IV. RESULTS AND DISCUSSION

Part one :-

IV.1. Experiments for solving the earlier technical problems:-

IV.1.1. Surface Sterilization :-

In this regard three methods of surface sterilization viz 1- immersion in 0.5% NaOCl for 10 min., 2- (immersion for 10 min.in 0.5% Na OCl + dipping for 2 min. in 70% ethanal) and 3- (immersion for 10 min.in 0.5% Na OCl followed by dipping in 70% ethanol and 0.1% Hg Cl_2 for 2 and 1 min, respectively) were investigated regarding their effect on contamination, browning and survival of both shoot tip and single node cutting explants of the three peach cultivars under study.

Data abtained from the conducted three experiments are presented in Tables (2,3and 4) for Florida Sun, Florida Prince and Early Grand peach (cvs.), respectively.

IV.1.1.a. Florida Sun cultivar :-

Regarding the contamination response to the various treatments of surface sterilization, it is quite evident as shown from Table (2) that the third treatment i.e immersion in 0.5% NaOCl for 10 min. following by dipping in 70% ethanol and 0.1% $HgCl_2$ for 2 and 1 min, respectively exhibited generally the lowest number of contaminated shoot tips as compared to two other treatments. However, such decrease was significant in comparison with 1 st treatment only (soaking in NaOCl alone) , while it did not reach level of significance as compared to 2 nd one (NaOCl + ethanol).

Nevertheless , three investigated treatments of surface sterilization were statistically of the same effectiveness regarding contamination of nodular cuttings explants .

Concerning the occurrence of browning in Florida Sun peach explants , it was obvious that number of browned shoot tips was not significantly differed in response to the three investigated treatments of surface sterilization as each compared to others . On the other hand, nodular cuttings showed more pronounced response than shoot tips , whereas lower number of browned single node cuttings was detected with applying treatment No. (3) "immersion in 0.5 % NaOCl + dipping in 70 % ethanol + dipping in 0.1 % $HgCl_2$ "

Referring the influence on number of survived explants, highest number of survived shoot tips explants was obtained by treatment (3) (immersion in 0.5% NaOCl + dipping in 70% ethanol + dipping in 0.1 % $HgCl_2$) and the lowest number resulted from treatment (1) (immersion in 0.5% NaOCl). Moreover, the same trend was also found with the single node cuttings.

Concerning both shoot tip and single node cutting explants it can be concluded that lowest rate of both Contamination, and browning that associated with the highest survival level were induced by treatment (3) (immersion in 0.5% NaOCl, + dipping in 70% ethanol + dipping in 0.1 % $HgCl_2$). Meanwhile, the reverse was found with the 1st treatment i.e (immersion for 10 min in 0.5% NaOCl).

IV.1.1.b. Florida Prince cultivar :

Data presented in Table (3) showed that Florida Prince shoot tip and single node cutting explants responded simmilarly to all surface-sterilization treatments with regard to contamination, browning, and survival percentage.

Nevetheless, it was noticed that treatment (3) (immersion in 0.5 % NaOCl + dipping in 70% ethanol and dipping in 0.1 % $HgCl_2$). reduced number of browning than treatment (l) (immersion in 0.5% NaOCl); especially shoot tips whereas difference was significant.

It is evidant that superiority of treatment (3) in reducing contamination and browning was also reflected beneficially on increasing survived explants in both shoot tips and single node cuttings, however difference than other treatments was still so little to be significant.

IV.1.1.C. Early Grand cultivar:

Table (4) shows that contamination was insignificantly affected by the three treatments, concerning both shoot tip and single node cutting explants. Browning in shoot tips was reduced significantly by both treatment(2) (immersion in NaOCl 0.5% and dipping in ethanol 70%) and treatment (3) (immersion in NaOCl 0.5 % + dipping in ethanol 70% + dipping in 0.1% $HgCl_2$). However, such trend was also found with single node cuting but the differencs were so small to be significant.

Survived explants of Early Grand Peach cv. were significantly higher in both explant types received treatment (3) of surface sterilization as compared with those of treatment (1). In additian, treatmenet (2) was in between these two extremes as it did not result in a significant difference than those two other treatments.

It is quite evidant that treatment (3) (immersion in 0.5% NaOCl + dipping in 70% ethanol and dipping in 0.1 % $HgCl_2$) was the most effective treatment of surface-sterilization as it resulted in more promising benefits in reducing both contaimination and browning but raised survival rate in the studied explants of Florida sun, Florida Prince and Early Grand Peach cultivars. In addition, with explants of Early Grand Peach Cultivar treatment (2) (immersion in 0.5 % NaOCl + dipping in 70% ethanol) gave a comparable influence.

The beneficial effect of (NaOCl) at 0.5 % concentration detected in the present study is in general agreement with the finding of **Hammerschlag** (1982) who reported that sterilized shoot tips of Peach in 0.5% Sodium hypochlorite (10 % clorox) for 15-20 minutes, reduced considerably ability of both browning and contamination.

Similarly **Miller** (1982) mentioned the effectiveness of the common surface - sterilization of Nemaguard by using 0.5% Sodium hypochlorite (10 % clorox).

Also, the present results are in agreement with **Guindy** (1990) who used 0.5 % sodium hypochlorite for 6-8 minutes for three peach rootstocks namely (Nemaguard, okinawa, and P. davidina). In addition **El-Zaher** (1993) used 0.5% sodium hypochlorite for 20. min. with two Peach rootstocks namely (Nemaguard and Meet-Ghamre).

Table(2) : Effect of various treatments of surface - sterilization on contamination, browning and survival of excised explant from ***Florida Sun*** Peach cultivar during 1994 and 1995 seasons*.

Treatment	No. of Contaminated explants		No. of browned explants		No. of Survived explants	
	shoot tip explants	**Single node cutting explants**	**shoot tip explants**	**Single node cutting explants**	**shoot tip explants**	**Single node cutting explants**
NaOCl 0.5 %	2 a	1.00 a	2.33 a	2.00 a	5.67 b	7.00 b
NaOCl 0.5 % + ethanol 70 %	1.33 ab	0.33 a	1.67 a	1.33 ab	7.00 ab	8.33 a
NaOCl 0.5 % + ethanol 70% + $HgCl_2$ 0.1 %	0.67 b	0.33 a	1.00 a	0.67 b	8.33 a	9.00 a

*an average of two seasons.

-initial No. of explants were 10.

-data was taken after 15 days.

-mean Separation within columns by L.S.D. 0.05.

: Effect of various treatments of surface - sterilization on contamination, browning and survival of excised explant from ***Early Grand*** Peach cultivar during 1994 and 1995 seasons*.

Treatment	No. of Contaminated explants		No. of browned explants		No. of Survived explants	
	shoot tip explants	**Single node cutting explants**	**shoot tip explants**	**Single node cutting explants**	**shoot tip explants**	**Single node cutting explants**
NaOCl 0.5 %	2.33 a	1.33 a	2.67 a	2.67 a	5.00 b	6.00 b
NaOCl 0.5 % + ethanol 70 %	1.67 a	1.00 a	1.67 b	2.00 a	6.67 ab	7.00 ab
NaOCl 0.5 % + ethanol 70% + $HgCl_2$ 0.1%	0.67 a	0.33 a	1.33 b	1.00 a	8.00 a	8.67 a

*an average of two seasons.

-initial No. of explants were 10.

-data was taken after 15 days.

-mean Separation within columns by L.S.D. 0.05.

IV.1.2 Effect of adding PVP (polyvinylpyrrolidone) to culturing media :-

Each of the conducted three experiments for this purpose included four levels of PVP (polyvinylpyrrolidone) added to culturing media i.e 10, 20, 40 and 80 mg/L, beside PVP omitted Ms basal medium (0.0) as control. Since, browning and survival responses of both shoot tip and single node cutting explants of three peach cultivars (Florida Sun, Florida prince and Early Grand to the different PVP levels were studied. Data abtained from 1st, 2nd and 3rd experiments were tabulated in Tatles 5,6 and 7, respectively.

IV.1.2.a Florida Sun Peach CV :-

Concerning the effcet of various PVP levels added to initiative culturing medium on browning of both shoot tip and single node cutting, data in Table (5) revealed that culturing medium supplemented with PVP at 40 mg per liter resulted significantly in reducing number of browned explants to the minimum rate as compared to those occurring with any of the other investigated media. On the other hand, other PVP rates added to culturing media not only failed to reduce browning of explants below control but also the reverse was true especially both treatments of the two lower PVP rates i.e, 10 and 20 mg/L which exhibited statistically greater number of browned explants, regardless of explants types. In addition, the highest rate of PVP (80mg/L) showed statistically the highest number of browned explants. While adding PVP at the highest level was in between.

As for the survival response of both shoot tip and single node cutting explants to PVP level, it was quite clear to be noticed that MS basal medium supplied with 40 mg PVP/L was statistically the superior treatment, whereas the highest survived number of cultured explants was achieved irrespective of explant types. In addition, adding of PVP to medium at 80 mg/L came next, while other rates of PVP added, beside control came third in this respect. Since, differences between the abovementioned three categories were significant.

IV.1.2.C. Early Grand Peaeh CV :-

Table (7) shows clearly that browning occurrence as influenced by different PVP treatments added to culturing media followed two trends of response with both explant types. Since, cultured shoot tips on PVP supplemented media either at 40 or 80 mg/L were equally the same from one hand and showed statisically the same browned number of cultured explants. However, adding PVP to culturing media either at 10 or 20 mg/L increased significantly number of browned shoot tips than control. Meanwhile, with the single node cuttings adding PVP at 40 mg/L was the superior and induced statistically the lowest number of browned explants, followed by 80 mg PVP/L which ranked second while both treatments of lower PVP rates i.e, 10/20 mg/L and control came statistically last as they represented third category in this respect.

Nevertheless, survival of shoot tip taken from Early Grand peach cv. as related to PVP level added to culturing media as shown from Table (7) revealed that both treatments of adding either 40 or 80 mg PVP to medium, beside control exhibited statistically the highest number of survived explants. However the reverse was true with those of both 10 and 20 mg/L PVP. Meanwhile, the highest survived number of single node cuttings was in closed relationship to those media supplied with PVP either at 40/80 mg/L, but control was the inferior in this respect. Moreover other PVP treatments came in between the aforesaid two extremes, whereas differances were siginficant.

The present results regarding the beneficial effect of adding PVP to culturing media against the occurrence of browning is in Partial agreement with the finding of **Muhammad and Vijais, (1988).**

Table (5) : Effect of adding different concentrations of PVP. (Polyvinylpyrrolidone) to the culture media on browning and survival of shoot tips and single node cuttings explants of ***Florida Sun.*** Peach cv., during 1994 and 1995 seasons*

Treatments	Explants			
PVP concentration	number of browned explants**		number of survived explants**	
	shoot tip	**single node cutting**	**shoot tip**	**single node cutting**
Control (0.0)	3.66 b	3.33 c	5.66 b	6.00 b
10 mg/L PVP	6.00 a	5.33 a	3.66 c	4.00 c
20 mg/L PVP	4.00 a	4.66 b	5.66 b	5.00 bc
40 mg/L PVP	1.66 c	1.00 d	8.00 a	9.00 a
80 mg/L PVP	4.00 b	3.66 c	3.66 c	6.00 b

* An avarege of two seasons.

** Initial number of cultured explants per each replicate were (10).

- Data was taken two weeks later from culturing.
- Mean separation within columns by L.S.D (0.05)

Table (6) : Effect of adding different concentrations of PVP. (Polyvinylpyrrolidone) to the culture media on browning and survival of shoot tips and single node cuttings explants of ***Florida Prince.*** Peach cv., during 1994 and 1995 seasons*

Treatments	Explants			
PVP concentration	number of browned explants**		number of survived explants**	
	shoot tip	single node cutting	shoot tip	single node cutting
Control (0.0)	5.00 b	6.66 a	4.00 bc	3.00 c
10 mg/L PVP	6.00 b	6.66 a	3.33 c	3.00 c
20 mg/L PVP	7.33 a	5.66 a	2.33 cd	4.00 c
40 mg/L PVP	2.33 c	1.66 c	7.00 a	8.00 a
80 mg/L PVP	5.00 b	3.33 b	4.33 b	6.00 b

* An avarege of two seasons.

** Initial number of cultured explants per each replicate were (10).

- Data was taken two weeks later from culturing.

- Mean separation within columns by L.S.D (0.05)

Table (7) : Effect of adding different concentrations of PVP. (Polyvinylpyrrolidone) to the culture media on browning and survival of shoot tips and single node cuttings explants of ***Early Grand.*** Peach cv., during 1994 and 1995 seasons*

Treatments	Explants			
PVP concentration	number of browned explants		number of survived explants	
	shoot tip	**single node cutting**	**shoot tip**	**single node cutting**
Control (0.0)	4.33 b	7.66 a	4.66 a	2.00 c
10 mg/L PVP	7.66 a	6.66 a	1.66 b	3.00 bc
20 mg/L PVP	6.66 a	5.66 a	2.66 b	4.00 b
40 mg/L PVP	4.33 b	2.66 c	5.00 a	7.00 a
80 mg/L PVP	4.66 b	4.33 b	4.66 a	5.00 a

* An avarege of two seasons.

** Initial number of cultured explants per each replicate were (10).

- Data was taken two weeks later from culturing.

- Mean separation within columns by L.S.D (0.05)

Part two:-

IV.2. The morphogenesis of Peach Shoot tip and nodel cutting:-

IV.2.1. Experiments on establishoment of explants (stage,1) :-

Two factors were studied during this stage and obtained data from the conducted experiments had been prepared for discussing as follows:-

IV.2.1.1. Effect of IBA and BA added to culturing media :-

Each of the conducted three experiments included five treatments which were representative of the different combinatians between two levels of both IBA (0.01 and 0.02 mg/L) and BA (0.1 and 0.2 mg/L) adde to MS basal medium contained charcool, beside IBA and BA omitted one as control. The response of both shoot tip and single node cutting explants excised in April/May from each of Florida Sun, Florida Prince and Early Grand peach cultivars were studied separately in experiments 1,2 and 3 respectively as follows:

IV .2.1.1.a. Florida Sun Peach CV:-

Regarding the response of proliferated shoots per every cultured explant (shoot tip / single node cutting) excised from Florida Sun cv. to the investigated media (varied in their IBA and BA contents), data obtained during 1994 and 1995 seasons are presented in Table (8,9 and 10) and Figure (1).

It is quite clear that all culturing media supplimented with any of IBA and BA combinations increased number of proliferated shoots per each of shoot tip or single node cutting explants than control. However the increase was more pronounced with both explant types cultured on MS basal medium supplemented with the combinations between the IBA lower rate (0.01 mg/L), from one hand and both BA added rates (0.10 / 0.20 mg/L) from the other. In other words 4 th and 5 th treatments as shown in Table (8) were the superior as they exceeded statistically the IBA and BA omitted medium (control) concerning their stimulating effect on the number of proliferated shoots per explant.

However, 5 th treatments (adding 0.01 mg IBA and 0.20 mg BA to one liter of the MS basal medium supplemented with 3g charcoal / L) showed a tendency to be more effecient than other investigated ones as shown from Figure (1) A and B for both shoot tip and single node cutting, respectively.

Moreover, treatments of adding IBA at 0.02 mg / L combined with either 0.1 or 0.2 mg BA/ l were in between the aforesaid two extremes.

IV.2.1.1.b. Florida Prince Peach cv.

Regarding the response of proliferated shoots per each cultured explant (shoot tip / single node cutting) of Florida Prince peach cv, data obtained in Table (9) revealed obviously that all combinations of IBA and BA added to charcoal supplemented MS basal medium increased significantly proliferation process over control during establishment stage. However, the investigated four combinations of IBA and BA added to culturing media were statistically the same but it could be noticed the tendency of both 4 th and 5 th treatments to be more effective. Moreover, treatment 4 (charcoal supplemented MS basal medium + 0.01 mg IBA and 0.1 mg BA) resulted in a relative increase in number of proliferated shoots per cultured explant (shoot tip/ single node cnthing) as shown from Figure (2).

IV.2.1.1.c. Early Grand peach cultivar :

Table (10) shows clearly the beneficial effect of the differential IBA + BA combinations added to MS basal medium in increasing number of proliferated shoots significantly over control with both shoot tip and single node cuttings explants of Early Grand peach cultivar. However, all combinations of IBA and BA were statistically similar, but both combinations of the lower IBA rate (0.01 mg / L) and two BA concentrations especially (o.1 mg/L) i.e 4 th treatment ranked first as shown from Table (10) and Figure (3)

Conclusively, culturing both kinds of peach explants (shoot tip or single node cutting) on MS basal medium supplemented with activated charcoal at 3g per liter and both combinations as of lower IBA level (0.01 mg /L) from one side and o.1 or 0.2 mg BA / L from the other were the superior treatments, regardless of peach cultivar.

These results are in the same line with those of **Hammerschlag (1980) and El-Zaher (1993)** who found that MS medium supplemented with 0.2 mg/L BA and 0.01-0.1 mg/L IBA produccd a consiberable number of shoots.

BA at 1.0 mg/L in MS media was fessible in shoot production of peach Almond hybird Almond shoot tips **(Tabachink & Kester 1977).** and 0.2 mg/L BA in peach, Sour Cherry and Apricot. **(Skirvin et at 1980).**

Table(8) : Effect of different combinations between IBA and BA supplemented to culturing media used through establishment stage on the number of proliferated shoots per each explant (shoot tip/single node cutting) of ***Florida Sun*** Peach cultivar during 1994 and 1995 seasons*.

Treatment IBA mg/L+BA mg/L	Average number of Shoots/explant **	
	Shoot tip explant	**Single node cutting explant**
0.00 + 0.00	1.00 c	0.80 c
0.02 + 0.10	1.20 bc	1.00 bc
0.02 + 0.20	1.30 abc	1.10 bc
0.01 + 0.10	1.50 ab	1.30 ab
0.01 + 0.20	1.70 a	1.50 a

- Mean separation within columns by L.S.D.(0.05).

* An average of two seasons.

** estimated (2 weeks) from culturing.

Table(9) : Effect of different combinations between IBA and BA supplemented to culturing media used through establishment stage on the number of proliferated shoots per each explant (shoot tip/single node cutting) of ***Florida Prince*** Peach cultivars during 1994 and 1995 seasons*.

Treatment IBA mg/L+BA mg/L	Average number of Shoots/explants	
	Shoot tips explants	**Single node cutting explants**
0.00 + 0.00	0.90b	0.70 b
0.02 + 0.10	1.30 ab	1.10 a
0.02 + 0.20	1.30 ab	1.20 a
0.01 + 0.10	1.60 a	1.40 a
0.01 + 0.20	1.50 a	1.30 a

- Mean separation within columns by L.S.D.(0.05).

* An average of two seasons.

** estimated (2 weeks) from culturing.

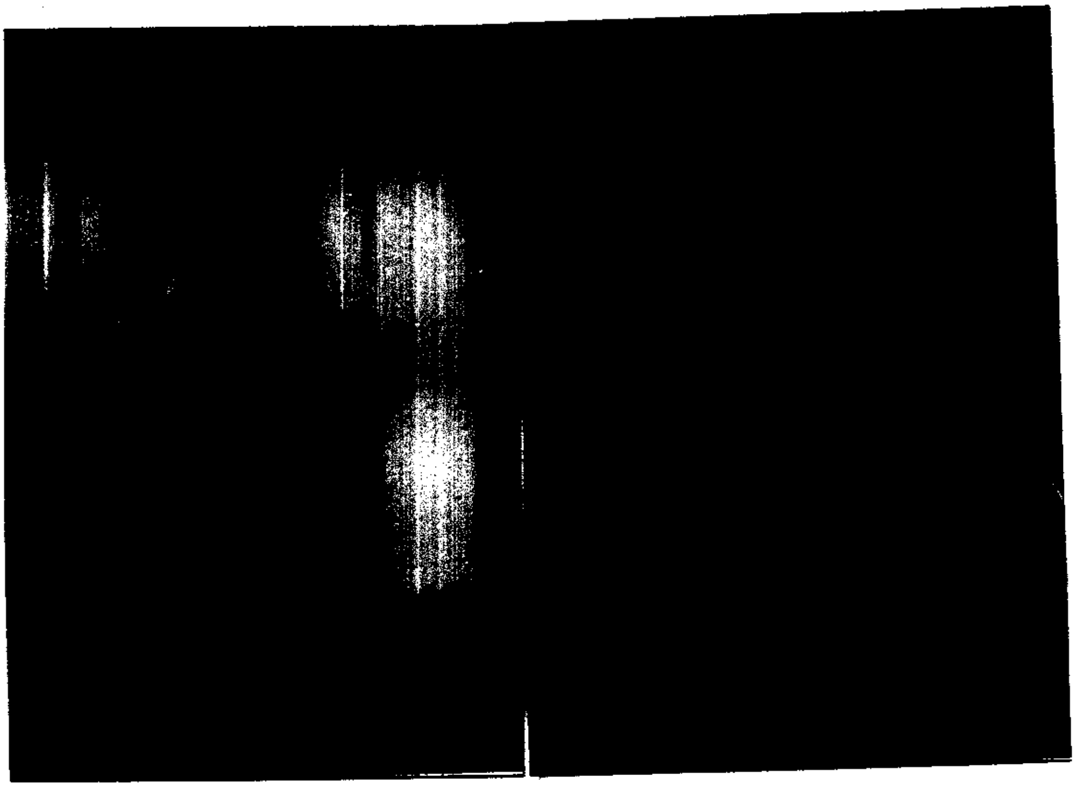
Table(10) : Effect of different combinations between IBA and BA supplemented to culturing media used through establishment stage on the number of proliferated shoots per each explant (shoot tip/single node cutting) of ***Early Grand*** Peach cultivars during 1994 and 1995 seasons*.

Treatment IBA mg/L+BA mg/L	Average number of Shoots/explants	
	Shoot tips explants	**Single node cutting explants**
0.00 + 0.00	0.70 b	0.50 b
0.02 + 0.10	1.10 ab	1.00 a
0.02 + 0.20	1.20 a	1.10 a
0.01 + 0.10	1.50 a	1.30 a
0.01 + 0.20	1.40 a	1.30 a

- Mean separation within columns by L.S.D.(0.05).

* An average of two seasons.

** estimated (2 weeks) from culturing.



(A) (B)

Figure (1) : proliferation of shoot tip (A) and Single node cutting (B) of ***Florida Sun*** Peach cv. cultured on MS basal medium supplemented with 3g activated charcoal plus 0.01 mg IBA and 0.2mg BA per liter during establishment stage.

IV.2.1.2. Effect of excising date :-

Regarding the effect of excising date i.e , month at which both shoot tip and single node cutting explants were sampled from trees of the three studied peach cultivars on the number of proliferated shoots per each individual explant cultured on (MS basal medium + 0.01 IBA + 0.1 BA +40 PVP), data obtained are presented in Table (11) .

It is quite clear that both excising date and the number of proliferated shoots per an individual explant (shoot tip or single node cutting) were in closed relationship. Since, the greatest number of proliferated shoots per explant was statistically induced by the May excised explants, irrespective of either explant kind or the peach cultivar.

Moreover, April and/or August excised explants ranked statistically second for both Florida Sun and Florida Prince peach cultivars, while with Early Grand cv. the June and July excised explants came next to the superior excising date (May). On the contrary, shoot tips and single node cuttings collected in March from any of the investigated three peach cultivars, as well as those excised in September (in most cases) ranked last and represented the inferior excising date in this respect. In addition, other excising dates of shoot tip and single node cutting explants were in between the abovementioned two extremes with a relative variation in this connection.

The present results regarding the effect of excising date on explants proliferation throughout the establishment stage may be explained logically on that fact based on the periodical changes in phenolic content of peach explants along the growing season around as will be discussed later. Hence, the increase in explant phenolic content at a given excising data certainly could be reflected negatively on potentiality of the employed explants to be proliferated.

Moreover, the obtained results are in partial agreement with that findings of **Sari-EL Deen** (1973) and **Mahamed** (1983) who reported that buds of Drak almond cv. and Golden Japanese plum cv. respectively were characterized by their higher phenole level in early and late season (March & November).

Table (11) : Average number of Proliferated Shoots per shoot tip and single node cutting of three Peach cvs., through establishment stage as affected by excising date during growing seasons of (1994 and 1995 years)*.

Excising date	Average number of developed Shoots per each explant**					
	Florida Sun		***Florida Prince***		***Early Grand***	
	Shoot tip	**Single node cutting**	**Shoot tip**	**Single node cutting**	**Shoot tip**	**Single node cutting**
March	2.50 e	1.90 e	2.10 e	2.00 d	2.30 e	1.60 f
April	6.50 b	5.05 c	4.80 b	4.10 b	4.00 c	3.90 c
May	8.20 a	6.90 a	5.92 a	4.45 a	7.00 a	5.70 a
June	4.50 d	4.00 d	3.10 d	2.85 c	5.30 b	4.95 b
July	5.90 bc	4.95 c	3.40 d	2.90 c	5.35 b	4.95 b
August	6.20 b	5.50 b	4.10 c	3.85 b	3.00 d	2.85 d
September	2.70 e	2.10 e	2.95 d	1.90 d	2.95 d	2.50 e

- Mean Separation within Columns by L.S.D. (0.05)

* An average of two seasons.

** estimation was done (3) weeks from culturing.

IV.2.2. Multiplication of shoots stage II

IV.2.2.1 Effect of various BA concentrations added:-

In this connection three experiments were conducted, each encloded three levles of BA added to IBA omitted MS basal medium (contained 40mg PVP / liter) from one hand, while an experiment was devoted for each of the three peach cultivars from the other. Data obtanied are tabulated in Table (12), (13) and (14) for the conducted experiments on Florida Sun, Florida Prince and Early Grand Peach cvs, repectively.

IV.2.2.1.a Florida Sun Peach cv:-

Regarding the response of average number of the proliferated or axillary shootlets (laterals) per an individual cultured shoot during multiplication stage, Table (12) shows obviously that adding of intermediate BA concentration (1.0 mg/L) was the superior. Hence, the greatest number of shoots were significantly induced as compared to those of both lower (0.1mg/L) and the highest (2.0 mg/L) concentrations. Morever, the investigated three levles of BA added to media, could be arranged into the following descending order:- treatment (2), treatment (3), and Treatment (1), regarding their effeciency on the developed shootlets per each cultured shoot during multiplication stage. However, this trend was more pronounced with those shoots originated from shoot tip explant.

Nevertheless, the second treatment (adding1.0 mg/L BA) exhibited also its superiority in increasing the length of each developed shoot than those of two other levels. The increase was significant irrespective of the explant types (shoot tip and single node cutting) from which the cultured shoot was originated. However the lower level (0.1 mg/L) resulted in inducing more longer shoots than those of the highest BA level ,(2.0 mg/L) added to media. This could be explained partially by competetion effect which may be taken place and became more pronounced with the increasing number of developed shootlets induced by higher BA level.

IV.2.2.1.b. Florida Prince Peach cv. :

Data from Table (13) showed obviously that the same trend of response which previously mentioned with Florida Sun cv. was also detected with the Florida Prince cv., regarding both growth parameters (No of developed shoots and average length of each).

However the differences between the superior treatment (1.0 mg BA/L) and two other ones were significant, but the rate of variation was generally less pronourced and did not reach level of significance especially when both 1st and 3rd treatments were compared each to other.

IV.2.2.1.C. Early Grand Peach cv.:

Regarding the effect of BA rate added to culturing media used for multplying the proliferated shoots of Early Grand peach cv., on the number of shootlets (laterals) obtained, Table (14) shows obviously the same trend previously found with both Florida Sun and Florida Prince cultivar, regardless of explant kind.

As for, the average length of developed shoots during multiplication stage in relation to culturing media varied in their BA content, the 2nd treatment tended to be more effective but differences were relatively lower. Since, the increase did not reach significant level when both 2nd and 3rd treatments were compared each to other from one hand and 1st treatments was compared to the third one from the other.

These results are in agreement with those of **Hammerschlag** (1980) and **El-Zaher** (1993), who found that increasing level of BA added (from 1.0 to 2.0 mg/L) to media increased the proliferation rate of some Peach cultivars.

Generally, it could be safely concluded that IBA omitted MS basal medium supplemented with (1.0 mg BA + 40 mg PVP/L) was the most preferable treatment during multiplication stage, since the highest number and longest shoots were obtained with the three peach cultivars.

Table (12) : Effect of various BA concentrations added to IBA omitted MS basal medium (supplemented with 40 mg/litre PVP) on some growth measurements through multiplication stage of ***Florida Sun*** Peach cultivars during (1994 - 1995) seasons*

Treatments (BA added /L)	average No. of shoots (lateral)** per cultured shoot***		average length of shoot (lateral)** developed after culturing shoots***	
	shoot tip***	single node cutting***	shoot tip***	single node cutting***
0.1 mg/L	3.50 c	3.20 b	3.00 b	2.70 b
1.0 mg/L	7.20 a	6.30 a	3.80 a	3.50 a
2.0 mg/L	4.60 b	3.90 b	2.27 c	2.00 c

- Mean followed by the same letter / s within each column were not significantly different by L.S.D. at (0.05)

* An average of two seasons

** Measuring was done 30 days from culturing

*** Cultured shoots in this stage were originated through the earlier stage (establishment) of either shoot tip or single node cutting.

Table (13) : Effect of various BA concentrations added to IBA omitted MS basal medium (supplemented with 40 mg/litre PVP) on some growth measurements through multiplication stage of ***Florida Prince*** Peach cultivars during (1994 - 1995) seasons*

Treatments (BA added /L)	average No. of shoots (lateral)** per cultured shoot***		average length of shoot (lateral)** developed after culturing shoots***	
	shoot tip***	single node cutting***	shoot tip***	single node cutting***
0.1 mg/L	3.00 c	2.90 b	2.60 b	2.30 ab
1.0 mg/L	6.50 a	5.60 a	3.76 a	2.50 a
2.0 mg/L	4.40 b	3.30 b	2.70 b	2.05 b

- Mean followed by the same letter / s within each column were not significantly different by L.S.D. at (0.05)

* An average of two seasons

** Measuring was done 30 days from culturing

*** Cultured shoots in this stage were originated through the earlier stage (establishment) of either shoot tip or single node cutting.

Table (14) : Effect of various BA concentrations added to IBA omitted MS basal medium (supplemented with 40 mg/litre PVP) on some growth measurements through multiplication stage of ***Early Grand*** Peach cultivars during (1994 - 1995) seasons*

Treatments	average No. of shoots (lateral)** per cultured shoot***		average length of shoot (lateral)** developed after culturing shoots***	
(BA added /L)	shoot tip***	single node cutting***	shoot tip***	single node cutting***
0.1 mg/L	3.30 c	3.20 b	2.28 b	2.45 b
1.0 mg/L	7.00 a	5.80 a	3.80 a	3.20 a
2.0 mg/L	4.80 b	3.50 b	3.00 ab	2.80 ab

- Mean followed by the same letter / s within each column were not significantly different by L.S.D. at (0.05)

* An average of two seasons

** Measuring was done 30 days from culturing

*** Cultured shoots in this stage were originated through the earlier stage (establishment) of either shoot tip or single node cutting.

IV.2.2.2. Effect of different combinations of IBA and BA:-

An experiment was carried out for each peach cultivar, whereas four combinations between two concentrations of both BA (1.0& 2.0mg/L) and IBA (0.02 & 0.2mg/L) were added to the P.V.P. (40mg/L) supplemented MS basal medium for investigating their effect during multiplication stage. Data obtained were tabulated in Tables (15), (16) and (17), as well as illustrated in Figures (4), (5) and (6) for Florida Sun, Florida Prince and Early Grand peach cvltivars, respectively.

IV.2.2.2.a. Florida Sun Peach cv.:

Data in Table (15) revealed clearly that adding 1.0mg BA in combination with IBA either at 0.2 or 0.02mg per one liter of MS basal medium contained PVP (40 mg/L) induced the greatest number of proliferated shoots during multiplication stage for shoots initiated from both shoot tip and single node cutting explants. However, the (1.0mg BA + 0.2 mg IBA/L) supplemented medium tended to be more effective as shown from Figure (4). On the contrary, when the higher BA level (2.0 mg) was combined with the lower IBA rate (0.02 mg) i.e, treatment, (2) it resulted in the lowest number of developed shoots during the multiplication stage. While, treatment (4) i.e, adding both BA and IBA each at the higher rate (2.0 + 0.02 mg/L) was in between.

IV.2.2.2.b. Florida Prince Peach cv.:

From data presented in table (16) and Figure (5), it could be noticed clearly that adding BA at 1.0 mg/L combined with 0.2 mg IBA per liter to culturing medium used for multiplication stage was the superior treatment as it exhibited statistically the greatest number of proliferated shoots with both shoot tip and single node cutting explants. Meanwhile, the combination at which both BA and IBA were added at the lower rate (1.0 and 0.02 mg/L, respectively) i.e, treatment (1) was the inferior. However, adding BA at 2.0 mg/L either combined with 0.02 or 0.2 mg IBA /L showed intermediate effect as compared to the abovementioned two treatments.

IV.2.2.2.C Early Grand Peach Cultivar :

Table (17) and Figure (6) show that adding BA and IBA to the culturing medium each at the higher rate i.e 2.0 and 0.2 mg/L, respectively was the most effective treatment and exceeded statistically all other treatments in increasing number of proliferated shoots per each cultured explant of Early Grand peach cv. However, the reverse was true when the shoots were cultured on media suppliemented with BA and IBA each at its lower rate i.e, 1.0 mg and 0.02 mg/L for both, respectively. In addition, adding 1.0 mg BA and 0.2 mg IBA/L came second to the superior one, while 2.0 mg BA + 0.02 mg IBA ranked third in this concern.

The present results, regarding the response to levels of both IBA and BA added in combination to culture media are in accordance with the finding of **Guindy (1990)** who found that the best average number of shoots of Nemaguard peach rootstock was obtained by adding 1.0 mg/L BA + 0.02 mg/L IBA and, 2.0 mg/L BA + 0.2 mg/L IBA.

Conclusively, it could be noticed clearly that proliferation of cultured shoots during multiplication stage was responded obviously to the IBA + BA combinations. However, each peach cultivar followed its own trend, but it could be observed that the combination of BA at 1.0 mg and IBA at 0.2 mg/L was the most preferable treatment with both Florida Sun and Florida Prince cultivars. In addition, the combination between the higher rate of both BA (2 mg) and IBA (0.2 mg) was the snperior for Early Grand peach cv.

Nevertheless, multiplying of proliferated shoots from the shoot tip explant surpassed vigourausly those of the single node cutting when both were compared under culturing on the same medium, irrespective of peach cultivar

Table(15) : Effect of different combinations between BA and IBA concentrations added to the PVP supplemented MS basal medium on average number of developed shootlets (laterals) per cultured shoot through multiplication stage of ***Florida Sun*** Peach cultivar during 1994 and 1995 seasons*.

Treatments (concentrations of BA + IBA added/L)	average No of shootlets (laterals)**per cultured shoot***	
	Shoot tip***	Single node cutting***
1.0 + 0.02	26.66 a	24.33 a
2.0 + 0.02	14.33 c	13.33 c
1.0 + 0.2	27.66 a	24.66 a
2.0 + 0.2	18.66 b	16.66 b

- means followed by the same letter/s within each column were not significantly different by L.S.D. at 5% level.

* an average of two seasons.

** measuring was done 30 days from culturing.

*** cultured shoots in this stage were originated through the establishment stage of either shoot tip or single node cutting.

Table(16) : Effect of different combinations between BA and IBA concentrations added to the PVP supplemented MS basal medium on average number of developed shootlets (laterals) per cultured shoot through multiplication stage of ***Florida Prince*** Peach cultivar during 1994 and 1995 seasons*.

Treatments (concentrations of BA + IBA added/L)	average No of shootlets (laterals)**per cultured shoot***	
	Shoot tip***	Single node cutting***
1.0 + 0.02	12.66 b	9.66 c
2.0 + 0.02	13.33 b	12.33 b
1.0 + 0.2	23.33 a	20.66 a
2.0 + 0.2	14.00 b	11.33 b

- means followed by the same letter/s within each column were not significantly different by L.S.D. at 5% level.

* an average of two seasons.

** measuring was done 30 days from culturing.

*** cultured shoots in this stage were originated through the establishment stage of either shoot tip or single node cutting.

Table(17) : Effect of different combinations between BA and IBA concentrations added to the PVP supplemented MS basal medium on average number of developed shootlets (laterals) per cultured shoot through multiplication stage of ***Early Grand*** Peach cultivar during 1994 and 1995 seasons*.

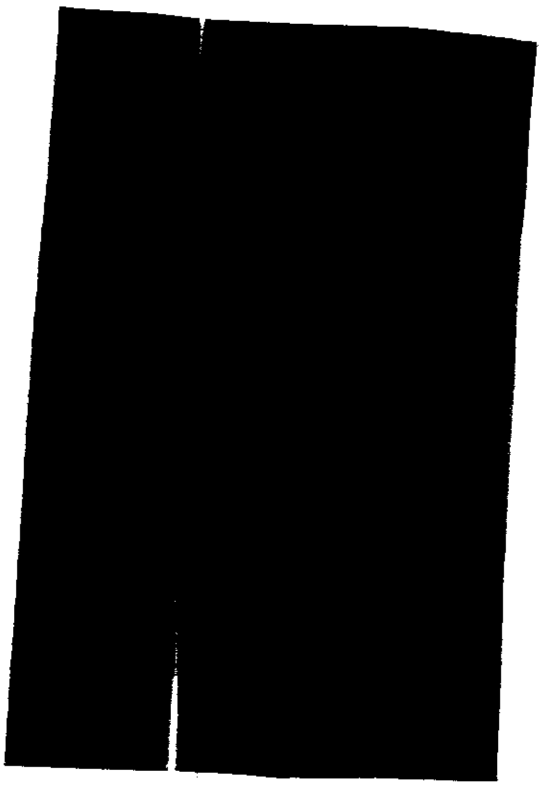
Treatments (concentrations of BA + IBA added/L)	average No of shootlets (laterals)**per cultured shoot***	
	Shoot tip***	Single node cutting***
1.0 + 0.02	9.00 d	6.33 d
2.0 + 0.02	13.33 c	11.66 c
1.0 + 0.2	16.33 b	14.33 b
2.0 + 0.2	21.00 a	18.00 a

- means followed by the same letter/s within each column were not significantly different by L.S.D. at 5% level.

* an average of two seasons.

** measuring was done 30 days from culturing.

*** cultured shoots in this stage were originated through the establishment stage of either shoot tip or single node cutting.



(A) (B)

Figure (4) : Multiplication of shoots originated from shoot tips (A) and single node cuttings (B) of ***Florida Sun*** Peach cultivar after four weeks from culturing on MS basal medium supplemented with PVP, BA and IBA at 40.0, 1.0 and 0.2 mg/L ., respectively.

IV.2.3. Experiments conducted during rooting stage:- :

Three experiments were devoted for each peach cultivar to study the effect of three levels (0.5,1.0 and 2.0 mg/L) of both IBA and NAA added to the rooting media (MS basal medium at one half strength supplemented with 3g activated charcoal /L). Hence, each of these auxins were added either solely or both in combinatians to be investigated regarding the response of callusing, rooting measurements and survival percentage of newly developed peach plantlets through conducting the following three separated experiments:-

IV.2.3.1. Effect of IBA level added:-

Data obtained were presented in Tables (18), (19) and (20) for Florida Sun, Florida Prince and Early Grand peach cultivars, respectively:

IV.2.3.1.a. Florida Sun Peach cultivar :

Table (18) shows, however no callus was formed by those shoots proliferated from shoot tip explant of Florida Sun cv. when cultured on either IBA omitted medium (control) or both rooting media provided with IBA at the two lower concentrations (0.5 and 1.0 mg/L), while small amount of callus was occurred under culturing on2.0 mg IBA - medium on the other hand, callus was slightly or moderately formed by such shoots initiated from single node cutting when cultured on IBA supplemented MS basal medium either at 0.5 or 1.0/2.0 mg IBA/L, respectively.

As for the effect of IBA level on average number of developed rootlets per cultured shoot and survival percentage, data obtained revealed obviously that both parameters followed the same trend of response. Since, both characteristics were positively in closed relationship with the supplemented IBA rate to rooting media. In other words, adding of 2.0 mg IBA per one liter of charcoal supplemented MS basal medium (at 1/2 strengh) resulted significantly in the highest survival percentage of cultured shoots which having statistically the most abundant number of developed rootlets per each. In addition, other investigated treatments of IBA added level could be arranged into the following descending order: a- adding of 1.0 mg IBA ranked second, followed by the 0.5 mg IBAand the IBA omitted medium which was the inferior - Such trend was true and differences were significant as each treatment was compared to others, regardless of the explant kind from which the employed shoots for rooting were derived.

IV.2.3.1.b. Florida Prince peach cultivar :

Referring callus formation by proliferated shoots from both shoot tip and single node cutting explants as influenced by different rooting media varied in their IBA content, data in Table (19) revealed nearly the same trend previously detected with Florida Sun peach cv. However, originated shoots from shoot tip explant of Floride Prince peach cv. were more responded to increasing the rate of IBA added to rooting media than those of Florida Sun cv.

As for the rooting and survival percentage of Florida Prince cultured shoots, Table (19) shows clearly that increasing of the IBA level added to 1.0 mg and 2.0 mg per one liter of rooting medium exhibited statistically the highest values of both survived percentage of shoots and number of developed rootlets per each for those proliferated from shoot tip and single node cutting explants, respectively. On the contrary the IBA omitted medium (control) was the inferior followed by that of 0.5 mg IBA added per liter. Differences between these abovementioned categories were significant.

IV.2.3.1.C. Early Grand Peach cultivar :

It is qiute clear from data of Table (20) that callusing did not take place under culturing on either IBA omitted or 0.5 mg IBA supplemented media irrespective of the origin of cultured shoots of Early Grand peach cv. However, both rooting media supplemented with either 1.0 or 2.0 mg IBA per liter induced small amount of callus, except for culturing the proliferated shoots from single node cutting whereas callus was intermediately formed.

With regard to the influence of the level of IBA added to rooting media on rooting and survival percentage of cultured shoots of Early Grand peach cv., it could be noticed that the trend previously found with Florida Prince cv. was also detected for the Early Grand peach cv. Except the omitted IBA MS basal medium (control) whereas the shoots proliferated from shoot tip falled completely to form roots and finally did not survive with the later cultivar.

Hence, supplementing 1.0 mg IBA and 2.0 mg IBA/L per one liter of MS basal medium were the most preferable rooting media for shoots originated from shoot tip and single node cutting explants pespectively.

Generally, it could be noticed that three peach cultivars were varied in their potentiality for rooting and remaining survive. Florida Sun came first followed by the Florida Prince, while Early Grand came last, such observation was true when the number of developed roots and survival percentage obtained under a given rooting media of each cultivar were compared to those of two others

The present results regarding the response of rooting to IBA where in general agreement with those findings of **(Skirivin, et al., 1981,** on Peach and sour cherry), **(Ochatt and Caso, 1983,** on Peach, **Pietropaolos and Reisch, 1984** on plum and **Antonelli and Chiariotti, 1988)** on peach.

All reported the importance of IBA as the proper level supplied to rooting media.

Table(18): Effect of IBA concentration added to rooting media (charcoal supplemented MS basal medium at ½ strenght) on some measurements* of Callus, rooting and survival percentage of cultured shoots of ***Florida Sun*** Peach cultivar during 1994 and 1995 Seasons**

Concentration of IBA	Origin of cultured shoots					
	Shoot tip/explant			Single node cutting/ explant		
	Callus formation	Average root number	Survival percentage	Callus formation	Average root number	Survival percentage
0.00mg/L	—	1.2 d	22 % d	—	1.50 d	30% d
0.5mg/L	—	1.50 c	56% c	S	2.40 c	56% c
1.0mg/L	—	2.30 b	64% b	M	3.60 b	67% b
2.0mg/L	S	3.50 a	70 % a	M	5.90 a	74% a

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S and M mean small and medium, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

Table(19): Effect of IBA concentration added to rooting media (charcoal supplemented MS basal medium at ½ strenght) on some measurements* of Callus, rooting and survival percentage of cultured shoots of ***Florida Prince*** Peach cultivar during 1994 and 1995 Seasons**

Concentration of IBA	Origin of cultured shoots					
	Shoot tips/explants			Single node cuttings/ explants		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00mg/L	——	1.00 d	20% c	——	1.20 d	25 % d
0.5mg/L	——	1.50 c	40.% b	S	1.90 c	43 % c
1.0mg/L	S	3.00 a	47 % a	M	3.10 b	48 % b
2.0mg/L	M	2.30 b	40 % b	M	5.00 a	50 % a

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S and M mean small and medium, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

Table(20): Effect of IBA concentration added to rooting media (charcoal supplemented MS basal medium at ½ strenght) on some measurements* of Callus, rooting and survival percentage of cultured shoots of ***Early Grand*** Peach cultivar during 1994 and 1995 Seasons**

Concentration of IBA	Origin of cultured shoots					
	Shoot tips/explants			Single node cuttings/ explants		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00mg/L	——	0.00 d	00% c	——	1.00 d	22 % d
0.5mg/L	——	1.20 c	36 % b	——	1.60 c	39 % c
1.0mg/L	S	2.60 a	40 % a	S	2.60 b	43.30 % b
2.0mg/L	S	2.00 b	40 % a	M	4.60 a	45 % a

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S and M mean small and medium, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

IV.2.3.2. Effect of NAA added to rooting media:-

Data obtained from the experiments coducted on explants of Florida Sun, Florida Prince and Early Grand peach cultivars are presented in Tables (21), (22) and (23), respectively.

IV.2.3.2.a. Florida Sun peach cultivar :

Regarding callus formation of Florida Sun shoots during rooting stage as influenced by level of NAA added to media, it could be noticed that NAA was more effective than IBA. Since, small quantities was formed by those shoots proliferated from shoot tip when cultured either on 1.0 or 2.0 mg NAA added, while with those of single node cutting the formed amount of callus was small, medium or large when they were cultured on MS basal rooting media (1/2 strength) supplemented with 0.5,1.0 and 2.0 mg, respectively. Moreover, the NAA omitted medium (control) prevented cultured shoots from callusing, regardless of the origin of these shoots.

Pertaining the average number of developed rootlets per cultured shoot in response to rate of supplemented NAA to rooting media, Table (21) shows that shoots of both single node cutting and shoot tip explants followed the same trend previously found with IBA added. The, greatest number of developed rootlets per shoot was always concomitant to the higher rate of NAA, while the developed rootlets were statistically depressed by decreasing the NAA level from 2.0 to 1.0 and 0.5 mg/L. In addition, the NAA omitted MS basal (1/2 strength) was the inferior as it resulted signficantly in the lowest number of developed shootlets / shoot.

However,it could be safely observed that NAA at various levels was more effective than IBA in stimulating rooting of proliferated shoots from shoot tip explant, as both auxins were compared each to other under the same level. Meanwhile, both IBA and NAA were equally effective with those shoots proliferated from single node cutting.

As for the survival percentage of cultured shoots of Florida Sun peach cv., it is quite clear to be observed that it was in closed relationship with the rooting measurement. Which was positively reflected on ability of cultured shoots to remain alive. The differences obtained were significant as cultured shoots of any rooting media were compared each to another. However, the 2.0 mg NAA supplemented medium was the supprior, while the NAA omission was the inferior. The response of survival % to NAA was more pronounced than IBA, but both followed the same trend regarding the effect of added level.

IV.2.3.2.b. Florida Prince peach cv.:

Table (22) shows that callus formation of Florida Prince cultured shoots in relation to NAA added to rooting media followed typically the same trend previously detcted with the

IBA for the same peach cultivar, with only exception that adding NAA at 2.0 mg/L induced larger amount of callus by shoots proliferated from single node cutting.

Nevertheless, both number of developed rootlets per cultured shoot and survived plantlets as affected by NAA added followed the same trend from one side and they were positively related in their responses from the other. All differences between the various rooting media regarding the aforesaid two meaurements were signficant. The higher level of NAA (2.0 mg/L) was statistically the superior for shoots of both explant kinds, while omission of NAA was the inferior in this respect. Moreover, two other levels (0.5 and 1.0 mg/L) were in between the aforesaid two extremes with significant tendency for 1.0 mg/L to be more effective than 0.5 mg/L. On the other hand it could be noticed to some extent that NAA was relatively more effective than IBA for rooting of shoots developed from two explant types.

IV.2.3.2.C. Early Grand Peach cv.:

Table (23) declares that callusing of cultured shoots proliferated from shoot tip explant of Early Grand Peach cv. in response to NAA added to rooting media followed the same trend previously discussed with IBA for the same peach cultivar. However, shoots from single node cutting exhibited more pronounced response to NAA rather than IBA, whereas both 0.5 and 1.0 mg NAA induced a moderate quantities of callus while 2.0 mg resulted in larger and greater amount.

As for the rooting and survival of cultured shoots obtained results in Table (23) revealed obviously the lower poteniality of this cultivar as compared to two other ones. Since, culturing of proliferated shoots from shoot tip on the auxin omitted medium did not succeed to root and consequently failed to remain alive. On the other hand both survival percentage of cultured shoots and the average number of developed rootlets per each were continuously increased with increasing level from 0.5 to 2.0 mg/L, whereas differences were significant between shoots of both two explant kinds. The rate of increase resulted by NAA was relatively lower especially in the survival % as compared with that occurred with IBA.

Data obtained from the present investigation go in line with the earlier findings of **(Skirvin et al., 1981)**, **(Miller et al., 1982)**, **(Ruzic et al., 1984)**, **(Snir, 1984, and Hammerschlag, 1987)**, regarding the benaficial effect of NAA of rooting process .

Table(21): Effect of NAA concentration added to rooting media (charcoal supplemented MS basal medium at ½ strenght) on some measurements* of Callus, rooting and survival percentage of cultured shoots of ***Florida Sun*** Peach cultivar during 1994 and 1995 Seasons**

Concentration of NAA	Origin of cultured shoots					
	Shoot tip/explant			Single node cutting/ explant		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00mg/L	——	1 .2 d	22 % d	——	1.50 d	30% d
0.5mg/L	——	2.00 c	43 % c	S	2.30 c	50 % c
1.0mg/L	S	3.10 b	55 % b	M	3.60 b	58 % b
2.0mg/L	S	5.30 a	60 % a	L	5.60 a	65 % c

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S and M mean small and medium, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

Table(22): Effect of NAA concentration added to rooting media (charcoal supplemented MS basal medium at ½ strenght) on some measurements* of Callus, rooting and survival percentage of cultured shoots of ***Florida Prince*** Peach cultivar during 1994 and 1995 Seasons**

Concentration of NAA	Origin of cultured shoots					
	Shoot tip/explant			Single node cutting/ explant		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00mg/L	——	1.00 d	20 % d	——	1.20 d	25 % d
0.5mg/L	——	1.50 c	38 % c	S	2.00 c	40 % c
1.0mg/L	S	2.00 b	45 % b	M	2.50 b	48 % b
2.0mg/L	M	4.40 a	56 % a	L	4.30 a	58 % a

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.

- S and M mean small and medium, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

Table(23): Effect of NAA concentration added to rooting media (charcoal supplemented MS basal medium at ½ strenght) on some measurements* of Callus, rooting and survival percentage of cultured shoots of ***Early Grand*** Peach cultivar during 1994 and 1995 Seasons**

Concentration of NAA	Origin of cultured shoots					
	Shoot tip/explant			Single node cutting/ explant		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00mg/L	——	0.00 d	00 % d	——	1.00 d	22 % b
0.5mg/L	——	1.30 c	15 % c	M	2.80 c	20 % c
1.0mg/L	S	2.00 b	33 % b	M	3.50 b	38 % a
2.0mg/L	S	4.20 a	38 % a	L	5.30 a	40 % a

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S and M mean small and medium, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

IV.2.3. Effect of Various Combinations of IBA + NAA added to rooting media:-

Nine treatments represented the different combinations between two auxins (IBA + NAA) each added at three rates (0.5, 1.0 or 2.0 mg) to one liter of charcoal supplemented MS basal medium (½ strength), beside auxin omitted one as control were investigated regarding their effect on three measurements (callussing, rooting and survival %) of cultured shoots originated from shoot tip and single node cutting explants. Data obtained during both 1994 & 1995 seasons are presented in Tables (24), (25) and (26), as well as illustrated by Figures (7), (8) and (9) for Florida Sun, Florida Prince and Early Grand Peach cultivars, respectively.

IV.2.3.a. Florida Sun Peach Cultivar :

Data obtained in Table (24) revealed that callusing did not take place after culturing on both rooting media of either auxin omission (control) or supplemented with IBA + NAA (each at 0.5 mg/L), regardless of explant kind from which cultured shoots were induced. However, it was slightly formed after culturing axillary shoots (proliferated from shoot tip explant) on rooting media supplemented with combinations of either (0.5 mg NAA +1.0/2.0 mg IBA) from one hand or those of (1.0 mg NAA + 0.5/ 1.0 mg IBA) from the other. Moreover, with increasing the added rates of both NAA and IBA to rooting media, callus formation was stimulated obviously, whereas shoots proliferated from shoot tip explant formed a moderate quantities of callus.

Nevertheless, proliferated shoots from single node cutting induced a larger quantities of callus after culturing on rooting media supplied with 2.0 mg NAA combined with either 1.0 or 2.0 mg IBA per liter. Meanwhile, culturing the single node cutting - prolif erated shoots on rooting media contained any of either two combinatians of (1.0 mg NAA + IBA at 1.0/2.0 mg/L) or the (2.0 mg NAA + 0.5 mg IBA / L) resulted in inducing an intermediate quantity of callus, while other treatments showed a small quantity of formed callus.

Concerning the effect of combinations between IBA and NAA added to rooting media on the developed number of rootlets and survival percentage of Florida Sun cultured shoots during rooting stage, data in Table (24) revealed that both parameters are in positive relationship. All rooting media supplied with different IBA + NAA combinations increased significantly both investigated characteristics than control - Meanwhile, two combinations between the lowest NAA rate (0.5 mg) and 1.0 / 2.0 mg IBA per one liter were the superior treatments for cultured shoots originated from both shoot tip and single node cutting explants. However, the aforesaid superior combinations were statistically of the same effectiveness with the shoot tip-proliferated shoots, but the 0.5 mg NAA + 1.0 mg IBA/L was more effective with those of single node cutting as shown from Table (24) and Figure (7). Moreover, different combinations of adding NAA at 1.0 mg + IBA at 0.5, 1.0 or 2.0 mg/ L ranked second in this concern. However, those combinations between 1.0 mg NAA and the lower concentration of IBA showed a relative tendency to be more effective with proliferated shoots from single node cutting, but the reverse was true for those of shoot tip. In addition other combinations fell in between.

Nevertheless, culturing shoots proliferated from single node cutting of Florida Sun Peach cv. showed relatively higher potentiality for rooting and surviving than those regenerated from shoot tip.

IV.2.3.b. Florida Prince Peach cultivar:

With regard to the response of callus fromation to the different (NAA + IBA) combinations added, data in Table (25) showed that cultured shoots of Florida Prince peach cv. did not induce callus under the auxin omitted rooting media (control), rgardless of the explant type from which the employed shoots were induced. However, adding any of (NAA + IBA) combinations stimulated callusing process with a variable degrees. Since, all combinations of (IBA + NAA) resulted in inducing a moderate quantities of callus by shoots proliferated from shoot tip explant, except culturing on supplemented rooting media with 0.5 mg IBA + 0.5/1.0 mg NAA which formed a small quantity, beside adding both auxins at the highest rate (2.0 mg from each /

liter) whereas a larger amount of callus was occurred. On the other hand the response was more pronounced with those shoots of single node cuttings, especially under culturing in a rooting media supplied with all combinations of the highest rate of NAA.

Referring the effect of adding different (IBA + NAA) combinations to rooting media on number of developed rootlets and survival % of cultured shoots during rooting stage Table (25) and Figure (8) show that culturing shoots of Florida Prince Peach cv. on the MS basal medium (½ strength) supplied with charcoal + NAA + IBA at 3.0, 1.0 and 1.0 mg/L, respectively was the most favourable. Moreover, adding (0.5 mg NAA + 1.0/ 2.0 mg IBA), as well as (1.0 mg NAA + 0.5 / 2.0 mg IBA) followed second to the abovementioned superior treatment for proliferated shoots from both explant kinds. On the contrary the auxin omitted medium (control) exhibited the lowest values of both rooting and survival parameters, regardless of explant type. In addition, all other treatments were intermediately effective except two combinations of adding NAA + IBA either both were combined together each at the lowest (0.5 mg) or the highest (2.0 mg) rates which showed the lowest response to NAA + IBA combinations.

IV.2.3.C. Early Grand Peach Cultivar:

Regarding callus formation of Early Grand shoots during rooting stage, data in Table (26) showed that it was not occurred under culturing on the auxin ommitted medium. However, it was observed clearly with any of IBA + NAA supplemented media. Such response was more pronounced than the previously detected with the two other peach cultivars. The induced quantity of callus was gradually increased with increasing the added rates of both IBA and NAA, whereas all combinations of 2.0 mg NAA from one hand and any added rates (0.5, 1.0 or 2.0 mg/L) of IBA from the other resulted in producing larger quantities of callus by shoots from both explant kinds. Besides two combinations of 1.0 mg NAA + 1.0/2.0 mg IBA also stimulated vigorously the callus formation in cultured shoots of single node cutting. In addition other IBA + NAA combinations resulted in inducing an intermediate quantity of callus except adding (NAA + IBA) each at 0.5 mg for shoots of both explant types and (0.5 mg NAA + 1.0 mg IBA/L) with only proliferated shoots from shoot tip explant.

With respect to effect on number of developed rootlets and survival percentage of cultured shoots of Early Grand peach cv., Table (26) and Figure (9) show clearly that the most promoting response was always concomitant to the MS basal medium (at one half strength) supplemented with 3.0 + 0.5 + 0.5 mg per liter of charcoal, NAA and IBA respectively. The superiority of such treatment pertaining its beneficial effect in increasing number of developed rootlits and survival % over other added combinations was significant. On the contrary, adding (NAA + IBA) each at the highest rate (2.0 mg/L) was the least effective combination, especially with cultured shoots proliferated from shoot tip which failed completely to root and consequently to survive. Moreover, rooting and surviving of cultured shoots were entirely absent under planting in the auxin omitted rooting medium (control). However, adding both NAA and IBA each at 1.0 mg/L ranked second and followed in a descending other by both combinations of 0.5 mg NAA + 1.0/2.0 mg IBA, as weel as (1.0 mg NAA + 0.5 mg IBA).

In addition, other IBA + NAA cominations were less effective. The present results are in general agreement with the findings of **Hartmann and Kester, (1975), Skirvin, et al, (1980), Dirr, (1982) and Guindy, (1990)** who mentioned the beneficial effect of adding NAA at the range of 0.1 mg/L plus IBA at 2.0 mg/L to the modified MS media on rooting of the proliferated shoots of prunus spp.

Table (24): Callusing, rooting and survival measurements* in cultured shoots of ***Florida Sun*** Peach cv. as affected by different IBA and NAA combinations added to rooting media (charcoal supplemented MS basal medium at 1/2 strength) during 1994 and 1995 seasons**.

Concentration of NAA + IBA	Origin of cultured shoots					
	Shoot tip explant			Single node cutting explant		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00 + 0.00	—	0.90 h	9 g	—	1.70 h	13 h
0.50 + 0.50	—	4.40 g	40 f	—	4.60 g	44 g
0.50 + 1.00	S	7.60 a	65 a	S	8.10 a	67 a
0.50 + 2.00	S	7.40 a	65 a	S	7.50 b	65 b
1.00 + 0.50	S	5.20 e	53 d	S	7.10 c	61 c
1.00 + 1.00	S	6.60 c	53 d	M	5.80 e	55 e
1.00 + 2.00	M	7.00 b	60 b	M	5.20 f	53 f
2.00 + 0.50	M	4.80 f	50 e	M	5.20 f	53 f
2.00 + 1.00	M	5.30 e	50 e	L	5.90 e	55 e
2.00 + 2.00	M	6.30 d	55 c	L	6.60 d	57 d

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S, M and L mean small, medium and large, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

Table (25): Callusing, rooting and survival measurements* in cultured shoots of ***Florida Prince*** Peach cv. as affected by different IBA and NAA combinations added to rooting media (charcoal supplemented MS basal medium at 1/2 strength) during 1994 and 1995 seasons**.

Concentration of NAA + IBA	Origin of cultured shoots					
	Shoot tip explant			Single node cutting explant		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00 + 0.00	—	0.70 i	7 g	—	1.50 g	11 h
0.50 + 0.50	S	4.00 g	35 f	S	4.40 e	40 g
0.50 + 1.00	M	7.40 b	55 b	S	7.40 b	58 b
0.50 + 2.00	M	6.20 d	45 d	M	7.20 b	56 bc
1.00 + 0.50	S	5.20 e	53 c	M	5.60 c	55 c
1.00 + 1.00	M	8.30 a	61 a	M	8.50 a	64 a
1.00 + 2.00	M	6.80 c	53 c	M	7.20 b	57 bc
2.00 + 0.50	M	4.80 f	53 c	L	5.20 d	46 d
2.00 + 1.00	M	5.30 e	42 e	L	5.70 c	44 e
2.00 + 2.00	L	3.20 h	40 e	L	4.10 f	42 f

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% level.
- S, M and L mean small, medium and large, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.

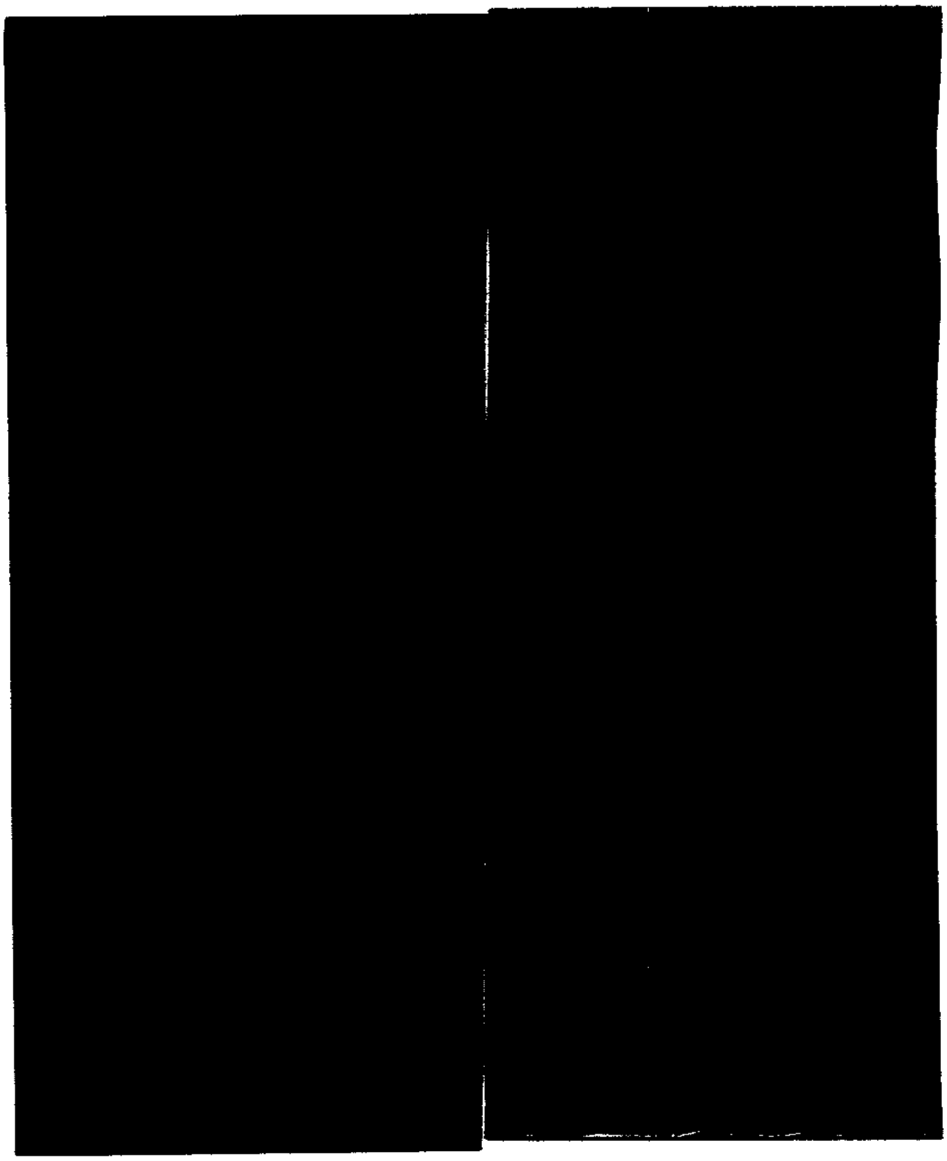
Table (26): Callusing, rooting and survival measurements* in cultured shoots of ***Early Grand*** Peach cv. as affected by different IBA and NAA combinations added to rooting media (charcoal supplemented MS basal medium at 1/2 strength) during 1994 and 1995 seasons**.

Concentration of NAA + IBA	Origin of cultured shoots					
	Shoot tip explant			Single node cutting explant		
	Callus formation	**Average root number**	**Survival percentage**	**Callus formation**	**Average root number**	**Survival percentage**
0.00 + 0.00	—	0.00 f	00 i	—	0.00 i	00 i
0.50 + 0.50	S	4.40 a	57 a	S	4.60 a	55 a
0.50 + 1.00	S	3.10 c	46 c	M	3.50 c	50 b
0.50 + 2.00	M	2.20 d	46 c	M	2.80 d	46 c
1.00 + 0.50	M	2.00 d	38 d	M	2.20 e	48 c
1.00 + 1.00	M	3.50 b	54 b	L	3.90 b	50 b
1.00 + 2.00	M	1.00 e	23 f	L	1.90 f	33 e
2.00 + 0.50	L	1.00 e	18 g	L	1.80 f	27 f
2.00 + 1.00	L	0.80 e	12 h	L	1.30 g	18 g
2.00 + 2.00	L	0.00 f	00 i	L	0.80 h	8 h

- Means Followed by the same letter within each column were not significantly different by L.S.D at 5% levl.
- S, M and L mean small, medium and large, respectively.

* measuring was done 2 months later from culturing.

** an average of two seasons.



A B

Figure (7) : Rooting of shoots originated from shoot tip (A) and single node cutting (B) explants of ***Florida Sun*** Peach cv. after culturing and subculturing (3 times) on MS basal medium (at one half strength) supplemented with charcoal + NAA + IBA at 3.0, 0.5 and 1.0 mg/L, respectively.

IV.3. Changes in shoot tip and single node cutting contents of phenolic compounds as influenced by excising date from trees of three peach cultivars:

Both explant kinds i.e, shoot tip and single node cutting were excised periodically at one month interval from trees of the three peach cultivars during growing season of 1993 year. Data obtained regarding the changes in phenolic compounds level as affected by the advancement of season are presented in Table(27).

It could be noticed obviously the great differences of phenolic content in relation to excising date of both explant types when a level at a given date was compared to those of others.

Shoot tip and single node cutting excised at the begining of growing season i.e in March exhibited the highest level of phenolic compounds, then it decreased severly in April. Such decrease was smoothly continued with the aging till May at which the minimum level of phenolic compounds was obviously detected (regardless of either explant kind or peach cultivar). Thereafter, the level of phenolic compounds in both explant kinds started to be increased again till September. However, the rate of such increase was more pronounced in June, while it continued slightly during July and August to show its other maximum value (peak) in September.

Nevertheless, it could be concluded that exhibited changes in phenolic content through the advancement of growing season followed to great extent a general trend of response for three peach cultivars "with very limeted exceptions". Such trend showed two peaks i.e, 1st in March and 2nd in September, while the reverse " the lowest level of phenolic content" was detected with May excised explants. Moreover, other excising dates were in between the abovementioned two extremes.

On the other hand, three peach cultivars were relatively varied in their phenolic contents, whereas Florida Sun explants were generally poorer especially throughout the duration from April till August when the levels of the same explant kind at every sampling date of the three peach cultivars were compared each to other. In addition, Florida Prince explants were richer in their phenolic compounds than those of the two other peach cvs. especially throughout duration of June, July and August.

Table (27): Periodical changes in phenolic compounds contents in two peach explants types excised from three peach cultivars along growing season around during 1993 year.

Month	Florida Sun		Florida Prince		Early Grand	
	S.T.	N.C.	S.T.	N.C.	S.T.	N.C.
March	370.30 a	395.40 a	370.10 a	390.30 b	350.13 a	359.40 b
April	190.20 f	220.10 f	280.10 e	265.60 e	270.50 c	350.20 c
May	158.80 g	175.30 g	220.30 g	260.10 e	175.20 e	240.15 f
June	235.10 c	263.15 d	300.10 d	320.10 c	270.11 c	280.14 e
July	210.50 d	280.00 c	330.00 b	320.50 c	260.14 d	275.05 e
Aug.	200.30 e	250.10 e	260.15 f	290.10 d	310.30 b	320.13 d
Sep.	350.15 b	370.32 b	310.50 c	400.25 a	310.80 b	370.10 a

- mean separation within columuns by L.S.D. (0.05)

- S.T. and N.C. mean shoot tip and nodular cutting.