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ROOTABILITY OF *PYRUS BETULAEFOLIA* L. ROOTSTOCK SEMI HARDWOOD CUTTINGS AS AFFECTED BY AUXIN, WOUNDING, ROOTING MEDIA AND TIME OF COLLECTION.

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ABSTRACT

This search was carried out to study the effect of different Auxin, wounding treatments and rooting media on rooting percentage of *Pyrus betulaefolia* rootstock of semi hard wood cuttings during two seasons 2006 – 2007. While the cutting were prepared in mid Aug., Sep., Oct. and Nov. in each season. The treatments were IBA (3000, 4000, 5000 ppm), NAA (1500, 2000, 2500, 3000 ppm) and two mix of them in addition wounding treatment only and mix of wounding and the same of IBA concentration and control treatment.The rooting media were sand : peat moss (1:1, 2:1), sand : peat moss : perlite (1:1:1) and peat moss : vermiculite (1:1) and all cuttings were put in the media under intermittent mist irrigation system in the saran house of Horticulture Research Institute Agriculture Research Center. The important results were found with IBA 5000 ppm with medium consisted of sand and peat moss (1:1) in each of Aug.2006 and 2007.

In Sep. 2006 IBA 5000 ppm with medium of sand : peat moss : perlite (1:1:1) but in Sep. 2007 IBA 3000 ppm with medium of sand: peat moss: perlite (1:1:1) gave best results.

In Oct. 2006 best results were found with IBA 5000 ppm with sand: vermiculite (1:1).

In Oct. 2007 the best results were recorded by mix of IBA 3000 ppm + NAA 2000 ppm with medium of sand : peat moss : perlite (1:1:1).

In Nov. 2006 the best results were found by IBA 4000 with medium of sand: peat moss: perlite (1:1:1).

In Nov. 2007 the highest rooting percentage was obtained by mix of IBA 3000 ppm + NAA 2000 ppm with medium of sand : peat moss (2:1).

In the conclusion the results could be recommended by preparing the semi hard wood cuttings in Nov. follow by with Oct. and Aug.. The best treatment at all was the mix of IBA 3000 ppm + NAA 2000, IBA 4000 ppm + wounding and IBA 5000 ppm. While the best rooting media is sand: peat moss (1:1) or peat moss: vermiculite (1:1) regardless of any treatments or any timing of collection.

Keywords: Pear, *Pyrus betulaefolia*, Propagation, Semi hard wood cuttings**,** IBA, NAA, Wounding, Rooting media, Time of collection, Endogenous hormones.

INTRODUCTION

Pyrus betulaefolia is a pear rootstock has a vigorous growth, resistant to leaf spot and pear aphid, tolerant to alkali soils, adaptable to a wide range of climatic conditions and resistant to pear decline virus but susceptible to fire blight disease (Hartmann and Kester 1972).

It is one of the important pear rootstock because it needs a medium chilling unit or chilling requirements (Nee and Fuchigami 1990).

Propagation by cutting is one of common vegetative methods of the reproduction by which great numbers of plant species, including pear, apple rootstocks and others fruits. The timing of cutting preparation in relation to plant maturity is very important factor affecting rootability of the cutting, with easily rooted rootstocks. Timing is not critical but as the difficulty of propagation increases, the exactness of the timing becomes more important (EL-Banna, *et. al.* 1993).

The time in of year in which cutting are taken from their parent tree has a strong influence on the rooting ability (Gellini 1966). Stem cuttings of P.syriaca were collected in August and September (Al-Bukhari, *et. al*. 2002).

(Gueriero and Loreti, 1968) found that the rooting of MM_{106}, MM_{111}, and MM_{26} clonal apple rootstock was high for November cutting.

The best one for inducing rooting was IBA, particularly at lower concentration (500 compared with 1000 and 2000 ppm) (Sato, and Hosoe, 1998).

Cutting of Le-cont and Pyrus betulafolia pear were treated with IBA 1000,2000,3000,4000 and 8000 ppm by (Fadle, *et. al.* 1986 and Hussein, *et. al.* 2006).

Semi-hardwood cutting of 10 cultivar of P. serotina [P. pyrifolia] were taken on different date and rooted in different media after treatment with different concentration of IBA or NAA (Lin, and Lin, 1990).

(Howard, 1968) stated that wounding between nodes of both plum and apple cutting enhanced rooting percentage comparable to those obtained by unwounded cutting.

(Gorecki, 1979 and Gzynozyk & Grzyb, 1979), working with apple and cherry reported the stimulation effect of the combination treatment between exogenous auxin and wounding its base on rooting ability.

Peat moss is an important component in soil less potting media, and its price was expensive which has forced growers to seek other sources of organic amendments. Nursery stock producers need organic amendments that resist decomposition, provide proper aeration and water holding capacity, are non toxic to plants and people (workers and customers) and support plant growth. Several researchers have described benefits of and limitations for use of leaf compost (Sawhney, 1976).

In order to overcome such constraints the present study was planned to test the effect of auxin, wounding, rooting media and time of collection on rooting percentage as well as in the levels of endogenous hormones of rootstock semi hard wood cutting of *Pyrus betuloefolia* in mid of August, September, October, and November in 2006 - 2007 seasons.

MATERIALS AND METHODS

The present work was undertaken to test auxin, wounding, rooting media and time of collection on rooting percentage as well as changes in the levels of endogenous hormones (IAA, GA3& ABA) of control semi hardwood cuttings of *Pyrus betulaefolia* rootstock in August, September, October, and November in 2006-2007 seasons.

From one year old *P. betuloefolia* transplants grown on the Ali - Mobarak Agricultural Research Station (Cairo – Alex rood km. 107). The stem cuttings were about (10-15 cm length) with tow upper leaves. The basal end of the cuttings to about two cm. were dipped for 5 seconds in solution of different treatments and Rhizolex (5 gm/liter) as a fungicide. The following treatments were carried out:-

1- IBA 3000 ppm.
2- IBA 4000 ppm.
3- IBA 5000 ppm.
4- NAA 1500 ppm.
5- NAA 2000 ppm.
6- NAA 2500 ppm.
7- NAA 3000 ppm.
8- IBA 3000 ppm + NAA 1500 ppm.
9- IBA 3000 ppm + NAA 2000 ppm.
10- One Wound.
11- Two Wound.
12- One WOUND + IBA 3000 ppm.
13- One WOUND + IBA 4000 ppm.
14- One WOUND + IBA 5000 ppm.
15- Control.

The following four mixed media were used :

1- Sand: Peat moss 1:1 v/v.
2- Sand: Peat moss 2:1 v/v.
3- Sand: Peat moss: Perlite 1:1:1 v/v/v.
4- Peat moss: Vermiculite 1:1 v/v.

Cuttings were inserted in plastic boxes filled with rooting media under intermittent mist condition in saran house. After two months cuttings were removed gently and rooting percentage was recorded. The experiment was arranged in a factorial experiment (15 growth regulator and wounding treatments x 4 rooting media) contain sixty treatments in a complete randomize design. Each treatment had three replicates and seven cuttings for each. These treatments were done at mid of Aug., Sep., Oct. and Nov. for each season.

The level of endogenous hormones in combined stem and leaves sample were determined in each collocation date in both seasons 2006 and 2007. The level of IBA, GA_3, and ABA were determined by using HPLC according to the method described by (Wasfy and Orrin, 1975). The results expressed as mg/100g fresh weight.

The obtained data were subjected to analysis of variance (ANOVA) according (Snedecor and Cochran 1980). M. static program was used to compare between means of treatments according to (Waller and Duncan, 1969) at probability of 5%.

RESULTS AND DISCUSSION

Table (1) shows the effect of some growth regulators, wounding and rooting media treatments on rooting percentage of semi – hardwood cuttings of *Pyrus betulaefolia* in Aug. 2006.

As for the effect of the studied treatments, it is obvious that IBA at 5000 ppm proved to be the best one significantly (26.22%) regardless of rooting media type. In addition, a mixture of sand: peat (1:1) or peat: vermiculite (1:1) showed the significantly highest rooting % (19.37 and 20.31%, respectively) regardless of the used treatments.

Considering the interaction between the tow studied factors (treatments and rooting media),one can detect that cuttings treated with IBA at 5000 ppm and inserted in sand : peat (1:1) exhibited the greatest rooting media (38.1%) whereas those received NAA at 1500 ppm and planted in any studied rooting media resulted in the lowest rooting media (4 - 4.8%).

In the first time With respect to the second season Aug. 2007 data in table (2) revealed that, IBA at 5000 ppm still the superior treatment (31%) regardless of the used rooting media. Whereas the mixture of sand: peat (2: 1) proved here to be the best treatment or rooting media (18.1%) regardless of the other factor.

As for the interaction, it is apparent that cuttings treated with 5000 ppm IBA and inserted in sand : peat (1:1) still the superior treatment significantly (38.1%) opposite to cuttings received 1500 NAA and planted in any tried rooting media as well as cuttings treated with 2500 ppm NAA+ sand: peat (1:1) or sand : peat: perlite (1:1:1) in addition to the control cutting which inserted in peat: vermiculite(1:1) which failed completely to strike adventitious roots.

Table (1) : Effect of Some growth regulators, wounding treatments and rooting media on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Aug.2006

Media / Treat	% of rooted cuttings								Mean	
	Sand: peat 1:1 / V:V		Sand: peat 2 :1 / V:V		Sand: peat : perlite 1 : 1: 1 / V : V :V		Peat: Vermeculite 1:1 / V:V			
IBA 3000 ppm	19.10	e	23.80	d	19.10	e	28.60	c	22.65	B
IBA 4000 ppm	28.60	c	14.10	f	23.80	d	19.10	e	21.40	BC
IBA 5000 ppm	38.10	a	14.40	f	19.10	e	33.30	b	26.22	A
NAA 1500 ppm	4.00	h	4.80	h	4.80	h	4.80	h	4.80	H
NAA 2000 ppm	9.50	G	4.80	h	9.50	g	19.10	e	10.73	G
NAA 2500 ppm	14.30	F	14.30	f	4.80	h	9.50	g	10.73	G
NAA 3000 ppm	19.10	e	4.80.	h	14.30	f	14.30	f	13.13	F
IBA 3000+ NAA 1500	14.30	f	23.80	d	19.10	e	23.80	d	20.25	CD
IBA 3000+ NAA 2000	19.00	e	14.30	f	14.30	f	28.60	c	19.05	DE
One Wound	19.00	e	4.80	h	19.10	e	28.60	c	17.88	E
Two Wound	28.60	c	19.10	e	14.30	f	23.80	d	21.45	BC
One WOUND + IBA 3000	23.80	d	19.10	e	23.80	d	23.80	d	22.63	B
One WOUND + IBA 4000	19.10	e	14.30	f	14.30	f	23.60	d	17.8	E
One WOUND + IBA 5000	23.80	d	14.30	f	19.00	e	14.30	f	17.82	E
CONTROL	9.50	g	14.30	f	9.50	g	9.50	g	10.70	G
Mean	19.37	A´	13.67	C´	15.25	B´	20.31	A´		

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Table (2) : Effect of Some growth regulators wounding treatments and rooting media on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Aug.2007

Treat \ Media	% of rooted cuttings								Mean	
	Sand: peat 1:1 / V:V		Sand: peat 2:1 / V:V		Sand: peat : perlite 1 : 1: 1 / V : V :V		Peat: Vermeculite 1:1 / V:V			
IBA 3000 ppm	14.3	f	23.8	d	14.3	f	19.0	e	17.9	G
IBA 4000 ppm	23.8	d	19.0	e	23.8	d	14.3	f	20.2	E
IBA 5000 ppm	38.1	a	28.6	c	23.8	d	33.3	b	31.0	A
NAA 1500 ppm	0.0	i	0.0	i	0.0	i	0.0	i	0.0	L
NAA 2000 ppm	4.8	h	4.8	h	0.0	i	9.5	g	4.8	K
NAA 2500 ppm	0.0	i	9.5	g	0.0	i	9.5	g	4.8	K
NAA 3000 ppm	14.3	f	14.3	f	9.5	g	9.5	g	11.9	H
IBA 3000+ NAA 1500	19.0	e	28.6	c	28.6	c	23.8	d	25.0	C
IBA 3000+ NAA 2000	28.6	c	23.8	d	28.6	c	14.3	f	23.8	D
One Wound	19.0	e	19.0	e	14.3	f	19.0	e	17.9	G
Two Wound	9.5	g	4.8	h	14.3	f	14.3	f	10.7	I
One WOUND + IBA 3000	23.8	d	28.6	c	14.3	f	14.3	f	20.2	E
One WOUND + IBA 4000	14.3	f	23.8	d	19.0	e	19.0	e	19.0	F
One WOUND + IBA 5000	28.6	c	33.3	b	23.8	d	23.8	d	27.4	B
CONTROL	4.8	h	9.5	g	9.5	g	0.0	i	6.0	J
Mean	16.2	B´	18.1	A´	14.9	B´	14.9	B´		

Means followed by the same letter (s) in each column , line or interaction are insignificantly different at 5% level

In the second time dealing with Sept. 2006 cuttings, data of table (3) clearly indicated that IBA at 5000 ppm still the most effective treatment regardless of the used rooting media (33.33%). In addition, peat: vermiculite (1:1) medium appeared to be the superior one (20.95%) regardless of auxin and or wounding treatments.

The interaction was significant where cuttings treated with 4000 ppm IBA and planted in sand: peat (1:1) or received 5000 ppm IBA and inserted in sand: peat: perlite (1:1:1) exhibited the significantly greatest rooting % (38.10 & 38.10), whereas those treated with NAA at 1500 or 2000 ppm and planted in sand: peat (2:1) medium failed completely to root.

With respect to the second season (Sept. 2007) table (4) indicates that IBA at 3000 ppm showed the highest rooting% (17.86) regardless of the tested rooting media. In addition, a mixture of sand: peat: perlite (1:1:1) exhibited the greatest rooting (11.11 %), regardless of auxin and wounding treatment.

As for the interaction between the two studied factors, it is noticed that cuttings treated with IBA at 3000 ppm or one wound + 3000 ppm IBA and inserted in sand: peat: perlite (1:1:1) medium as well as those received IBA at 5000 ppm and planted in peat: vermiculite (1:1) medium proved to be the superior in rooting% (23.81,23.81 & 23.81).

On the other hand, control cuttings as well as those treated with NAA at 1500 or 2000 or 3000 ppm or wound alone and inserted in most rooting media could not form adventitious roots.

In the first time With respect to Oct. 2006 cuttings, table (5) revealed that treating cuttings with one wound+ 4000 ppm IBA resulted in the highest significant rooting% (30. 92) regardless of the used rooting media.

In addition, the mixture of sand: peat (2:1) media showed the higher rooting% (19.35) regardless of auxin and or wounding treatments than that of sand : peat (1:1) only.

As for the interaction between the two studied factors, it is apparent that cuttings treated with IBA at 5000 ppm and inserted in a rooting medium consisted of peat: vermiculite (1:1) was the super most treatment (42.80%). Whereas, cuttings received 2500 ppm NAA and planted in either sand: peat (1:1) or sand: peat (2:1) medium failed completely to strike roots.

Table (3) : Effect of Some growth regulators wounding and rooting media treatments on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Sept .2006

Media / Treat	% of rooted cuttings								Mean	
	Sand: peat 1:1 / V:V		Sand: peat 2 :1 / V:V		Sand: peat : perlite 1 : 1: 1 / V : V :V		Peat: Vermeculite 1:1 / V:V			
IBA 3000 ppm	19.10	e	23.80	d	23.80	d	33.30	b	25.00	BC
IBA 4000 ppm	38.10	a	9.50	g	14.30	f	33.30	b	23.80	CD
IBA 5000 ppm	33.30	b	28.60	c	38.10	a	33.30	b	33.33	A
NAA 1500 ppm	4.80	h	0.00	i	4.80	h	4.80	h	3.60	K
NAA 2000 ppm	9.50	g	0.00	i	9.50	g	9.50	g	7.13	J
NAA 2500 ppm	14.30	f	9.50	g	4.80	h	14.30	f	10.73	HI
NAA 3000 ppm	9.50	g	0.00	i	14.30	f	14.30	f	9.53	I
IBA 3000+ NAA 1500	19.10	e	19.10	e	19.10	e	19.10	e	19.10	G
IBA 3000+ NAA 2000	19.10	e	19.10	e	19.10	e	23.80	d	20.27	FG
One Wound	14.30	f	28.60	c	23.80	d	23.80	d	22.63	DE
Two Wound	23.80	d	23.80	d	19.10	e	33.30	b	25.00	BC
One WOUND + IBA 3000	28.60	c	33.30	b	33.30	b	9.50	g	26.17	BC
One WOUND + IBA 4000	19.10	e	23.80	d	19.00	e	23.80	d	21.42	EF
One WOUND + IBA 5000	28.60	c	23.80	d	14.30	f	28.60	c	23.83	CD
CONTROL	14.30	f	14.30	f	9.50	g	9.50	g	11.90	HI
Mean	19.70	B´	17.15	C´	17.79	C´	20.95	A´		

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Table (4) : Effect of Some growth regulators wounding treatments and rooting media on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Sept.2006

Treat \ Media	% of rooted cuttings				Mean
	Sand: peat 1:1 / V:V	Sand: peat 2 :1 / V:V	Sand: peat : perlite 1 : 1: 1 / V : V :V	Peat: Vermeculite 1:1 / V:V	
IBA 3000 ppm	14.29 c	19.05 b	23.81 a	14.29 c	17.86 A
IBA 4000 ppm	4.76 e	0.00 f	9.52 d	9.52 d	5.95 E
IBA 5000 ppm	14.29 c	14.29 c	9.52 d	23.81 a	15.48 B
NAA 1500 ppm	9.52 d	0.00 f	9.52 d	0.00 f	4.76 E
NAA 2000 ppm	9.52 d	0.00 f	14.29 c	0.00 f	5.95 E
NAA 2500 ppm	4.76 e	14.29 c	4.76 e	0.00 f	5.95 E
NAA 3000 ppm	0.00 f	0.00 f	4.76 e	0.00 f	1.19 F
IBA 3000+ NAA 1500	14.29 c	14.29 c	14.29 c	14.29 c	14.29 B
IBA 3000+ NAA 2000	14.29 c	9.52 d	14.29 c	9.52 d	11.90 C
One Wound	0.00 f	0.00 f	19.05 b	0.00 f	4.76 E
Two Wound	4.76 e	4.76 e	9.52 d	0.00 f	4.76 E
One WOUND + IBA 3000	9.52 d	14.29 c	23.81 a	9.52 d	14.29 B
One WOUND + IBA 4000	19.05 b	0.00 f	9.52 d	9.52 d	9.52 D
One WOUND + IBA 5000	0.00 f	0.00 f	0.00 f	9.52 d	2..38 F
CONTROL	4.76 e	0.00 f	0.00 f	0.00 f	1.19 F
Mean	8.25 B´	6.03 C´	11.11 A´	6.67 C´	

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Table (5) : Effect of Some growth regulators wounding and rooting media treatments on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Oct. .2006

Media / Treat	% of rooted cuttings								Mean	
	Sand: peat 1:1 / V:V		Sand: peat 2 :1 / V:V		Sand: peat : perlite 1 : 1: 1 / V : V :V		Peat: Vermeculite 1:1 / V:V			
IBA 3000 ppm	19.10	f	23.80	e	38.10	b	19.10	f	25.02	C
IBA 4000 ppm	19.10	f	23.80	e	19.10	f	33.30	c	23.83	CD
IBA 5000 ppm	28.60	d	23.80	e	14.30	g	42.80	a	27.38	B
NAA 1500 ppm	4.80	i	9.50	h	4.80	i	4.80	i	5.98	HI
NAA 2000 ppm	14.30	g	4.80	i	9.50	h	0.00	j	7.15	GH
NAA 2500 ppm	0.00	j	0.00	j	9.50	h	9.50	h	4.75	I
NAA 3000 ppm	9.50	h	0.00	j	9.50	h	14.30	g	8.33	GH
IBA 3000+ NAA 1500	23.80	e	19.00	f	28.60	d	23.80	e	23.80	CD
IBA 3000+ NAA 2000	9.50	h	33.30	c	28.60	d	28.60	d	25.00	C
One Wound	23.80	e	33.30	c	19.10	f	19.10	f	23.83	CD
Two Wound	23.80	e	23.80	e	14.30	g	9.50	h	17.85	F
One WOUND + IBA 3000	23.80	e	23.80	e	19.10	f	14.30	g	20.25	E
One WOUND + IBA 4000	33.30	c	38.10	b	28.50	d	23.80	e	30.92	A
One WOUND + IBA 5000	19.10	f	23.80	e	28.60	d	19.10	f	22.65	D
CONTROL	4.80	i	9.50	h	4.80	i	4.80	i	5.98	HI
Mean	17.15	B´	19.35	A´	18.43	AB´	17.69	AB´		

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Regarding Oct. 2007 cuttings, table (6) clearly show that treating cuttings with a mixture of 3000 ppm IBA + 2000 ppm NAA resulted in the highest signification rooting % (26.19) regardless of the used rooting media.

Meanwhile, peat: vermiculite (1:1) rooting medium proved to be the excellent one significantly compared with any other rooting medium (9.5%) regardless of auxin or wounding treatment.

The interaction between auxin or wounding treatments and rooting media revealed that cuttings treated with IBA at 3000 ppm + NAA at 2000 ppm and planted in sand: peat: perlite (1:1:1) rooting medium had the highest significant rooting % (38.10) opposite to those received 2 wounds alone or NAA at 3000 ppm as well as the control which inserted in most studied rooting media (0% rooting).

With regard to cuttings of Nov. 2006, table (7) illustrated that both IBA at 5000 and 4000 ppm gained the highest significantly rooting % (21.45 & 21. 48 respectively) regardless of the type of rooting media.

In addition, both of sand: peat (1:1) and peat: vermiculite (1:1) rooting media proved to be significantly better (13.66% & 13.66) than that of sand : peatmoss : perlite (1:1:1), regardless of the used treatment. As for the interaction, one can detect that cuttings treated with IBA at 4000 ppm and planted in sand: peat: perlite (1:1:1) exhibited the greatest rooting % (33.3%), whereas those received NAA at 2000 or 2500 ppm and inserted in sand: peat: perlite (1:1:1) as well as control cuttings in both sand: peat either at (1:1) or (2:1) took the other way around (0% rooting).

In Table (8) it is obvious that cuttings prepared in Nov. 2007 and treated with IBA at 3000 ppm + NAA at 2000 ppm gained the highest significant rooting % (39.29) than any other treatments regardless of the used rooting media. Meanwhile, sand: peat (2:1) and sand: peat: perlite (1:1:1) media surpassed significantly other studied ones (22.54 & 21.90%) respectively regardless of auxin and wounding treatments.

The interaction between the two studied factors indicates that cuttings treated with IBA at 3000 ppm + NAA at 2000 ppm and inserted in sand: peat (2:1) media exhibited the greatest rooting% (66.67). On the contrary, control cuttings planted in most tried rooting media failed completely to form adventitious roots.

Table (6) : Effect of Some growth regulators wounding treatments and rooting media on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Oct. 2007

Treat \ Media	% of rooted cuttings								Mean	
	Sand: peat 1:1 / V:V		Sand: peat 2 :1 / V:V		Sand: peat : perlite 1 : 1: 1 / V : V :V		Peat: Vermeculite 1:1 / V:V			
IBA 3000 ppm	19.05	d	9.52	f	9.52	f	9.52	f	11.90	C
IBA 4000 ppm	9.52	f	19.05	d	9.52	f	9.52	f	11.90	C
IBA 5000 ppm	14.29	e	19.05	d	14.29	e	4.76	g	13.10	B
NAA 1500 ppm	4.76	g	4.76	g	0.00	h	23.81	c	8.33	F
NAA 2000 ppm	0.00	h	9.52	f	0.00	h	4.76	g	3.57	I
NAA 2500 ppm	4.76	g	9.52	f	9.52	f	0.00	h	5.95	H
NAA 3000 ppm	4.76	g	0.00	h	0.00	h	9.52	f	3.57	I
IBA 3000+ NAA 1500	9.52	f	14.29	e	14.29	e	14.29	e	13.10	B
IBA 3000+ NAA 2000	19.05	d	28.57	b	38.10	a	19.05	d	26.19	A
One Wound	14.29	e	9.52	f	0.00	h	14.29	e	9.52	E
Two Wound	4.76	g	0.00	h	0.00	h	0.00	h	1.19	J
One WOUND + IBA 3000	14.29	e	9.52	f	9.52	f	9.52	f	10.71	D
One WOUND + IBA 4000	4.76	g	0.00	h	9.52	f	14.29	e	7.14	G
One WOUND + IBA 5000	9.52	f	9.52	f	0.00	h	9.52	f	7.14	G
CONTROL	0.00	h	9.52	f	4.76	g	0.00	h	3.57	I
Mean	8.9	C´	10.2	B´	7.9	D´	9.5	A´		

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Table (7) : Effect of Some growth regulators wounding treatments and rooting media on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Nov.2006

Media / Treat	% of rooted cuttings				Mean
	Sand: peat 1:1 / V:V	Sand: peat 2 :1 / V:V	Sand: peat : perlite 1 : 1: 1 / V : V :V	Peat: Vermeculite 1:1 / V:V	
IBA 3000 ppm	28.60 b	14.30 e	14.30 e	9.50 f	16.68 B
IBA 4000 ppm	19.10 d	19.10 d	33.30 a	14.30 e	21.45 A
IBA 5000 ppm	28.60 b	19.10 d	19.10 d	19.10 d	21.48 A
NAA 1500 ppm	14.30 e	14.30 e	14.30 e	0.00 h	10.73 E
NAA 2000 ppm	9.50 f	19.10 d	0.00 h	14.30 e	10.73 E
NAA 2500 ppm	19.10 d	9.50 f	0.00 h	14.30 e	10.73 E
NAA 3000 ppm	14.30 e	14.30 e	9.50 f	0.00 h	9.53 F
IBA 3000+ NAA 1500	14.30 e	9.50 f	9.00 f	23.80 c	14.15 C
IBA 3000+ NAA 2000	14.30 e	4.80 g	9.50 f	9.50 f	9.53 F
One Wound	9.50 f	14.30 e	9.50 f	14.30 e	11.90 D
Two Wound	4.80 g	9.50 f	4.80 g	14.30 e	8.35 G
One WOUND + IBA 3000	9.50 f	14.30 e	9.50 f	14.30 e	11.90 D
One WOUND + IBA 4000	9.50 f	9.50 f	9.50 f	28.60 b	14.28 C
One WOUND + IBA 5000	9.50 f	14.30 e	14.30 e	19.10 d	14.30 C
CONTROL	0.00 h	0.00 h	9.50 f	9.50 f	4.75 H
Mean	13.66 A´	12.39 AB´	11.07 B´	13.66 A´	

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Table (8) : Effect of Some growth regulators, wounding and rooting media treatments on rooting persentage of *pyrus betuloefolia* semi hardwood cuttings in Nov.2007

Media / Treat	% of rooted cuttings								Mean	
	Sand: peat 1:1 / V:V		Sand: peat 2 :1 / V:V		Sand: peat : perlite 1 : 1: 1 / V : V :V		Peat: Vermeculite 1:1 / V:V			
IBA 3000 ppm	9.52	k	4.76	l	0.00	m	0.00	m	3.57	J
IBA 4000 ppm	14.29	j	0.00	m	28.57	g	38.10	e	20.24	E
IBA 5000 ppm	14.29	j	14.29	j	0.00	m	14.29	i	10.71	H
NAA 1500 ppm	23.81	h	19.05	i	0.00	m	23.81	c	16.67	F
NAA 2000 ppm	14.29	j	0.00	m	0.00	m	14.29	i	7.14	I
NAA 2500 ppm	0.00	m	28.57	g	38.10	e	14.29	i	20.24	E
NAA 3000 ppm	14.29	j	42.86	d	47.62	c	14.29	i	29.76	C
IBA 3000+ NAA 1500	19.05	i	28.57	g	28.57	g	14.29	i	22.62	D
IBA 3000+ NAA 2000	0.00	m	66.67	a	38.10	e	52.38	b	39.29	A
One Wound	4.76	l	19.05	i	9.52	k	0.00	m	8.33	I
Two Wound	14.29	j	9.52	k	14.29	j	14.29	i	13.10	G
One WOUND + IBA 3000	4.76	l	38.10	e	28.57	g	19.05	h	22.62	D
One WOUND + IBA 4000	14.29	j	33.33	f	42.86	d	0.00	m	22.62	D
One WOUND + IBA 5000	33.33	f	33.33	f	52.38	b	19.05	h	34.52	B
CONTROL	0.00	m	0.00	m	0.00	m	9.52	j	2.38	J
Mean	12.06	C´	22.54	A´	21.90	A´	16.51	B´		

Means followed by the same letter (s) in each column, line or interaction are insignificantly different at 5% level

Table (9) illustrate the relationship between rooting ability and endogenous hormone level of control semi hardwood cuttings betuloefolia pear rootstock prepared from Aug. up to Nov. in 2006 and 2007 seasons in combined stem and leaves sample.

It is apparent that control cuttings taken in Aug. and Sept. 2006 showed the relatively higher rooting% (10.7 & 11.9) as compared with those prepared in Oct. and Nov. 2006 (6.0 & 4.8%). Such increase was accompanied with a relative increase in both IAA level (0.085 & 0.076 mg/100g) and GA_3 level (1.95 & 3.46 mg/100g) and relative decrease in ABA level (0.038 & 0.023 mg/100g).

Such results go in line with those shown in the second season (2007) where Aug. and Oct. cuttings exhibited relatively higher rooting % (3.57 & 3.67) and greater GA_3 level (0.462 & 0.320 mg/100g) without ABA content.

Table (9) Endogenous hormones level (mg/ 100g) in control stem and leaves of *Pyrus betuloefolia* semi hardwood cuttings in relation to rooting % in Aug., Sep., Oct. and Nov. in 2006 and 2007 seasons

2006 season				
Collection date	Rooting %	IAA Level (mg/100g F.W.)	GA3 Level (mg/100g F.W.)	ABA Level (mg/100g F.W.)
Aug. 2006	10.7	0.085	1.95	0.038
Sep. 2006	11.9	0.076	3.46	0.023
Oct. 2006	6.0	0.04	1.60	0.055
Nov. 2006	4.8	0.00	0.88	0.084
2007 season				
Season	Rooting %	IAA Level (mg/100g F.W.)	GA3 Level (mg/100g F.W.)	ABA Level (mg/100g F.W.)
Aug. 2007	3.57	0.01	0.462	0.00
Sep. 2007	1.19	0.00	0.360	0.01
Oct. 2007	3.67	0.00	0.320	0.00
Nov. 2007	2.38	0.01	0.110	0.03

In conclusion, one can say that rooting % of Pyrus betulaefolia semi hardwood cuttings ranged from (23.8 - 66.67%) according to date of collection, season, treatments and rooting media. The lowest rootability (23.8%) was shown in cuttings prepared in Sept. 2007 and treated by IBA at 3000 ppm then planted in sand: peat: perlite (1:1:1) rooting medium. On the other hand, the greatest rootability (66.67%) was detected in cuttings collected in Nov. 2007 and received 3000 ppm IBA + 2000 ppm NAA then inserted in sand: peat (2:1) medium.

In general, Nov. seemed to be the proper month for preparing the semi hardwood cuttings of Pyrus betulaefolia such results are going in line with the finding of (Gueriero and Loreti, 1968) found that the rooting of MM_{106}, MM_{111}, and MM_{26} clonal apple rootstock was high for November cutting.

(Aly, 1994) followed in a decreasing order by Oct. then Aug, Meanwhile, a mixture of IBA at 3000 ppm + NAA at 2000 ppm proved to be the best treatment for inducing adventitious roots formation on semi hardwood cuttings, followed in a decreasing order by wounding + IBA at 4000, these results are similar to those found by (Kuden and Kaska 1990) they showed that on vegetative propagation of the apple rootstocks MM.106 and MM.109 and Quince A rootstocks (for pears), involving treatment of cuttings by wounding and IBA application, these could be produced very quickly for budding at a suitable time under subtropical conditions. Then IBA at 5000 ppm alone.

A rooting medium consists of sand: peat moss (2:1) seemed to encourage root formation on cutting's basis followed descendingly by peat: vermiculite (1:1) and sand: peat: perlite (1:1:1). The obtained data are in harmony with the findings of (Enaiat Abd El-Aziz, *et. al.* 1992) They reported that the highest rooting percent was recorded for the same cutting, treated with 2000 ppm IBA and planted in sand + peat moss Data of endogenous hormones level revealed that rootability of betulaefolia semi hardwood cuttings was positively correlated with the higher levels of both IAA and GA_3 and negatively with ABA level.

Such findings are similar to the results obtained by (Hussein *, et. al.* 2006).

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قدرة التجذير للعقل نصف الخشبية لأصل الكمثرى البتشيليفوليا تحت تأثير الأكسين ، التجريح ، بيئة التجذير وميعاد التجهيز.

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تم أجراء هذا البحث لدراسة تأثير استخدام معاملات الأكسين المختلفة ومعاملات التجريح على نسبة تجذير العقل نصف الخشبية للأصل الجذرى الكمثرى البتشيليفوليا وذلك خلال موسمين زراعيين متتاليين 2006 – 2007 وتم تجهيز العقل فى منتصف شهر أغسطس ، سبتمبر ، أكتوبر ، نوفمبر فى كلا من الموسمين. وقد أشتملت المعاملات على (IBA 3000 ، 4000 ، 5000 ppm) و(NAA 1500 ، 2000 ، 2500 ، 3000 ppm) ومخلوطين منهما (IBA 3000 ppm + NAA 1500 ppm) و(IBA 3000 ppm + NAA 2000 ppm) بالأضافة الى معاملات التجريح (جرح – جرحين) ، جرح مع كلا من IBA 3000 ، 4000 ، 5000 ppm بالأضافة الى معاملة المقارنة وقد تم معاملة جميع العقل بالمطهر الفطرى وزراعتها فى صناديق بلاستيكيه التى أحتوت على البيئات التالية (رمل + البيت موس بنسبة 1 : 1 ، 2 : 1) ، (رمل + البيت موس + البيرليت بنسبة 1 : 1 : 1) ، (بيت موس + الفيرميكيوليت بنسبة 1 : 1) ووضعت جميع البيئات المزروعه بالعقل تحت ظروف الضباب المتقطع فى الصوب السيران بمعهد بحوث البساتين مركز البحوث الزراعيه . وكانت أهم النتائج المتحصل عليها من المعاملة IBA 5000 ppm مع بيئه خليط الرمل والبيتموس بمعدل 1 : 1 فى كل من أغسطس 2006 ، 2007 .وفى سبتمبر 2006 كانت أفضل النتائج IBA 5000 ppm مع بيئة الرمل : البيت موس: البيرليت بنسبة 1:1:1 أما فى سبتمبر 2007 أفضل نتائج كانت 3000 مع بيئة الرمل : البيت موس : البيرليت بنسبة 1:1:1 . وفى أكتوبر 2006 كانت أفضل معاملة الرمل والفيرميكيوليت 1 : 1 ، وكانت معاملة المخلوط IBA 3000 ppm + NAA 2000 ppm فى أكتوبر 2007 مع بيئة الرمل : البيت موس : البيرليت 1 : 1 : 1 .أفضل معاملة فى نوفمبر 2006 IBA IBA 4000 ppm مع بيئة الرمل + البيت موس + البيرليت 1 : 1 : 1 ، أما نوفمبر 2007 أظهر المخلوط IBA 3000 ppm + NAA 2000 ppm أفضل نسبة تجذير.

وتوصى النتائج بتجهيز العقل نصف الخشبية فى شهر نوفمبر كأفضل شهر يلية شهرى أكتوبرو أغسطس ، وأفضل معاملة على الأطلاق كانت مخلوط IBA 3000 ppm + NAA 2000ppm و معاملة IBA 4000 ppm + التجريح IBA 5000 ppm .