

Studies on Date Palm Propagation by Offshoots *

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ABSTRACT

In 2017, three experiments were carried out at Nakheel Palestine farm in Jericho-Palestine to study the effect of Indole Butyric Acid (IBA), some rooting media, and different colors of polyethylene bags on rooting of aerial date palm offshoots.

The experiments consisted of four IBA treatments viz.; T₁: control, T₂: localized IBA powder, T₃: IBA through irrigation' and T₄: T₂+T₃. In addition to eight rooting media treatments namely M1: control, M2: organic matter, M3: organic matter + soil + sand, M4: organic matter + Tuff, M5: soil +Tuff, M6: sand +Tuff, M7: peat moss +Tuff, and M8: peat moss + vermiculite. As well as eight colors of polyethylene bags viz., control (transparent), white, black, green, red, blue, yellow and brown.

Among IBA treatments used, the treatment T₂ significantly influenced almost all the root and shoot parameters of aerial date palm offshoots. While among various rooting media treatments experimented, the treatment M7 was the most effective for almost all the root and shoot parameters. Furthermore, among different colors of polyethylene bags tested, the blue bag was significantly superior in almost all the root and shoot parameters studied in the experiment.

Key words: Date Palm, Aerial Offshoots, Rooting, Growing Media, IBA, Polyethylene Bags.

دراسات حول إكثار نخيل التمر بواسطة الفسائل

ملخص:

تم انجاز ثلاث تجارب في مزرعة نخيل فلسطين في أريحا-فلسطين خلال عام 2017 لدراسة تأثير هرمون التجذير (IBA) Indole Butyric Acid، بعض أوساط التجذير، وعدة ألوان من أكياس النايلون على الفسائل الهوائية لنخيل التمر. تألفت التجارب من أربع معاملات هي شاهد، هرمون IBA موضعي على منطقة التجذير، هرمون IBA سقي، هرمون IBA موضعي+سقي. وثمانى معاملات لأوساط تجذير هي شاهد، مادة عضوية، مادة

عضوية+رمل+تراب، مادة عضوية+توف، تراب+توف، رمل+توف، بيتاموس+توف، بيتاموس+فيرميكلاليت. وثمانى معاملات لألوان أكياس النايلون هي شاهد (شفاف)، أبيض، أسود، أخضر، أحمر، أزرق، أصفر، بني.

من بين معاملات IBA المستخدمة، المعاملة هرمون IBA موضعي أحدثت تأثير معنوي في معظم المعايير المتعلقة بالمجموع الجذري والمجموع الخضري للفسائل الهوائية لنخيل التمر. ومن بين العديد من معاملات أوساط التجذير التي جربت، كانت المعاملة بيتاموس+توف هي الأكثر فاعلية في معظم الصفات المدروسة والمتعلقة بالمجموع الجذري والمجموع الخضري. ومن بين ألوان مختلفة من أكياس النايلون التي تم اختبارها، كان لون كيس النايلون الأزرق متفوق بشكل ملحوظ في معظم المعايير المتعلقة بالمجموع الجذري والمجموع الخضري التي تمت دراستها في التجربة.

الكلمات المفتاحية: نخيل التمر، الفسائل الهوائية،

التجذير، الأوساط الزراعية، IBA، أكياس نايلون ملونه.

INTRODUCTION

Offshoots are normally used in date palm (*Phoenix dactylifera*) propagation due to their root regeneration ability (Zaid & de Wet, 2002). An independent plant needs a good root development and it depends on a good development of the root initiation zone (RIZ) of the offshoot (Hodel et al., 1998; Pittenger et al., 2000; Hodel and Pittenger, 2003; Afzal et al., 2011). Poor or no root initiation in aerial offshoots was one of the most serious problems in date palm propagation. Several approaches to overcome this problem have been made with variable results (Ismail & Alegali, 1993; AL-Mana et al., 1996; Okawara et al., 2003; Al-khateeb et al., 2015). Root-promoting auxin group of chemicals like Indole Butyric Acid (IBA) and naphthalene acetic acid (NAA) have been extensively used in the rooting of different plant species including date palm. Al-Najm (2009) reported that treatment date palm offshoots with IBA at 1000 ppm led to high average of root number and root length in comparison with the other tested concentration. Ismail & Alegali (1993) have used 1000, 2000 and 3000 ppm concentrations of IBA to root different date palm offshoots of different cultivars and sizes. After one year, he found that 'Barnsee' and 'Ahmed Sayed'

cultivars were the best to root while 'Elhora' cultivar did not produce any roots under all IBA concentrations. Qaddoury and Amssa (2004) found that the higher concentration of IBA results in more and earlier rooting in treated offshoots as compared with untreated ones.

Rooting medium was an important factor in determining the extent of root formation of date palm offshoots (AL-Mana et al., 1996). The highest rooting percentages were obtained using the perlite: peat moss (3:1) medium followed by the wood shavings: peat moss (1:1) and perlite: peat moss (1:1) media. Sand medium was inferior to the other growing media.

Keeping all these aspects in view, the present study was undertaken with the following objectives: (1) to study the effect of indole-3-butyric acid (IBA) on rooting of aerial date palm offshoots. (2) to evaluate different rooting media on root and shoot parameters of aerial date palm offshoots. (3) to study the effect of different colors of polyethylene bags on rooting of aerial date palm offshoot.

MATERIAL AND METHODS

Three independent experiments of aerial layering of Medjool date palm offshoots were carried out during the year 2017 at Nakheel Palestine farm, Jericho-Palestine.

- ◆ Experiment 1: Effect of indole-3-butyric acid (IBA) on rooting of aerial date Palm offshoots.

The experimental design followed was a completely randomized block design (CRBD) with ten replicates. The plot size was a single offshoot. The experiment consisted of four treatments viz., T1: control, T2: localized IBA powder, T3: IBA through irrigation and T4: T2 + T3.

Every offshoot was wrapped using transparent polyethylene bag, which wrapped around the offshoot base and tied at the bottom, then the base of offshoots for treatment 2 (T2: localized IBA powder) and treatment 4 (T4: T2 + T3) were treated with IBA powder. The polyethylene bags were properly filled with an equal amount of wet wood shavings for all the treatments. The polyethylene bags were tightly

tied at the top. For treatment 3 (T3: IBA through irrigation) and treatment 4 (T4: T2 + T3), a liquid solution of IBA at a concentration of 1000 ppm was applied five times through irrigation water at ten days intervals.

- ◆ Experiment 2: Effect of some rooting medium on propagation of aerial date palm offshoots.

The experimental design followed was a completely randomized block design (CRBD) with four replicates. The plot size was a single offshoot.

The experiment consisted of eight treatments viz., M1: control (wood shavings), M2: organic matter, M3: organic matter + soil + sand, M4: organic matter + Tuff, M5: soil + Tuff, M6: sand + Tuff, M7: peat moss + Tuff, and M8: peat moss + vermiculite.

Every offshoot was wrapped using transparent polyethylene bag, which wrapped around the offshoot base and tied at the bottom, then polyethylene bags were properly filled with an equal amount of growing media according to the treatments (wet wood shavings as control, organic matter, organic matter + soil + sand, organic matter + tuff, soil + tuff, sand + tuff, peat moss + tuff, and peat moss + vermiculite). The polyethylene bags were tightly tied at the top.

- ◆ Experiment 3: Rooting of aerial offshoots of date palm by using different colors of polyethylene bags.

The applied experimental design was a completely randomized block design (CRBD) with three replicates. The plot size was a single offshoot.

The experiment consisted of eight treatments viz., control (transparent), white, black, green, red, blue, yellow and brown.

Every offshoot was wrapped using polyethylene bag with different colors (transparent as control, white, black, green, red, blue, yellow, and brown), which wrapped around the offshoot base and tied at the bottom and filled properly with an equal amount of wet wood shavings. The polyethylene bag was then tightly tied at the top.

The offshoots for the three experiments were separated from their mother plants after six months

from air layering and the following observations for root and shoot parameters were recorded at the same time for each experiment.

The main roots that are arising directly from the base of offshoots were counted and expressed as the number of main roots/offshoot. The length of the longest root was measured and expressed in centimeters. The diameter of thickest root was measured and expressed in millimeter. The rooting zone on the basal portion of the offshoots which successfully produced the roots was measured and expressed in centimeters.

Offshoots were weighed and expressed in grams. Length of shoot were measured and expressed in centimeters. The number of newly leaves emerged per offshoot was counted. Out of many leaves, the largest one was measured from base to tip and expressed in centimeters. The length of the stem of offshoot was measured and expressed in centimeters. Trunk circumference and diameter of the base of the offshoots were

measured and expressed in centimeters.

All the data for the three experiments was separately statistically analyzed (Little and Hills, 1978) and the significant difference to the treatment means were separated according to LSD test at 5 % level.

RESULTS

The results for the first, second and third experiments are presented as follows:

◆ Experiment 1:

Root Parameters: There were no significant differences among the treatments in root parameters studied in the experiment as compared to control except for the length of the longest root. The maximum length of the longest root (34.2 cm) was recorded with the treatment T2: localized IBA powder and the minimum (1.0) was recorded with control (Table1).

Table 1:
Effect of indole-3-butyric acid (IBA) on some root parameters of aerial date palm offshoots

Treatment	Number of main roots/ offshoot	Length of the longest root (cm)	Diameter of the root (mm)	Length of rooting zone (cm)
T1: Control	4.9 a	22.1 c	7.70 a	19.4 a
T2: Localized IBA powder	6.4 a	34.2 a	9.75 a	22.7 a
T3: IBA through irrigation	5.4 a	27.5 b	9.15 a	20.2 a
T4: T2 + T3	5.5 a	28.5 b	8.75 a	20.5 a
LSD 0.05	2.8	4.8	2.10	4.2

Shoot Parameters: The highest weight of an offshoot (8517.7 g) was recorded with the T2. Other treatments (T3 and T4) gave similar results to the control (Table 2). There were no significant differences among the treatments in the length of offshoot as compared to control. The maximum length of largest leaf, the number of newly leaves per offshoot, the length of the stem and the diameter of the base offshoot were recorded with the T2 which was on par with the T3 and T4,

and the minimum was recorded with the control (Table 2). The maximum trunk circumference (61.5 cm) was recorded with the treatment T2 and the minimum of 49.9 cm was recorded with the control (Table 2).

Table 2:

Effect of indole-3-butyric acid (IBA) on some shoot parameters of aerial date palm offshoots

Treatment	Weight of offshoot (gm)	Length of offshoot (cm)	Length of largest leaf (cm)	Number of newly leaves/ offshoot	Length of the stem (cm)	Trunk circumference (cm)	Diameter of the base of offshoot (cm)
T1: Control	5819.8 b	218.1 a	163.6 b	2.3 b	41.2 b	49.9 c	10.5 b
T2: Localized IBA powder	8517.7 a	233.6 a	194.7 a	3.1 a	52.4 a	61.5 a	13.0 a
T3: IBA through irrigation	6823.6 b	224.5 a	182.2 ab	2.8 ab	48.6 a	54.6 bc	12.8 a
T4: T2 + T3	6461.3 b	219.2 a	184.9 ab	2.7 ab	48.4 a	55.9 b	11.7 ab
LSD 0.05	1390.3	25.8	25.3	0.7	5.3	5.6	2.1

◆ Experiment 2:

Root Parameters: There were no significant differences among the treatments in root parameters studied in the experiment as compared to control except for the diameter of the root. The maximum diameter of the root (13.4 mm) was recorded with the treatment M7 and the minimum of 8.8 mm was recorded with the control which was on par to other treatments (Table 3).

Table 3:

Effect of some rooting medium on some root parameters of aerial date palm offshoots

Treatment	Number of main roots/ offshoot	Length of the longest root (cm)	Diameter of the root (mm)	Length of rooting zone (cm)
M1: Control	5.8 a	24.5 a	8.8 b	18.8 a
M2: Organic matter	6.0 a	26.5 a	11.3 ab	20.8 a
M3: Organic matter+soil+sand	6.5 a	34.3 a	10.4 ab	21.0 a
M4: Organic matter+Tuff	5.5 a	29.5 a	10.3 ab	20.0 a
M5: Soil+Tuff	5.5 a	24.0 a	9.4 b	18.5 a
M6: Sand+Tuff	7.3 a	27.3 a	10.5 ab	20.0 a
M7: Peatmoss+Tuff	8.8 a	35.0 a	13.4 a	25.0 a
M8: Peatmoss+vermiculite	7.0 a	33.8 a	9.8 b	22.5 a
LSD 0.05	6.1	11.96	3.17	10.2

Shoot Parameters: The highest weight of an offshoot (9376 g) was recorded with the treatment M7. Other treatments gave similar results to the control (Table 4). No significant differences were recorded among the treatments in length of offshoot and trunk circumferences. The maximum length of the leaf (196.0 cm) was recorded with the treatment M7 which was on par to all treatments except M4. The maximum number of newly leaves/offshoots (2.75) was recorded with the M7 which was on par with M3, M4, and M5. The maximum length of the length of the stem (50.8 cm) was recorded with the M7 which was on par with M3, and M8 treatments. The maximum diameter of the base of offshoot (14.8 cm) was recorded with the M7 which was on par with M3, M4, M6, and M8 treatments (Table 4).

Table 4:

Effect of some rooting medium on some shoot parameters of aerial date palm offshoots.

Treatment	Weight of offshoot (kg)	Length of offshoot (cm)	Length of largest leaf (cm)	Number of newly leaves/ offshoot	Length of the stem (cm)	Trunk circumference (cm)	Diameter of the base of offshoot (cm)
M1: Control	6544 b	203 a	ab 164.3	b 1.25	39.8 d	53.0 a	9.5 c
M2: Organic matter	6885 b	210 a	178.3 ab	1.50 b	45.3 bc	50.5 a	9.8 c
M3: Organic matter+soil+sand	7601ab	215 a	174.8 ab	1.75 ab	49.8 ab	56.5 a	12.3 abc
M4: Organic matter+Tuff	6283 b	204 a	164.0 b	1.75 ab	42.8 cd	51.3 a	11.5 abc
M5: Soil+Tuff	6421 b	211 a	176.5 ab	1.75 ab	40.8 cd	50.5 a	11.3 bc
M6: Sand+Tuff	6959 b	207 a	176.3 ab	1.50 b	45.5 bc	54.3 a	13.3 ab
M7: Peatmoss+Tuff	9376 a	232 a	196.0 a	2.75 a	50.8 a	57.3 a	14.8 a
M8: Peatmoss+vermiculite	7974 ab	219 a	184.8 ab	1.50 b	48.8 ab	55.3 a	12.8 abc
LSD 0.05	2217	36	31.84	1.22	5.0	10.6	3.27

◆ Experiment 3:

Root Parameters: There were no significant differences among the treatments in the number of main roots/offshoot and length of rooting zone (Table 5). The maximum length of the longest root (32 cm) was recorded with the blue bags, which was on par with all treatments except with white bag. Also, the maximum diameter of the root (13.7 mm) was recorded with the blue bags which was on par with all treatments except yellow bag (Table 5).

Table 5:

Effect different colors of polyethylene bags on some root parameters of aerial date palm offshoots

Treatment	Number of main roots/ offshoot	Length of the longest root (cm)	Diameter of the root (mm)	Length of rooting zone (cm)
Control	4.7 a	22.7 ab	8.7 ab	17.3 a
White	5.3 a	21.0 b	10.0 ab	17.0 a
Black	5.3 a	24.0 ab	8.5 ab	17.3 a
Green	9.7 a	25.7 ab	10.3 ab	19.0 a
Red	5.7 a	31.7 a	9.8 ab	18.0 a
Blue	6.7 a	32.0 a	13.7 a	23.3 a
Yellow	5.0 a	22.3 ab	8.0 b	18.0 a
Brown	6.0 a	29.3 ab	12.0 ab	20.0 a
LSD 0.05	6.7	10.1	5.34	6.87

Shoot parameters: The highest weight of an offshoot (7490 gm) was recorded with blue bag which was on par with the white, green, red, yellow and brown bags (Table 6). The maximum length of shoot (233.7 cm) was recorded with the blue bag which was on par with green and brown bags. The maximum length of largest leaf (188.7 cm) was recorded with the blue bag which was on par with green, red and brown bags. The maximum number of newly leaves/offshoots (3.33) was recorded with the white bag which was on par with blue bag and the minimum (1.0) was recorded with red bag which was on par

with black bag. There were no significant differences among the treatments in the length of the stem. The maximum trunk circumference (62.0 cm) was recorded with the blue bag, which was on par with white, green and brown bags. The maximum diameter of the base of offshoot (16.3 cm) was recorded with the blue bag, which was on par with white, green, red and brown bags (Table 6).

Table 6:

Effect different colors of polyethylene bags on some shoot parameters of aerial date palm offshoots

Treatment	Weight of offshoot (gm)	Length of offshoot (cm)	Length of largest leaf (cm)	Number of newly leaves/offshoot	Length of the stem (cm)	Trunk circumference (cm)	Diameter of the base of offshoot (cm)
Control	4352 b	189.7 b	137.7 b	2.33 bc	46.7 a	49.0 cd	11.7 b
White	5627 ab	184.3 b	135.7 b	3.33 a	44.0 a	53.0 abcd	13.0 ab
Black	4508 b	184.3 b	148.0 b	1.33 de	35.7 a	47.3 d	11.0 b
Green	6259 ab	213.7 ab	158.0 ab	2.17 bc	45.0 a	57.3 abc	13.5 ab
Red	5238 ab	188.7 b	150.0 ab	1.00 e	42.3 a	49.7 bcd	14.0 ab
Blue	7490 a	233.7 a	188.7 a	2.83 ab	49.7 a	62.0 a	16.3 a
Yellow	5732 ab	193.7 b	132.7 b	2.0 cd	39.3 a	49.7 bcd	11.3 b
Brown	6894 a	217.4 ab	168.7 ab	2.53 bc	45.7 a	59.0 ab	13.7 ab
LSD 0.05	2319	32.03	39.88	0.73	15.2	9.87	4.42

DISCUSSION

The experimental results obtained from the first, second and third experiments regarding root and shoot parameters of the aerial offshoots are discussed and compared with previous studies.

- ◆ Experiment 1: Results indicated that the treatment (T2: localized IBA powder) was significantly superior in almost all the root and shoot parameters studied in the experiment 1 (Table 1 and 2).

The improvement in rooting and shoot enhancement was most likely due to rapid root induction in response to the treatment (T2: localized IBA powder). IBA, as a most popular synthetic hormone, induces cell division, cell elongation resulting in plant growth and development, regulates the permeability of plasma membrane, stimulates pH and electrical gradients, enforces transport of auxins, sugars, amino acids and inorganic ions and induces growth.

These results are in conformity with many other reports of earlier workers (Qaddoury and Amsa, 2004; Al-Najm, 2009; Al-Jabar, 2010; Darwesh et al., 2013).

- ◆ Experiment 2: Results indicated that the treatment M7: peat moss +Tuff was significantly superior in almost all of the root and shoot parameters studied in the experiment 2 (Table 3 and 4).

This result may be due to the rapid rooting in response to growing media (M7) which has the capacity to improve the rhizosphere. Thus, substrate (M7: peat moss +Tuff) to facilitate better aeration as well as keeping the growing media with good moisture content resulted in the development of better root and shoot parameters of the aerial offshoots.

These results are supported by the findings of Al-Mana et al., (1996) who reported the highest rooting percentages of date palm offshoots were obtained by using the perlite: peatmoss.

- ◆ Experiment 3: Results indicated that the treatment blue bag was significantly superior in almost all the root and shoot parameters studied in the experiment 3 (Table 5 and 6).

This result may be due to the differences in temperature, humidity, lighting and sunray inside blue polyethylene bags cases better rooting and

shooting of aerial offshoots. In addition, blue bags reflect high-energy wave (blue wave) and absorbed all spectrum colors.

It can be concluded from these studies that treating aerial date palm offshoots with T2: localized IBA powder, using growing media M7: peat moss +Tuff, and using blue polyethylene bags will result in better rooting and shoot enhancement.

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