

*Principes*, 40(4), 1996, pp. 179-181, 217-219

## Improving Root Development on Ground and Aerial Date Palm Offshoots

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### ABSTRACT

Date Palm (*Phoenix dactylifera*, L.) represents the most important fruit tree in Saudi Arabia for fruit production, ornamental, and landscape purposes. During recent years, there has been a big demand for date palm offshoots. The survival of the small aerial offshoots, which require special nursery conditions, is very low. Therefore, this investigation was carried out to study the effect of different rooting media and NAA and/or catechol on root development of small-size ground and aerial offshoots of two date palm cultivars: "Shish" and "Shahl."

Results showed that the rooting medium is an important factor in determining the extent of root formation of offshoots. The highest rooting percentages were obtained when the perlite : peat moss (3:1) medium was used followed by the woodshavings : peat moss (1:1) and perlite : peat moss (1:1) media. Sand medium is inferior as compared to the others studied. Rooting of ground offshoots was increased by NAA and/or catechol treatments. On the other hand, NAA and/or catechol treatments appeared to be essential for good root formation and development on aerial offshoots.

Date palm trees are mainly propagated through the offshoots. Ground offshoots of large sizes are usually used for this purpose. The use of small-sized and aerial (high and unrooted) offshoots is not practical due to their low survival. They are usually discarded during the separation of large-sized ones (Reuveni et al. 1972). However, these offshoots can regenerate roots and be used successfully if an inverted mist system is used (El-Hamady et al. 1992).

Auxins have been implicated in the adventitious root initiation of several plant species (Gasper and Hofinger 1989). However, there is no agreement on the effect of applied auxins on root formation of date palm offshoots. Auxin treatment was found to effectively increase rooting of date palm aerial offshoots (Gupta and Godara 1984). No such effect was found in other reports (Reuveni et al. 1972). It has been reported that besides the suitable auxin content of the plant material, there are several other rooting co-factors that occur naturally in cuttings of several plant species. These co-factors appear to act synergistically with auxins in root initiation in hard-to-root cuttings (Hess 1968,

James et al. 1980, Jones and Hopgood 1979, James and Thurbon 1981). The action of these co-factors in root promotion could be, at least partly, in protecting the root-inducing, naturally occurring auxin (IAA) from destruction by the enzyme, IAA-oxidase (Donoho et al. 1962, Fadl et al. 1979). These co-factors are thought to be phenolic compounds (Hess 1968).

As far as the authors know, no information concerning the effect of phenolic compound treatment on rooting of detached date palm offshoots is available in the literature. Thus, this study was carried out for the following purposes: (1) evaluation of different rooting media on root development of small ground and aerial offshoots of the "Shishi" date palm cultivar; and (2) testing the effect of NAA and/or catechol on root formation and regeneration on small ground and aerial offshoots of the "Shahl" date palm cultivar.

### Materials and Methods

This study was carried out during 1992 and 1993 in the lathhouse at the Agricultural Research Station of Deirab, College of Agriculture, King Saud University. Ground offshoots of weights ranging from 2 to 6 Kg and different weights of aerial offshoots were separated from both "Shish" and "Shahl" date palm cultivars in late spring. After separation, all offshoots were sterilized by soaking them in Bafastin solution (containing 50% Carbendazin) for 30 minutes. These offshoots were used for the following two experiments (Fig. 1).

*Experiment No. 1—Evaluation of Different Rooting Media.* The sterilized offshoots were planted in plastic containers (eight gallons) filled with six different rooting media as follows: 1—Woodshavings; 2—Mixture of woodshavings : peat moss (3:1 v/v); 3—Mixture of woodshavings : peat moss (1:1 v/v); 4—Mixture of perlite : peat moss (3:1 v/v); 5—Mixture of perlite : peat moss (1:1 v/v); 6—Sand.



1. Section of the general layout of the experiment in the lathhouse.

Each of the six media was represented by five ground offshoots, where each offshoot was considered as a replicate. The same media were used for the aerial offshoots, except medium number 6 was eliminated for lack of offshoots. The planted offshoots were randomly arranged in the lathhouse. The offshoots were irrigated using a simple drip irrigation system, and each offshoot received the same amount of water.

Six months later, the offshoots were dug out and the percentage rooting and the length of the longest roots were determined. Then, all the formed roots were removed and the total fresh weight for each offshoot was recorded. The small diameter roots (less than 0.5 cm) were separated and their weight was determined and the percentage that this weight represented from the total was calculated.

*Experiment No. 2—Effect of NAA and/or Catechol Treatments.* Thirty six ground offshoots and a similar number of aerial offshoots from “Shahl” cultivar were prepared as described before. These offshoots were treated basally with one of the following treatments: 1—dusting offshoot bases with rooting powder containing 8% NAA; 2—soaking offshoot bases in solution containing 25 ppm of catechol; 3—soaking offshoot bases in

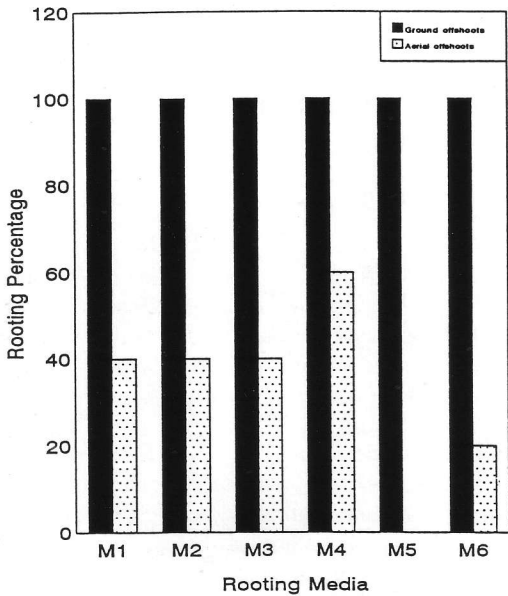
solution containing 50 ppm of catechol; 4—treatment No. 2 + treatment No. 1; 5—treatment No. 3 + treatment No. 1; 6—control (untreated).

The offshoots were planted in plastic containers (eight gallons) filled with a mixture of perlite: peat moss (1:1 v/v). Six offshoots from each type were used for each treatment. Each offshoot was considered as a replicate. The experiment was arranged randomly in the lathhouse, and was dug out for examination six months later. The same procedure and data taken in the first experiment were followed.

## Results

### *Experiment No. 1—Evaluation of Different Rooting Media.*

*Ground Offshoots.* Data in Figs. 2 and 3 indicated that root regeneration of “Shish” offshoots was achieved in all treatments. The longest roots were obtained when a mixture of woodshavings: peat moss (3:1) was used (Fig. 4). It was also found that the greatest total fresh root weight was obtained in the perlite: peat moss (3:1) media. On the other hand, the lowest total fresh root weight was obtained when sand medium was used (Fig. 5). It was also found that the ratio of the weight of the small diameter roots to the weight of the



2. Effect of rooting media on rooting percentage of "Shish" date palm cultivar ground and aerial offshoot (M1 = Woodshavings; M2 = Woodshavings : Peat Moss [3:1]; M3 = Woodshavings : Peat Moss [1:1]; M4 = Perlite : Peat Moss [3:1]; M5 = Perlite : Peat Moss [1:1]; M6 = Sand).

total roots was greatest in perlite : peat moss (1:1) or perlite : peat moss at the same ratio (Fig. 6).

*Aerial Offshoots.* The highest rooting percentage was obtained when the perlite : peat moss (3:1) medium was used (Figs. 2 and 7). On the other hand, lowest values were obtained in the sand medium. Longest roots were found in the woodshavings : peat moss (3:1) medium. Also, sand media had the shortest root length (Fig. 4).

It was also shown that the greatest fresh weight of the newly formed roots were in the woodshavings : peat moss (1:1) medium, followed by the perlite : peat moss (3:1). Total root fresh weight, however, was drastically reduced in the sand medium (Fig. 5). It was also evident that the highest ratio of the small diameter root weight to the total fresh root weight was obtained in the woodshavings : peat moss (1:1) followed by the woodshavings : peat moss (3:1) treatment, while the sand medium had the lowest percentage (Fig. 6).

*Effect of NAA and/or Catechol Treatments. Ground offshoots.*

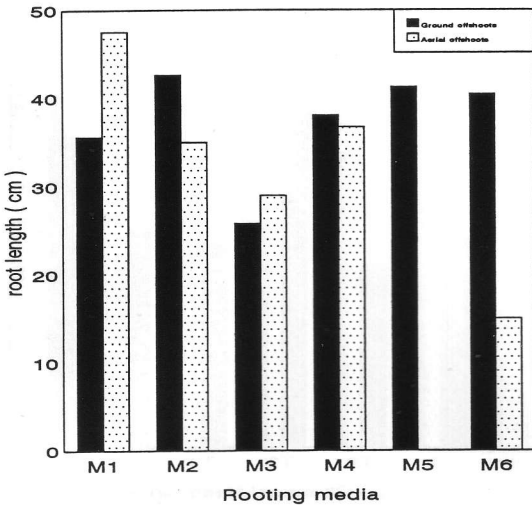
Data of this study demonstrated that all treatments showed 100% root regeneration (Fig. 8).

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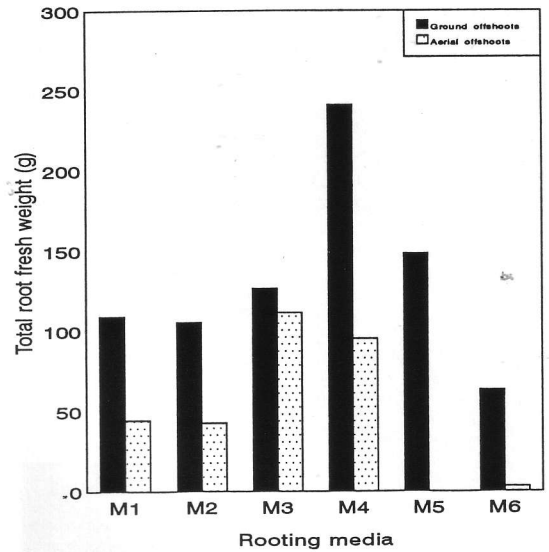


3. Effect of different rooting media on root development on ground offshoots. Media used (left to right) are : Woodshavings (WS), Woodshavings : Peat moss (3:1), Sand, Perlite : Peat moss (1:1), Woodshavings : Peat moss (1:1), and Perlite : Peat moss (1:1).

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4. Effect of rooting media on length of longest root of "Shish" date palm cultivar ground and aerial offshoots (M1 = Woodshavings; M2 = Woodshavings : Peat Moss [3:1]; M3 = Woodshavings : Peat Moss [1:1]; M4 = Perlite : Peat Moss [3:1]; M5 = Perlite : Peat Moss [1:1]; M6 = Sand).



5. Effect of rooting media on total root fresh weight of "Shish" date palm cultivar ground and aerial offshoots (M1 = Woodshavings; M2 = Woodshavings : Peat Moss [3:1]; M3 = Woodshavings : Peat Moss [1:1]; M4 = Perlite : Peat Moss [3:1]; M5 = Perlite : Peat Moss [1:1]; M6 = Sand).

The greatest root length was achieved in the control and the 50 ppm catechol treatments (Fig. 9). It was also found that the largest fresh root weight was obtained in the control and the NAA + 50 ppm catechol treatments (Fig. 10).

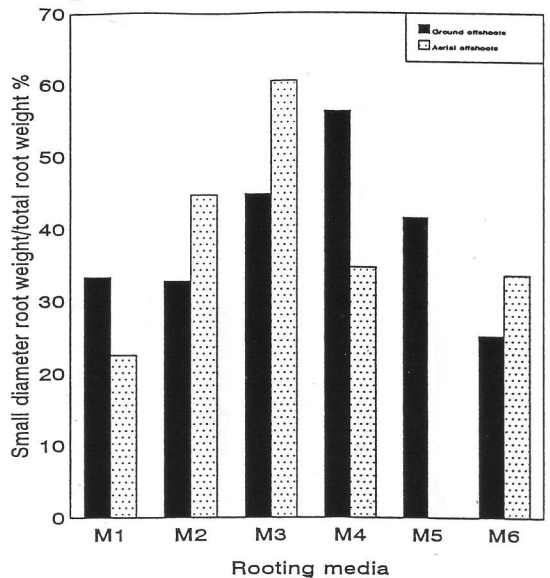
When the ratio of the weight of the small root diameter: total roots weight was considered, it became evident that the NAA + 50 ppm catechol treatment was the best followed by the 25 ppm catechol treatment (Fig. 11).

*Aerial Offshoots.* Data showed that the highest rooting percentage was achieved in the NAA treatment. This was followed by those offshoots treated with NAA + 50 ppm catechol. The rooting percentage of the catechol treated offshoots was either equal (in the 25 ppm) or lower (in the 50 ppm) than the control (Fig. 8).

Longest roots were obtained in the 25 ppm and 50 ppm catechol treatments. On the other hand, shortest roots were obtained in the control (Fig. 9).

Total fresh weight of the newly formed adventitious roots was greatest in the NAA treatment, followed by the 50 ppm catechol and the NAA + 25 ppm catechol treatments in decreasing order. The lowest root fresh weight was obtained in the untreated offshoots (Fig. 10).

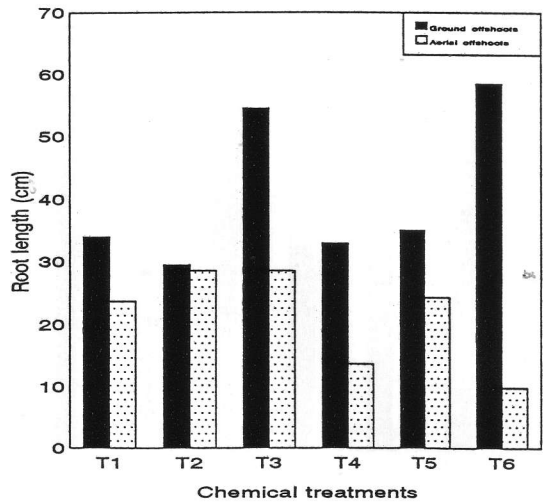
Highest small-diameter root percentages were obtained in the 50 ppm catechol and NAA + 25 ppm catechol treatments in an increasing order. Lower values were obtained in the control, NAA



6. Effect of rooting media on small diameter root weight/total root weight of "Shish" date palm cultivar ground aerial offshoots (M1 = Woodshavings; M2 = Woodshavings : Peat Moss [3:1]; M3 = Woodshavings : Peat Moss [1:1]; M4 = Perlite : Peat Moss [3:1]; M5 = Perlite : Peat Moss [1:1]; M6 = Sand).



7. Comparison between root development of "Shish date palm aerial offshoots in sand or Perlite : Peat moss (3:1) media.

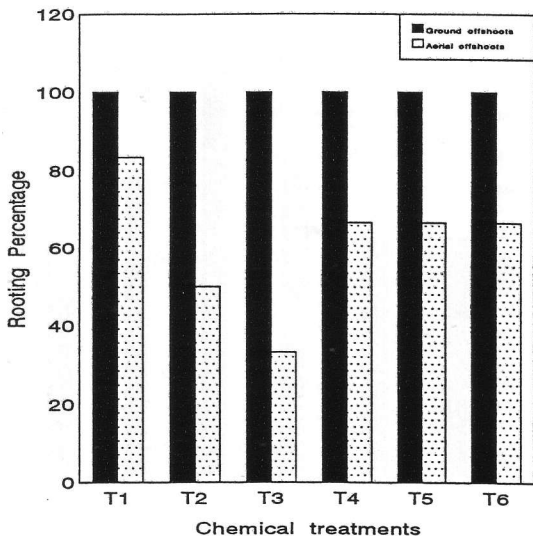


9. Effect NAA and/or catechol treatments on length of longest root of "Shahl" date palm cultivar ground and aerial offshoots (T1 = NAA; T2 = 25 ppm catechol; T3 = 50 ppm catechol; T4 = NAA + 25 ppm catechol; T5 = NAA + 50 ppm catechol; T6 = control).

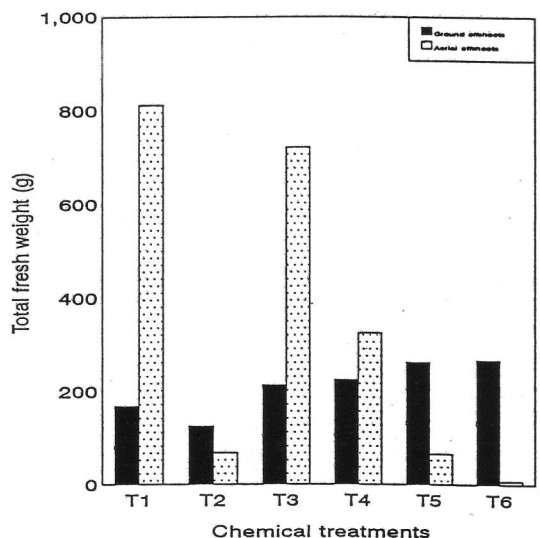
+ 50 ppm, or NAA + 25 ppm catechol treatments (Fig. 11).

### Discussion

Rooting medium is an important factor in determining the extent of adventitious root formation

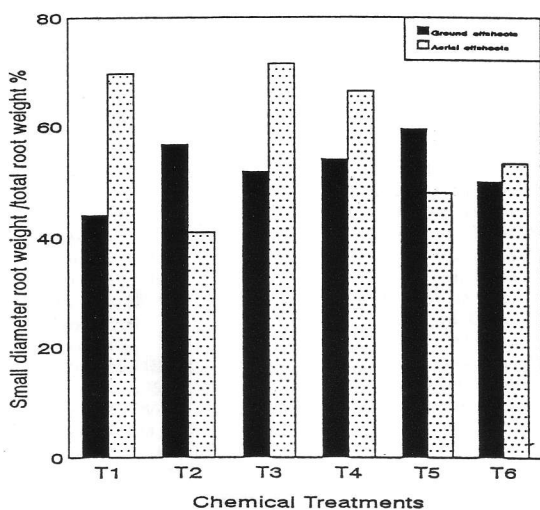


8. Effect of NAA and/or catechol treatments on rooting percentage of "Shahl" date palm cultivar ground and aerial offshoots (T1 = NAA; T2 = 25 ppm catechol; T3 = 50 ppm catechol; T4 = NAA + 25 ppm catechol; T5 = NAA + 50 ppm catechol; T6 = control).



10. Effect NAA and/or catechol treatments on root total fresh weight of "Shahl" date palm cultivar ground and aerial offshoots (T1 = NAA; T2 = 25 ppm catechol; T3 = 50 ppm catechol; T4 = NAA + 25 ppm catechol; T5 = NAA + 50 ppm catechol; T6 = control).





11. Effect NAA and/or catechol treatments on small root percentage of "Shahl" date palm cultivar ground and aerial offshoots (T1 = NAA; T2 = 25 ppm catechol; T3 = 50 ppm catechol; T4 = NAA + 25 ppm catechol; T5 = NAA + 50 ppm catechol; T6 = control).

in many plant species (Hartmann et al. 1990). This was shown to be also true for root formation and development in date palm offshoots. The sand medium was found to be inferior to other media mixtures evaluated in this study.

It is expected that as the small-diameter roots form a high percentage of the total formed roots, the absorption capacity of the root system will increase (El-Hamady et al. 1992). Thus, a greater small-diameter root percentage is expected to increase offshoot survival chances. The highest percentages were obtained in the perlite : peat moss (3:1) followed by the woodshaving : peat moss (1:1) and perlite : peat moss (1:1), and the lowest in the sand medium. As a rooting medium sand is inferior to the other ones studied. Both rooting percentage as well as all studied root characters were inferior in the sand medium. Total fresh root weight in the sand medium was rather low so that continued survival was doubtful.

A small rooting percentage was increased over the control by use of NAA and/or catechol, which might give some support for application of such a treatment.

On the other hand, NAA and/or catechol treatments appeared to be essential for good root development on aerial offshoots. However, no synergistic effect was evident in this respect as indicated for other plant species (Hess 1968, James et al.

1980, Jones and Hopgood 1979, James and Thurbon 1981). Auxin treatments were reported to be effective in inducing root formation on aerial offshoots whereas IBA treatment was found to be effective in increasing rooting of high offshoots (Gupta and Godara 1984), which is in agreement with the results of this study. However, other workers did not find such an effect (Reuveni et al. 1972).

The following conclusions could be obtained from this study: (1) The use of rooting media other than sand is recommended since it improved the rooting percentage in aerial offshoots. Moreover, root quality in both ground and aerial offshoots was also better when the other studied media were used. (2) Treating aerial offshoots with NAA and/or catechol seems to be required for attaining good rooting. Thus, these treatments might be recommended.

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