RESULTS AND DISCUSSION

IV.1. GRAPE CULTIVARS

IV.1.A. ESTABLISHMENT STAGE :

IV.1.A.1. EFFECT OF CULTIVAR AND NUTRIENT MEDIUM : -

Regarding the effect of cultivar on explant development and shootlets, Table (1-A) indicates that either nicroses or chlorophyll had not significantly affected by different cultivars. However, King ruby cultivar significantly enhanced shootlets whilist Ruby seedless was the lowest one in this respect.

Data tabulated in Table (1-B) states that nicroses was significantly reduced when Nitsch and Nitsch medium was used instead of Murashige and Skoog medium. However, shootlets and chlorophyll were significantly increased as Nitsch and Nitsch medium was involved in relation to Murashige and Skoog medium.

With respect to the interaction between cultivar and medium type Table (1-C) and Fig (1) reflect that interaction between different cultivars and Nitsch and Nitsch medium slightly reduced nicroses as compared with the other interactions. On contrast, the reverse was true in case of growth and chlorophyll.

Generally, the above mentioned results indicate that Nitsch and Nitsch medium surpassed Murashige and Skoog medium in reducing nicroses as well as increasing shootlets and chlorophyll. These results are in general agreement

Table (1) Effect of different cultivars and medium types on explant development and shootlets of some grape cultivars.

1-A : Effect of cultivar : -

Growth parameters / Cultivars	Nicroses	shootles	Chlorophyll
Delight	1.83 a	3.17 cd	3.83 a
Black rind	1.83 a	2.83 d	3.83 a
Riche baba	1.33 a	2.83 d	4.00 a
Flame seedless	1.50 a	3.67 bc	4.17 a
Matrouh black	1.50 a	2.83 d	4.00 a
Queen	1.50 a	3.50 cd	4.00 a
Thompson seedless	1.83 a	3.33 cd	4.50 a
Cardinal	1.33 a	4.17 ab	4.00 a
Emperor	1.83 a	3.00 cd	4.00 a
King ruby	1.17 a	4.33 a	3.83 a
Beauty seedless	1.33 a	4.17 ab	4.00 a
Gold	1.33 a	3.33 cd	3.83 a
Ruby seedless	1.67 a	2.83 d	4.00 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

1-B : Effect of medium type.

Growth parameters / Medium type	Nicroses	shootles	Chlorophyll
Murashige and skoog	1.82 a	2.85 b	3.01 b
Nitsch and Nitsch	1.26 b	3.92 a	3.69 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

1-C : Effect of the interaction between cultivar and medium type.

Growth parameters / Cultivar / Medium type	Nicroses		shootles		Chlorophyll	
	Murashige and Skoog	Nitsch and Nitsch	Murashige and Skoog	Nitsch and Nitsch	Murash-ige and Skoog	Nitsch and Nitsch
Delight	2.33 a	1.33 ab	2.67 de	3.67 abcd	3.33 b	4.33 ab
Black rind	2.00 ab	1.67 ab	2.33 e	3.33 bcde	3.33 b	4.33 ab
Riche baba	1.67 ab	1.00 b	2.33 e	3.33 bcde	3.67ab	4.33 ab
Flame seedless	1.67 ab	1.33 ab	3.00 cde	4.33 ab	4.00 ab	4.33 ab
Maturouh black	1.67 ab	1.33 ab	2.33 e	3.33 bcde	3.67 ab	4.33 ab
Queen	2.00 ab	1.00 b	2.67 de	4.33 ab	3.33 b	4.67 a
Thompson seedless	2.33 a	1.33 ab	2.67 de	4.00 abc	4.33 ab	4.67 a
Cardinal	1.67 ab	1.00 b	3.67 abcd	4.67 a	3.67 ab	4.33 ab
Emperor	2.33 a	1.33 ab	2.33 e	3.67 abcd	3.67 ab	4.33 ab
King ruby	1.33 ab	1.00 b	4.00 abc	4.67 a	3.67 ab	4.00 ab
Beauty seedless	1.67 ab	1.00 b	3.67 abcd	4.67 a	3.67 ab	4.33 ab
Gold	1.33 ab	1.33 ab	3.00 cde	3.67 abcd	4.00 ab	4.67 a
Ruby seedless	1.67 ab	1.67 ab	2.33 e	3.33 bcde	3.67 ab	4.33 ab

Means followed by the same letter, within each parameter, are not significantly different from each other at 1 % level.

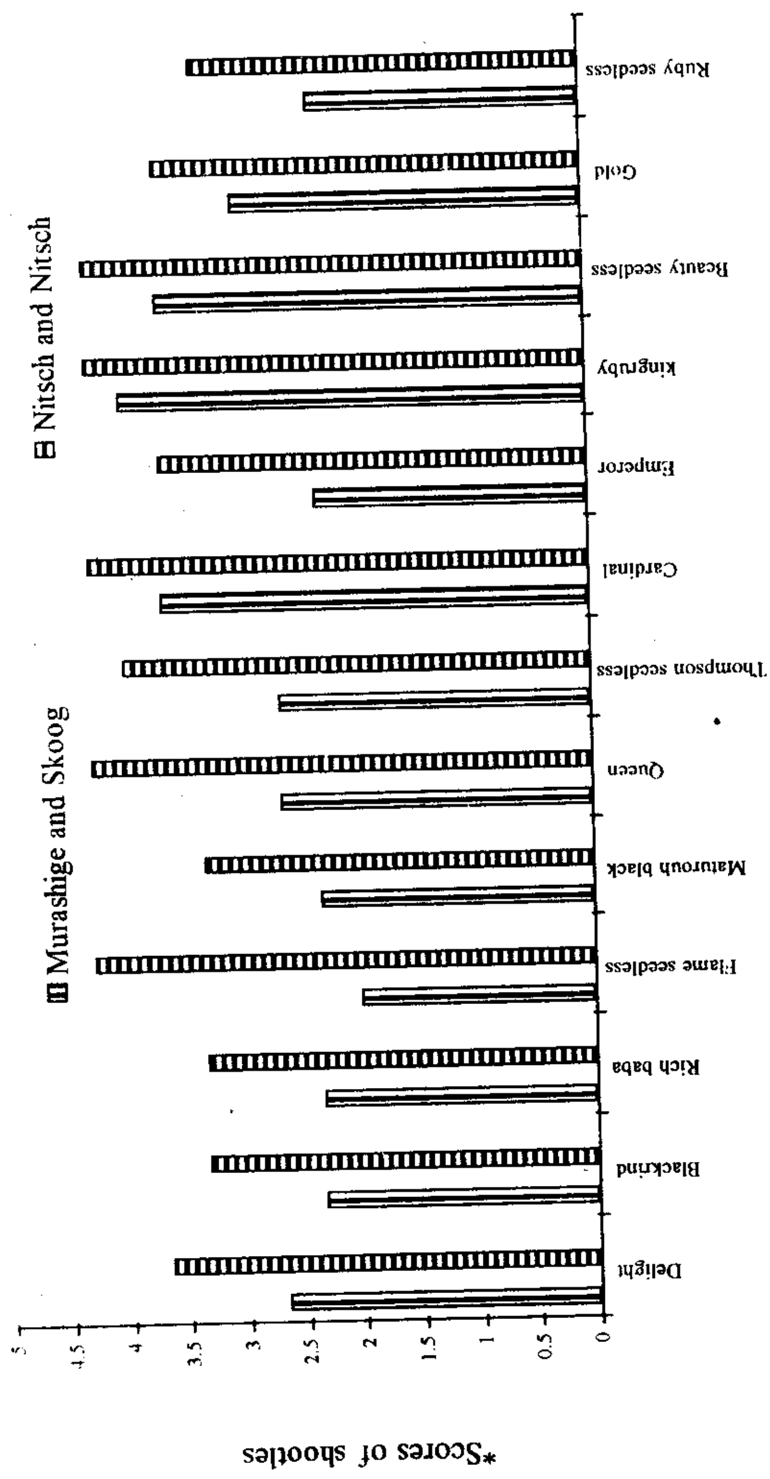


Fig (1) Effect of interaction between cultivar and medium type on shootles ion.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 ; and excellent = 5 .

with the finding of Vilapland and Mullins, (1989) who mentioned that Glory vine succeeded in arising buds on Nitsch and Nitsch medium which developed into shoots and finally into plantlets. Also, the above mentioned results partially go in line with the finding of Jako, (1986). He showed that the best development of the cultured Pinot noir and Merbt grape cultivars were occurred on a medium containing Murashige & Skoog macroelement and Nitsch & Nitsch microelement with various additives.

IV.1.A.2. EFFECT OF EXPLANT TYPE AND NUTRIENT MEDIUM:

Concerning the effect of nutrient medium, Table (2-A) clarifies that Nitsch & Nitsch followed with Murashig and Skoog induced significant reduction of nicroses in comparison with Anderson medium. However, shootlets and chlorophyll were significantly improved as Nitsch & Nitsch medium was used instead of Anderson medium. Meanwhile, Murashige and Skoog slightly surpassed Anderson medium without any significancy in both shootlets and chlorophyll parameters. Furthermore, Table (2-B) and Fig (2) deal with the effect of the explant on explant development & shootlets. It is clear that nicroses and chlorophyll were not significantly affected by using either shoot tip or one node cutting explants. However using of shoot tip explant significantly enhanced shootlets as compared with one node cutting. In regard to the interaction between the medium and explant, Table (2-C) reveals that interactions between either shoot tips or one node cuttings and Nitsch & Nitsch medium significantly reduced nicroses as compared with the interactions between different explants and Anderson medium. However, interaction between shoot tip and Nitsch & Nitsch medium significantly stimulated increase in shootlets in relation to the other interactions. In the same

Table (2) Effect of different explants and medium types on explant development and shootlets of Thomposn seedless grape.

2-A : Effect of medium type.

Growth parameters / Medium type	Nicroses	shootles	Chlorophyll
Murashige and Skoog	2.50 b	2.50 b	2.50 ab
Nitsch and Nitsch	1.83 b	3.50 a	2.83 a
Anderson	3.50 a	1.83 b	2.17 b

Means of nutrient medium treatments followed by the same letter, within each column for each categary are not significantly different from other at 5 % level

2-B : Effect of explant.

Growth parameters / Explant	Nicroses	shootles	Chlorophyll
Shoot tips	2.44 a	3.00 a	2.67 a
One node cuttings	2.78 a	2.22 b	2.33 a

Means of explant treatments followed by the same letter, within each column for each categary are not significantly different from other at 5 % level

2-C : Effect of the interaction between medium type and explant.

Growth parameters	Nicroses			shootles			Chlorophyll		
Medium types / Explant	Murash-ige and Skoog	Nitsch and Nitsch	Ande-rson	Murash-ige and Skoog	Nitsch and Nitsch	Ande-rson	Mura-shige and Skoog	Nitsch and Nitsch	Ande-rson
Shoot tips	2.33 bc	1.67 c	3.33 ab	2.67 b	4.33 a	2.00 b	2.67 ab	3.00 a	2.33 ab
One node cuttings	2.67 abc	2.00 c	3.67 a	2.33 b	2.67 b	1.67 b	2.33 ab	2.67 ab	2.00 b

Means followed by the same letter, within each parameter, are not significantly different from each other at 1 % level.

Fig (2) shootles developed from shoot tips of Thompson seedless grape plants.

time, the aforementioned interaction show a significant increase in chlorophyll in comparison with one node cutting and Anderson medium. On the contrary, all interactions between either shoot tip or one node cutting and both Murashige & Skoog and Nitsch & Nitsch media showed slight differences among them in chlorophyll without any significancy.

The above mentioned results can be summerized that both shoot tip and one node cutting showed similar trend on nicroses and chlorophyll, while shoot tip was superior in shootlets. These results are nearly in disagreement with the finding of Hwang and kim, (1990). They stated that shoot tips and axillary bud segments of Riesling grape had no differences in growth.

IV.1.A.3. EFFECT OF MEDIUM STATE : -

Table (3) and Fig (3A) deal with the effect of medium state on explant development and shootlets of Thompson seedless grape. It is clear that solid medium significantly reduced the nicroses as compared with the semi-solid one, while no significancy was noticed with the liquid medium state. However, solid medium significantly enhanced shootlets in relation to both semi-solid and liquid ones. On the other hand, medium states failed completely to induce any significant differences on chlorophyll.

From the above results, it appear that solid medium was superior in reducing nicroses and increasing plantlets regeneration. These results confirm the finding of Gabr and Tisserat, (1985) they reported that the best growth response of date palm was obtained from shoot tips cultured on solid agar medium for 2 weeks. Also with the finding of Stamp et al (1990) who found that solid medium was superior to liquid medium for grapevine segments.

IV.1.B. PROLIFERATION STAGE : -

IV.1.B.1. EFFECT OF MEDIUM STATE : -

Table (4) and Fig (3B) summarized the effect of medium state on growth and proliferation of Thompson seedless grape. It appear that different medium states had no significant effect on nicroses. However, growth was significantly enhanced when solid medium was involved in comparison with the semi-solid medium while no significant differences were shown as compered to liquid medium state. On the contrary semi-solid medium significantly encouraged proliferation as compared with the liquid medium state. On the other hand, liquid medium significantly improved chlorophyll as compared with the semi-solid medium.

The above data proved that proliferation increased greatly when semi-solid medium was used. These results are in contrary to the finding of Barlass and Skene (1978) as well as Skene and Barless (1981). They stated that solid medium enhanced adventitions shoots formation.

IV.1.B.2.EFFECT OF CYTOKININ TYPE AND CYTOKININ- LIKE :

Data tabulated in Table (5) and Fig (4 & 5) reveal that thidiazuron at 2 mg/l significantly induced harmful effect on growth, proliferation, and chlorophyll, while both nicroses and callus production were significantly increased. Meanwhile, either, 6-benzylaminopurine or zeatin had slight differences on callus production without any significancy. However, Kinetin, caused significant decrease in both callus production and nicroses as compared

Table (3) Effect of medium state on explant development and shootlets of Thompson seedless grape.

Growth parameters / Medium state	Nicroses	shootles	Chlorophyll
Solid	1.67 b	4.00 a	2.67 a
Semi solid	3.00 a	1.67 b	1.33 a
Liquid	2.67 ab	2.33 b	2.00 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (4) : Effect of medium state on growth and proliferation of Thompson seedless grape.

Growth parameters / Medium state	Nicroses	Growth	Proliferation	Chlorophyll
Solid	1.67 a	2.67 a	3.33 ab	3.33 ab
Semi solid	2.00 a	1.67 b	4.33 a	3.00 b
Liquid	1.33 a	2.00 ab	2.33 b	4.00 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

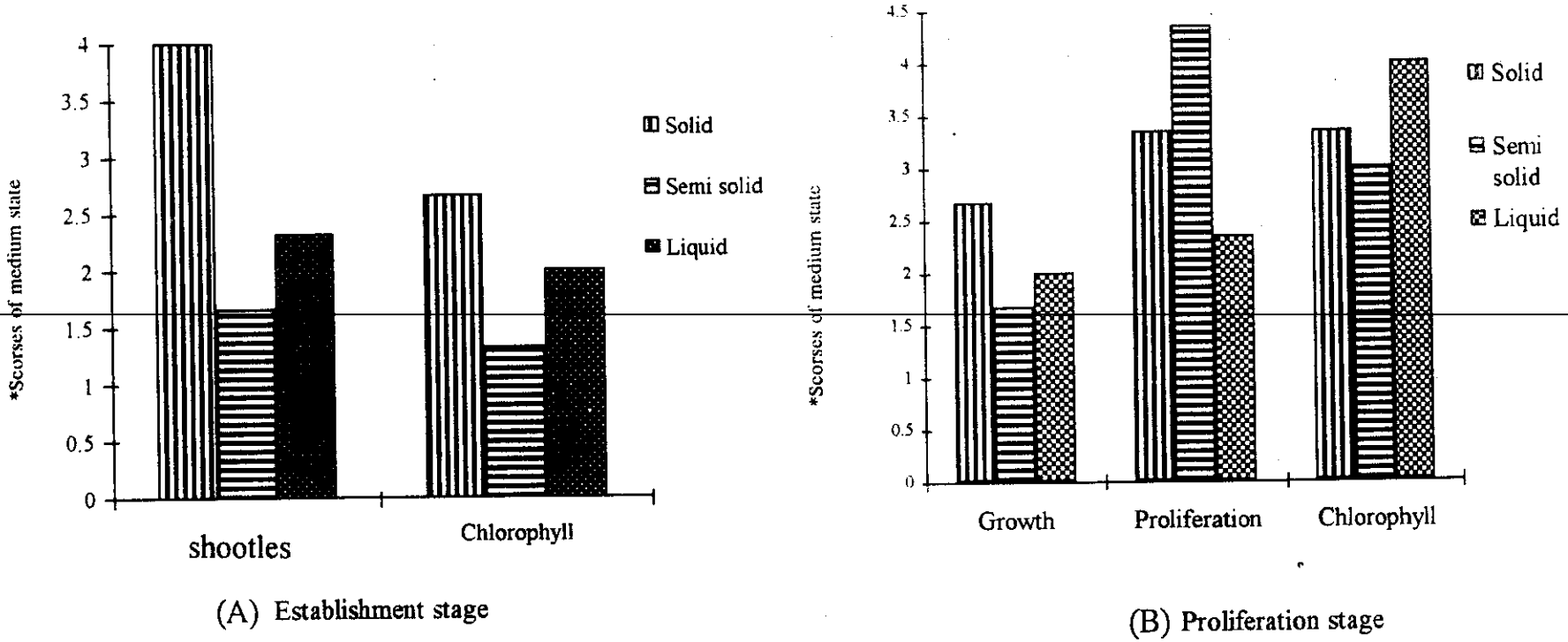


Fig (3) Effect of different medium states on shootles (A) and proliferation (B) of Thompson seedless grape.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

Table (5) Effect of different Cytokinin types and Cytokinin-like on growth and proliferation parameters of Thompson seedless grape.

Growth parameters / cytokinin types and cytokinin-like	Callus	Nicroses	Growth	Proliferation	Chlorophyll
Kinetin	1.00 c	1.33 c	3.00 a	1.67 bc	4.00 a
BAP	2.33 ab	2.00 bc	1.67 b	4.00 a	3.33 a
Zeatin	1.67 bc	2.33 b	2.00 b	2.67 b	3.67 a
Thidiazuron	3.00 a	4.67 a	1.00 c	1.33 c	1.33 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

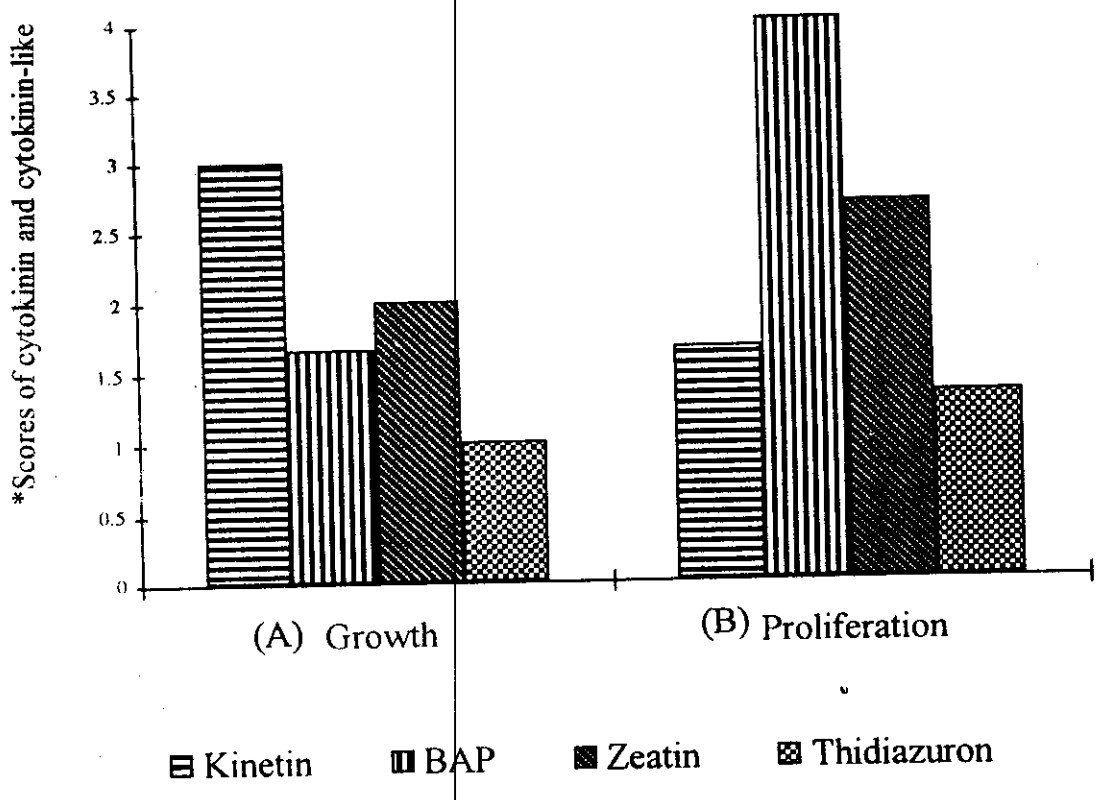
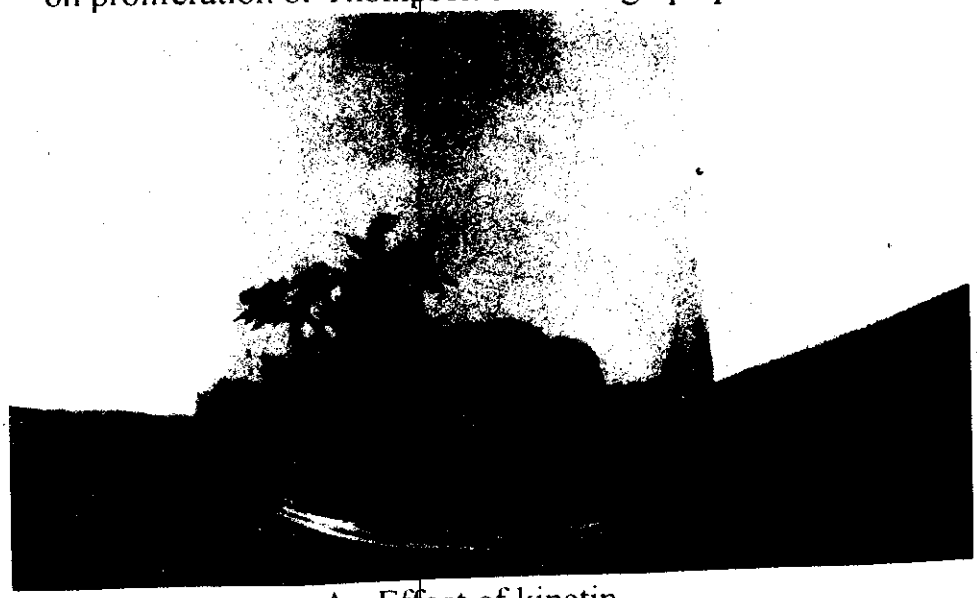


Fig (4) Effect of different cytokinin types and cytokinin-like on growth (A) and proliferation (B) of Thompson seedless.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

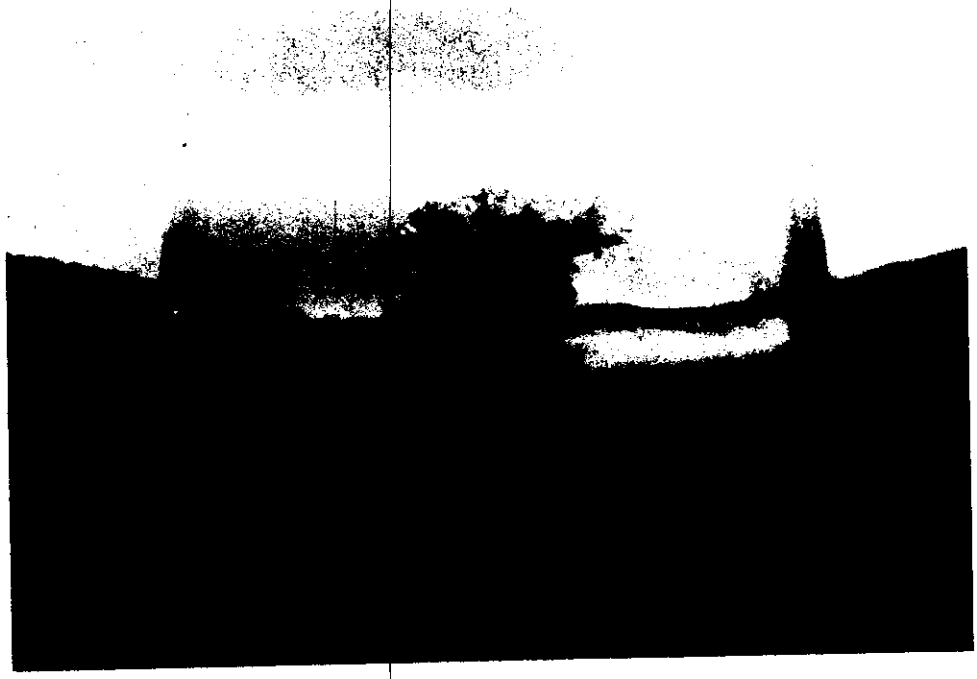
Fig (5) Effect of cytokinin type and cytokinin-like at the rate 2 mg/L on proliferation of Thompson seedless grape plants.



A : Effect of kinetin

B : Effect of zeatin

C : Effect of 6-benzylaminopurine



D : Effect of thidiazuron

with thidiazuron. On the other hand, growth was increased significantly when kinetin was supplemented to the medium in comparison with 6-benzylaminopurine, zeatin, and thidiazuron. Meanwhile chlorophyll improved significantly when either kinetin , BAP, or zeatin were added to the medium in relation to thidiazuron. On the contrary, 6-benzylaminopurine significantly enhanced proliferation in relation to the others. Moreover, kinetin and zeatin enhanced proliferation with somewhat similar trend without any significant differences.

In general, the above results indicated that kinetin improved growth and chlorophyll as well as reduced nicorses. However, 6-benzylamino-purine and zeatin increased proliferation to a great extent. These results are in harmony with the findings of Goussard, (1982) who stated that maximum shoot proliferation of cv. Chenin blanc occurred with 2 mg/l of both BA and zeatin riboside. Also, Novak and Juvova, (1982) reported that kinetin increased shoot growth. Meanwhile, Hagagy, (1992) showed that kinetin greatly improved growth and chlorophyll while BAP and zeatin increased proliferation of Williams banana plants.

IV.1.B.3. Effect of Cytokinin and Cytokinin-Like concentration:

IV.1.B.3.a. Effect of cultivar and 6-benzylaminopurine (BAP) concentration :

Referring to the effect of different cultivars on nicroses, growth, proliferation and chlorophyll, it is clear from Table (6-A) that the effect of cultivar was more or less variable and the variance between cultivars were greatly interrelated with slight differences among them. Nicroses was significantly reduced with Black rind cultivar while King ruby cvs showed the greatest nicrotic tissues. However, Riche baba and Flame seedless cvs

produced significant increase in growth in than other ones, but the reverse was true with Queen cultivar. On the contrary, proliferation was significantly increased when Beauty seedless was included as compared with Delight, Black rind, Queen, Thompson seedless, and Cardinal cultivars. Furthermore using of Flame seedless, Queen, and Gold cultivars induced significant increase in chlorophyll in relation to Riche baba and Matrouh black.

Considering the effect of 6-benzylaminopurine (BAP) concentrations, Table (6-B) and Fig (6&7) explain that supplemention of the medium with 4mg/l BAP significantly enhanced increase in both nicroses and proliferation while growth and chlorophyll were significantly decreased as compared with 2mg/l.

Dealing with the effect of interactions between cultivar and 6-benzylaminopurine , Table (6-C) and Fig (8) indicate that nicroses was slightly reduced in most cases of interaction between different cultvairs and 2mg/l BAP in comparison with those of 4mg/l. However, growth and chlorophyll took the other way around in this respect as they increased when interaction of 2mg/l and different cultivars were involved. On the other hand, interactions of 4 mg/l BAP and different cultivars enhanced proliferation as compared with those interacted with 2mg/l.

The above data showed that 2mg/l BAP improved growth and chlorophyll while decreased nicroses. However 4mg/l increased proliferation to a large extent . These results are in cordance with the findings of Safadi et al

Table (6) : Effect of different concentrations of 6-benzylaminopurine (BAP) on growth and proliferation of some grape cultivars.

6-A . Effect of cultivar.

Growth parameters / Cultivars	Nicroses	Growth	Proliferation	Chlorophyll
Delight	1.83 abc	2.33 bc	2.67 bc	2.83 ab
Black rind	1.50 c	2.17 bc	2.50 bc	2.83 ab
Rich baba	2.00 abc	3.00 a	3.00 ab	2.33 b
Flame seedless	1.83 abc	3.00 a	3.00 ab	3.17 a
Matrouh black	1.67 bc	2.67 ab	3.00 ab	2.33 b
Queen	1.67 bc	1.83 c	2.67 bc	3.17 a
Thompson seedless	2.00 abc	2.67 ab	2.67 bc	2.83 ab
Cardinal	2.33 ab	2.67 ab	2.00 c	2.83 ab
Emperor	1.83 abc	2.83 ab	3.00 ab	2.83 ab
King ruby	2.50 a	2.83 ab	3.00 ab	2.83 ab
Beauty seedless	1.83 abc	2.83 ab	3.67 a	2.67 ab
Gold	2.00 abc	2.50 abc	2.33 bc	3.00 a
Ruby seedless	1.88 abc	2.83 ab	3.00 ab	2.83 ab

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

(6-B) : Effect of BAP concentration.

Growth parameters / concentration mg/L	Nicroses	Growth	Proliferation	Chlorophyll
2	1.46 b	3.26 a	2.10 b	3.21 a
4	2.36 a	2.00 b	3.51 a	2.41 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

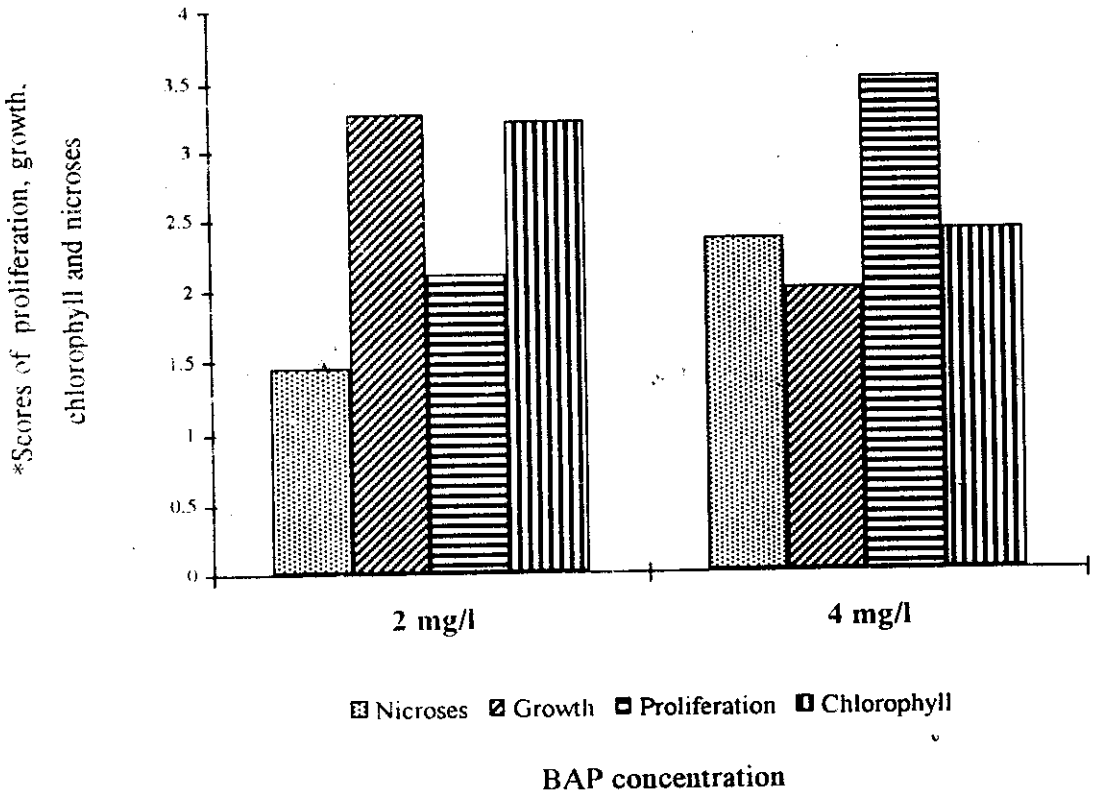


Fig (6) Effect of different concentrations of 6-benzylaminopurine (BAP) on nicroses growth, proliferation, and chlorophyll of some grape cultivars.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

Fig (7) Effect of 6-benzylaminopurine (BAP) concentrations on proliferation of Thompson seedless grape

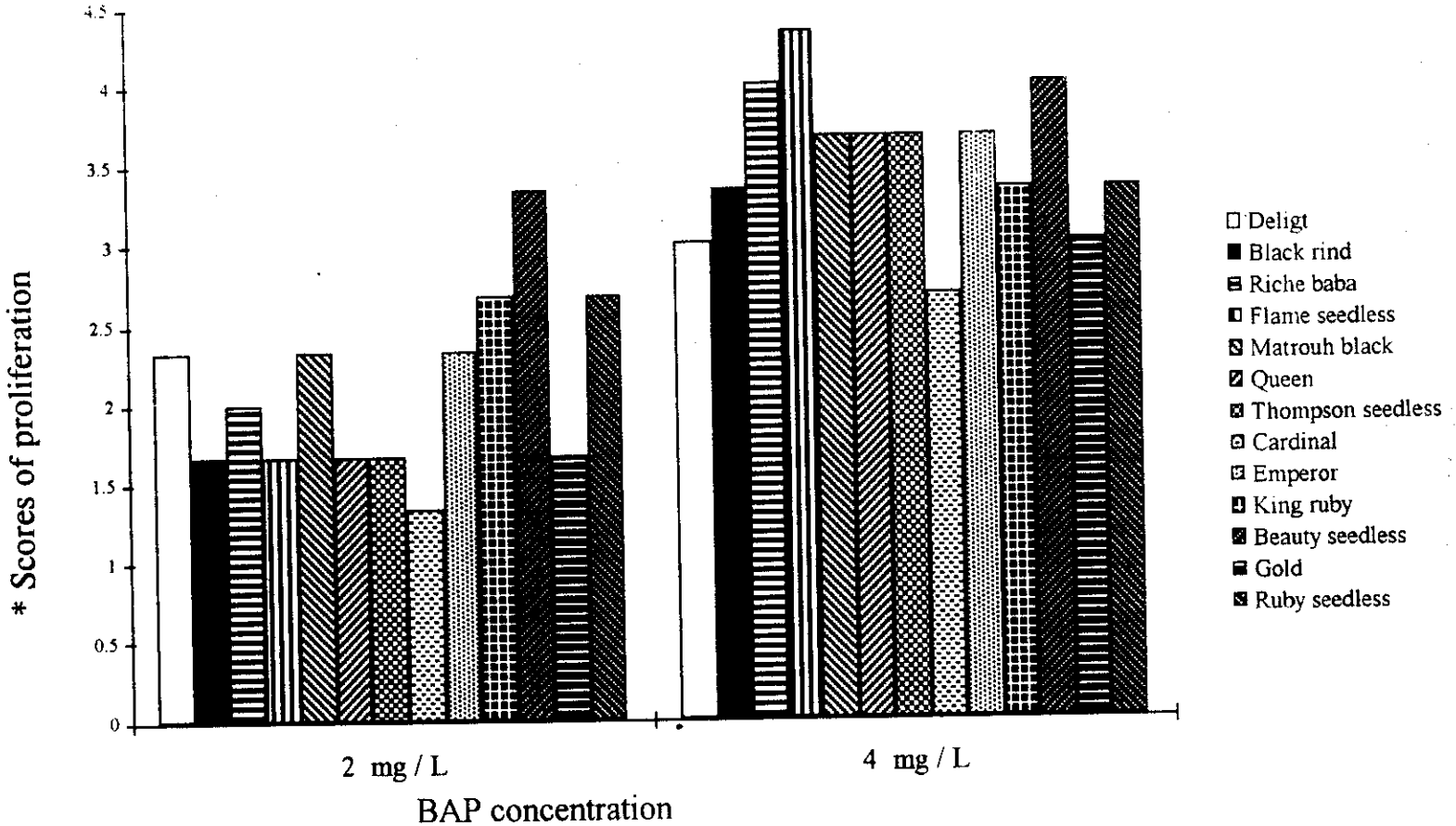
A : Effect of 2 mg /l BAP

B : Effect of 4 mg /l BAP

6-C . Effect of the interaction between cutivar and BAP concentration.

Concentration mg/l	Nicroses		growth		proliferation		Chlorophyll	
Cultivar	2	4	2	4	2	4	2	4
Delight	1.67 bcd	2.33 abc	2.67 cde	2.00 efg	2.33 defg	3.00 bcde	3.00 abc	2.67 bcd
Blak rind	1.00 d	2.00 abcd	3.00 bcd	1.33 g	1.67 fg	3.33 abcd	3.33 ab	2.33 cd
Riche baba	1.33 cd	2.67 ab	3.33 abc	2.67 cde	2.00 afg	4.00 ab	2.67 bcd	2.00 d
Flame black	1.33 cd	2.33 abc	3.67 ab	2.33 def	1.67 fg	4.33 a	3.33 ab	3.00 abc
Matrouh black	1.00 d	2.33 abc	3.33 abc	2.00 efg	2.33 defg	3.67 abc	2.67 bcd	2.00 d
Queen	1.33 cd	2.00 abcd	2.33 def	1.33 g	1.67 fg	3.67 abc	3.33 ab	3.00 abc
Thompson seedless	1.33 cd	2.67 ab	3.33 abc	2.00 efg	1.67 fg	3.67 abc	3.33 ab	2.33 cd
Cardinal	1.67 bcd	3.00 a	3.00 bcd	2.33 def	1.33 g	2.67 cdef	3.67 a	2.00 d
Emperor	2.00 abcd	1.67 bcd	3.67 ab	2.00 efg	2.33 defg	3.67 abc	3.00 abc	2.67 bcd
King ruby	2.33 abc	2.67 ab	4.00 a	1.67 fg	2.67 cdef	3.33 abcd	3.67 a	2.00 d
Beauty seedless	1.33 cd	2.33 abc	3.33 abc	2.33 def	3.33 abcd	4.00 ab	3.00 abc	2.33 cd
Gold	1.67 bcd	2.33 abc	3.00 bcd	2.00 efg	1.67 fg	3.00 bcde	3.33 ab	2.67 bcd
Ruby seedless	1.33 cd	2.33 abc	3.67 ab	2.00 efg	2.67 cdef	3.33 abcd	3.33 ab	2.33 cd

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.



Fig(8) Effect of interaction between cultivar and BAP concentration.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

(1987). They reported that the highest proliferation of buds and shoots occurred when the cultured medium was supplemented with 2 or 5 ppm BA. However, lower concentrations (0.5 or 1 ppm) induced vigorous normal shoots formation. However, the aforementioned results are somewhat disagreed with findings of Harris and Stevenson (1979). They stated that 1mg/l BA was suitable for proliferation of Muscat d'hambourg and Pinot blanc. Moreover, Goussard (1981) referred that maximum proliferation occurred when 2 mg/l BA or zeatin riboside was used .

IV.1.B.3.b. Effect of thidiazuron (TDZ) concentration:

Regarding the effect of different thidiazuron concentrations on nicroses, growth, proliferation and chlorophyll of Thompson seedless grape. It is quite evident from Table (7) and Fig (9) that callus production and nicroses were increased significantly when concentration of TDZ increased from 0.5 mg/l up to 2 mg/l for callus production and 4 mg/l for nicroses. However, using of 0.5 mg/l significantly increased growth while 0.5 and 1 mg/l of TDZ significantly improved chlorophyll in relation to the other concentrations used. On the other hand, proliferation was increased significantly when 1 mg/l TDZ was supplemented to the cultured medium in comparison with the others .

The lower concentrations (0.5-1mg/l) of thidiazuron decreased callus production and nicroses while largely increased proliferation, growth and chlorophyll. These results confirmed the findings of Gray and Benton, (1991) and Hagagy, (1992). They indicated that the highest number of shoots (proliferation) occurred when thidiazuron was supplemented to the medium at either 5 IM or 0.5 mg/l for grape and banana plants respectively.

Table (7) : Effect of different thidiazuron (TDZ) concentrations on growth and proliferation of Thompson seedless grape.

Pararmeters / Concentrations mg/L	Callus	Nicroses	Growth	Proliferation	Chylorophyll
0.5	1.00 b	2.00 c	3.00 a	2.33 b	4.00 a
1.0	1.33 b	2.33 c	2.33 b	3.67 a	3.33 a
2.0	2.33 a	4.33 b	1.00 c	1.67 bc	1.67 b
4.0	1.00 b	5.00 a	1.00c	1.00 c	1.00 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

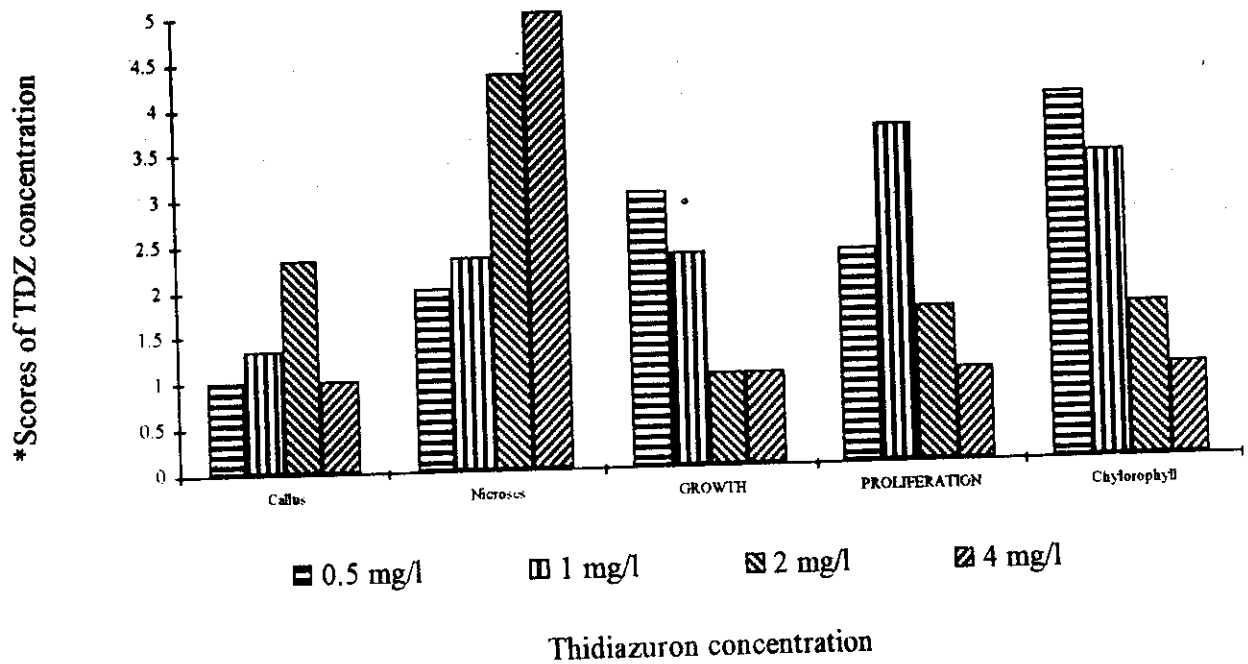


Fig (9) :Effect of different thidiazuron (TDZ) concentrations on callus, growth, nicroses, proliferation and chlorophyll of Thompson seedless grape.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

IV.1.C. ROOTING STAGE : -

IV.1.C.1.EFECT OF MEDIUM STATE : -

Data tabulated in Table (8) and Fig (10) reveal that callus production and chlorophyll had not significantly affected by medium state involved in this study. However, semi-solid medium significantly increased nicroses increament and proliferation as compared with the other medium states. On the contrary, solid medium significantly improved growth in relation to semi-solid one whilist liquid medium showed non significant differences when compared with either solid or semi-solid medium states. On the other hand, liquid medium significantly increased rooting in comparison with the others.

The conclusion of the aformentioned results indicate that rooting of grape was encouraged when liquid medium was used. these results are confirmed with the findings of Harris & Stevenson, (1979) on grape; Werner & Boe , (1980) on apple; and Lee et. al., (1986) on sweet gum as they stated that rooting was promoted when no or low agar concentration was used in the cultured medium. Also, go these results in line with the finding of Harris and stevenson, (1982) were they found that rooting was increased when filter paper bridges immersed in liquid medium was used .

IV.1.C.2. EFFECT OF AUXIN TYPE AND CONCENTRATION :

Referring to the effect of auxin type, Table (9-A) and Fig (11) indicate, that differences of both callus production and chlorophyll from statistical point of view were lacking. However, indole-3-butyric acid significantly increased nicroses in comparison with the effect of indole-3-acetic acid while naphthalene acetic acid showed somewhat similar statistical level with both auxin types used . On the contrary, growth was significantly enhanced when

Table (8) Effect of different medium states on growth and rooting parameters of Thompson seedless grape.

Growth parameters / Medium state	Callus	Nicroses	Growth	Chylorophyll	Rooting
Solid	1.67 a	1.67 b	3.00 a	3.67 a	2.33 b
Semi solid	1.33 a	3.33 a	2.00 b	2.67 a	1.33 b
Liquid	1.33 a	2.33 ab	2.67 ab	3.67 a	4.00 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

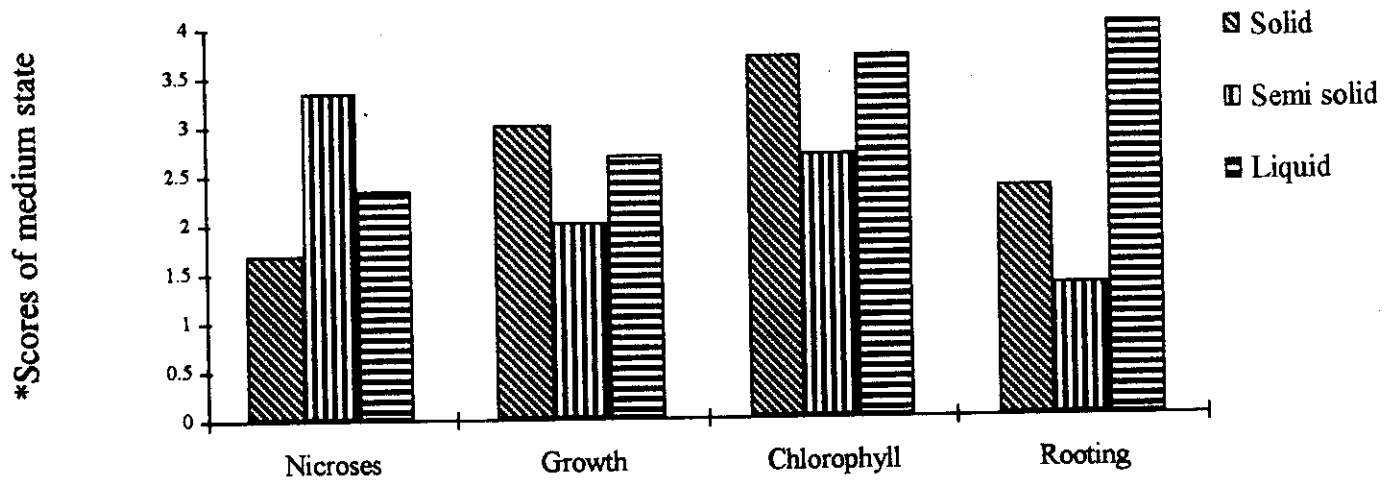


Fig (10) Effect of different medium states on rooting of Thompson seedless grape.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

indole-3-acetic acid was supplemented to the cultured medium as compared with either NAA or IBA treatments. On the other hand naphthalene acetic acid significantly encouraged rooting as compared with both indole-3-acetic acid and indole-3-butyric acid.

Concerning the effect of auxin concentration, Table (9-B) states that callus production and nicroses were significantly increased as the concentration of auxins increased up to 4 mg/l which encouraged the highest increment of callus production & nicroses parameters then followed with 2 mg/l as compared with 1 mg/l .However, using of either 1 or 2 mg/l of auxins resulted in significant increase of both growth and chlorophyll in comparison with 4 mg/l. Meanwhile, higher concentrations i.e., 2 and 4 mg/l significantly enhanced root formation in relation to the lower one (1mg/l).

Table (9 - C) and Fig (12) describe the effect of interaction between auxin type and concentration. It appear that different growth parameters showed more or less inter-related variances from statistical point of view. In most cases, interactions between indole-3-butyic acid at higher concentr-ation 4 mg/l induced the highest callus production, nicroses and growth. However, the lower concentrations interacted with any auxin type improved chlorophyll. On the other hand, rooting showed different trend as interaction between indole-3-butyric acid with higher concentrations (2or4mg/l) enhanced good rooting as compared with the other interactions.

The above results reflect that IBA and NAA with higher concentrations (2 & 4 mg/l) enhanced rooting. These results partially disagreed with the finding of Monette, (1988) who recommended 0.5-1 mg/l IBA for stimulation

Table (9) Effect of different auxin types with different concentrations on growth and rooting parameters of Thompson seedless grape.

9-A : Effect of auxin type.

Growth parameters / Auxin type	Callus	Nicroses	Growth	Chlorophyll	Rooting
NAA	1.67 a	1.78 ab	1.67 b	4.11 a	2.11 a
IAA	1.78 a	1.44 b	2.44 a	3.89 a	1.67 b
IBA	1.78 a	2.00 a	1.89 b	4.22 a	1.44 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

9-B : Effect of auxin concentration.

Growth parameters / Auxin concentration mg/L	Callus	Nicroses	Growth	Chlorophyll	Rooting
1.0	1.00 c	1.11 c	2.67 a	4.33 a	1.00 b
2.0	1.44 b	1.78 b	2.44 a	4.44 a	1.89 a
4.0	2.78 a	2.33 a	1.89 b	3.44 b	2.33 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

9-C : Effect of the interaction between auxin type and concentration.

Growth parameters	Callus			Nicroses			Growth			Chlorophyll			Rooting		
Concentration mg/L / Auxin type	1.0	2.0	4.0	1.0	2.0	4.0	1.0	2.0	4.0	1.0	2.0	4.0	1.0	2.0	4.0
NAA	1.00 c	1.33 bc	2.33 ab	1.33 bc	1.67 abc	2.33 ab	1.00 c	1.67 abc	2.33 ab	4.33 ab	4.67 a	3.33 b	1.00 c	1.67 abc	2.33 ab
IAA	1.00 c	1.33 bc	2.00 abc	1.00 c	1.33 bc	2.00 abc	1.00 c	1.33 bc	2.00 abc	4.00 ab	4.33 ab	3.33 b	1.00 c	1.33 bc	2.00 abc
IBA	1.00 c	1.67 abc	2.67 a	1.00 c	2.33 ab	2.67 a	1.00 c	2.67 a	2.67 a	4.67 a	4.33 ab	3.67 ab	1.00 c	2.67 a	2.67 a

Means followed by the same letter, within each parameter , are not significantly different from each other at 1% level.

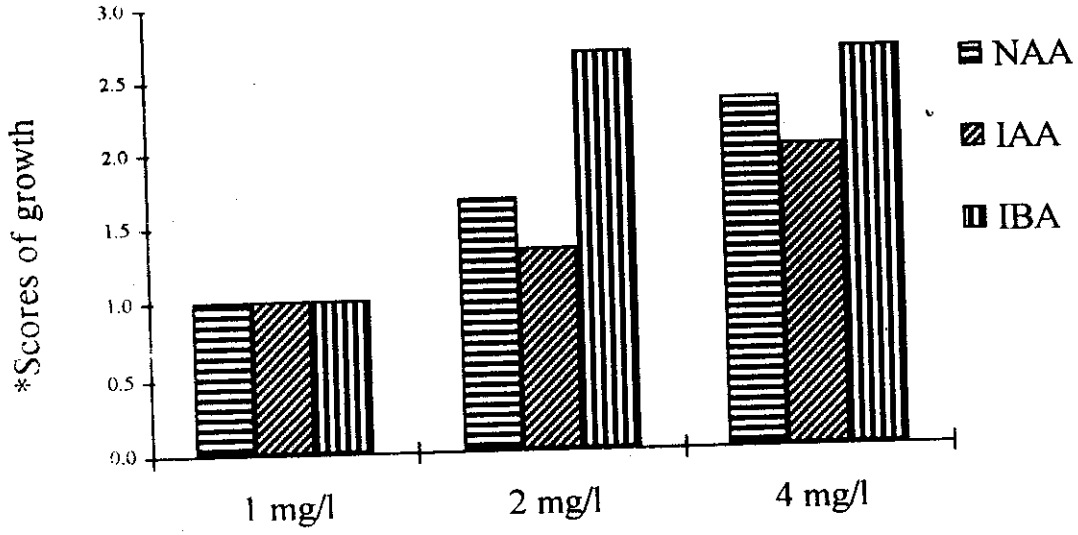
Fig (11) Effect of auxin type and concentration on rooting of Thompson seedless grape

Effect of 2 mg/l of NAA

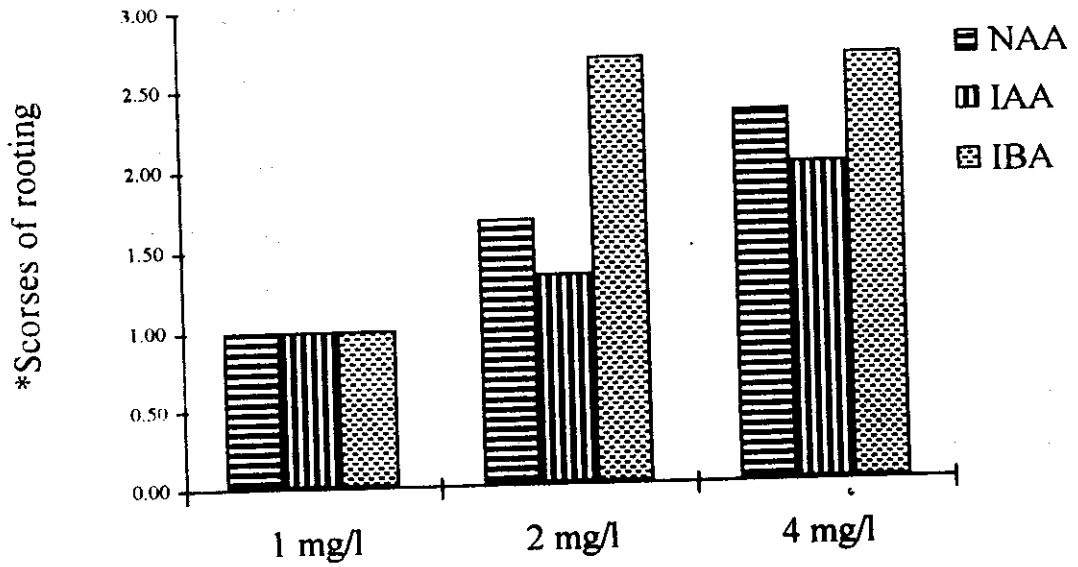
B:Effect of 2 mg/l IAA on rooting of grape

C : Effect of 2 mg /l IBA

Fig (12) : Effect of auxin type with different concentration on growth (A) and rooting (B) of Thompson seedless grape.



(A) Effect on growth



(B) Effect on rooting

of root formation. However, the obtained data confirmed the finding of Howang and kim (1990) whereas they found that 2.2 or 10.7 IM NAA increased root formation.

IV.1.C.3. EFFECT OF LIGHT REGIMES : -

IV.1.C.3.a. Effect of photoperiod treatments : -

Table (10-A) and Fig (13 & 14) state that callus production and nicroses significantly increased when continuous light and intermittant light were used. However, long day photoperiod treatment reduced significantly callus production and nicroses while the revers was true with both growth and chlorophyll in comparison with the other used photoperiods. On the other hand, short day photoperiod treatment significantly enhanced rooting.

With respect to the effect of cultivar, Table (10-B) reflects that most parameters especially growth, chlorophyll and rooting were not responded significantly from statistical point of view to different cultivars used in this study. However, interrelated variances were noticed among different cultivars in relation to callus formation and nicroses. In this concern, Flame seedless, Rudy seedless significantly surpassed Riche baba in callus production. However, nicroses increased significantly when Delight cultivar was used instead of Matrouh black, Gold, and Ruby seedless cultivars. Furthermore, Table (10-C) shows a great corelation in the interactions of photoperiods and cultivars of all criteria under investigation i.e. callus production, nicroses, growth, chlorophyll and rooting. These interrelated differences among cultivars with each other which led to difficulty in determining the exact level of significancy in the different interactions. In general, interactions of different

Table (10) Effect of different photoperiods on growth and rooting parameters of some grape cultivars.

10-A : Effect of photoperiod.

Growth parameters / Photoperiod	Callus	Nicroses	Growth	Chlorophyll	Rooting
Continuous light	2.72 a	3.21 a	1.66 c	2.10 c	1.00 d
Long day	1.36 c	1.18 c	4.28 a	4.31 a	1.57 b
Short day	1.74 b	2.27 b	2.77 b	3.20 b	2.03 a
intermitant light	2.59 a	3.30 a	1.38 c	1.77 c	1.31 c

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

10-B : Effect of cultivar.

Growth parametres / Cultivar	Callus	Nicroses	Growth	Chlorophyll	Rooting
Delight	2.00 ab	2.75 a	2.42 a	3.00 a	1.67 a
Riche baba	1.83 b	2.67 ab	2.75 a	2.49 a	1.58 a
Flame seedless	2.50 a	2.58 ab	2.25 a	3.00 a	1.58 a
Matrouh black	2.00 ab	1.83 c	2.42 a	3.08 a	1.50 a
Queen	2.00 ab	2.58 ab	2.67 a	2.92 a	1.58 a
Thompson seedless	2.08 ab	2.67 ab	2.33 a	2.75 a	1.33 a
Emperor	2.08 ab	2.50 ab	2.58 a	2.75 a	1.33 a
Gold	2.17 a	2.17 bc	2.50 a	2.75 a	1.25 a
Ruby seedless	2.42 a	2.17 bc	2.83 a	2.83 a	1.67 a
Black rind	2.00 ab	2.50 ab	2.50 a	2.83 a	1.67 a
Cardinal	2.17 ab	2.67 ab	2.33 a	3.00 a	1.33 a
King rupy	2.00 ab	2.67 ab	2.58 a	2.83 a	1.33 a
Beauty seedless	2.08 ab	2.58 ab	2.67 a	2.75 a	1.67 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

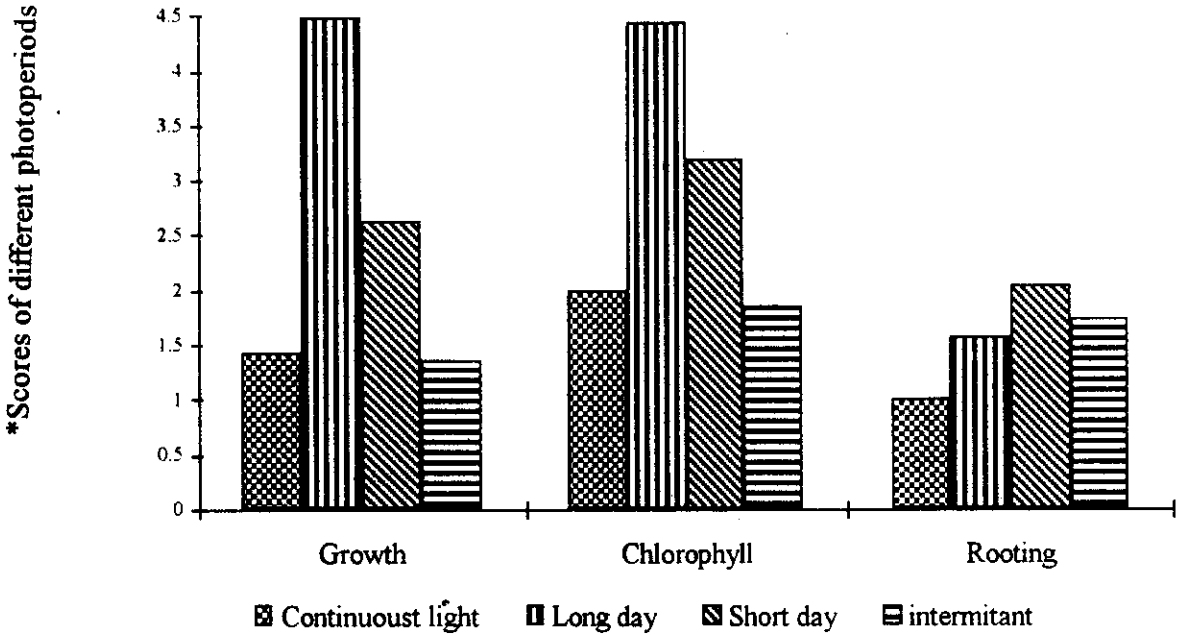
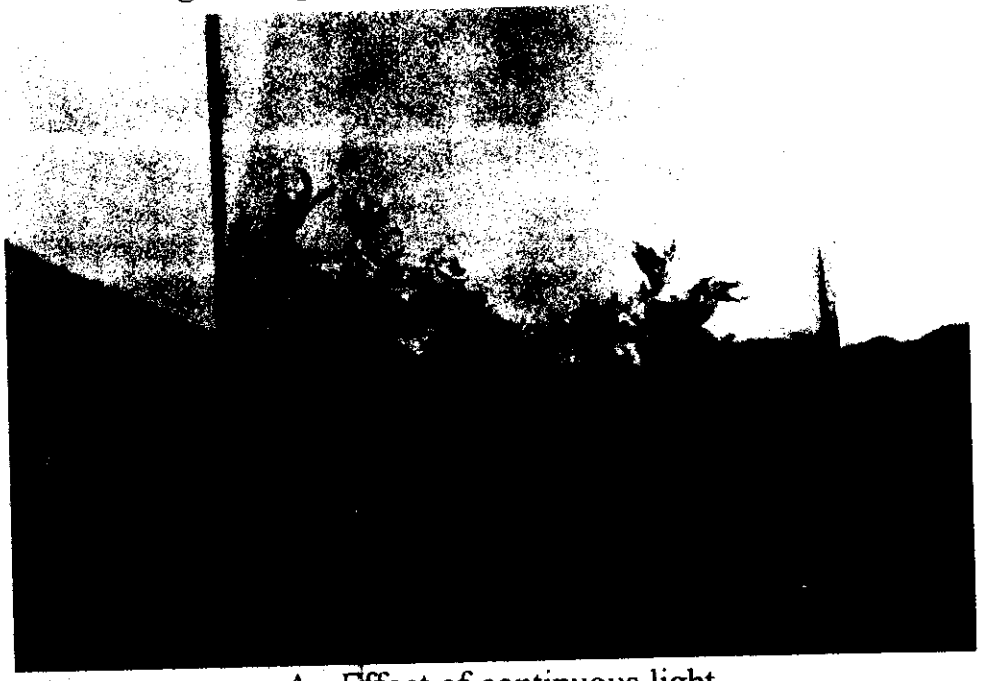


Fig (13) : Effect of different photoperiods on growth, chlorophyll and rooting of some grape cultivars.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

Fig (14) Effect of different photoperiod treatments on growth during rooting of Thompson seedless grape.



A : Effect of continuous light

B : Effect of long day photopriod

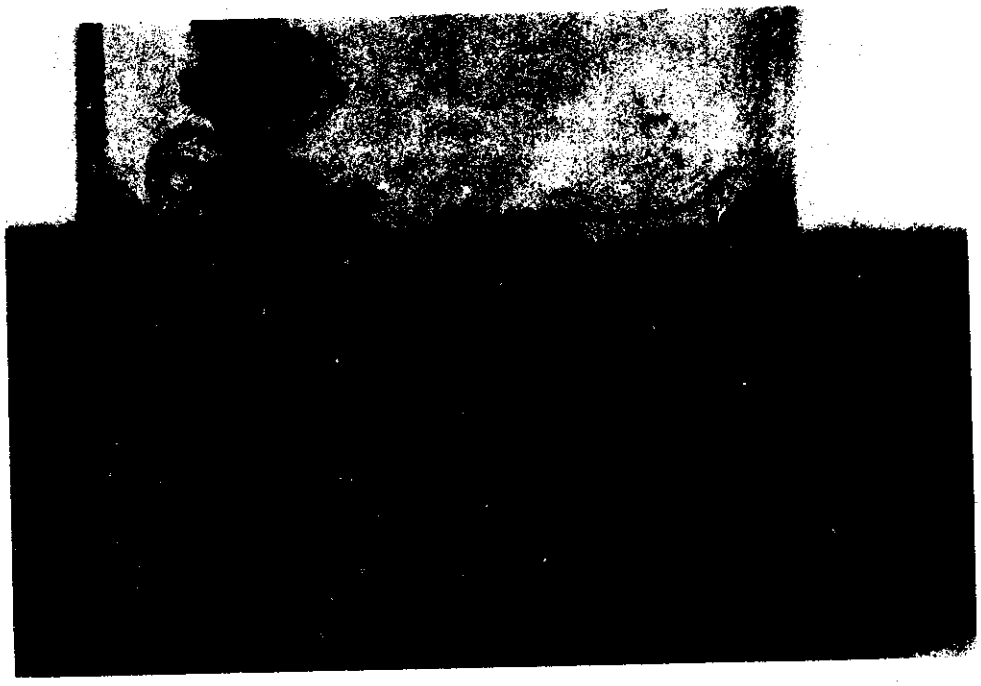
cultivars and either continuos light or intermittant light surpassed other interactions in case of callus production and nicroses. However , interactions between different cultivars and long day photoperiod enhanced growth and improved chlorophyll as compared with the others. On the contrary, rooting responded positively to the interactions between different cultivars and short day photoperiod treatment in comparison with the interactions of different cultivars and continuous light treatment.

Anyhow the results clarify that either long day or short day photoperiod treatments improved all growth and rooting parameters. These results are in partial agreement with the findings of Murashige, (1974); Pillai & Hildebrandt, (1969); Murashige, (1973) and kuhne, et. al. (1988). They stated that long day photoperiod improve growth and rooting parameters.

IV.1.C.3.b. Effect of darkening treatments : -

Table (11) and Fig (15 & 16) explain that addition of activated charcoal to the medium exerted an adverse effect on the cultured plants as it significantly increased nicroses while significantly decreased growth, chlorophyll, and rooting. However, outer coverage treatment significantly enhanced growth, chlorophyll, and rooting in comparison with the control. Also all darkening treatments except activated charcoal and control statistically gave the same effect in all parameters under study i.e. nicroses, growth, chlorophyll, and rooting. Meanwhile, rooting was highly increased when combination of surface and outer coverage treatment was used followed with outer coverage then surface coverage.

The data mentioned before indicate that all darkening treatments except activated charcoal and control increased growth and rooting characters. These



C : Effect of short day photoperiod

D : Effect of complete darkness

Table (11) Effect of different darkening treatments on growth and rooting parameters of Thomopson seedless garpe.

Growth parameters / Darking treatments	Nicroses	Growth	Chlorophyll	Rooting
Control	1.67 b	2.33 bc	2.67 b	1.67 b
Surface coverage	2.67 ab	3.00 ab	3.33 ab	3.00 a
Outer coverage	1.67 b	3.67 a	4.00 a	3.33 a
Surface coverage + outer coverage	2.33 ab	3.33 ab	3.67 ab	4.00 a
Charcoal	3.33 a	1.67 c	1.33 c	1.00 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

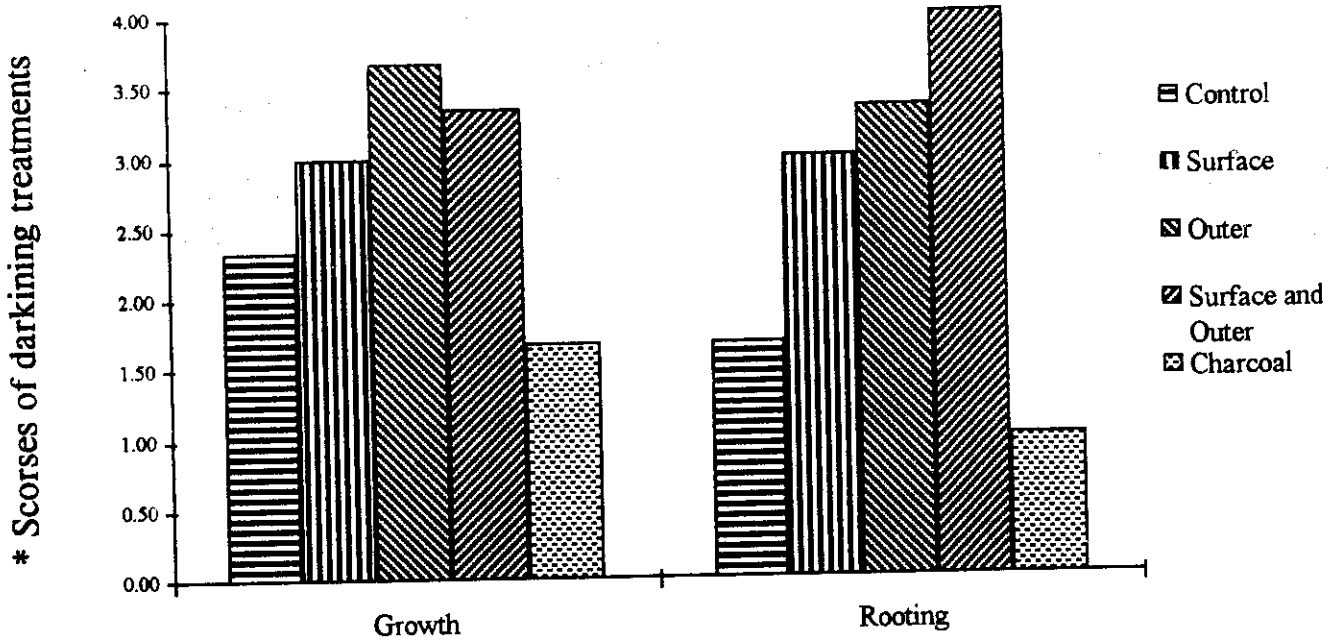


Fig (15) : Effect of different darking treatments on growth and rooting of Thompson seedless grape.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

Fig (16) Effect of added charcoal to the medium on growth during rootig of Thompson seedless grape.

results go in line with the findings of Hammerschlag, (1982) and Kuhne et. al., (1988). They mentioned that incubation of the cultured Myroblan plum in dark for 2 weeks or for one week in stone fruits enhanced rooting. However, the results showed an adverse effect of activated charcoal on growth and rooting and this is in general agreement with the finding of Antomelli and Chiariolt, (1988). Who revealed that adding activated charcoal to the medium inhibited the rooting of peach, nectarine, Mayfair and semi dwarf peach. However, the data disagreed with the findings of Rosati et. al., (1980) and Amin & Jaiswal, (1987). Whereas they mentioned that activated charcoal promoted rooting and growth.

IV.1.D. ACCLIMATIZATION (ADAPTATION) STAGE : -

IV.1.D.1. EFFECT OF AGRICULTURAL MEDIUM : -

Data tabulated in Table (12) and Fig (17, 18) clarify that combination of foam, sand, peat-moss and loam in one treatment significantly increased survivals. In the same time, increasing number of agricultural media as combination in one treatment significantly increase survivals than using either any one of them alone. Moreover, using of peatmoss alone significantly enhanced survival as compared with foam alone which failed completely to induce any survival. Meanwhile , combination of sand, peat-moss and loam in one treatment took the second rank in survivals then followed with combination of foam, peat-moss, and loam treatment then followed with combination of foam, sand, and peat-moss as compared with all other treatments either alone or in combinations.

Table (12) : Effect of different agriculture media treatments on survivals of Thompson seedless grape during acclimatization stage.

Treatments	Survival
Foam at the rate of 100% .	0.00 j
Sand at the rate of 100% .	2.00 ij
Peat-moss at the rate of 100% .	3.00 i
Loam at the rate of 100% .	2.00 ij
50% foam +50% sand .	4.00 i
50% foam +50% peat-moss .	8.00 h
50% foam +50% loam	7.00 h
50% sand +50% peat-moss	33.00 e
50% sand +50% loam	22.00 f
50% peat-moss +50% loam	15.00 g
33% foam +33% sand +33% peat-moss	42.00 d
33% foam + 33% sand +33% loam	31.00 e
33% foam +33% peat-moss +33% loam	45.00 c
33% sand +33% peat-moss +33% loam	56.00 b
25% foam +25% sand +25% peat-moss +25% loam	75.00 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

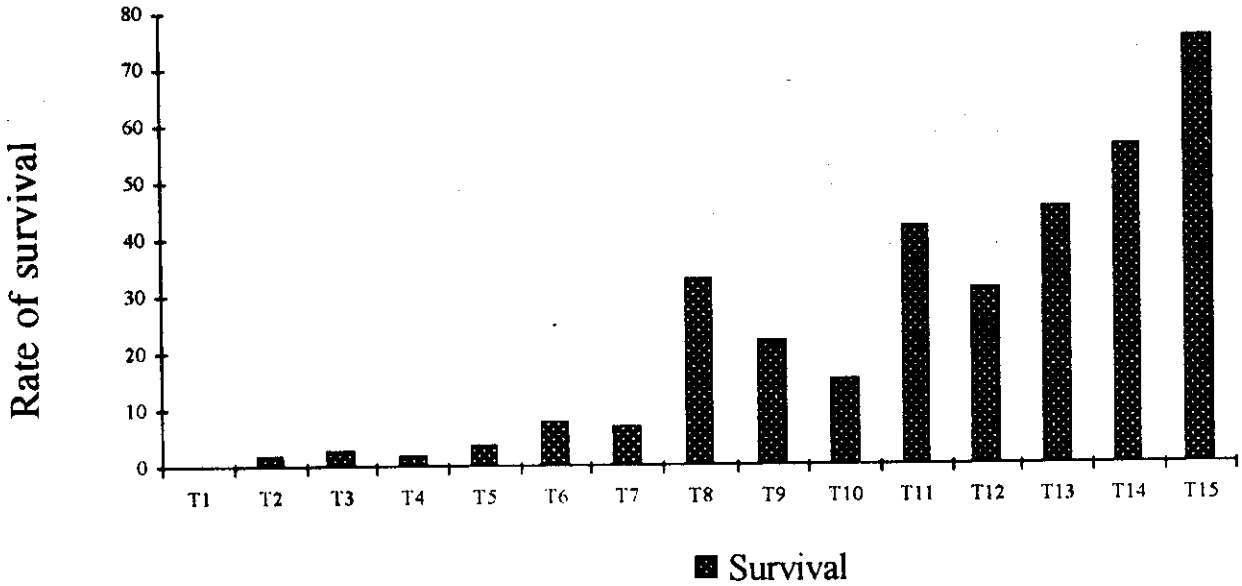
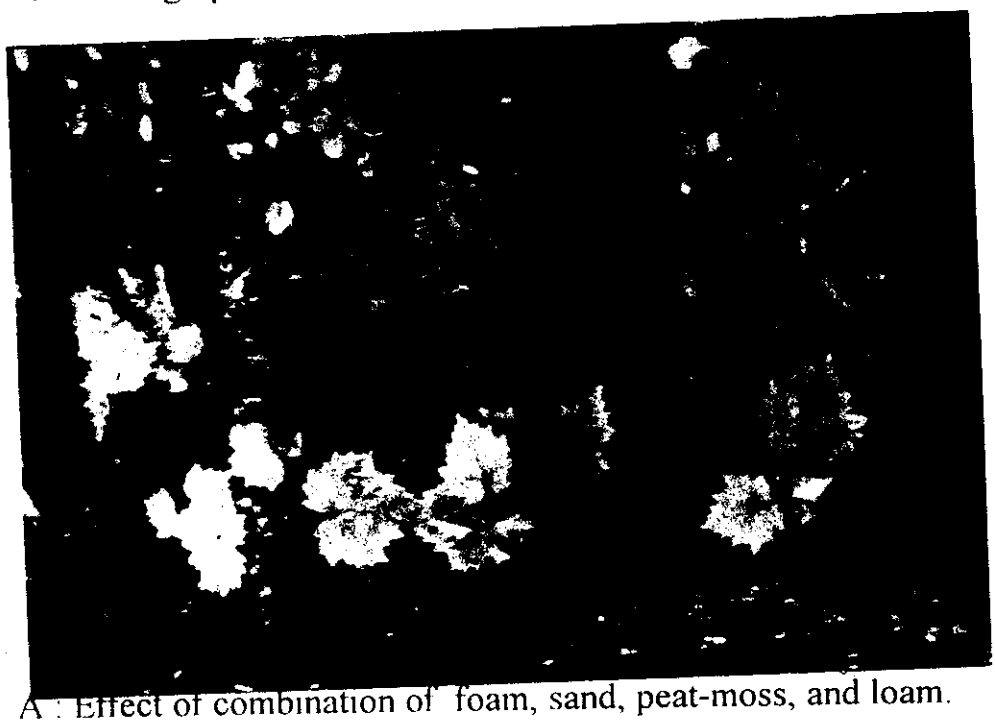


Fig (17) : Effect of different agricultural media treatments on survival % of Thompson seedless grape during acclimatization stage.

T1 : Foam at the rate of 100% , T2 : Sand at the rate of 100% , T3 : Peatmoss at the rate of 100% , T4 : Loam at the rate of 100% , T5 : 50% foam + 50% sand , T6 : 50% foam + 50% peat moss , T7 : 50% foam + 50% loam , T8 : 50% sand + 50% peatmoss , T9 : 50% sand + 50% loam , T10 : 50% peatmoss + 50% loam , T11 : 33% foam + 33% sand + 33% peatmoss , T12 : 33% foam + 33% sand + 33% loam , T13 : 33% foam + 33% peatmoss + 33% loam , T14 : 33% sand + 33% peatmoss + 33% loam , T15 : 25% foam + 25% sand + 25% peatmoss + 25% loam.

Fig (18) Effect of different agricultural media on survival percentage of Thompson seedless grape during acclimatized stage.



A : Effect of combination of foam, sand, peat-moss, and loam.

B : Effect of combination of foam, sand, and peat-moss

C : Effect of foam, sand, and peat-moss

IV.2. STRAWBERRY PLANTS : -

IV.2.A. ESTABLISHMENT STAGE : -

IV.2.A.1. EFFECT OF NUTRIENT MEDIUM AND CULTIVAR :

Table (13-A) explains that the differences in nicroses resulted from using different cultivars were lacking from statistical point of view. However, shootlets and chlorophyll were stimulated significantly when Chandler cultivar was used as compared with Barker cultivar in case of shootlets while Barker and Salvia in case of chlorophyll : On the contrary, the other used cultivars responded differently but slightly without any significancy when both aforementioned parameters were evaluated.

Regarding the effect of nutrient medium, Table (13-B) reveals that Murashige and Skoog medium significantly reduced nicroses while both shootlets and chlorophyll took the reverse trend of nicroses. On the contrary, Anderson medium behaved completely different than Murashige and Skoog medium in all parameters under study. Meanwhile, Nitsch and Nitsch medium took the intermediate position of either Murashige and Skoog or Anderson medium in all aforementioned parameters. Different media under investigation significantly varried than each other in all parameters i.e. nicroses growth, and chlorophyll.

Considering the effect of interaction between cultivar and medium type, Table (13-C) and Fig (19) clarify that nicroses was significantly dominated as the interactions between different cultivars and Anderson medium were taken in consideration. However, interactions of different cultivars and Murashige and Skoog medium significantly enhanced both shootlets and chlorophyll as

Table (13) Effect of different cultivars and medium types on explant development and shootlets of some strawberry cultivars.

Table (13-A) : Effect of cultivar .

Growth parameters / Cultivars	Nicroses	shootles	Chlorphyll
Balady	2.22 a	2.89 ab	2.56 ab
Barker	2.44 a	2.56 b	2.44 b
Chandler	2.11 a	3.22 a	3.00 a
Salvia	2.44 a	2.78 ab	2.11 b
Scoya	2.22 a	2.89 ab	2.56 ab

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (13-B) : Effect of medium type.

Growth parameters / Medium	Nicroses	shootles	Chlorophyll
MS	1.27 c	4.267 a	3.47 a
NN	2.00 b	2.80 b	2.53 b
AN	3.60 a	1.53 c	1.60 c

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

13-C : Effect of interaction between cultivar and medium type.

Growth parameters	Nicroses			shootles			Chlorophyll		
Medium types / Cultivar	Ms*	NN**	And***	Ms*	NN**	And***	Ms*	NN**	And***
Balady	1.33 cd	2.00 bc	3.33 a	4.67 a	2.67 cde	1.33 f	3.67 ab	2.67 cde	1.33 g
Barker	1.67 bcd	2.00 bc	3.67 a	3.33 bcd	2.67 cde	1.67 ef	3.33 abc	2.33 def	1.67 fg
Chandler	1.33 cd	1.67 bcd	3.33 a	4.67 a	3.67 abc	1.33 f	4.00 a	3.00 bcd	2.00 efg
Salvia	1.00 d	2.33 b	4.00 a	4.33 ab	2.33 def	1.67 ef	3.00 bcd	200 efg	1.33 g
Scoya	1.00 d	2.00 bc	3.67 a	4.33 ab	2.67 cde	1.67 ef	3.33 abc	2.67 cde	1.67 fg

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

* Murashige and Skoog medium

** Nitsch & Nitsch medium

*** Anderson medium

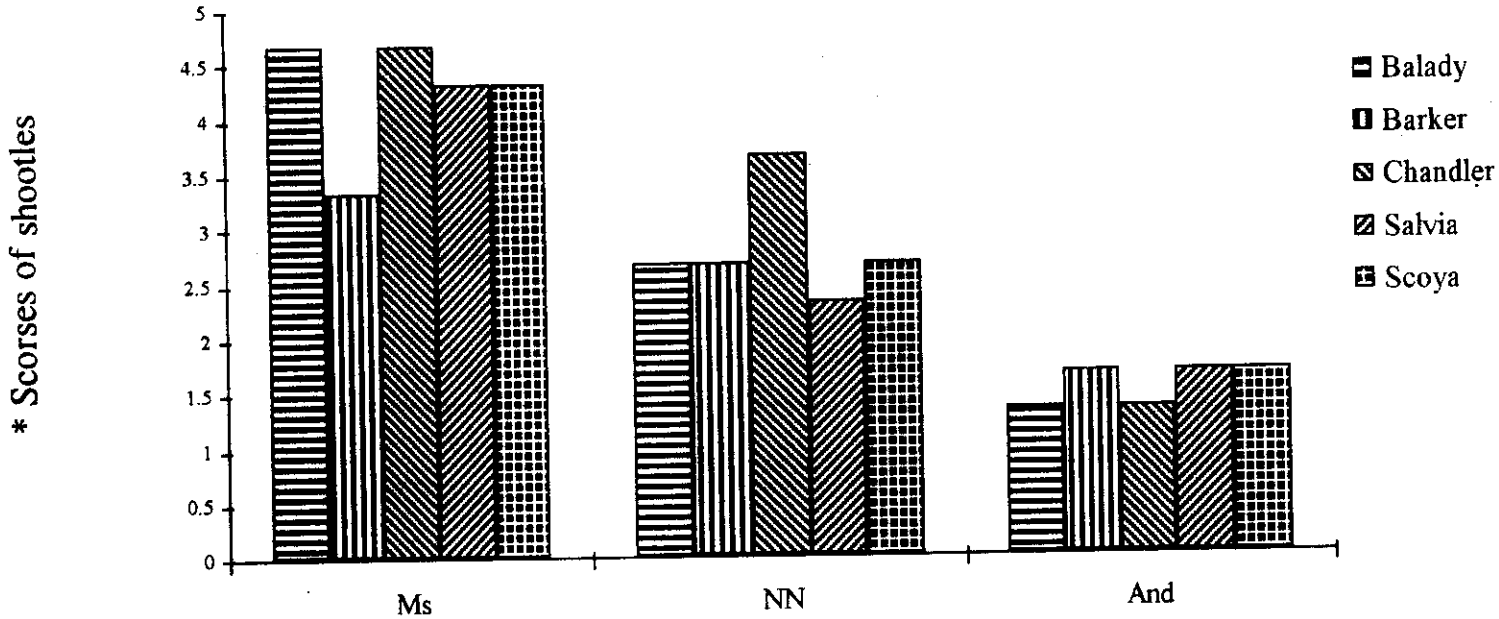


Fig (19) Effect of different cultivars and medium types on shootlets of some strawberry cultivars.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

compared with those of cultivars and Anderson medium.

IV.2.A.2. EFFECT OF MEDIUM TYPE AND EXPLANT :-

Table (14-A) deals with the effect of different medium types on explant development and shootlets of Barker strawberry plants. It is clear that Murashige and Skoog medium significantly reduced nicroses followed with Nitsch and Nitsch medium in comparison with Anderson medium. However, medium types, failed to induce any significant differences in proliferation. In contrast shootlets and chlorophyll were significantly superior when Murashige and Skoog medium was used in case of shootlets while both Murashige & Skoog and Nitsch & Nitsch media in case of chlorophyll, as compared with Anderson medium.

With respect to the effect of explant, Table (14-B) and Fig (20) reflect that shoot tips significantly surpassed one node cuttings in reducing the adverse effect of nicroses and significantly increased shootlets and proliferation. However, chlorophyll responded irrespectively to explant types from statistical point of view.

Referring to the interaction between medium type and explant, Table (14-C) indicates that interactions between Anderson medium and either shoot tip or one node cutting significantly increased nicroses in relation to the other interactions. However, interaction between shoot tip and Murashige and Skoog medium significantly increased both shootlets and proliferation in comparison with the interactions of one node cutting and different medium types . On the contrary , chlorophyll gave the same statistical effect with all interactions

Table (14) Effect of different explants and medium types on explant development and shootlets parameters of Barker strawberry plants.

Table (14-A) : Effect of medium type :

Growth parameters / Medium type	Nicroses	Proliferation	shootles	Chlorophyll
MS	2.17 c	1.67 a	2.33 a	2.67 a
NN	2.83 b	1.33 a	2.17 ab	2.33 a
AN	4.17 a	1.50 a	1.83 b	1.67 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (14-B) : Effect of Explant .

Explant	Nicroses	shootles	proliferation	Chorophyll
Shoot tip	2.67 b	1.89 a	2.44 a	2.22 a
One node cutting	3.33 a	1.11 b	1.78 b	2.22 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

14-C : Effect of interaction between medium type and explant.

Growth parameters	Nicroses		shootles		Proliferation		Chlorophyll	
Explant / Medium types	Shoot tip	One node cutting	Shoot tip	One node cutting	Shoot tip	One node cutting	Shoot tip	One node cutting
MS	1.67 e	2.67cd	2.33 a	1.00 b	3.00 a	1.67 b	2.67 a	2.67 a
NN	2.33de	3.00 c	1.67ab	1.00 b	2.33 ab	2.00 b	2.67 a	2.00 ab
And	4.00ab	4.33 a	1.67ab	1.33 b	2.00 b	1.67 b	1.33 b	2.00 ab

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Fig (20) Effect of explant type on shootlets of Barker strawberry plants.

A : Plantlets developed from shoot tip

B : Plantlets developed from one node cuttings

except interaction of shoot tip and Anderson medium which showed significant decrease.

The results indicate that Murashige and Skoog medium was superior in reducing nicroses and increased shootlets and chlorophyll. These results are confirmed with the findings of Maliarcikova & Lvanicka, (1975); Vertesy, (1976); Lee and Kim, (1979); Kartha et. al, (1980); Lee and Park, (1980); Waithaka et. al. (1980); and Maliarcikova, (1981). They recommended using of Murashige and Skoog medium for strawberry plants.

IV.2.A.3. EFFECT OF MEDIUM STATE : -

Concerning the effect of medium state, Table (15) and Fig (21) state that solid medium significantly reduced the harmful effect of nicroses and significantly increased shootlets as compared with semi-solid medium. Meanwhile, significant differences between semi-solid medium and liquid medium in either nicroses or shootlets were abscent. On the contrary, chlorophyll responded negatively to different medium states without any significancy but only slight differences were noticed between solid medium and either semi-solid or liquid medium states.

In general the results indicate that solid medium increased shootlets and chlorophyll as well as reducing nicroses.These results are in harmony with the finding of Badawy et al (1990) who reported that the best shoot formation was obtained when solid medium was used.

Table (15) Effect of different medium states on explant development and shootlets parameters of Balady strawberry plants.

Medium state	Nicroses	shootles	Chlorophyll
Solid	1.67 b	3.67 a	2.33 a
Semi solid	3.33 a	1.67 b	1.33 a
Liquid	2.33 ab	2.00 b	1.67 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

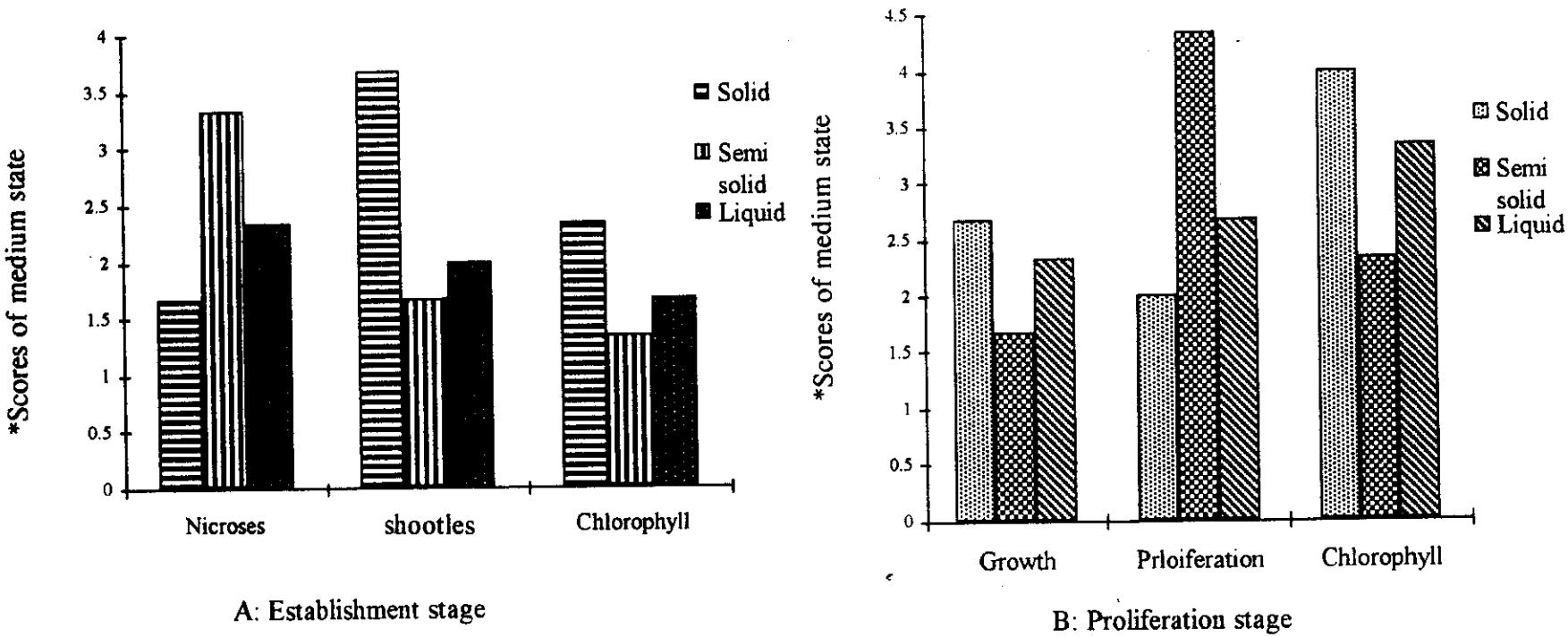


Fig (22) Effect of different medium states on growth (A) and proliferation (B) of Balady strawberry plants.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

IV.2.B. PROLIFERATION STAGE : -

IV.2.B.1. EFFECT OF MEDIUM STATE : -

Table (16) summerized the effect of medium state on growth and proliferation parameters of Balady strawberry plants. It appear that solid and liquid medium states significantly succeeded in reducing nicroses in relation to semi-solid one. However, different medium states failed to induce any significant differences in growth. On the other hand, semi-solid medium significantly stimulated proliferation in comparison with the other medium states. In contrast, chlorophyll significantly improved as solid medium was used then followed with liquid medium state.

IV.2..B.2. EFFECT OF CYTOKININ TYPES AND CYTOKININ-LIKE

Data tabulated in Table (17) and Fig (22 & 23) clarifiy that thidiazuron had a harmful effect on all growth criteria as it significantly increased nicroses and callus production whilist growth, proliferation and chlorophyll were significantly decreased as compared with the other cytokinins. However, kinetin significantly encouraged growth while both kinetin and zeatin significantly improved chlorophyll in comparison with the other cytokinin types and cytokinin-like. On contrary, 6-benzylaminopurine significantly enhanced proliferation in relation to the others. Meanwhile, zeatin took the second rank in studied cytokinins and cytokinin-like in encouraging proliferation.

IV.2.B.3. EFFECT OF CYTOKININ AND CYTOKININ-LIKE CONCENTRATION:

IV.2.B.3.a. Effect of 6-benzylaminopurine concentration :-

Table (18) and Fig (24) explains that lower concentration of 6-benzylaminopurine (1mg/l) significantly reduced nicroses and callus production. However, increasing the concentration from 2 to 4 mg/l resulted in

Table (16) Effect of different medium states on growth and proliferation parameters of Balady strawberry plants.

Medium state	Nicroses	Growth	Proliferation	Cholorophyll
Solid	1.67 b	2.67 a	2.00 b	4.00 a
Semi solid	3.00 a	1.67 a	4.33 a	2.33 b
Liquied	1.33 b	2.33 a	2.67 b	3.33 ab

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (17) : Effect of different cytokinin types and cytokinin- like on growth and proliferation of Balady strawberry plants.

Growth parameters	Nicroses	Callus	Growth	Proliferation	Chlorophyll
Kinetin	1.33 b	1.00 c	3.33 a	2.00 c	4.33 a
6-benzylami-nopurine	2.33 b	2.00 b	1.67 bc	4.33 a	2.67 b
Zeatin	2.00 b	1.67 bc	2.33 b	3.00 b	4.00 a
Thidiazuron	4.33 a	3.33 a	1.00 c	1.67 c	1.33 c

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

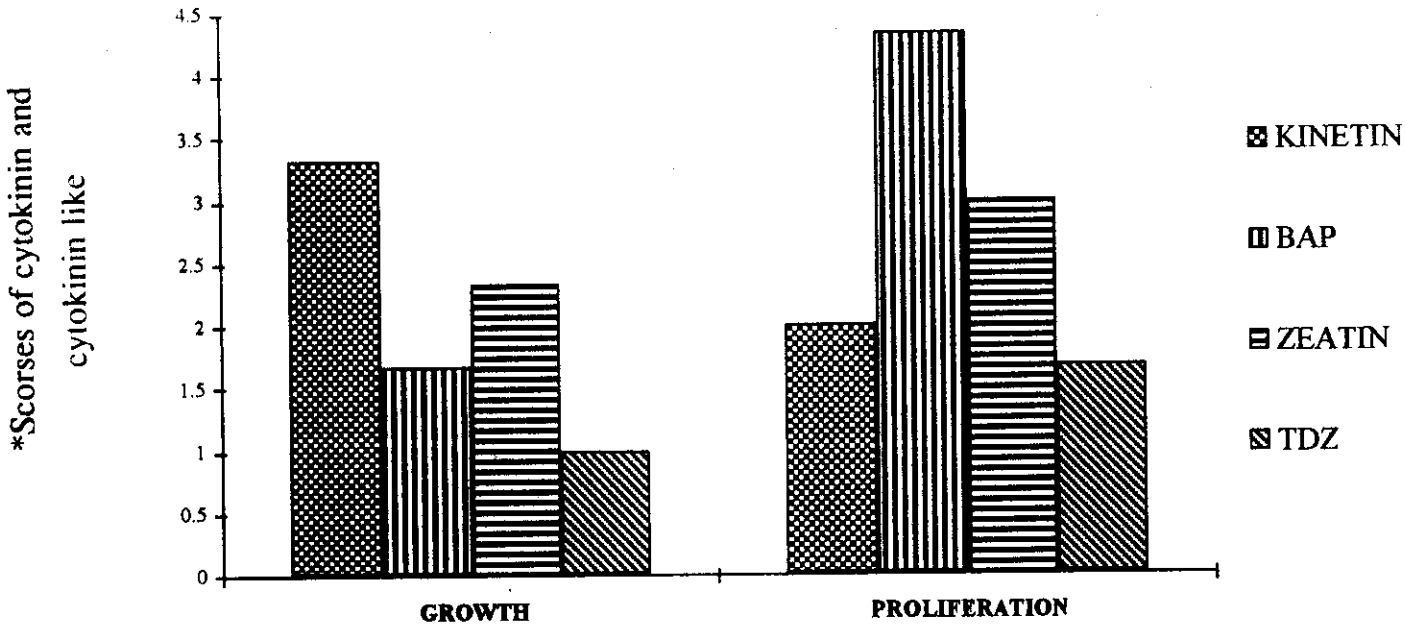


Fig (22) Effect of different cytokinin types and cytokinin-like on growth and proliferation of Balady strawberry.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

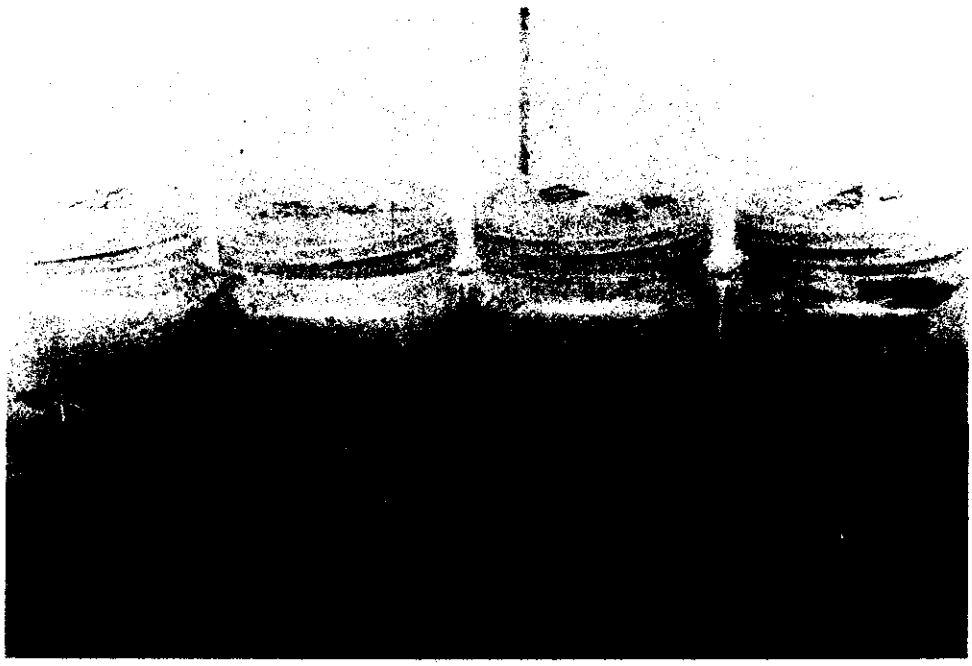


Fig (23) Effect of different cytokinin types and cytokinin-like at the rate of 2 mg / L on proliferation of Balady strawberry plants.

Table (18) Effect of different concentrations of 6-benzylaminopurine (BAP) on growth and proliferation parameters of Balady strawberry plants.

Concentration mg / L	Nicroses	Callus	Growth	Proliferation	Chlorophyll
1	1.73 c	1.27 c	3.47 a	2.07 b	4.20 a
2	2.33 b	1.87 b	2.33 b	4.13 a	2.60 b
4	3.80 a	3.53 a	1.60 c	2.40 b	1.67 c

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

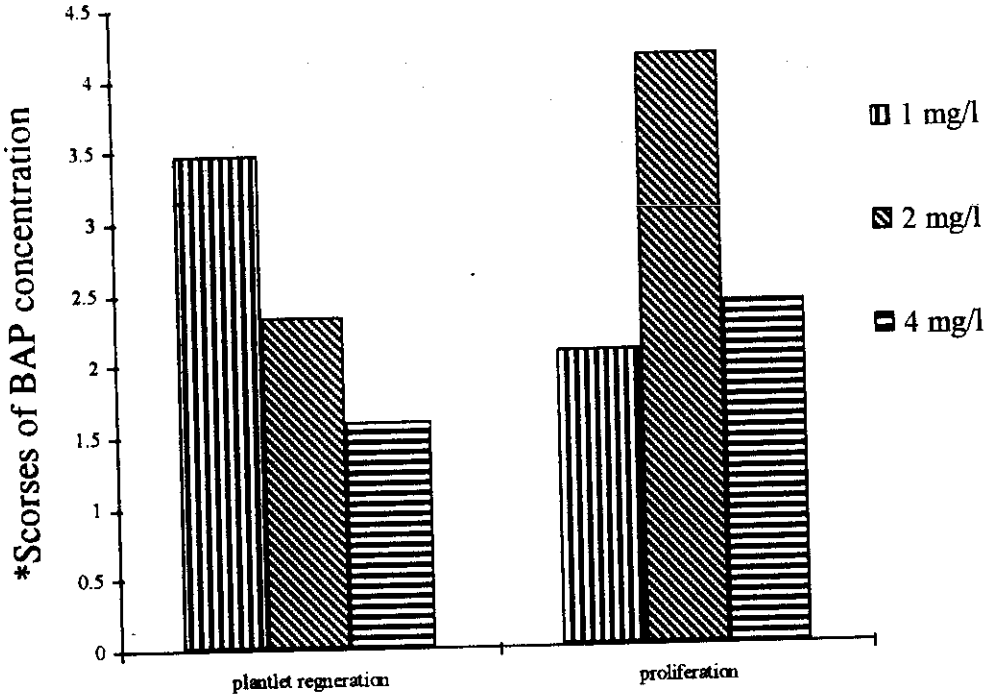


Fig (24) : Effect of different concentration of BAP on growth and proliferation of Balady strawberry plants.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

significant increase in both callus production and nicroses. On the other hand, growth and chlorophyll were significantly increased when 1 mg/l BAP was used in comparison with higher ones (2&4 mg/l). In contrast, supplementating the medium with 2 mg/l BAP significantly increased proliferation in relation to the other concentrations.

The aforementioned results state that kinetin enhanced growth and chlorophyll while 6-benzylaminopurine increased proliferation. Meanwhile, lower concentrations increase both growth and chlorophyll while higher concentrations increase both nicroses and proliferation . These results are in general agreement with the findings of Lee and Park, (1980) Wickremasinghe and Fernando, (1988). They stated that 2 mg/l BA induced the highest proliferation of some strawberry cultivars. Also, the above results confirmed the finding of Waithaka et. al., (1980) who reported that low kinetin concentration induced single plant with elongated shoot. However, higher concentration up to 10 mg/l kinetin promoted production of multiple shoots.

IV.2.b.3.b Effect of thidiazuron concentration :-

Regarding the effect of thidiazuron concentration Table (19) and Fig (25& 26) state that niceroses depend mainly on thidiazuron concentration since increasing the concentration from 0.5 to 2 mg/l led to significant increase in nicroses and callus production which was reflected in a harmful effect on growth, proliferation and chlorophyll. However, addition of lower concentrations (0.5& 1mg/l) to the cultured medium resulted in significant increase in growth , proliferation , and chlorophyll as compared with the higher ones .

Table (19) Effect of different concentrations of Thidiazurone (TDZ) on growth and proliferation parameters of Balady strawberry plants.

Growth parameters / Concentrations	Nicroses	Callus	Growth	Proliferation	Chlorophyll
0.0	1.33 c	1.00 c	3.33 a	1.67 b	4.33 a
0.5	1.67 bc	1.67bc	3.33 a	4.00 a	4.33 a
1.0	2.67 b	2.33 b	2.33 a	4.33 a	3.33 a
2.0	5.00 a	3.67 a	1.00 b	1.00 b	1.00 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (20) Effect of different medium states on rooting parameters of Balady strawberry plants.

Growth parameters / Medium state	Callus	Nicroses	Growth	Chlorophyll	Rooting
Solid	1.67 a	1.67 b	3.67 ab	3.33 b	2.33 b
Semi solid	1.33 a	3.33 a	2.67 b	2.33 c	1.67 b
Liquid	1.33 a	2.00 b	4.67 a	4.33 a	4.33 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

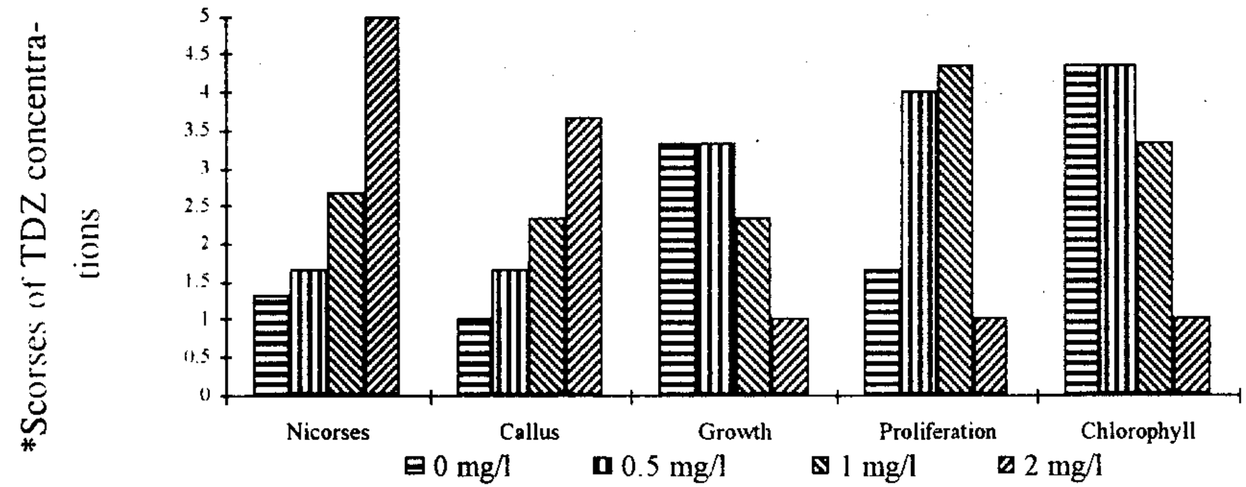


Fig (25) Effect of different concentrations of Thidiazuron (TDZ) on growth and proliferation of Balady strawberry plants.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

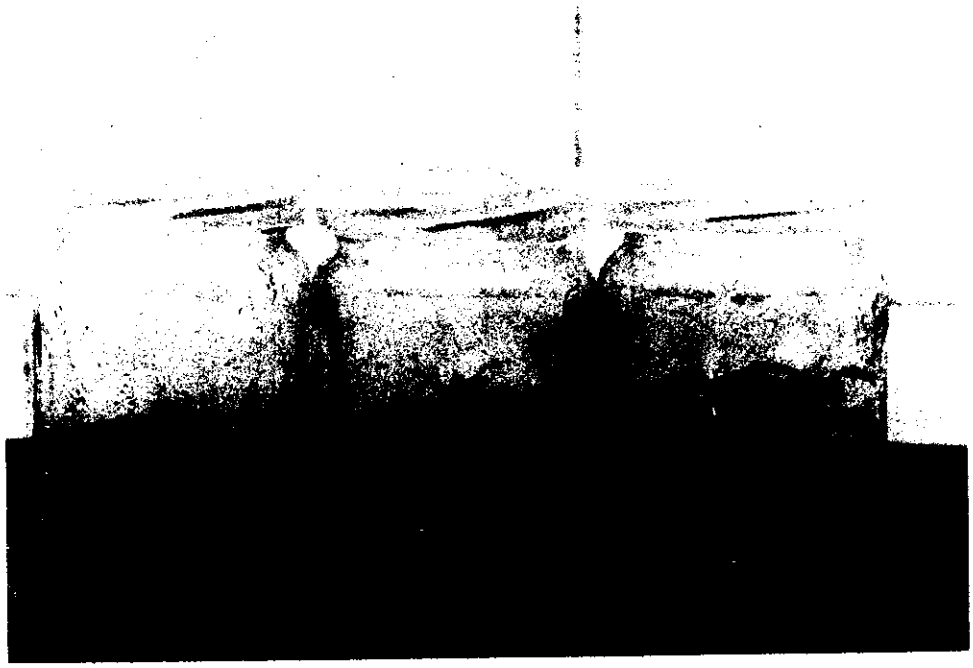


Fig (26) Effect of different thidiazuron concentrations on proliferation of Balady strawberry plants.

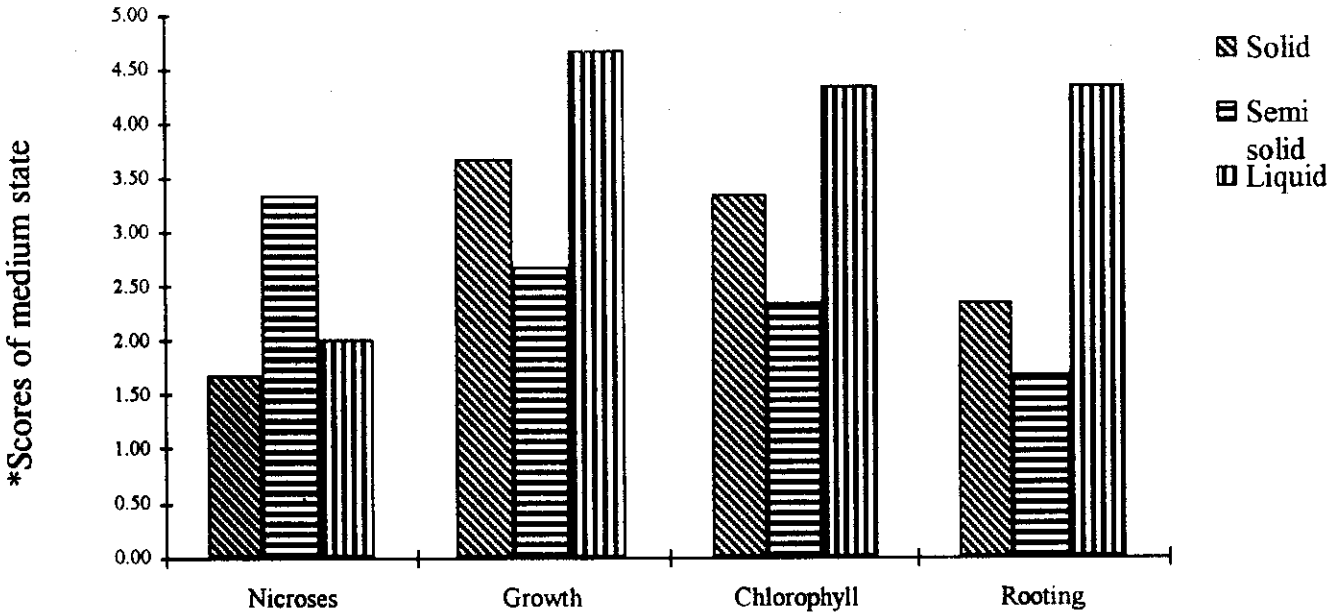


Fig (27) Effect of different medium states on rooting of Balady strawberry plants.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

IV.2.C. ROOTING STAGE :-

IV.2.C.1 EFFECT OF MEDIUM STATE :

Table (20) and Fig (27) indicate that different medium states failed to induce any significant effect on callus production . However , liquid and solid medium significantly reduced nicroses in relation to semi-solid medium. In contrast , liquid medium significantly increased growth, chlorophyll and rooting as compared to semi-solid medium. Meanwhile , solid and liquid medium states were significantly the same in case of growth while they significantly varied in case of chlorophyll and rooting whereas the former one was more effective.

IV.2.C.2. EFFECT OF AUXIN TYPE AND CONCENTRATION:

Referring to the effect of auxin type, Table (21-A) and Fig (28) state that callus production had not been affected statistically by addition of different auxin types to the cultured medium . However , indole-3- acetic acid significantly reduced nicroses in relation to indol-3-butyric acid . On contrary , growth was significantly stimulated when either naphthalene acetic acid or indole-3-acetic acid were supplemented to the medium. Furthermore , addition of indole-3-acetic acid to the medium resulted in significant improvement of chlorophyll . Moreover , using of either indole-3-butyric acid or naphthalene acetic acid led to significant increase of rooting .

With regared to the effect of auxin concentration, Table (21-B) reveals that increasing of auxin concentrations from 1mg/l to 2mg/l and from 2mg/l to 4mg/l resulted in significant increase of both callus production and nicroses . However , supplementation of the medium with 1 mg/l auxin significantly

Table (21) Effect of different auxin types with different concentrations on growth and rooting parameters of Balady strawberry plants.

Table (21-A) : Effect of auxin type.

Growth / Auxin types	Callus	Nicroses	Growth	Chlorophyll	Rooting
NAA	1.67 a	1.89 ab	2.33 a	3.11 b	3.00 a
IAA	1.67 a	1.78 b	2.67 a	3.78 a	2.44 b
IBA	2.00 a	2.33 a	1.89 b	2.89 b	3.44 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (21-B) : Effect of concentration.

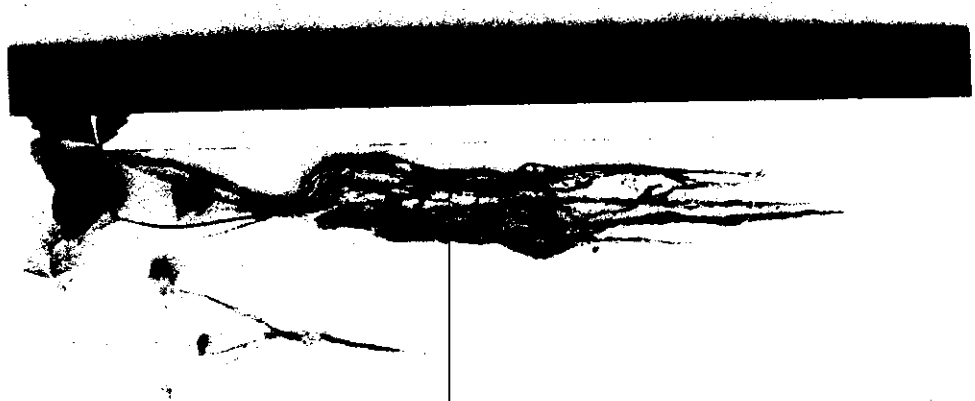
Growth parameters / Concentration mg/L	Callus	Nicroses	Growth	Chlorophyll	Rooting
1	1.00 c	1.33 c	2.89 a	3.78 a	2.33 b
2	1.67 b	2.00 b	2.33 b	3.33 b	3.44 a
4	2.67 a	2.67 a	1.67 c	2.67 c	3.11 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Fig (28) Effect of auxin type on growth rooting of Balady strawberry plants.

A : Effect of 2 mg /l of IAA

B : Effect of 2 mg /l of IBA



C : Root development from IAA (a) and from IBA (b).

enhanced both growth and chlorophyll parameters in comparison with the other concentrations. Meanwhile, continuous increasing of auxin concentrations up to 4mg/l led to significant adverse effect on growth and chlorophyll . On contrary, using of either 2 or 4 mg/l auxin resulted in significant increase in root formation .

Concerning the interaction between auxin type and concentration, Table (21-C) and Fig (29) reflect that interactions of higher auxin concentration (2 mg/l and 4 mg/l) and different auxin types specially indole-3- butyric acid enhanced callus production, nicroses and rooting . However, interactions between lower concentration (1mg/l)and different auxin types encouraged growth and improved chlorophyll with great extent as compared with the others .

The above results reveal that addition of either IBA or NAA to the cultured medium at the rate of 2 or 4 mg/L encouraged root formation . These results are assured by the finding of Yehia , (1986) who found that good root system was produced when subcultured on rooting medium supplemented with 3 mg/L IBA .However, partially disagreed with the finding of Badawi et. al. (1990). They mentioned that supplementation of the rooting medium with 1mg/l IBA enhanced root formation .

IV.2.C.3. EFFECT OF LIGHT REGIMES :-

IV.2.C.3.A. EFFECT OF PHOTOPERIOD TREATMENTS :-

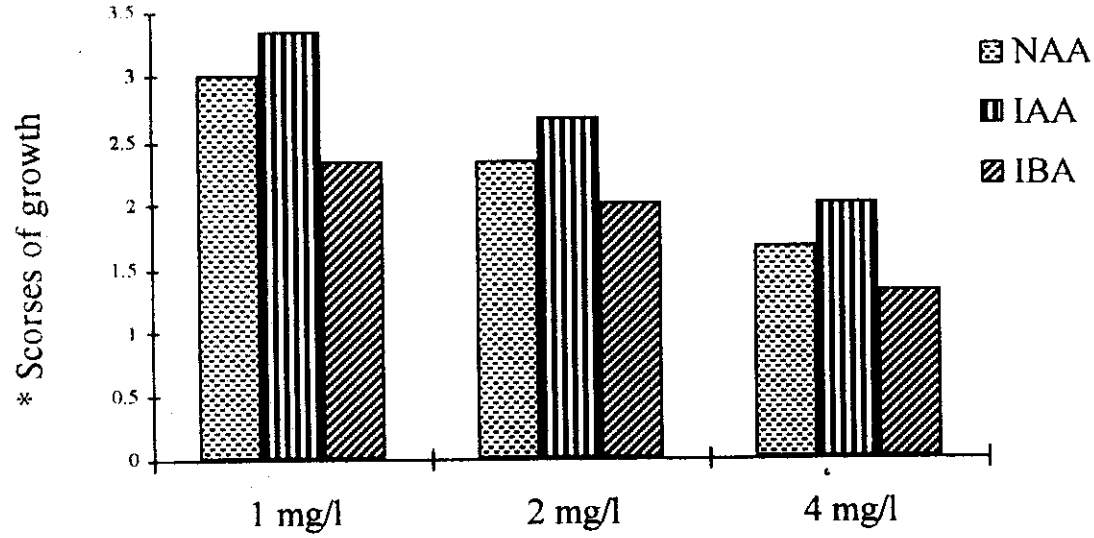
Dealing with the effect of photoperiod treatments, Table (22-A) and Fig (30&31) explain that continuous light significantly increased callus production then followed with intermittant light as compared with the other photoperiod

Table (21-C) : Effect of interaction between auxin type and concentration.

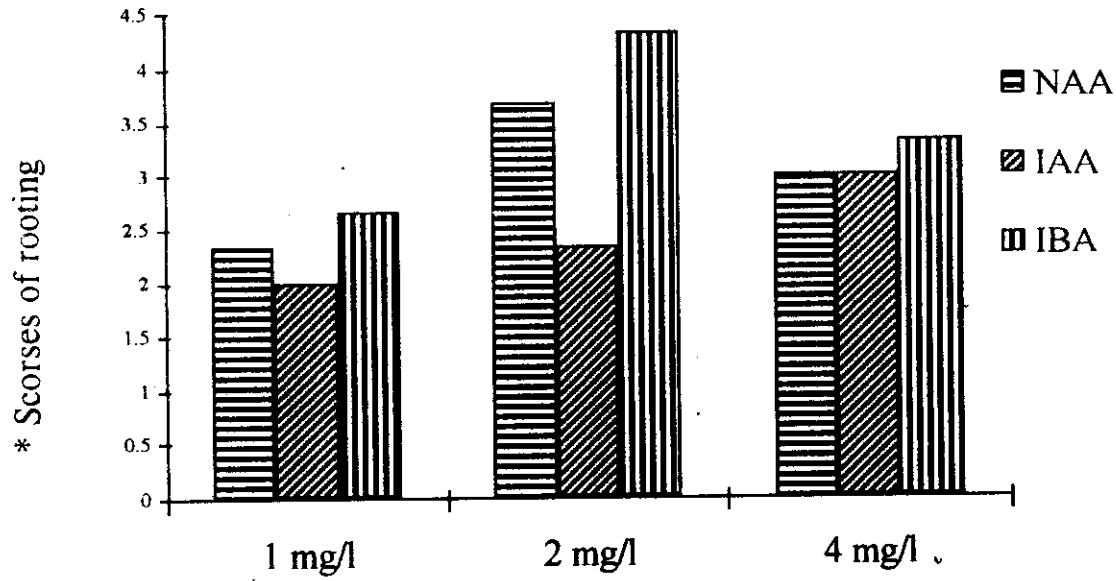
Concentration mg/l	Callus			Nicroses			Growth			Chlorophyll			Rooting		
Auxin type	1	2	4	1	2	4	1	2	4	1	2	4	1	2	4
NAA	1.00 f	1.33 ef	2.67 ab	1.33 de	2.00 bcd	2.33 abc	3.00 b	2.33 cd	1.67 ef	3.67 abc	3.00 cde	2.67 de	2.33 de	3.67 ab	3.00 bcd
IAA	1.00 f	1.67 de	2.33 bc	1.00 e	1.67 cde	2.67 ab	3.33 a	2.67 bc	2.00 de	4.33 a	4.00 ab	3.00 cde	2.00 e	2.33 de	3.00 bcd
IBA	1.00 f	2.00 cd	3.00 a	1.67 cde	2.33 abc	3.00 a	2.33 cd	2.00 de	1.33 f	3.33 bcd	3.00 cde	2.33 e	2.67 cde	4.33 a	3.33 bc

Means followed by the same letter, within each parameter, are not significantly different from each other at 1 % level.

Fig (29) : Effect of interation between auxin type and concentrations on growth (A) and rooting (B) of Balady strawberry plants.



A - Different auxin types and concentrations



B - Different auxin types and concentrations

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

treatments used. Also , both continuous light and intermittant light significantly increased nicroses. However, long day photoperiod treatment was preferred as it significantly reduced both callus production and nicroses increament while significantly encouraged the best growth and chlorophyll . The lowest growth and chlorophyll occurred under both continuous light and intermittant light regimes. Furthermore, short day photoperiod treatment significantly enhanced rooting as compared with the other used photoperiods treatments.

Considering the effect of cultivar, Table (22-B) clarifies that callus production was significantly decreased when Salvia cv. was used as compared with the other cultivars under investigation. On the contrary, both nicroses and chlorophyll were not affected statistically by cultivar type. However , growth was significantly enhanced when Barker cultivar was used instead of imported cutltivars . On the other hand, rooting was significantly improved as Scoya cultivar was involved in the study insted of using either Barker or Saliva cultivar .

With respect to the interaction between photoperiod and cultivar, Table (22-C) reflects that most of interactions between either continuous light or intermittant light and different cultivars encouraged higher callus production and nicroses as compared to the other interactions. However growth and chlorophyll were greatly improved when interactions of long day photoperiod and different cultivars were taken in account . On the contrary , interactions of either short day photoperiod intermitant light and different cultivars interactions encouraged rooting with high extent .

Table (22) Effect of different photoperiods on grwoth and rooting parameters of some strawberry cultivars.

Table (22-A) : Effect of photoperiod.

Growth parameters / Photoperiods	Callus	Nicroses	Growth	Chlorophyll	Rooting
Continuous light	3.20 a	3.40 a	1.33 d	1.67 c	1.20 c
Long day	1.27 d	1.40 c	4.00 a	4.20 a	1.87 b
Short day	1.67 c	2.07 b	3.07 b	2.93 b	2.33 a
Intermitant light	2.67 b	3.27 a	1.80 c	2.00 c	2.00 b

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

Table (22-B) : Effect of cultivar.

Cultivars	Callus	Nicroses	Growth	Chlorophyll	Rooting
Balady	2.25 a	2.50 a	2.67 ab	2.83 a	1.83 abc
Barker	2.33 a	2.50 a	3.00 a	2.75 a	1.75 bc
Chandler	2.25 a	2.75 a	2.25 b	2.50 a	2.00 ab
Salvia	1.83 b	2.75 a	2.33 b	2.50 a	1.50 c
Scoya	2.33 a	2.42 a	2.5 b	2.92 a	2.17 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

22-C : Effect of interaction between photoperiod and cultivar.

Photoperiods	Callus				Nicroses				Growth				Chlorophyll				Rooting			
Cultivers	Continuous Light	long day	short day	intermitant+ light	Continuous Light	long day	short day	intermitant+ light	Continuous Light	long day	short day	intermitant+ light	Continuous Light	long day	short day	intermitant+ light	Continuous Light	long day	short day	intermitant+ light
Balady	3.67 a	1 g	1.33 fg	3 abc	4 a	1 h	1.33 fgh	3.33 abc	1.33 ij	4.33 ab	3.33 cde	1.67 hij	1.33 i	4.67 a	3.33 cde	2 ghi	1.33 cd	1.67 bcd	2 abc	2.33 ab
Barker	3.33 ab	1.33 fg	2 def	2.67 bcd	2.67 cde	1.33 gh	2 efg	3 bcd	1.67 hij	4.67 a	3.33 cde	2.33 fgh	1.67 hi	4.33 ab	3 def	2 ghi	1 d	2 abc	2.33 ab	1.67 bcd
Chandler	3 abc	1 67 efg	2 def	2.33 cde	3.33 abc	1.67 fgh	2.33 def	3.67 ab	1 i	3.33 cde	3 def	1.67 hij	1.67 hi	4 abc	2.67 efg	1.67 hi	1 d	2 abc	2.67 a	2.33 ab
Salvia	2.67 bcd	1 g	1.33 fg	2.33 cde	3.67 ab	1.67 fgh	2.33 def	3.33 abc	1.67 hij	3.67 bcd	2.67 efg	1.33 ij	1.33 i	3.67 bcd	3 def	2 ghi	1 d	1.67 bcd	2 abc	1.33 cd
Scoya	3.33 ab	1.33 fg	1.67 efg	3 abc	3.33 abc	1.33 gh	2 efg	3 bcd	1 i	4 abc	3 def	2 ghi	2.33 fgh	4.33 ab	2.67 efg	2.33 fgh	1.67 bcd	2 abc	2.67 a	2.33 ab

Means followed by the same letter, within each parameter, are not significantly different from each other at 1 % level.

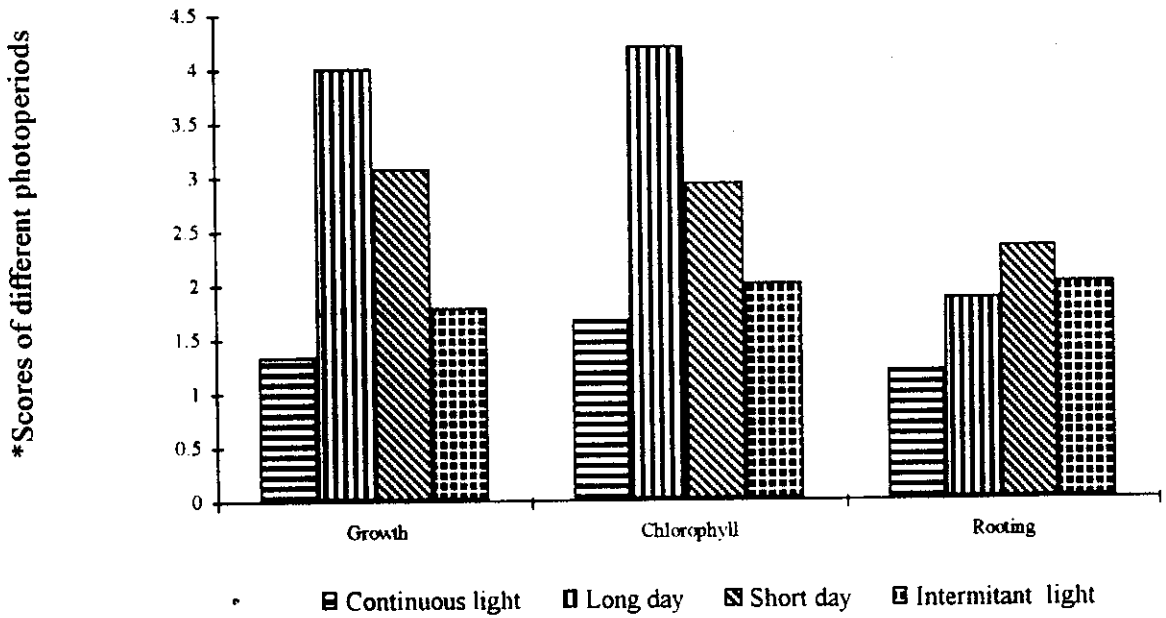
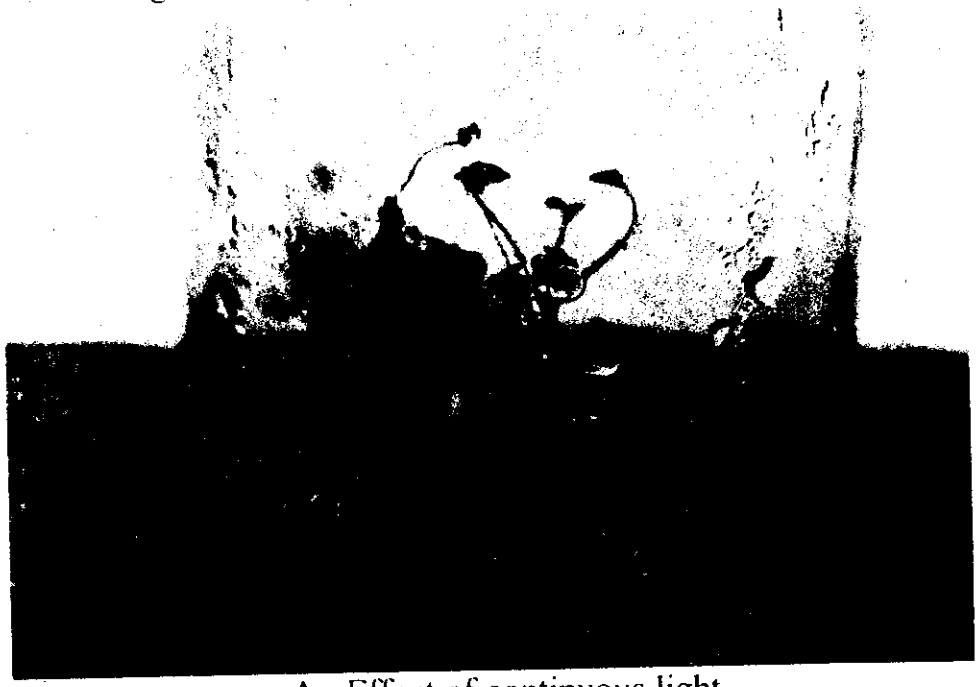


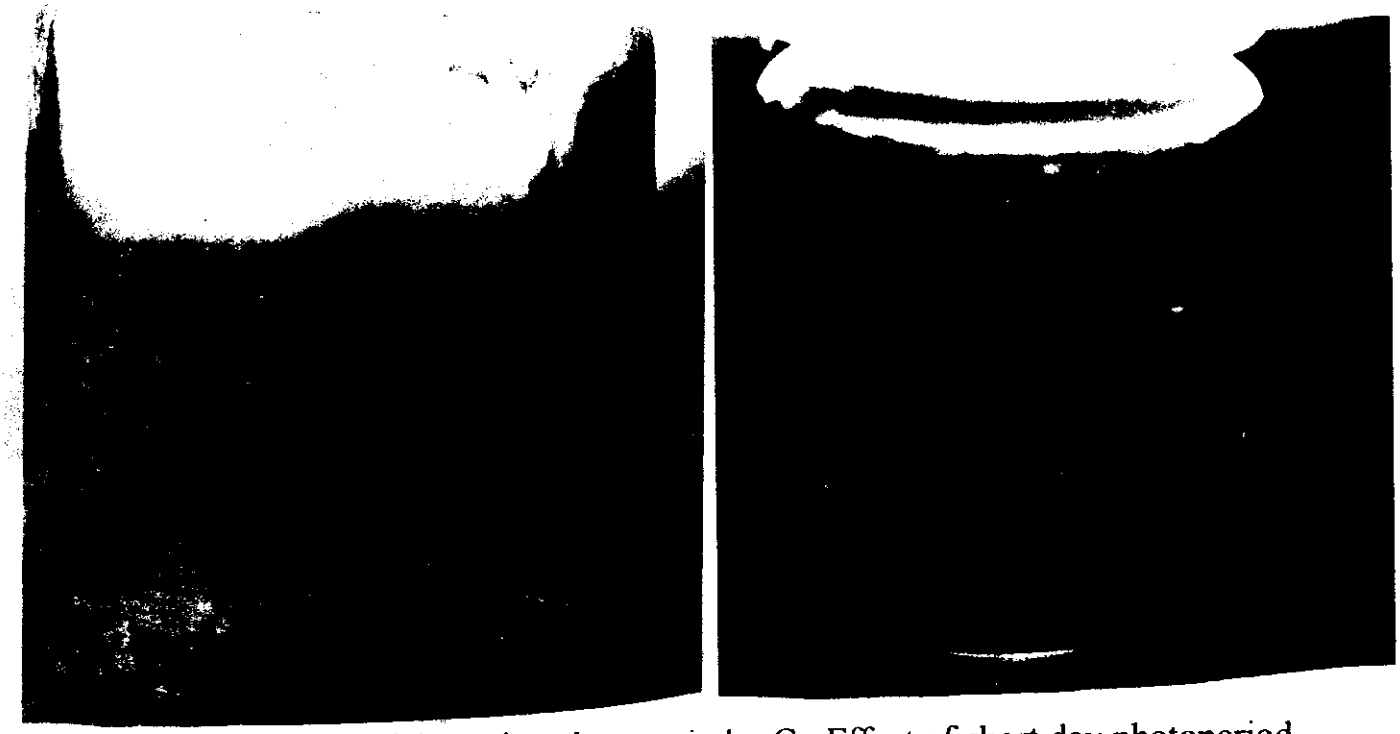
Fig (30) Effect of different photoperiods on growth chlorophyll and rooting of some strawberry cultivars.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

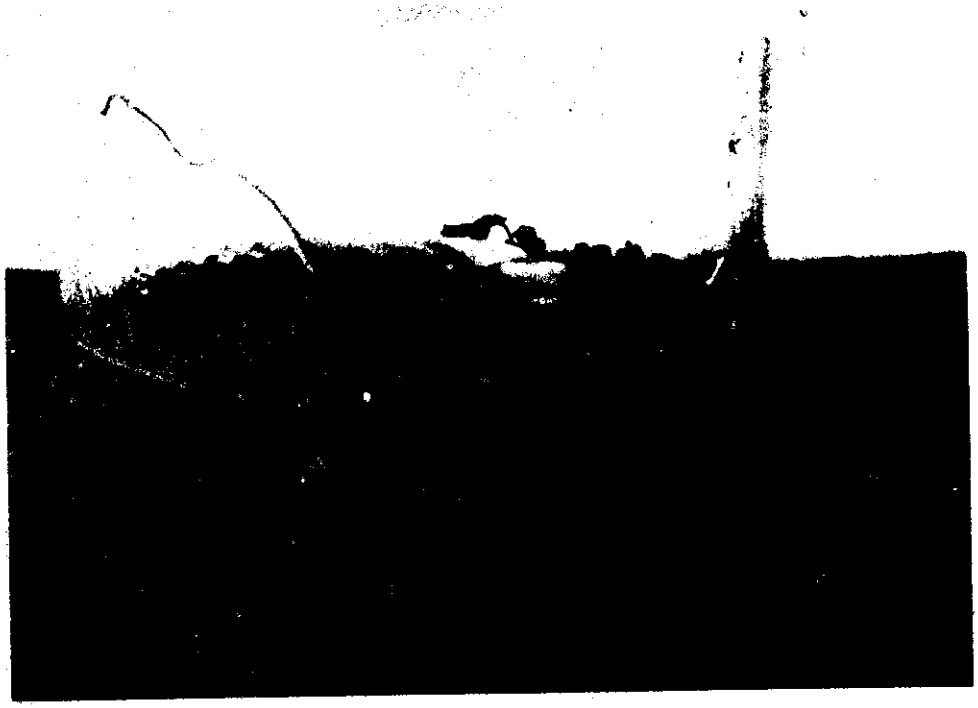
Fig (31) Effect of different photoperiod treatments on growth parameters during rooting of Balady strawberry plants.



A : Effect of continuous light



B : Effect of long day photoperiod C : Effect of short day photoperiod



D : Effect of intermittent light

E : Complete darkness

The above results pointed out long day photoperiod treatment improved all characters under investigation except rooting which was stimulated greatly by using short day or intermittant light photoperiod treatments. These results go partially in line with the finding of Mokra, (1988) . He indicated that growth and biomass weight of *in vitro* strawberry explants increased greatly under 16 hours of light /8 hours dark than those under 8 hours light /16 hours dark or 12 hours light / 12 hours dark. Meanwhile, the results are some what in harmony with the finding of Hanke, (1992) who stated that cultured explant rooted well under short day (10 hours light) or long day (16 hours light) in the 8 th or 12 th week before planting out.

IV.2.C.3.B. EFFECT OF DARKENING TREATMENTS : -

Table (23) and Fig (32&33) indicate that addition of activated charcoal to the cultured medium resulted in harmful effect as it significantly increased nicroses and significantly decreased growth, chlorophyll and rooting. However, growth was significantly increased as outer coverage treatment was used comparing with the control. Meanwhile either outer coverage, surface coverage, or the combination of both treatments showed similar level of growth and chlorophyll. On the contrary, rooting was significantly increased when combination of surface and outer coverage treatment was used in comparison with the control. Moreover, either surface coverage or combination treatment was far away from significancy on root formation.

Generally the above results reflect that addition of activated charcoal to the cultured medium induced a harmful effect on the cultured explant. However, most coverage treatment improved growth and rooting parameters. These results disagreed partially with the finding of Boxus, (1981) who found

Table (23) : Effect of different darkening treatments and medium additives on growth and rooting of Balady strawberry plants.

Treatments	Nicroses	Growth	Chlorophyll	Rooting
Control	1.67 b	2.67 bc	3.00 b	1.33 c
Outer coverage	2.67 ab	4.00 a	3.67 ab	3.33 b
Surface coverage	2.00 b	3.33 ab	4.33 a	4.00 ab
Surface & outer coverage	2.33 ab	3.67 ab	4.00 a	4.67 a
Charcoal 300 mg/l	3.33 a	1.67 c	1.33 c	1.33 c

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

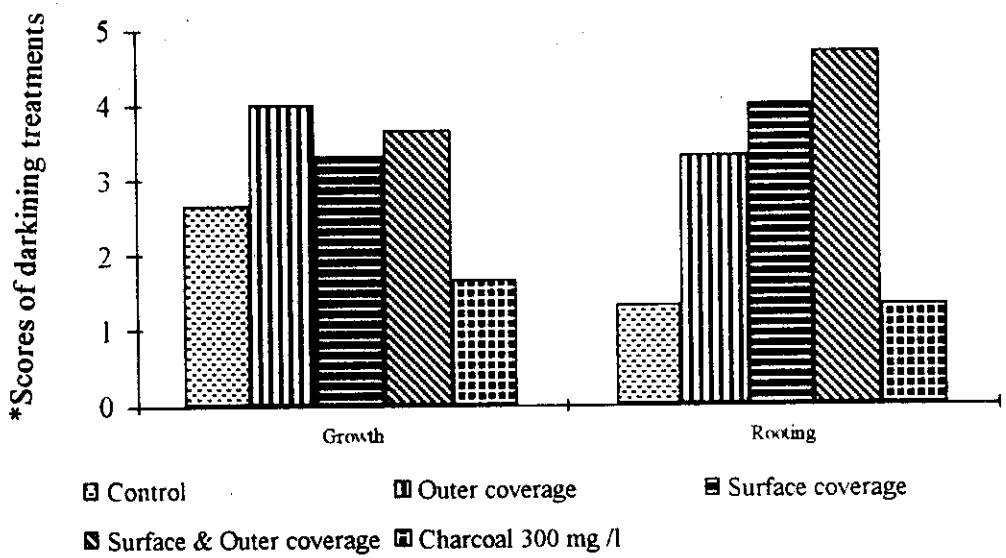


Fig (32) : Effect of different darkening treatments and medium additives on growth and rooting of Balady strawberry plants.

* These scores were given as follow : Negative results = 1 ; below average = 2 ; average = 3 ; above average = 4 and excellent = 5 .

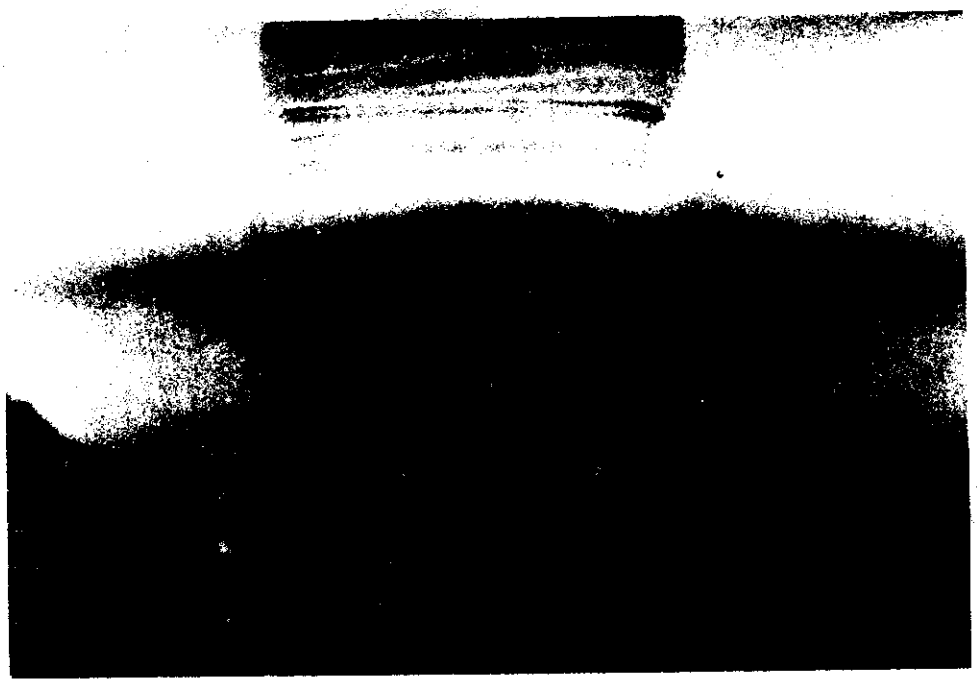
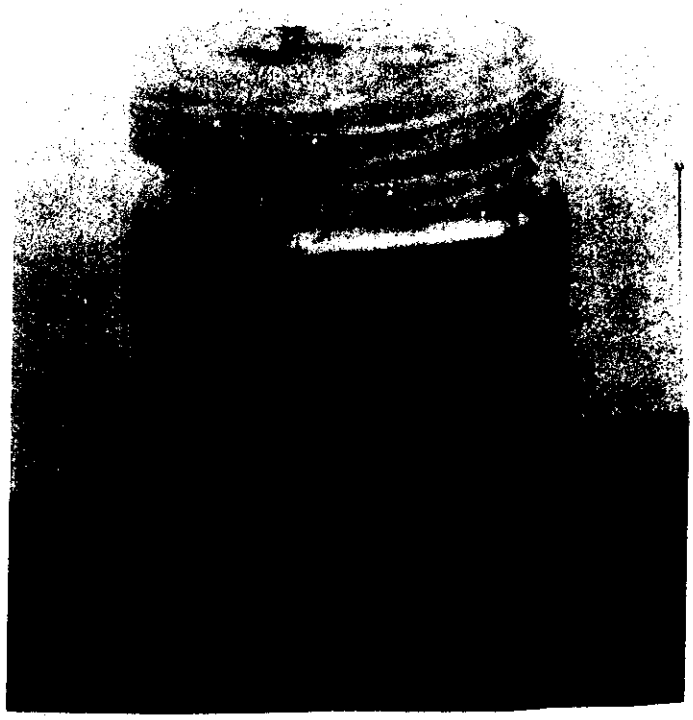


Fig (33) A : Root primordia development in Balady strawberry plants.



B : Effect of added charcoal on growth and development of Balady starwberry plants.

that rooting occurred on the medium supplemented with 0.05% activated charcoal.

IV.2.D. ACCLIMATIZATION (ADAPTATION) STAGE : -

IV.2.D.1. EFFECT OF AGRICULTURAL MEDIUM : -

Table (24) and Fig (34, 35) states that the combination of foam, sand, peat-moss, and loam in one treatment encouraged the highest significant increase of survivals as compared with the rest treatments. Meanwhile, the combination of foam, sand and peat-moss in one treatment followed the aforementioned treatment in increasing survivals. Furthermore, addition of either foam or sand to any combination resulted in increasing survivals with higher rates. In addition, increasing the number of agricultural media in one combination led to increase the survivals. However, using foam alone for acclimatization failed completely in inducing any survival. On the contrary, sand alone or peat-moss alone succeeded in enhancing a lesser rates of survival as compared with the other combinations.

The aforementioned results revealed that combination treatment of foam, sand, peat-moss and loam, followed with the combination of foam, sand, and peat-moss enhanced the highest survival rates. These results are nearly in general agreement with the finding of Popov, (1974) who reported that 100% of success was obtained from plants transplanted into sterilized loam, peat-moss and sand.

Table (24) Effect of different agricultural media treatments on survivals of Balady strawberry during acclimatization stage.

Treatments	Survival
Foam the rate of 100 % .	0.00 i
Sand at the rate of 100 % .	8.00 ij
Peat-moss at the rate of 100 % .	5.00 jk
Loam at the rate of 100 % .	2.00 ki
50 % foam + 50 % sand .	12.00 gh
50 % foam + 50 % peat-moss .	13.00 g
50 % foam + 50 % loam .	7.00 ij
50 % sand + 50 % peat-moss .	43.00 c
50 % sand + 50 % loam .	32.00 f
50 % peat-moss + 50 % loam .	9.00 hi
33 % foam + 33 % sand + 33 % peat-moss .	78.00 b
33 % foam + 33 % sand + 33 % loam .	41.00 cd
33 % foam + 33 % peat-moss + 33 % loam .	39.00 de
33 % sand + 33 % peat-moss + 33 % loam .	36.00 e
25 % foam + 25 % sand + 25 % peat-moss + 25 % loam .	89.00 a

Means followed by the same letter, within each column, are not significantly different from each other at 1 % level.

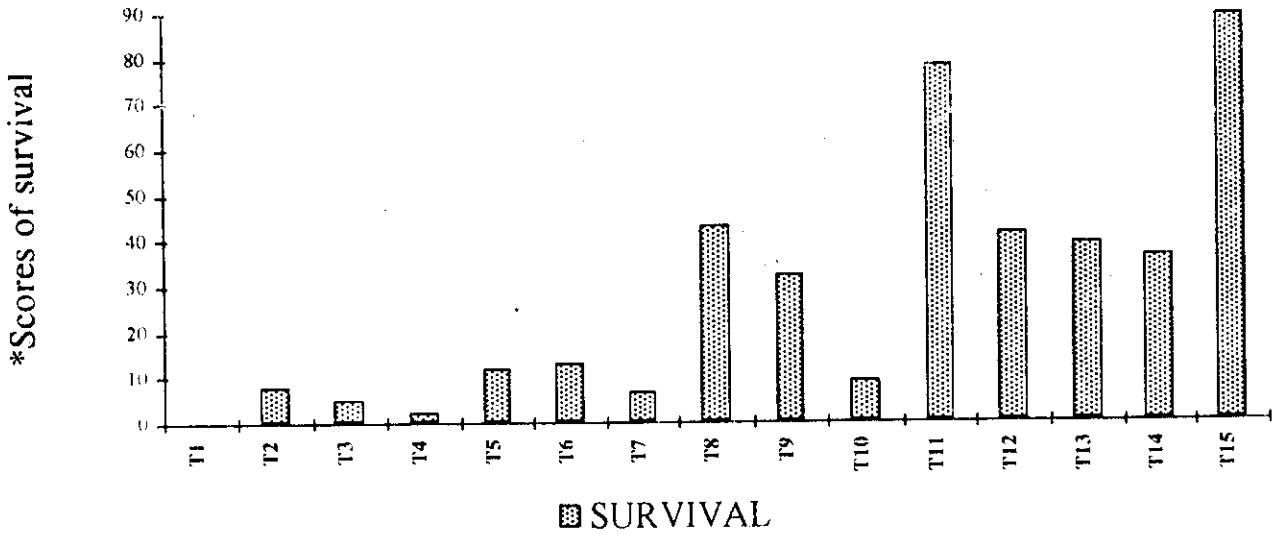


Fig (34) Effect of different agricultural media treatments on survival of Balady strawberry,during acclimatization stage.

T1 : Foam at the rate of 100% , T2 : Sand at the rate of 100% , T3 : Peatmoss at the rate of 100% , T4 : Loam at the rate of 100% , T5 : 50% foam + 50% sand , T6 : 50% foam + 50% peat moss , T7 : 50% foam + 50% loam , T8 : 50% sand + 50% peatmoss , T9 : 50% sand + 50% loam , T10 : 50% peatmoss + 50% loam , T11 : 33% foam + 33% sand + 33% peatmoss , T12 : 33% foam + 33% sand + 33% loam , T13 : 33% foam + 33% peatmoss + 33% loam , T14 : 33% sand + 33% peatmoss + 33% loam , T15 : 25% foam + 25% sand + 25% peatmoss + 25% loam.

Fig (35) : Effect of different combination of agricultural media on survival rate of acclimatized strawberry plants .

A : Combination of foam, sand, peat-moss, and loam

B : Combination of sand and peat-moss

C : Combination of sand and Loam