J. Agric. Sci. Mansoura Univ., 34 (4): 3469 - 3481, 2009

OPTIMIZING DATE PALM AERIAL OFFSHOOTS AVAIL THROUGH VEGETATIVE PROPAGATION

El-Kosary, S.
Pomology Department, Fac. of Agric., Cairo Univ.,Giza, Egypt.

ABSTRACT

Date palm (*Phoenix dactylifera* L.) trees are essential components of farming systems in dry and semi arid regions and can be produced equally well in small farm units as large scale commercial plantation units. So, palm tree is an excellent candidate for cultivation in Egyptian Agricultural Project in new reclamation regions, i.e. Toshkay and Shark El-Aoinate. Date palm multiplication by transplanting offshoots still remains the best and most common method. Thus, this experiment was carried out to evaluate the rooting possibility and optimizing aerial offshoots avail through vegetative propagation by plant growth regulators injection. In this research, aerial offshoots of Samany and Zaghloul date palm cultivars weighing 7-9 kg were planted in two dates, mid of March and September in each season (2004 and 2005) at nursery of Pomology Dept., Fac. Agric. Cairo Univ. All aerial offshoots were treated by 7 injection treatments, before planting, by 5 ml auxin solution as follows: 1) distilled water (control), 2) 500 ppm IBA, 3) 1000 ppm IBA, 4) 1500 ppm IBA, 5) 500 ppm NAA, 6) 1000 ppm and NAA 7) 1500 NAA. Samany cultivar increased significantly roots number/aerial offshoot than Zaghloul cultivar. Whereas, the reverse was true concerning root length. Plantation at mid of March was better than that of mid September for all recorded parameters of aerial offshoots. Using auxin injection in the aerial offshoots bases significantly increased rooting percentage and means of roots number, length, diameter and length of developed leaves. Moreover, aerial offshoots injected by IBA at 1000 ppm or NAA at 1000 or 1500 ppm and planted in mid of March were the preferable for rooting percentages of Samany and Zaghloul cultivars and means of roots number, length, diameter and length of developed leaves.

Keywords: Aerial offshoots, Cultivar, Date palm, growth regulators, IBA, Injection, NAA, *Phoenix dactylifera*, Rooting, Samany, Zaghloul.

INTRODUCTION

Date palm, *Phoenix dactylifera* L., is one of the oldest fruit trees in the world and is mentioned in Quraan and Bible. Date palm trees are essential components of farming systems in dry and semi arid regions which well produce in small farm units or as larger scale commercial plantation units. Also, the importance of palm tree lies in its high tolerance to environmental stresses ranging from high temperature, salinity and drought. So, palm tree is an excellent candidate for cultivation in Egyptian Agricultural Project in new reclamation regions, i.e. Toshkay and Shark El-Aoinate. The tremendous advantage of palm tree is its requirement for limited inputs, long term productivity and multiple purposes attributes. Date palms are vegetative propagated by offshoots which arise from lateral buds as young offshoots, varying in size and morphology (Bougeudoura, 1983). Unfortunately reliable quantities of offshoots can not always be obtained whenever needed for large scale plantation. The production of offshoots by some date palm cultivars is in frequent or erratic (Toutain & Rhiss, 1973 and Katyal & Dutta, 1976). The

potential for offshoot production also decreases with parent age. Other problems associated with this standard propagation technique are the low percentage of successful establishment of transplanted offshoots and the high portion of unsuitable offshoots that are damaged during detachment. The failure of offshoots to rooted has been mostly attributed to offshoot characteristics, such as weight, size, age, height, cultivar, removal time and method from parent palm and pre and post cultural treatments (Nixon & Carpenter, 1978; Bouguedoura, 1983; Al-Ghamdi, 1988; Saidi *et al*., 1993; Rizk & Omima, 2003 and Hodel & Pittenger, 2003 a & b). Areial offshoots of date palm did not develop roots. Therefore, they are usually discarded and rarely used for propagation (Reuveni *et al*., 1972 and Vij *et al*., 1977). Rooting capacity however are correlated with greater quantities of endogenous substances promoters or smaller quantities of rooting inhibitors, which are correlated with offshoot age and weight (Reuveni & Adato, 1974; Dowson & Pansiot, 1985; Al-Ghamdi, 1988; El-Hammady *et al*., 1992; Lavee *et al*., 1994; Gaspar *et al*., 1997 and Qaddoury &Amssa, 2003). Mohammed *et al*. (1993) and Dawoud (2001) reported that mid January to mid July were the best months for producing the highest percentage of offshoot rooting and it may be differed according to the cultivars. Many researchers tried dipping offshoots bases in auxin (IAA, IBA, NAA) solution to increase their rooting ability (Reuveni *et al*., 1972; Gupta & Godara, 1984; Atalla & Sonbal, 1993; Saidi *et al*., 1993; Al-Mana *et al*., 1996; Gaspar *et al*., 1997; Sourour, 2001; Qaddoury & Amssa, 2003 & 2004; Al-Obeed, 2005; Rizk, 2006 and El-Deeb *et al*., 2008). El-Hodairi *et al*. (1992) found that injected bases of date palm offshoots with NAA gave the best rooting response (number, length and dry weight of roots).

The main objective of the present study is to evaluate the effect of growth regulators injection on promotion adventitious roots of Samany and Zaghloul date palm aerial offshoots and optimizing the aerial offshoots avail in propagation date palm.

MATERIALS AND METHODS

This study was carried out during two successive seasons (2004 and 2005) in greenhouse at nursery of Pomology, Pomology Department, Faculty of Agriculture, Cairo University, Giza, Egypt. Samany and Zaghloul date palm aerial offshoots weighing 7-9 kg were used in this experiment. All aerial offshoots were separated, from about 15-17 year's old mother palms, during the 2nd week of March and September in the two seasons of study. Mother palm grown in the Experimental Research Station, Faculty of Agriculture, Cairo University, Giza, and received the normal agriculture practice. After aerial offshoots' separation, they were cleaned by removing the old leaf bases and the fibers surrounding the stem. Samany and Zaghloul date palm aerial offshoots were trimmed to 60 cm (distance from the base at its widest point to the cutted tip). Then, aerial offshoots bases were surface sterilized by soaking in 10% of Clorox (commercial solution of sodium hypochlorite 5.25 % active ingredient) containing 2 drops of Tween-20 for 10 minutes. After that,

the cut surface of aerial offshoots was rinsed by tab water three times and covered with bitumen. Aerial offshoots bases of each Samany and Zaghloul date palm cultivars were exposed to auxin injection treatments using 5 ml/aerial offshoot as follows: 1) distilled water (control treatment), 2) 500 ppm IBA, 3) 1000 ppm IBA, 4) 1500 ppm IBA, 5) 500 ppm NAA, 6) 1000 ppm NAA and 7) 1500 ppm NAA. Each of the above treatments was consisted of three replicates with 5 aerial offshoots in each replicate. The aerial offshoots were planted in plastic bags (50X50 cm) filled with a mixture of peat moos : vermiculite : sand (1:1:1, v/v/v).

An inverted mist irrigation system provided water for the aerial offshoots was used. So, only the bases of the aerial offshoots were sprinkled with water automatically for five minutes every hour (El-Hammady *et al*., 1992). The bases of the aerial offshoots were regularly examined. When any sign of infection was visible, it was directly treated with the suitable fungicide.

After 12 months of planting, the following data were recorded: rooting percentage (%), means of roots number, root length (cm), root diameter (cm) and length of developed leaves (cm).

Statistical analysis: The obtained data were subjected to analysis of variance. Three replicates were employed in each treatment, each replicate contained 5 aerial offshoots. The mean values were compared using LSD method at 5 % level using MSTATC (1987) software package. The data were tabulated and statistically factorial analyzed according to the randomized complete block design method (Snedecor & Cochran, 1989) with three factors (A: cultivar, B: planting date: C: injection treatment). The percentages were transformed to the arcsine to find the binomial percentages according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Rooting percentage (%):

Tables 1 and 2 exhibit that no significant differences were recorded in rooting percentage as affected by cultivar, planting date or the interaction between them in both seasons. Whereas, injection treatment of auxin and interactions between auxin treatments with cultivars or with planting date or with both of them had significantly effect on rooting percentage of Samany or Zaghloul aerial offshoots in both seasons. Whatever, Samany date palm aerial offshoots produced rooting percentages (74.76% in the 1st and 75.24% in the 2nd seasons) lower than that produced by Zaghloul date palm aerial offshoots (76.67% in both seasons). Also, aerial offshoots planted in March produced rooting percentage (76.19 and 77.62%) better than that planted in September (75.24 and 74.29%) in the first and second seasons, respectively.

Hundred percent of rooted Samany or Zaghloul date palm aerial offshoots resulted by injection 1000 ppm IBA or NAA or 1500 ppm NAA in both seasons. The same rooting percentage was also reported from the interaction between auxin injection (1000 ppm IBA or NAA or 1500 ppm NAA) at different planting dates (March or September) of the studied cultivars in both seasons.

Table 1: Effect of cultivar, planting date, auxin and interaction between them on rooting percentage of date palm aerial offshoots during 2004 season (data recorded at 12 months from planting).

Auxin (ppm)	Planting date (2004 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh. cv.				
1) 0.0 (cont.)	26.67	26.67	26.67	33.33	26.67	30.00	30.00	26.67	28.33
2) 500 IBA	53.33	60.00	56.67	53.33	46.67	50.00	53.33	53.33	53.33
3)1000 IBA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
4)1500 IBA	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33
5)500 NAA	46.67	66.67	56.67	46.67	60.00	53.33	46.67	63.33	55.00
6)1000 NAA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
7)1500 NAA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	74.29	78.10	76.19	75.24	75.24	75.24	74.76	76.67	-

LSD at 5 % level for: Cultivar (A) = N.S. Planting date (B) = N.S.
A X B = N.S. Auxin (C) = 6.70 A X C = 9.47
B X C = 9.47 A X B X C = 13.40 (Sam. = Samany, Zagh. = Zaghloul)

Table 2: Effect of cultivar, planting date, auxin and interaction between them on rooting percentage of date palm aerial offshoots during 2005 season (data recorded at 12 month from planting).

Auxin (ppm)	Planting date (2005 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh. cv.				
1) 0.0 (cont.)	33.33	26.67	30.00	20.00	26.67	23.33	26.67	26.67	26.67
2) 500 IBA	46.67	60.00	53.33	53.33	53.33	53.33	50.00	56.67	53.33
3)1000 IBA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
4)1500 IBA	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33	93.33
5) 500 NAA	66.67	66.67	66.67	46.67	53.33	50.00	56.67	60.00	58.33
6)1000 NAA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
7)1500 NAA	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	77.14	78.10	77.62	73.33	75.24	74.29	75.24	76.67	-

LSD at 5 % level for: Cultivar (A) = N.S. Planting date (B) = N.S.
A X B = N.S. Auxin (C) = 6.42 A X C = 9.08
B X C = 9.08 A X B X C = 12.84 (Sam. = Samany, Zagh. = Zaghloul)

The interaction between the three factors under study (cultivar, planting date and treatments of auxin injection) cleared that percentage 100 % was recorded with Samany and Zaghloul aerial offshoots planted in March or September when treated by 1000 ppm IBA or NAA or by 1500 ppm NAA in both seasons.

Means of roots number:

Roots numbers per Samany and Zaghloul aerial offshoots were affected significantly by cultivar, planting date and injection treatments as well as the interactions between them in the two seasons (Tables 3 and 4). Samany aerial offshoots produced higher roots number higher that produced from Zaghloul aerial offshoots in the two seasons. Also, aerial offshoots planted in March raised the means number of roots per aerial offshoot comparing with that planted in September in both seasons.

No significant differences were recorded between treatments of auxin injection by 1500 ppm of either IBA or NAA. They raised root production comparing other treatments. In the second season, the results in this respect were obviously found but with injection by 1000 or 1500 ppm NAA.

The interaction between cultivars and planting date revealed that Samany or Zaghloul aerial offshoots planted in March produced mean number of roots higher than that planted in September. Also, the interaction between cultivar and auxin injection treatment cleared that highest root number per aerial offshoot of either Samany or Zaghloul was obtained by treatment no 7 (1500 ppm NAA) in the first season and treatment number 6 (1000 ppm NAA) in the second season.

Table 3: Effect of cultivar, planting date, auxin and interaction between them on mean roots number per Samany and Zaghloul aerial offshoots during 2004 season (data recorded at 12 months from planting).

Auxin (ppm)	Planting date (2004 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh. cv.				
1) 0.0 (cont.)	15.33	15.00	15.17	14.97	14.30	14.63	15.15	14.65	14.90
2) 500 IBA	31.97	33.80	32.88	31.97	29.97	30.97	31.97	31.89	31.93
3)1000 IBA	53.40	55.63	54.51	54.83	50.70	52.17	54.11	53.17	53.64
4)1500 IBA	64.37	62.40	63.38	62.57	58.83	60.70	63.47	60.62	62.04
5)500 NAA	31.47	30.57	36.02	31.23	30.60	30.92	31.35	30.59	30.97
6)1000 NAA	61.57	61.10	61.33	59.10	61.00	60.05	60.33	61.05	60.69
7)1500 NAA	66.77	61.77	64.27	60.53	62.30	61.41	63.65	62.04	62.84
Mean	46.41	45.75	46.08	45.03	43.96	44.49	45.72	44.86	-

LSD at 5 % level for: Cultivar (A) = 0.65 Planting date (B) = 0.65
A X B = 0.92 Auxin (C) = 1.21 A X C = 1.72
B X C = 1.72 A X B X C = 2.43 (Sam. = Samany, Zagh. = Zaghloul)

Table 4: Effect of cultivar, planting date, auxin and interaction between them on mean roots number per Samany and Zaghloul aerial offshoots during 2005 season (data recorded at 12 month from planting).

Auxin (ppm)	Planting date (2005 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh.cv.				
1) 0.0 (cont.)	16.43	14.93	15.68	16.27	15.77	16.02	16.35	15.35	15.85
2) 500 IBA	44.53	45.27	44.90	43.10	44.30	43.70	43.82	44.78	44.30
3)1000 IBA	62.00	62.17	62.08	62.53	61.60	62.07	62.27	61.88	62.08
4)1500 IBA	63.23	61.47	62.35	64.20	61.60	62.90	63.72	61.53	62.63
5)500 NAA	36.00	35.70	35.85	32.27	32.53	32.40	34.13	34.12	34.13
6)1000 NAA	69.33	64.57	66.95	63.13	61.47	62.30	66.23	63.02	64.63
7)1500 NAA	66.70	64.00	65.35	64.80	60.67	62.73	65.75	62.33	64.04
Mean	22.17	49.73	50.45	49.47	48.28	48.87	50.32	49.00	-

LSD at 5 % level for: Cultivar (A) = 0.51 Planting date (B) = 0.51
A X B = 0.72 Auxin (C) = 0.96 A X C = 1.36
B X C = 1.36 A X B X C = 1.93 (Sam. = Samany, Zagh. = Zaghloul)

Regarding the interaction between cultivar, planting date and treatment injection, Samany aerial offshoots planted in March and injected by 1500 ppm NAA in the first season or by 1000 ppm NAA in the second season produced the highest mean of roots per aerial offshoot comparing with other interactions. Whoever, there is no significant differences were detected between injection by 1000 or 1500 ppm of IBA or NAA in their promotion of root production in the second season.

Root length (cm):

Mean root length of Samany and Zaghloul aerial offshoots significantly affected by cultivar, planting date, auxin and the interactions between them in the two seasons (Tables, 5 and 6). Zaghloul aerial offshoots produced higher root length than Samany aerial offshoots in the first and second seasons. Moreover, planting in March increased aerial offshoots root length comparing with planting in September in the two seasons. Also, auxin treatment injection number 7 (1500 ppm NAA) produced the highest aerial offshoots root length comparing with other treatments during both seasons.

Table 5: Effect of cultivar, planting date, auxin and interaction between them on mean root length (cm) of date palm aerial offshoots during 2004 season (data recorded at 12 months from planting).

Auxin (ppm)	Planting date (2004 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh.cv.				
1) 0.0 (cont.)	36.15	35.59	35.87	29.99	30.22	30.11	33.07	32.90	32.99
2) 500 IBA	44.13	51.21	47.67	38.50	41.44	39.97	41.31	46.33	43.82
3)1000 IBA	77.11	79.83	78.47	60.90	65.31	63.11	69.01	72.57	70.79
4)1500 IBA	78.57	76.83	77.70	67.49	69.12	68.31	73.03	72.97	73.00
5)500 NAA	51.27	54.92	53.09	48.25	46.70	47.47	49.76	50.81	50.28
6)1000 NAA	87.80	88.35	88.07	71.70	73.33	72.51	79.75	80.84	80.29
7)1500 NAA	90.94	91.23	91.08	80.35	79.98	80.17	85.64	85.61	85.62
Mean	66.57	68.28	67.42	56.74	58.01	57.38	61.65	63.15	-

LSD at 5 % level for: Cultivar (A) = 0.54 Planting date (B) = 0.54
A X B = 0.76 Auxin (C) = 1.01 A X C = 1.43
B X C = 1.43 A X B X C = 2.03 (Sam. = Samany, Zagh. = Zaghloul)

Table 6: Effect of cultivar, planting date, auxin and interaction between them on mean root length (cm) of date palm aerial offshoots during 2005 season (data recorded at 12 month from planting).

Auxin (ppm)	Planting date (2005 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh. cv.				
1) 0.0 (cont.)	36.00	34.37	35.18	34.50	35.32	34.91	35.25	34.84	35.05
2) 500 IBA	51.33	55.28	53.30	50.29	53.15	51.72	50.81	54.21	52.51
3)1000 IBA	81.22	88.48	84.85	70.43	77.51	73.97	75.83	82.99	79.41
4)1500 IBA	92.12	89.89	91.00	82.37	84.22	83.30	87.24	87.06	87.15
5)500 NAA	61.96	63.45	62.70	64.15	64.16	64.15	63.05	63.80	63.43
6)1000 NAA	98.26	99.80	99.03	86.90	85.63	86.27	92.58	92.72	92.65
7)1500 NAA	102.97	102.78	102.87	95.36	95.38	95.37	99.17	99.08	99.12
Mean	74.84	76.29	75.56	69.14	70.77	69.95	71.99	73.53	-

LSD at 5 % level for: Cultivar (A) = 0.55 Planting date (B) = 0.55
A X B = 0.78 Auxin (C) = 1.04 A X C = 1.47
B X C = 1.47 A X B X C = 2.08 (Sam. = Samany, Zagh. = Zaghloul)

The interaction between cultivar and planting date revealed that Zaghloul aerial offshoots produced the highest root length when planted in March comparing with other interactions in the two seasons. Moreover, the highest root length was measured from the interaction between Samany aerial offshoots that injected by 1500 ppm NAA (treatment No. 7) comparing with other interactions in both seasons. Also, the interaction between planting date and injection treatments demonstrated that highest root length was obtained from aerial offshoots planted in March and injected by 1500 ppm NAA (treatment No. 7) comparing with other interactions in the two seasons.

Either Samany or Zaghloul aerial offshoots produced the highest root length when they were planted in March and injected by 1500 ppm NAA comparing with other interactions in the two seasons. Whatever, NAA treatments had the dominant effect to increase root length comparing with IBA treatments during study.

Root diameter (cm):

Tables 7 and 8 show that means of aerial offshoots root diameter were affected significantly by cultivar, planting date, auxin and the interactions between them in both seasons except the effect of cultivar, planting date and interaction between them in the first season only. Samany aerial offshoots gave the higher root diameter than Zaghloul aerial offshoots in both seasons. Also, aerial offshoots planted in March produced higher root diameter than that planted in September during the two seasons. In addition, auxin treatment No. 7 (1500 ppm NAA) recorded the highest root diameter comparing with other treatments in the two seasons.

The interaction between cultivar and planting date exhibited that the highest mean of aerial offshoot root diameter was obtained form interaction between Samany cultivar with March planting date during the two seasons. Also, the highest aerial offshoot root diameter was recoded with Samany cultivar when treated by NAA (1000 ppm) in the first season or 1500 ppm NAA in the second season comparing with other interaction in this respect. In addition, the highest root diameter was observed with aerial offshoots injected by 1500 ppm NAA (treatment No. 7) that planted in September in the first season or that planted in March in the second season comparing with other interactions in this respect.

Concerning the interaction between cultivar, planting date and auxin, it was clearly noticed that highest mean of aerial offshoots root diameter (1.06 cm) was recorded with Samany cultivar that planted in September and injected by 1000 ppm NAA (treatment No. 6) comparing with other interactions in the first season. While in the second season, the highest value in this respect (1.17 cm) was recoded with Samany aerial offshoots planted in March and injected by 1500 ppm NAA (Treatment No. 7) comparing with other interactions.

Table 7: Effect of cultivar, planting date, auxin and interaction between them on mean root diameter (cm) of date palm aerial offshoots during 2004 season (data recorded at 12 months from planting).

Auxin (ppm)	Planting date (2004 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh.cv.				
1) 0.0 (cont.)	0.53	0.52	0.52	0.55	0.55	0.55	0.54	0.54	0.54
2) 500 IBA	0.57	0.54	0.55	0.62	0.57	0.60	0.60	0.56	0.57
3)1000 IBA	1.00	0.86	0.93	0.76	0.78	0.77	0.88	0.82	0.85
4)1500 IBA	0.97	0.96	0.96	0.87	0.88	0.88	0.92	0.92	0.92
5)500 NAA	0.82	0.74	0.78	0.92	0.92	0.92	0.87	0.83	0.85
6)1000 NAA	1.01	1.01	1.01	1.06	0.96	1.01	1.04	0.98	1.01
7)1500 NAA	1.04	1.03	1.03	1.03	1.05	1.04	1.03	1.04	1.04
Mean	0.85	0.81	0.83	0.83	0.82	0.82	0.84	0.81	-

LSD at 5 % level for: Cultivars (A) = N.S. Planting date (B) = N.S.
A X B = N.S. Auxin (C) = 0.06 A X C = 0.08
B X C = 0.08 A X B X C = 0.12 (Sam. = Samany, Zagh. = Zaghloul)

Table 8: Effect of cultivar, planting date, auxin and interaction between them on mean root diameter (cm) of date palm aerial offshoots during 2005 season (data recorded at 12 month from planting).

Auxin (ppm)	Planting date (2005 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh. cv.				
1) 0.0 (cont.)	0.57	0.54	0.56	0.54	0.58	0.56	0.56	0.56	0.56
2) 500 IBA	0.64	0.58	0.61	0.65	0.55	0.60	0.65	0.57	0.61
3)1000 IBA	0.93	0.78	0.86	0.86	0.85	0.86	0.90	0.82	0.86
4)1500 IBA	1.02	0.99	1.01	0.89	0.85	0.87	0.96	0.92	0.94
5)500 NAA	0.81	0.73	0.77	0.64	0.66	0.65	0.72	0.69	0.71
6)1000 NAA	0.99	0.96	0.98	0.99	0.92	0.96	0.99	0.94	0.97
7)1500 NAA	1.17	1.03	1.10	1.00	1.00	1.00	1.09	1.01	1.05
Mean	0.88	0.80	0.84	0.80	0.77	0.79	0.84	0.79	-

LSD at 5 % level for: Cultivars (A) = 0.02 Planting date (B) = 0.02
A X B = 0.03 Auxin (C) = 0.05 A X C = 0.07
B X C = 0.07 A X B X C = 0.10 (Sam. = Samany, Zagh. = Zaghloul)

Length of developed leaves (cm):

Tables 9 and 10 clear that mean length of developed leaves did not differ significantly affected by cultivars in both seasons. The same result was also noticed due to the effect of planting date and interaction between cultivar and planting date in the first season only. Whatever, planting aerial offshoots in March increased the mean length of developed leaves per aerial offshoot comparing with that planted in September in both seasons. Also, injected NAA at 1000 or 1500 ppm in the first season or by 1500 ppm in the second season increased significantly the length of developed leaves comparing with other auxin injections.

The interaction between cultivar and planting date revealed that Samany aerial offshoots planted in March raised the new elongation of leaves comparing with other interactions in the two seasons. Also, Samany aerial offshoots injected by 1500 ppm NAA produced the longest new growth of

leaves comparing with other interactions in the two seasons. Moreover aerial offshoots planted in March and injected by 1000 ppm NAA in the first season or injected by 1500 ppm NAA in the second season produced the highest length of developed leaves comparing with other interaction in this regard.

Table 9: Effect of cultivar, planting date, auxin and interaction between them on mean length (cm) of developed aerial offshoots leaves during 2004 season (data recorded at 12 months from planting).

Auxin (ppm)	Planting date (2004 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam	Zagh.	
	Sam.cv	Zagh. cv.		Sam.cv	Zagh. cv.				
1) 0.0 (cont.)	30.92	38.89	34.90	32.59	40.80	36.69	31.75	39.85	35.80
2) 500 IBA	71.13	71.75	71.44	69.29	99.33	84.31	70.21	85.54	77.88
3)1000 IBA	94.78	97.33	96.06	101.59	98.27	99.93	98.18	97.80	97.99
4)1500 IBA	104.17	99.26	101.71	96.44	73.63	85.03	100.00	86.44	93.37
5)500 NAA	68.59	64.79	66.69	69.13	59.56	64.34	68.86	62.17	65.52
6)1000 NAA	106.74	106.33	106.54	103.60	102.64	103.12	105.17	104.49	104.83
7)1500 NAA	109.66	99.29	104.47	102.82	100.26	101.54	106.24	99.77	103.01
Mean	83.71	82.52	83.12	82.21	82.07	82.14	82.96	82.30	-

LSD at 5 % level for: Cultivar (A) = N.S. Planting date (B) = N.S.
A X B = N.S. Auxin (C) = 2.70 A X C = 3.81
B X C = 3.81 A X B X C = 5.40 (Sam. = Samany, Zagh. = Zaghloul)

Table 10: Effect of cultivar, planting date, auxin and interaction between them on mean length (cm) of developed aerial offshoots leaves during 2005 season (data recorded at 12 months from planting).

Auxin (ppm)	Planting date (2005 season)						Cultivar		Mean
	March		Mean	September		Mean	Sam.	Zagh.	
	Sam.cv.	Zagh. cv.		Sam.cv.	Zagh. cv.				
1) 0.0 (cont.)	36.78	49.54	43.16	36.71	40.81	38.76	36.74	45.17	40.96
2) 500 IBA	65.71	65.50	65.60	71.72	76.88	74.30	68.72	71.19	69.95
3)1000 IBA	95.74	86.62	91.18	95.97	95.57	95.77	95.85	91.10	93.47
4)1500 IBA	110.70	97.29	103.99	94.70	92.22	93.46	102.70	94.75	98.73
5)500 NAA	78.73	80.82	79.78	69.25	68.20	68.72	73.99	74.51	74.25
6)1000 NAA	100.63	100.42	100.53	100.53	93.44	96.99	100.58	96.93	98.76
7)1500 NAA	113.42	113.14	113.28	100.29	99.86	100.42	107.21	106.50	106.85
Mean	85.96	84.76	85.36	81.41	81.00	81.20	83.68	82.88	-

LSD at 5 % level for: Cultivar (A) = N.S. Planting date (B) = 1.24
A X B = 1.76 Auxin (C) = 2.32 A X C = 3.29
B X C = 3.29 A X B X C = 4.65 (Sam. = Samany, Zagh. = Zaghloul)

Referring to interaction between cultivar, planting date and auxin injection, Samany aerial offshoots recorded the highest new growth length of leaves when planted in March and injected by 1500 ppm NAA comparing with other interactions in the two seasons.

From the aforementioned results, auxin injection played a positive role in increasing percentage of rooted Samany and Zaghloul date palm aerial offshoots comparing with untreated ones in the two seasons. These results are compatible with Dowson & Pansiot (1985), Al-Ghamdi, (1988), El-Hammady *et al*. (1992), El-Hodairi *et al*. (1992), Atalla & Sonbal (1993), Saidi *et al*. (1993), Lavee *et al*. (1994), Al-Mana *et al*. (1996), Gaspar *et al*. (1997), Sourour (2001), Qaddoury & Amssa (2003 & 2004) and Rizk (2006).Thy found that auxins (NAA, IAA or IBA) are widely used in the induction of small weight or aerial offshoots rooting.

Samany cultivar increased significantly root number/aerial offshoot than Zaghloul cultivar. Whereas, Zaghloul cultivar produced roots taller than Samany cultivar. These results are in accordance with Dawoud (2001) and Rizk & Omima (2003). They found that offshoot rooted significantly affecting by cultivars.

Planting in mid of March was better than planting in mid of September for all recorded parameters of aerial offshoots. These results are also agree with Mohammed *et al*. (1993), Dawoud (2001) and Rizk & Omima (2003).

Using auxin injection in the aerial offshoots bases significantly increased rooting percentage and means of roots number, length, diameter and new vegetative growth length. Moreover, aerial offshoots injected by IBA at 1000 ppm or NAA at 1000 or 1500 ppm and planted in mid of March increased rooting percentage of Samany and Zaghloul cultivars and means of roots number, length, diameter and length of developed leaves. These results are parallel with those findings by Attalla & Sonbal (1993), Saidi *et al*. (1993), Lavee *et al*. (1994), Al-Mana *et al*. (1996), Gaspar *et al*. (1997), Sourour (2001), Rizk & Omima (2003), Qaddoury & Amssa (2003 & 2004), Al-Obeed (2005), Rizk (2006) and El-Deeb *et al.* (2008).

It is known that adventitious root induction can be stimulated by exogenously applied auxins, but the mechanism of this physiological response has not yet been clearly elucidated. Although auxins are primarily associated with the induction of adventitious roots, they are also intimately involved in such processes as cell division, cell elongation and cell differentiation (Kotsias & Roussos, 2001; Trobec *et al.*, 2005; Sedria, 2006).

Conclusion:

From the aforementioned results, the unused aerial offshoots of Samany and Zaghloul date palm cultivar can be successfully involved in mass propagation production by using auxin injection method in aerial offshoots bases before planting in nursery under green house using inverted mist system of irrigation. Auxin Application can be done by 1000 ppm of either IBA or NAA.

REFERENCES

Al-Ghamdi, A. S. (1988). Rooting of date palm offshoots as affected by offshoots size, cultivar and indole butyric acid injection. Acta Hort., 226: 379-388.

Al-Mana, F. A.; M. A. El-Hammady; M. A. Bacha and A. O. Abd-ElRahman (1996). Improving root development on ground and aerial date palm offshoots. Principes, 40 (4): 179-181.

Al-Obeed, R. S. (2005). Rooting of aerial offshoots of four date palm (*Phoenix dacylifera* L.) cultivars by air layering method using polyethylene bags. Pakistan J. Bio. Sci., 8 (7): 978-981.

Attalla, A. M. and H. M. Sonbal (1993). Influence of some growth regulators on root formation of date palm upper offshoots palm. Third symposium on date palm in Saudia. King Faisal Univ., Saudi Arabia.

Bougeudoura, N. (1983). Development and distribution of axillary buds in *Phoenix dactylifera* L. Proc. of The First Symp. On Date Palm. King Faisal Univ., Al-Hassa Saudi Arabia. 23-26 Mach, Vol. (1):40-45

Dawoud, D. H. (2001). Some factors affecting growth and rooting of date palm offshoots. Proceedings of The Second International Conference On Date Palm, Al-Ain, UAE, 25-27 March, 164-175.

Dowson, V. H. W. and F. P. Pansiot (1985). Improvement of date palm growing. Second FAO, Technical Conference on The Improvement of Date Production on processing. Dates. Bag., 85.

El-Deep, M. D.; M. M. Sourour and M. M. Marwa (2008). Vegetative propagation of date palm (*Phoenix dacylifera* L.) by rooting small offshoots. The Third International Conference On Date Palm, El-Arish Egypt, 25-27 April, pp. 9.

El-Hammady, M. A; F. A. Al-Mana and M. A. Bacha (1992). Greenhouse rooting of date palm offshoots using an inverted mist system. Annals of Agric. Sci., Ain Shams Univ., Cairo, 37 (2): 523-529.

El-Hodairi, M.H.; A.S. El-Fagih; A.A. Amer and S. Subhadrabandhu (1992). The effect of indole acetic acid (IAA), Indole butyric acid (IBA) and naphthalene acetic acid (NAA) on the growth of Taaghiyaat date palm (*Phoenix dacylifera* L.). Acta Hort., 321: 326-333.

Gaspar, T.; C. Kevers and J. F. Hausman (1997). In dissociable chief factors in the inductive phase of adventitious rooting. In A. Altman and Y. Waisel (eds), Biology of Root Formation and Development. Plenum Press, New York, p. 55-63.

Gupta, O. P. and N. R. Godara (1984). Rooting in aerial aerial offshoots of date palm. Haryana Agric. Univ. J. Res., 14: 82-84.

Hodel, D. R. and D. R. Pittenger (2003 a). Studies on the establishment of date palm (*Phoenix dactylifera* 'Deglet Noor') offshoots. Part I. Observations on root development and leaf growth. Palms, 47 (4): 191-200.

Hodel, D. R. and D. R. Pittenger (2003 b). Studies on the establishment of date palm (*Phoenix dactylifera* 'Deglet Noor') offshoots. Part II. Size of offshoot. Palms, 47 (4): 201-205.

Katyal, S. L. and C. P. Dutta (1976). Scope and problems of the date industry in India. Indian Farming, 26 (1): 3-5.

Kotsias, D. and P.A. Roussos (2001). An investigation on the effect of different plant growth regulating compounds in in vitro shoot tip and node culture of lemon seedlings. Scientia Horticulturae, 89; 115–128.

Lavee, S.; N. Avidan; R. L. M. Pierik; M. Geibel; D. Treutter and W. Feucht (1994). Chlorogenic acid an independent morphogenesis regulator or a cofactor. Acta Hort., 381: 405-412.

Mohammed, S.; E. Mohammed and H. El-Tohami (1993). Effect of planting date of the offshoots of the date palms on the rooting percentage, number of roots and number of leaves. Proc. of The Third Symp. On Date Palm. In Saudi Arabia, 17-20 Jan., Vol. (1): 209-216.

Nixon, R.W. and J.B. Carpenter (1978). Growing Dates in the United States. U.S. Dept. of Agriculture, Agric. Information Bulletin No. 207: USDA. Technical Document 63 pp.

Qaddoury, A. and M. Amssa (2003). Impact of indole butyric acid on the rooting capacity of young date palm offshoots. Acta Botanica Gallica, 150, 2: 213-222.

Qaddoury, A. and M. Amssa (2004). Effect of exogenous indole butyric acid on root formation and peroxidase and indole-3-acetic acid oxidase activities and phenolic contents in date palm offshoots. Bot. Bull. Acad. Sin., 45: 127-131.

Reuveni, O. and I. Adato (1974). Endogenous carbohydrates, root promoters and root inhibitors in easy and difficult-to-root date palm (*Phoenix dactylifera* L.) offshoots. J. Amer. Soc. Hort. Sci., 99: 361-363.

Reuveni, O., Y. Adato and H. Lilien-Kipnis (1972). A study of new and rapid methods for the vegetative propagation of date palms. Proc. Forty-ninth Ann. Date Growers Inst., 49:17-24.

Rizk, S.A.Y. (2006). Some factors affecting on rooting ability of Sewy date palm offshoots in Sewa oasis, Egypt. 2- Effect of offshoot weight and auxin application on rooting %, and growth of Sewy date palm. Minufiya J. Agric. Res., 31, 4: 1007-1015.

Rizk, S. A. Y. and M. Omima (2003). Physiological studies on the rooting ability of offshoots of some date palm cultivars. The International Conference on Date Palm and Joint Events, Saudi Arabia, King Saudi Univ., Al-Qassem, 16-19 Sept. pp. 17.

Saidi, M.; Kh. Assarry and M. Allawy (1993). Rooting of small offshoots by mist system. Proceedings of The Third Symposium On Date Palm. In Saudi Arabia, 17-20 Jan., (1): 189-196.

Sedria, M. (2006). Studies of Adventitious Root Formation in Woody Species. Ph D Thesis. Faculty of Landscape Planning, Horticulture and Agricultural Science, Swedish University of Agricultural Sciences, Alnarp, Sweden.

Snedecor, G.W. and W.G. Cochran (1989). Statistical Methods. 7th Ed., Iowa State Univ. Press. Ames. Iowa, U.S.A., pp 593.

Sourour, M. M. (2001). Rooting ground and aerial offshoots of three date palm cultivars grown in North Sinai using IBA and NAA compounds. J, Adv. Agric. Res., Vol. 6 (4): 883-893.

Steel, R. G. D. and J. H. Torrie (1980). Reproduced from principles and procedures of statistics. Printed with the permission of C. I. Bliss, pp. 448-449.

Toutain, G. and A. Rhiss (1973). Date palm yield. 2. Offshoot formation on young date palms. Al-Awamia, 48: 79-87.

Trobec, M.; F. Sampar; R. Veberic and G. Osterc (2005). Fluctuations of different endogenous phenolic compounds and cinnamic acid in the first days of the rooting process of cherry rootstock 'GiSelA 5' leafy cuttings. Journal of Plant Physiology, 162; 589-597.

Vij, B. K.; S. K. Kalra and M. S. Pajwa (1977). Studies of rooting high offshoots in date palm. Punjab Hort. J., 17: 135-138.

تعظيم منفعة الفسائل الهوائية لنخيل البلح بواسطة الإكثار الخضرى

سامى القصرى

قسم بساتين الفاكهة – كلية الزراعة – جامعة القاهرة – جيزة – مصر

أجريت هذه الدراسة فى مشتل بساتين الفاكهة بكلية الزراعة جامعة القاهرة بهدف زيادة الاستفادة من الفسائل الهوائية لنخيل البلح خلال عملية الإكثار الخضرى باستخدام الحقن بمنظمات النمو (الأكسينات) . وفى هذه الدراسة استخدمت فسائل هوائية ذات وزن ٧-٩ كجم من صنفى السمانى والزغلول والتى أجرى عليها سبعة معاملات حقن (٥سم لكل فسيلة هوائية) كما يلى: ١) ماء مقطر فقط (الكنترول) ، ٢) ٥٠٠ جزء فى المليون إندول حامض البيوتريك (IBA) ، ٣) ١٠٠٠ جزء فى المليون IBA ، ٤) ١٥٠٠ جزء فى المليون IBA ، ٥) ٥٠٠ جزء فى المليون نفثالين حامض الخليك (NAA) ، ٦) ١٠٠٠ جزء فى المليون NAA ، ٧) ١٥٠٠ جزء فى المليون NAA . وتمت الزراعة فى منتصف شهرى مارس وسبتمبر وذلك فى موسمي ٢٠٠٤ و ٢٠٠٥ فى أكياس بلاستيكية على وسط من الرمل والبيت موس والفيرمكيوليت (١: ١: ١ حجماً) .

وأوضحت النتائج أن صنف السمانى أعطى زيادة معنوية فى متوسط عدد الجذور لكل فسيلة هوائية مقارنة بصنف الزغلول . بينما أعطت الفسيلة الهوائية للزغلول جذراً أطول معنوياً من جذور السمانى . وكانت الزراعة فى مارس أفضل من الزراعة فى سبتمبر فى جميع النتائج . وقد كانت نتائج الحقن باستخدام ١٠٠٠ جزء فى المليون IBA أو ١٠٠٠ أو ١٥٠٠ جزء فى المليون NAA أفضل من حيث نسبة التجذير وعدد وطول وقطر الجذور وكذلك متوسط الزيادة فى النمو الخضرى للأوراق . وتحققت نفس النتيجة فى التفاعل بين موعد الزراعة مع هذه المعاملات من الحقن فى كلا الموسمين . ومن نتائج هذه الدراسة يمكن التوصية بإمكانية الاستفادة من الفسائل الهوائية فى إكثار نخيل البلح بعد حقنها بتركيز ١٠٠٠ جزء فى المليون من إندول حامض البيوتريك أو نفثالين حامض الخليك .