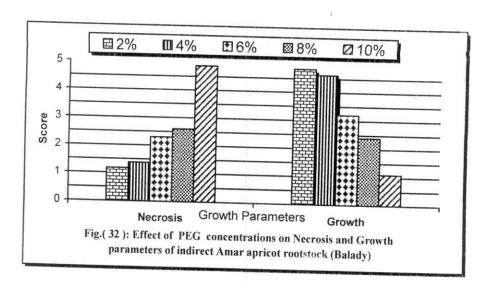
4.2.III.b.2.1. Evaluation of Polyethylene glycol levels.

Table (47) and Fig (32) explains the evaluation of different PEG levels on tissue cultural parameters. (i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots) of *in vitro* Amar apricot rootstock (Balady) plants. It is clear that addition 2 % PEG to culture medium enhanced a significant increase in Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant and No. of roots parameters in comparison with the other PEG concentrations. However, the reverse was true when Necrosis was considered. Meanwhile, Root length was significantly maximized when either 2 or 4 % PEG was added to culture medium.

Table (47) Evaluation of tissue culture parameters of *in vitro* regenerated plantlets from stored callas as affected by different PEG levels tolerated by Amar apricot rootstock (Balady) plantlets.

Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
2	1.17 E	4.83 A	7.33 A	3.43 A	0.53 A	13.33 A	2.57 A	5.00 A
4	1.37 D	4.63 B	5.67 B	3.00 B	0.40 B	11.00 B	2.43 A	4.00 AB
6	2.30 C	3.20 C	4.00 C	2.70 C	0.30 BC	8.33 C	1.93 B	3.67 ABC
8	2.60 B	2.40 D	2.67 D	1.93 D	0.23 CD	5.33 D	1.70 C	2.33 BC
10	4.87 A	1.10 E	1.00 E	1.20 E	0.17 D	1.67 E	1.20 D	1.67 C

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



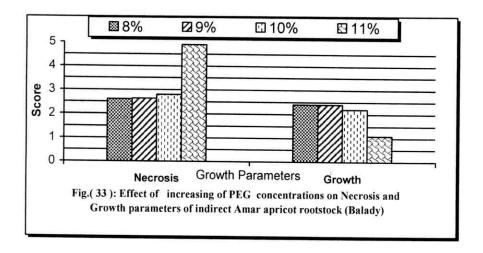
4.2.III.b.2.2. Induction of PEG tolerance.

Data in Table (48) and Fig. (33) reflects the effect of gradual exposure to increase in concentrations of PEG on the tissue cultural parameters *in vitro* Amar apricot rootstock (Balady) plants, it is appeared that supplementation of culture medium with 8 or 9 % PEG enhanced a significant increase of No. of shoots, Shoot length, No. of leaves/plant, Root length and No. of roots as compared with the other concentrations. However, supplementation of the culture medium with 8, 9 or 10 % was significant effective in increasing Growth and reducing Necrosis as compared with the other concentrations. On the other hand, statistical differences among different PEG concentrations were absent when Shoot thickness was concerned.

Table (48) Effect of gradual exposure of PEG levels on the tissue cultural parameters of indirect regenerated Amar apricot rootstock (Balady) plantlets.

Parameters PEG Conc. (%)	Necroses	Growth	No. of shoots		Shoot thickness	No. of leaves / plant	Root length	
8	2.60 B	2.40 A	2.67 A	1.93 A	0.23 A	5.33 A	1.70 A	2.33 A
9	2.63 B	2.40 A	2.67 A	1.80 A	0.20 A	5.67 A	1.63 A	2.67 A
10	2.80 B	2.20 A	2.00 AB	1.57 B	0.20 A	4.00 AB		2.00 AB
11	4.9 A	1.10 B	1.00 B	1.17 C	0.13 A	1.67 C	1.00 C	

Means of PEG concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



4.2.III.b.3. Effect of Agar.

4.2.III.b.3.1. Evaluation of Agar levels.

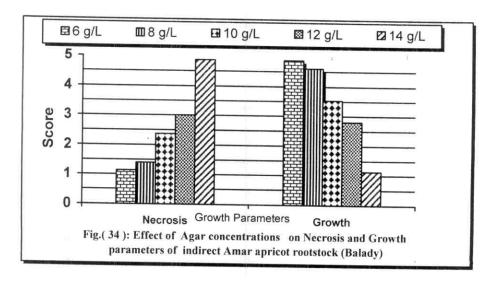
Data of Table (49) and Fig (34) shows evaluation of different agar levels on tissue cultural parameters. (i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots) of *in vitro* Amar apricot rootstock (Balady) plantlets. It is quite evident that

addition of agar at the rate of 6 g/L induced a significant reduction of necrosis significantly and significantly maximized growth, number of shoots, shoot length, shoot thickness and number of roots. Meanwhile, increasing agar concentration in the culture medium from 6 up to 8 g/L encouraged significant increase of number of leaves/plant and root length.

Table (49) Evaluation of tissue culture parameters of in vitro regenerated planets from stored callas as affected by different agar levels tolerated by Amar apricot rootstock (Balady) plantlets.

Parameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant	Root length	No. of roots
6	1.13 E	4.87 A	7.67 A	2.63 A	0.53 A	15.00 A	1.60 A	5.33 A
8	1.40 D	4.60 B	6.00 AB	2.30 B	0.43 B	12.00 A	1.50 A	4.00 B
10	2.37 C	3.53 C	4.33 BC	2.10 BC	0.30 C	8.00 B	1.40 AB	2.67 C
12	3.00 B	2.80 D	2.67 CD	1.93 C	0.20 D	5.00 BC	1.17 B	1.67 D
14	4.87 A	1.13 E	1.00 D	1.30 D	0.20 D	2.33 C	0.90 C	1.00 D

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level.



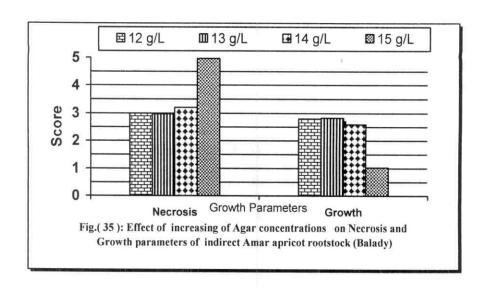
4.2.III.b.3.2. Induction of agar tolerance.

Data in Table (50) and Fig (35) reflects the effect of gradual exposure of agar levels on the tissue cultural parameters (i.e. Necrosis, Growth, No. of shoots, Shoot length, Shoot thickness, No. of leaves/plant, Root length and No. of roots) of indirect regenerated Amar apricot rootstock (Balady) plants. It is clear that addition of 12, 13 and 14 g/L agar to culture medium encouraged a significant increase of Growth parameter in comparison with 15 g/L agar concentration. However, the reverse was true when necrosis parameter was considered. Meanwhile, No. of shoots, Shoot length and No. of leaves/plant were significantly maximized when either 12 or 13 g/L agar was added to culture medium. On the other hand, statistical differences among different agar concentrations were absent when shoot thickness and number of roots were concerned. The abovementioned results conclude that the cultured in vitro plants may tolerate deficiency of free water which occurred by increase agar concentration up to 13 g/L.

Table (50) Effect of gradual exposure of agar levels on the tissue cultural parameters of indirect regenerated Amar apricot rootstock (Balady) plantlets.

Parameters Agar Conc. (g/L)	Necroses	Growth	No. of shoots	Shoot length	Shoot thickness	No. of leaves / plant		No. of roots
12	3.00 B	2.80 A	2.67 A	1.93 A	0.20 A	5.00 A	1.17 A	1.67 A
13	2.97 B	2.83 A	2.67 A	1.90 A	0.20 A	5.33 A	1.17 A	1.67 A
14	3.20 B	2.60 A	1.67 AB	1.60 B	0.17 A	3.00 B	1.10 A	1.33 A
15	4.97 A	1.03 B	1.00 B	1.00 C	0.10 A	2.00 B	0.80 B	1.00 A

Means of agar concentrations followed by the same letter(s) within each column are not significantly different at 1% level



4.2.IV. DNA finger printing using RAPD-PCR technique:

RAPD assay, for randomly amplified polymorphic DNA, was developed independently by two different laboratories (Welsh and McClelland, 1990; Williams et al., 1990). It detects nucleotide sequence polymorphism in a DNA amplification assay using only a single primer of arbitrary nucleotide sequence, RAPD assay was used as a tool to identify molecular markers linked to a trait of interest.

For primer; OP-A-16 (**Photo**, **27**), the band with molecular weight 1 K bp appeared in apricot rootstocks (Balady) (lane 3) while this band disappeared from the control sample (lane 2), while in primer OP-B6; the band with molecular weight 500 bp which found in control sample (lane 2) of apricot rootstock disappeared from the Balady rootstock (lane 3) (**Photo 28**). The

same results were obtained with primer OP-B7 (**Photo 29**). In this figure we found that the band with molecular size 600 bp found in control (lanes 2) while this band was not found in Balady rootstock; (lane 3).

Also, with primer OP-E7; the Balady rootstock led to avoidance of band with molecular weight 500 bp while this band appeared in control (**Photo 30**, lane 2).

For primer OP-E6 (**Photo 31**), no differences found among the two samples; control and apricot rootstocks (Balady).

From all above results, RAPD analysis can detect differences which occurred from tolerated rootstocks.

The detection of RAPD markers on the genomic map of different plants is beneficiate to improve breeding programs for these plants. It offers the simplest and fastest methods for detecting a great number of genomic markers in the shortest period of time (Welsh and McClelland, 1990; Williama et al., 1990; Novy and Vorsa, 1996; Autio et al., 1998 and Al-Tiraif et al., 1998).

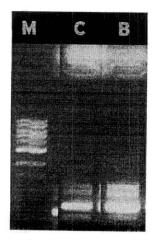


Photo (27): Primer A-16

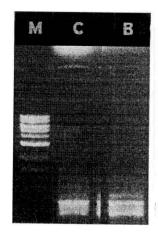


Photo (28): Primer B6



Photo (29): Primer B7

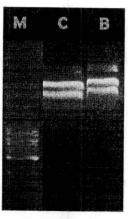


Photo (30): Primer E7

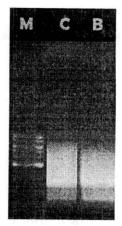


Photo (31): Primer E6

M = Marker C = Control B= Balady

