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Propagation of Okinawa Peach Rootstock Using Semi Hard-Wood Cutting

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THE investigation was conducted during the two successive seasons (2011 & 2012) on semi hard-wood cuttings from 6 years old Okinawa peach rootstock trees grown in a private orchard at El-Monofia governorate. Cuttings were collected at ten dates each two weeks started from first October till mid February. Cuttings were dipped for 5 seconds in 1000 or 2000 ppm indole butric acid (IBA) in addition to untreated cuttings (control).

Results showed that timing of the IBA treatments of cuttings had significantly affected on roots number and length and number of leaves of Okinawa peach cuttings in both seasons. It was found that IBA dipping at 15-November recorded the highest values of root length followed in a descending order by cuttings dipping at 1-November, whereas, the lowest values were obtained from dipping of cuttings at 15-February in both seasons. As for the concentration of IBA, it was found that dipping of cuttings with 2000 ppm IBA significantly recorded the highest number and length of roots and number of leaves followed, in a descending order, by dipping of cuttings with 1000 ppm whereas, the lowest values were obtained from untreated cuttings in the both seasons. A significant interaction was observed between timing of the IBA dipping of cuttings and concentration of IBA, the results show that dipping of cuttings with 2000 ppm IBA at 15-November recorded the highest values of on number and length of roots and number of leaves, whereas, the lowest values were obtained from the control at 15-February in both seasons.

"Okinawa" peach rootstocks were found to be resistant to both *M. javonica* and *M. incognita* (Brooks & Olmo, 1961, Sharpe, 1964 and Malo, 1967).

Very few attempts have been made for rooting peaches by leverage. Peach mallet, heel and softwood cuttings give roots with low percentages except for softwood cuttings taken from juvenile plants (young seedlings). These methods require mist propagation system. On the other hand, semi-hardwood cuttings cn give roots with high percentages regardless of cultivar, but also require specific conditions such as mist and well drained media. The least expensive method of rooting peach cuttings is through the use of hardwood cuttings inserted "in place" in the field. A rooting hormone (IBA) is also required for the rooting of all peach cuttings. The IBA concentration required depends upon the type of cutting used (Couvillon, 1985). Also, Leakey and Coutts (1989) defined apical cuttings as softwood or semi-hardwood cuttings with developing apex and young leaves,

which may produce rooting promoters with few canopy which helps in intensive planting.

Moreover, propagation by cuttings is one of the common vegetative methods of reproduction by which great numbers of plant species, including, fruit trees are maintained. Most nurserymen depend, largely, upon cuttings for propagation, due to the relative simplicity of the operation, the low unit cost of production, and the ease with which plants will cooperate in re-establishing themselves, Therefore, this method of propagation is considered one of the good practical and economic importance. It has been known that time of collecting and planting cuttings, exogenous auxin treatment, wounding the base of the cutting, soil temperature and internal cutting factors are responsible for the differences in the ability of rooting of various plant species. The timing of cutting preparation in relation to plant maturity is a very important factor affecting the ability of cutting for rooting, with easily rooted varieties or rootstocks. However, timing is not a critical factor but since the difficulty of propagation increases, the exactness of the timing becomes more important. Many investigators stated the season of the year which was critical for successful propagation by cuttings in many plant species. Chauhan and Maheshwari (1970) found that the average rooting in November planting of sub-terminal peach cuttings treated with IBA at 1000 ppm was 40.05% compared with 20,9% and 12.89% in August and July respectively. Doud and Carlson (1972) obtained the highest rooting percentage of peach, apricot, cherry, pear and apple cuttings in the autumn and lowest in winter.

Couvillon and Erez (1980) pointed out that semi-hard wood cuttings of 13 peach CVS rooting was improved by treatments with IBA at 1500 - 3500 ppm and basal wounding. Also, Babeev *et al.* (1986) reported that treatment of sour cherry, peach and plum softwood cuttings with IBA solution improved rooting and subsequent development, especially at 20-30°C solution temperature, treatment at 15°C or 40°C dramatically reduced the rooting capacity. It is suggested that for each species and CVS suitable IBA concentrations should be determined depending on the physiological status of the shoot.

The aim of this study is to improve the rooting of semi hard-wood Okinawa peach cuttings by determination the best concentration of IBA and planting time under mist propagation system conditions.

Materials and Methods

The investigation was conducted during two successive seasons 2011 and 2012 on semi hard-wood cuttings from Okinawa peach rootstock. Mother trees were 6 years old grown in a fine sandy soil at Tanboal road a private orchard in El-Monofia governorate. Cuttings were collected at ten dates from first October till mid February every two weeks. Cuttings were 20-30 cm long with 0.6 - 0.5 cm in diameter, transported to the greenhouse for wounding and dipping in IBA concentrations. The cutting base was wounded by making 3 cm long incision

into both sides of the bark. Cuttings base were dipped for 5 sec. in 1000 or 2000 ppm Indole Butric Acid (IBA) at ten dates as following :

- Untreated cuttings (control) at first October
- Untreated cuttings (control) at mid October
- Untreated cuttings (control) at first November
- Untreated cuttings (control) at mid November
- Untreated cuttings (control) at first December
- Untreated cuttings (control) at mid December
- Untreated cuttings (control) at first January
- Untreated cuttings (control) at mid January
- Untreated cuttings (control) at first February
- Untreated cuttings (control) at mid February
- 1000 ppm of IBA at first October
- 1000 ppm of IBA at mid October
- 1000 ppm of IBA at first November
- 1000 ppm of IBA at mid November
- 1000 ppm of IBA at first December
- 1000 ppm of IBA at mid December
- 1000 ppm of IBA at first January
- 1000 ppm of IBA at mid January
- 1000 ppm of IBA at first February
- 1000 ppm of IBA at mid February
- 2000 ppm of IBA at first October
- 2000 ppm of IBA at mid October
- 2000 ppm of IBA at first November
- 2000 ppm of IBA at mid November
- 2000 ppm of IBA at first December
- 2000 ppm of IBA at mid December
- 2000 ppm of IBA at first January
- 2000 ppm of IBA at mid January
- 2000 ppm of IBA at first February
- 2000 ppm of IBA at mid February

The treated cuttings were planted in the shade house of the Horticultural Research Institute, Giza, Egypt. The cuttings inserted to a depth of 19 cm in black bags filled with sand and peat at 3:1 and kept on the 16°C bottom heated Shade house. The mist interval was 5 sec.* every 5 minutes. Thirty cuttings in three replicates were used for each treatment. The survival percentage, the average number, root length and number of leaves were calculated at the beginning of May of both seasons.

Statistical analysis

All obtained data were statistically analyzed according to Snedecor and Cochran (1990). L.S.D. at 5% test was used for comparison between means of the studied treatments.

Results and Discussion

Number of roots

Data in Tables 1 & 2 and Fig.1 revealed that timing of the IBA dipping of peach cuttings had significantly affected the number of roots in both seasons. The maximum values were recorded at 15-November followed in a descending order by dipping of cuttings at 1-November, while, the minimum values were obtained from dipping of cuttings at 15-February in both seasons.

As for IBA concentration, it was found that dipping of cuttings in 2000 ppm of IBA significantly recorded the highest number of roots followed, in a descending order, by dipping of cuttings with 1000 ppm whereas, the lowest values were obtained from untreated cuttings in the both seasons.

A significant interaction was observed between timing of the IBA dipping of cuttings and concentration of IBA, the results show that dipping of cuttings with 2000 ppm IBA at 15-November recorded the highest values of number of roots, whereas, the lowest values were obtained from control at 15-February in both seasons.

Length of roots

As shown in Tables 3 & 4 and Fig. 2, it is appeared that timing of the IBA treatments had significantly effect on length of roots in the both seasons. Dipping cutings at 15-November recorded the highest values of root length followed, in a descending order, by dipping of cuttings at 1-November, whereas, the lowest values were obtained when cuttings were dipped at 15-February in both seasons.

As for the IBA concentration, it was found that dipping of cuttings with 2000 ppm IBA significantly recorded the highest length of roots followed, in a descending order, by dipping of cuttings with 1000 ppm while, the lowest values were obtained from untreated cuttings in the both seasons.

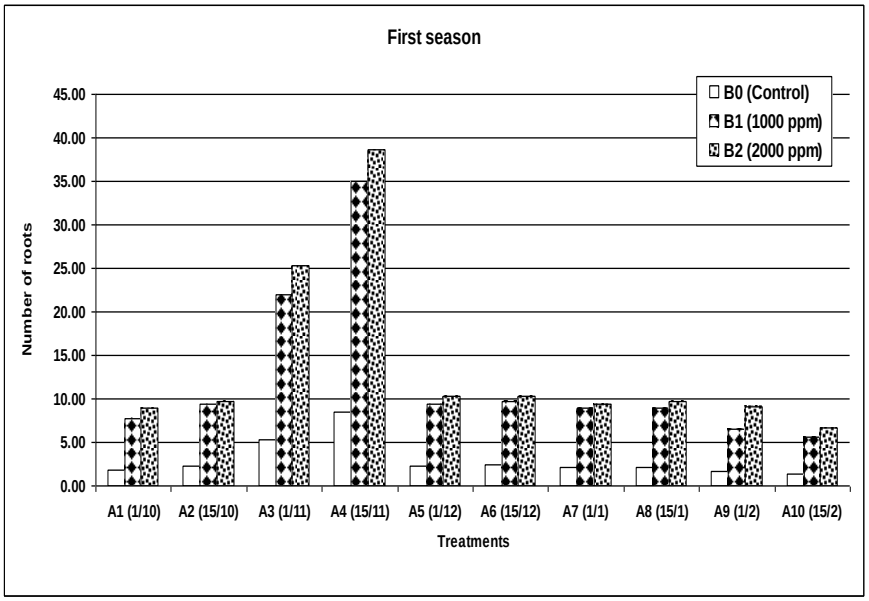
A significant interaction was observed between timing of the IBA dipping and concentration, the results show that dipping of cuttings in 2000 ppm IBA at 15-November recorded the highest values of roots length, whereas, the lowest values were obtained from untreated cuttings at 15-February in both seasons.

TABLE 1. Effect of different treatments on number of roots in the first season.

B / A	B0 (Control)	B1 (1000 ppm)	B2 (2000 ppm)	MEANS (A)
A1 (1/10)	1.87	7.67	9.00	5.56
A2 (15/10)	2.27	9.33	9.67	6.33
A3 (1/11)	5.36	22.00	25.33	15.78
A4 (15/11)	8.53	35.00	38.67	24.56
A5 (1/12)	2.27	9.33	10.33	6.56
A6 (15/12)	2.36	9.67	10.33	6.67
A7 (1/1)	2.19	9.00	9.33	6.11
A8 (15/1)	2.19	9.00	9.67	6.22
A9 (1/2)	1.60	6.56	9.11	5.22
A10 (15/2)	1.38	5.67	6.67	4.11
MEANS (B)	3.00	12.32	13.81	
LSD (A) =	3.13	A = Dates		
LSD (B) =	1.71	B = Concentration		
LSD (AXB) =	5.42			

TABLE 2. Effect of different treatments on number of roots in the second season.

B / A	B0 (Control)	B1 (1000 ppm)	B2 (2000 ppm)	MEANS (A)
A1 (1/10)	2.44	10.00	10.67	6.89
A2 (15/10)	2.27	9.33	12.67	7.33
A3 (1/11)	5.69	23.33	25.00	16.11
A4 (15/11)	6.90	28.33	31.33	19.89
A5 (1/12)	2.60	10.67	12.33	7.67
A6 (15/12)	2.76	11.33	13.67	8.33
A7 (1/1)	3.01	12.33	12.67	8.33
A8 (15/1)	3.66	15.00	12.00	9.00
A9 (1/2)	2.76	11.33	12.67	8.00
A10 (15/2)	2.36	9.67	10.00	6.56
MEANS (B)	3.44	14.13	15.30	
LSD (A) =	4.29	A = Dates		
LSD (B) =	2.35	B = Concentration		
LSD (AXB) =	7.43			



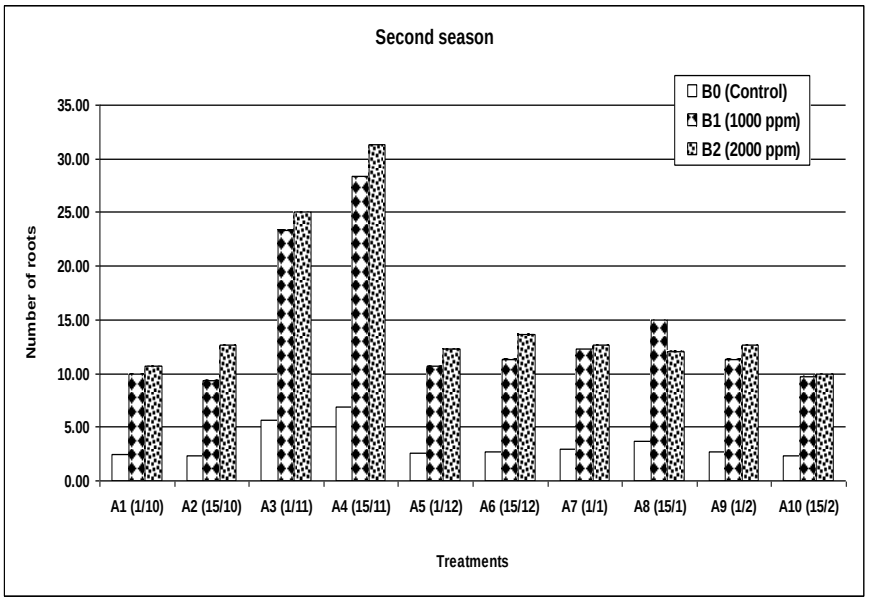


Fig. 1. Effect of different treatments on number of roots in the both season.

TABLE 3. Effect of different treatments on length of root in the first season.

B / A	B0 (Control)	B1 (1000 ppm)	B2 (2000 ppm)	MEANS (A)
A1 (1/10)	1.92	7.89	10.37	6.09
A2 (15/10)	2.24	9.19	13.04	7.41
A3 (1/11)	13.89	57.00	59.67	38.89
A4 (15/11)	16.08	66.00	69.33	45.11
A5 (1/12)	7.07	29.00	31.67	20.22
A6 (15/12)	6.90	28.33	29.67	19.33
A7 (1/1)	3.90	16.00	17.33	11.11
A8 (15/1)	4.79	19.67	21.00	13.56
A9 (1/2)	4.71	19.33	20.67	13.33
A10 (15/2)	1.95	8.00	9.33	5.78
MEANS (B)	6.35	26.04	28.21	
LSD (A) =	4.33	A = Dates		
LSD (B) =	2.37	B = Concentration		
LSD (AXB) =	7.50			

TABLE 4. Effect of different treatments on length of root in the second season.

B / A	B0 (Control)	B1 (1000 ppm)	B2 (2000 ppm)	MEANS (A)
A1 (1/10)	3.33	13.67	15.33	9.67
A2 (15/10)	4.95	20.33	22.67	14.33
A3 (1/11)	13.48	55.33	60.67	38.67
A4 (15/11)	15.35	63.00	72.33	45.11
A5 (1/12)	9.10	37.33	39.00	25.44
A6 (15/12)	8.21	33.67	34.00	22.56
A7 (1/1)	7.15	29.33	31.67	20.33
A8 (15/1)	6.17	25.33	28.67	18.00
A9 (1/2)	5.69	23.33	24.00	15.78
A10 (15/2)	2.84	11.66	13.67	8.44
MEANS (B)	7.63	31.30	34.20	
LSD (A) =	9.03	A = Dates		
LSD (B) =	4.95	B = Concentration		
LSD (AXB) =	15.64			

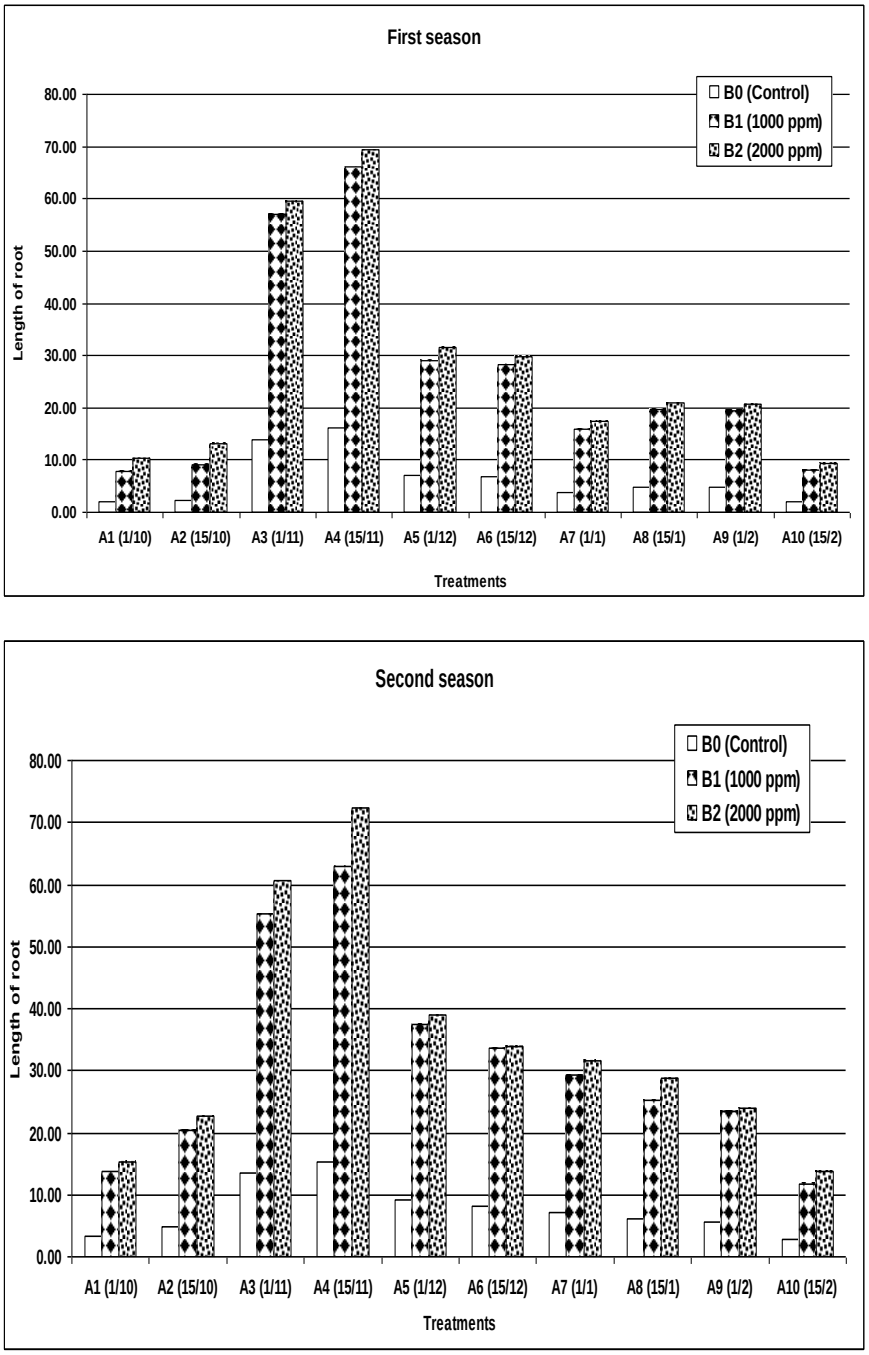


Fig. 2. Effect of different treatments on length of root in the both season.

Number of leaves

As shown in Tables 5 & 6 and Fig.3, it is obvious that timing of the IBA dipping of cuttings had significantly affected the leaves number of peach cuttings in both seasons. It was found that IBA dipping time at 15-November recorded the highest values of leaves number followed, in a descending order, by dipping of cuttings at 1-November, whereas, the lowest values were obtained when cuttings were dipped at 15-February in both seasons.

As for the IBA concentration, it was found that dipping of cuttings with 2000 ppm significantly recorded the highest number of leaves followed, in a descending order, by dipping of cuttings with 1000 ppm whereas, the lowest values were obtained from untreated cuttings in the both seasons.

A significant interaction was observed between timing of the IBA dipping and concentration of IBA, the results show that dipping of cuttings with 2000 ppm IBA at 15-November recorded the highest values of number of leaves, whereas, the lowest values were obtained from the control treatment at 15-February in both seasons.

The promotion effect of the different IBA concentrations on average number and length of roots and number of leaves of Okinawa semi hard-wood cuttings could be due that such treatments enhance the initiation, differentiation and development of root primordia and the elongation of the arising root cells. These results confirmed those reported by many workers since Couvillon and Erez (1980) pointed out that semi-hard wood cuttings of 13 peach CVS rooting was improved by treatments with IBA at 1500 - 3500 ppm and basal wounding. Also, Yu (1985) outlined that better rooting of soft wood peach cuttings required treatment with IBA.

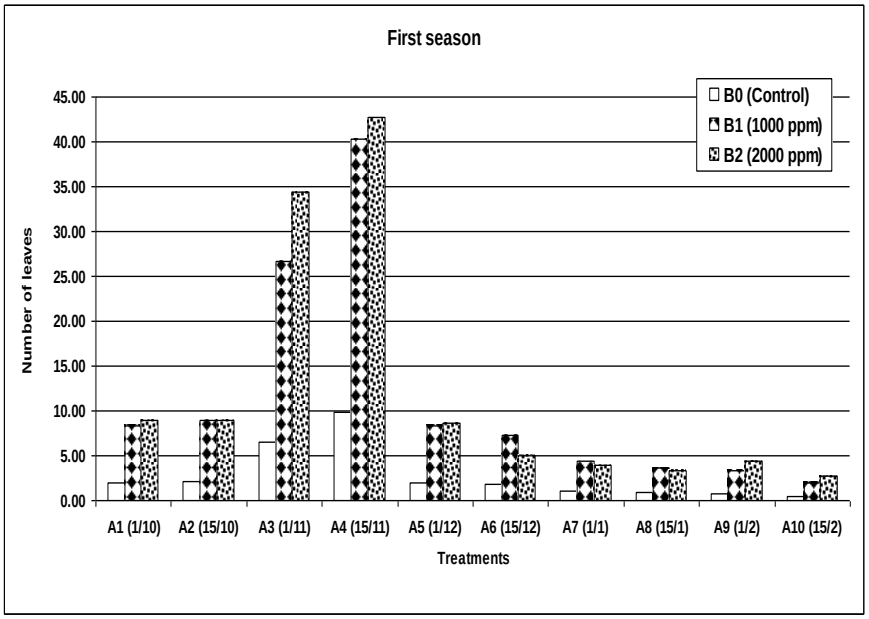
However, Babeev *et al.* (1986) stated that treatment of sour cherry peach cherry and plum soft-wood cuttings with IBA solution improved rooting and subsequent development, especially at 20 - 30°C solution. It is suggested that for cock species and CV suitable IBA concentrations should be determined depending on the physiological status of the shoot and its tissues, Similarly, Hartman, (1985) working with prune soft-wood cuttings demonstrated that when basal cuttings dipped in 4000 ppm of IBA, the cuttings rooted better (70% of the cuttings were rooted), earliest and resulted in the longest shoots.

TABLE 5. Effect of different treatments on number of leaves in the first season.

B / A	B0 (Control)	B1 (1000 ppm)	B2 (2000 ppm)	MEANS (A)
A1 (1/10)	2.03	8.33	9.00	5.78
A2 (15/10)	2.19	9.00	9.00	6.00
A3 (1/11)	6.50	26.67	34.33	20.33
A4 (15/11)	9.83	40.33	42.67	27.67
A5 (1/12)	2.03	8.33	8.67	5.67
A6 (15/12)	1.79	7.33	5.00	4.11
A7 (1/1)	1.06	4.33	4.00	2.78
A8 (15/1)	0.89	3.67	3.33	2.33
A9 (1/2)	0.81	3.33	4.33	2.56
A10 (15/2)	0.49	2.00	2.67	1.56
MEANS (B)	2.76	11.33	12.30	
LSD (A) =	5.76	A = Dates		
LSD (B) =	3.16	B = Concentration		
LSD (AXB) =	9.98			

TABLE 6. Effect of different treatments on number of leaves in the second season.

B / A	B0 (Control)	B1 (1000 ppm)	B2 (2000 ppm)	MEANS (A)
A1 (1/10)	1.71	7.00	7.67	4.89
A2 (15/10)	2.03	8.33	7.67	5.33
A3 (1/11)	6.17	25.33	33.33	19.56
A4 (15/11)	9.50	39.00	41.33	26.78
A5 (1/12)	1.71	7.00	8.67	5.22
A6 (15/12)	1.79	7.33	7.67	5.00
A7 (1/1)	0.57	2.33	3.67	2.00
A8 (15/1)	0.57	2.33	3.33	1.89
A9 (1/2)	0.65	2.67	3.33	2.00
A10 (15/2)	0.32	1.33	2.00	1.11
MEANS (B)	2.50	10.27	11.87	
LSD (A) =	5.25	A = Dates		
LSD (B) =	2.88	B = Concentration		
LSD (AXB) =	9.10			



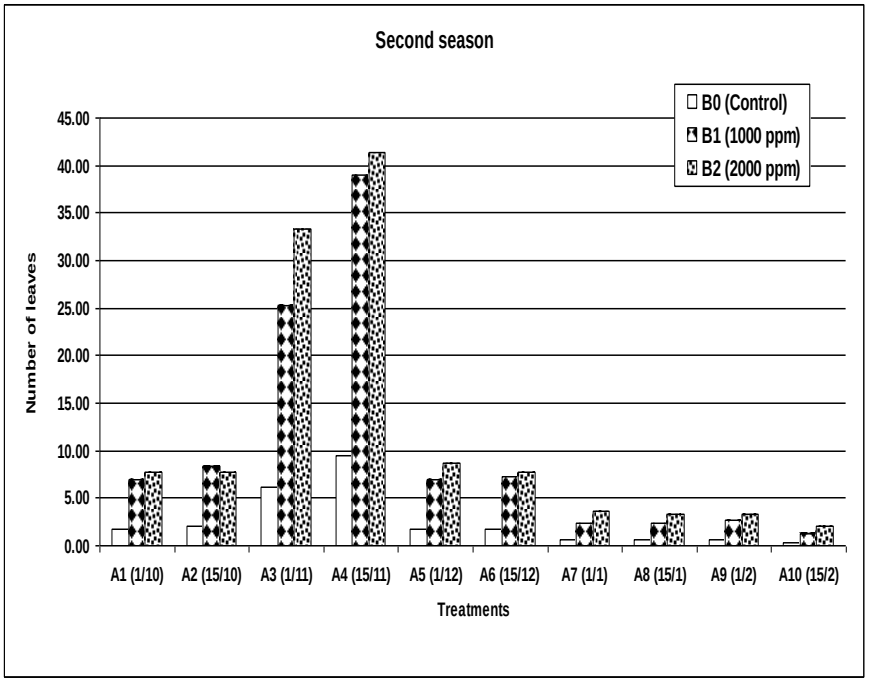


Fig. 3. Effect of different treatments on number of leaves in the both season.

The variability of semi hard-wood cuttings response to exogenous IBA concentrations at different dates (from mid October to mid December) quite possibly could be due to the physiological status of the mother rootstock trees and the maturation of its tissues. Moreover, the internal rooting promoters and rooting inhibitors for peach rootstock mother tree differ also during the season. So, there *i.e.* an exact time for cutting collection at which treating it by the exogenous auxin at the suitable concentration maximizes its rooting ability-response.

The highest rooting ability of Okinawa cuttings collected at early November confirm those reported by many workers since Chauhan and Maheshwari (1970) stated that the average of rooting in November plantation of sub—terminal peach cuttings treated with IBA at 1000 ppm was 40.65 % compared with 20.94 % and 12.89 % in August and July, respectively. Similarly, Doud and Carlson (1972) outlined that the highest rooting percentage of peach, apricot, cherry, pear and apple cuttings was in autumn and the lowest was in winter. Moreover, Fayek and Sweidan (1982) found that the best time for collecting hard-wood plum cuttings was mid November. Similarly, Yehia *et al.* (1982) stated that root ability of Hollywood hard wood cuttings was at its maximum when prepared in early November after that the percentage of rooted cuttings decreased gradually and reached its lowest value in the cuttings collected in mid February. Also, El-Banna *et al.* (1993) showed that the highest rooting ability percentage of Nemaguard hardwood cuttings induced by those treated by IBA at 1000 ppm combined with IBA at 2000 ppm followed by those treated with IBA at 2000 ppm and IBA at 1000 ppm. The maximum rooting percentage, root number and root length was induced by semi hard wood cutting prepared at mid November followed by those collected at early November respectively.

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الإكثار بالعقلة النصف خشبية لأصل خوخ الأوكيناوا

وسام أحمد نبيل
معهد بحوث البســاتين – مركز البحوث الزراعية – القاهرة – مصر.

تم اجراء البحث خلال موسمى ٢٠١١ و٢٠١٢ على العقل النصف الخشبية لأصل خوخ الأوكيناوا عمر ٦ سنوات نامى فى مزرعة خاصة تابعة لمحافظة المنوفية. حيث تم جمع العقل فى ١٠ مواعيد على فترات كل أسبوعين إبتداء من أول أكتوبر حتى منتصف فبراير، تم غمس قواعد العقل لمدة ٥ ثوانى فى محلول اندول بيوتريك أسيد بتركيزى ١٠٠٠ أو ٢٠٠٠ جزء فى المليون بالاضافة إلى زراعة العقل الغير معاملة (الكنترول).

وقد أشارت النتائج إلى أن توقيت زراعة العقل أثرت بشكل كبير فى عدد وطول الجذور بالاضافة إلى عدد الأوراق حيث لوحظ أن العقل المنزرعة فى منتصف نوفمبر سجلت أعلى القيم يليها العقل المنزرعة فى بداية نوفمبر بينما العقل المنزرعة فى منتصف فبراير سجلت أقل القيم فى كلا الموسمين، أما بالنسبة لنقع العقل فى اندول بيوتريك أسيد فقد لوحظ أن التركيز العالى من اندول بيوتريك أسيد (٢٠٠٠ جزء فى المليون) سجلت أعلى القيم فى عدد وطول الجذور بالاضافة إلى عدد الأوراق يليها نقع العقل فى تركيز منخفض (١٠٠٠ جزء فى المليون) بينما سجلت زراعة العقل الغير معاملة (الكنترول) أقل القيم فى كلا الموسمين، أما بالنسبة فيما يتعلق بتأثير نقع العقل فى اندول بيوتريك أسيد فى مواعيد مختلفة فقد لوحظ أن نقع العقل فى تركيز مرتفع من الاندول بيوتريك أسيد (٢٠٠٠ جزء فى المليون) فى منتصف نوفمبر سجلت أعلى القيم فى عدد وطول الجذور بالاضافة إلى عدد الأوراق بينما زراعة العقل الغير معاملة (الكنترول) فى منتصف فبراير سجلت أقل القيم فى كلا الموسمين.