

Case Study on the Trunk's Deformity of Date Palm Trees Used in Street Landscape in Riyadh, Saudi Arabia

Fahed A. Al-Mana and Yahia A. Ahmad

Department of Plant Production, College of Food and Agricultural Sciences,
King Saud University, P.O. Box 2460 Riyadh 11451, Saudi Arabia

Abstract: The presence of deformations has been observed in different areas on the trunks of date palm trees, *Phoenix dactylifera* L., planted and used in the landscape of sites and streets in Riyadh, Saudi Arabia. This study was conducted on the trunks of date palms, to investigate their cases and identify factors that led to distortion. The study was done on street islands planted with date palm trees in five different districts of Riyadh city. This study showed that date palm tree trunks used in the landscape of the streets were affected by damage and deformity at different heights on the trunk. The percentage of deformed date palm trees trunks in four studied districts reached (100%), while it was (70.3%) in the fifth "Al-Khozama" district. In all studied districts, most of the trunk's deformity of date palm trees started from the soil surface and the length of the deformation area on the trunks varied among these districts. The highest value of the average length of the deformation area was (119.6 cm) while the lowest value was (28.7cm). The results also showed that the highest value of the percentage of deformation (length of deformed area / length of trunk) on the trunk was (14-17%), while the lowest value was (6.26%). In this study, several of fungous species (*Macrophomina phaseolina*, *Fusarium oxysporum*, *Fusarium solani*) were isolated, purified and defined. The occurrence of this case is because of some irrigation systems used improperly and resulted in water reaching directly to the palm trunks.

Key words: Date palms trees • *Phoenix dactylifera* • Deformation • Street landscape

INTRODUCTION

Date palm *Phoenix dactylifera* L. is the most important tree planted in the Kingdom of Saudi Arabia, which represents the historic symbol of the country cultivation and economy. It is one of the important wealth which characterized by the Kingdom and constitutes the major part of its official emblem. The date palm trees since antiquity were the main source of food and development of many nations, especially in the Arabian Peninsula. Number of date palm trees planted in the Kingdom is close to 23.5 million trees and the number of date palm trees planted in Riyadh region is about 5.5 million trees [1]. The palm trees are used in landscape and beautification of the urban cities, where their presence complete the architecture formal view, take care of the aesthetic values, which are derived from the environment in the streets, plazas and gardens. So they are highlighted as one of the traditional Arabic elements. Palm trees are important elements in the design and landscape of sites, for their distinguished properties and can be used as accent plant

where each has its own character [2]. Date palm tree is the basic and the most important element in planting and landscape of streets at various locations in Riyadh region, Saudi Arabia. It is suitable to the environmental conditions of the Kingdom in terms of high temperatures and scarcity of water and increased salinity, in addition to the aesthetic and landscaping aspects which they confer on sites that are planted [3]. Palm tree is characterized by its suitability for the landscape in the streets and the various sites. This is due to the nature of the Palm- erect growth, its regular trunk and because it has no side branches obstruct the traffic or interfere with the buildings and other constructions at the sites. The most important special character of the date palm tree to be used in street landscape is its cylinder stem which is covered with the leaf bases in spiral form that give it a unique texture and picturesque. The diameter of the date palm trunk reaches 40-90 cm. depending on the variety, however, the trunk remains in same thickness along the stem as long as the service operations are regular [4]. While the palm tree increases in growth, its trunk

increases in growth. At the completion of the leaf growth and becoming dry, the trunk reaches the highest degree of inflation [5]. The roots of date palm are able to grow on moist soil conditions for a certain period, but with the continuation of moisture in the soil for a long time, it becomes harmful to the roots and the production of the dates [6]. Growth response of the date palm trees vary according to the irrigation methods and different water levels [7]. There are many studies on irrigation methods for date palm trees [8-10]. However, they did not address the negative effect of the irrigation on the trunk especially in the case of using irrigation methods in improper practices. Deformed trunks of date palm trees have been observed in several locations and streets in Riyadh region. The deformation on the trunks lose the sense on visual beauty of the date palm trees used in landscape and also affect consensus and the harmony between the palm trees and the other plant units used in landscape of the site. Therefore, this study aims to identify the case of trunk's deformity of date palm trees planted and used in the landscape of streets in various districts of Riyadh region and reasons lead to the deformation of these trunks.

MATERIALS AND METHODS

This study was conducted on the trunks of date palm trees, *Phoenix dactylifera* L. planted and used in the landscape of streets in Riyadh region during 2009. Five streets "median islands" planted with date palm trees were randomly selected in various districts of Riyadh city as follows:

- King Fahad district "Al- Imam Muhammad Bin Saud Street"
- Al-Gamaa district "Sheikh Hassan Bin Abdullah Al Al-Sheikh Street"
- Al-Khozama district "Prince Mishaal Bin Abdulaziz Street"
- Om Al-Hamam district "Prince Turki Bin Abdulaziz Street"
- Al-Nasseriah district "Prince Sattam Bin Abdulaziz Street"

Each median island of the selected streets in the various districts was divided into 3 parts. The study was carried out on 20 palm trees from each part. The percentage of the deformed trunks of date palm trees in each district was calculated. The lengths of the deformed area "separation of leaf bases" on the trunks of

date palm trees and distance of the deformed area from the soil surface were measured. Heights of the trunks of studied date palm trees in the selected streets were also measured. The percentage of the deformity for each date palm trunk was calculated (length of the deformed area/trunk length x 100). All observations on the used irrigation methods were recorded for each street in the various districts. The pH of the irrigation water was 7, while the water salinity "EC" ranged from 2.5-4.5 (dSm⁻¹). The layout of the study was Complete Randomized Design (CRD). Data were analyzed by the analytical program (SAS), using the revised LSD test at 5% level of probability to compare the mean values [10]. To find out which fungi species grow on the infected parts with rot at the bases of palm leaves, samples were collected from the infected leaf bases in all studied districts. The samples were isolated and analyzed in accordance with the biology method used for fungi extraction and purification [12]. This work was done in the fungal and bacterial diseases laboratory, Department of Plant Protection, College of Food and Agricultural Sciences, King Saud University.

RESULTS AND DISCUSSION

The data in this study show the case of the deformity on the trunks of date palm trees planted in the median islands of some streets in various districts of Riyadh region (Table 1). The percentages of deformed trunks of date palm trees were 100 % in all studied districts except "Al-Khozama" district where it was 70.3%. The results of statistical analysis showed that the length of the deformed area on the trunks of date palm trees varies among the different districts in Riyadh region. It found that the greatest average value of length of the deformed area was 119.6 cm. in "Om Al-Hamam" district "Prince Turki Bin Abdulaziz street", where it was observed that the date palm trees were irrigated by the bubbler method, in the addition of mobile irrigation tanks when water cease. The smallest value of length of the deformed area was 28.7 cm. in "Al-Khozama" district, where it was observed the irrigation of the date palm trees was by drip method, in addition to the mobile irrigation tanks. The results showed that most of the deformed areas on the trunks of date palm trees were starting at the soil surface in all districts. It is observed that these cases are referred to the separation of leaf bases from the trunk and the growth of the lateral roots on it. The increased moisture leads to stimulation of lateral roots to come out in large groups on the trunk of the date palm. Usually the roots emerge from the tissue of the trunk at a height of

Table1: Case of trunk's deformation of date palm trees planted in streets of the various districts in Riyadh region.

Districts	Deformedtrunks%	Length of deformed area(cm)			Height of deformed area from the soil surface (cm)			Length of the palm trunk(m)	Deformation%	Observation on Irrigation methods
		lowest value	highest value	Mean	lowest value	highestvalue	Mean			
King Fahad	100	25	121	66.73 c*	0	169	5.52 b	6.79 d	9.93 bc	Floodirrigation +
Al- Gamaa	100	15	214	81.43 b	0	236	21.62 a	7.16 c	11.48 b	Bubbler irrigation+
Al-Khozama	70.3	0	103	28.65 d	0	1.00	0.4 b	4.64 e	6.26 d	Drip irrigation +
Om Al-Hamam	100	49	217	119.62 a	0	173	5.73 b	8.58 a	14.17 a	Bubbler irrigation+
Al-Nasseriah	100	31	164	70.80 b c	0	1.00	0.4 b	8.11 b	8.74 c	Bubbler irrigation+
L.S.D at 0.05	--	--	--	12.53	--	--	12.62	0.21	1.83	--

*Means followed by the same letter (s) within column are not significantly different at the 5% level of L.S.D. test.

+ Additional irrigation applied by mobile water tanks at water cease or by hoses connected to the fixed water outlets in median street islands.

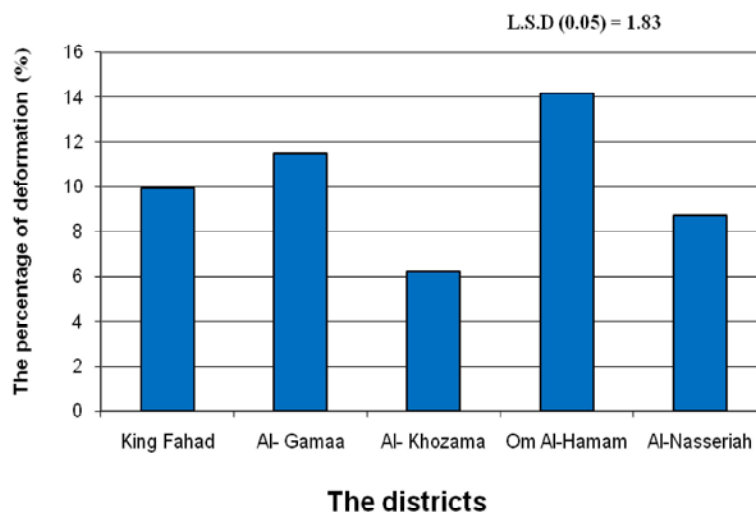


Fig. 1: The percentage of deformation (length of the deformation area / length of the trunk) of date palms grown in streets of the various Riyadh districts

30 cm. from the soil surface where they grow and extend under the leaf bases, so this stress leads to cracking and separation of leaf bases from the trunk [13]. The results showed that the greatest average height of the deformed area from the soil surface in "Al-Gamaa" district was 21.62 cm. while the smallest average height was 0.4 in "Al-Khozama" and "Al-Nasseriah" districts. However, most of the deformed areas were near or at the soil surface in the various districts. The results also showed that the percentage of deformation of date palm trunks (length of deformed area / length of trunk) was the highest in "Om Al-Hamam" district (14.17 %) and the lowest in "Al-Khozama" district (6.26%). The percentage of deformation was greater in "Om Al-Hamam" than in the other districts (Fig. 1).

The results of this study showed that the percentage of deformation on the trunks of date palm trees planted in the median islands in Riyadh region, varied according to the used irrigation method. The percentage of deformation obtained when using bubbler irrigation method was

greater than those obtained when either drip irrigation or flood irrigation was used (Fig. 2). For all the used irrigation methods, additional irrigation by mobile water tanks was applied when water cease or by hoses connected to the fixed water outlets in median street islands. The percentage of deformation on the trunks of date palm trees was the lowest when using drip irrigation and the highest with the use of bubbler irrigation or flood irrigation method. The reason for increasing the percentage of the deformation when using the bubbler irrigation may be attributed to damage of its water outlets and so water reaching directly and continuously to the trunks at different heights. It also may attribute the cause of increasing the percentage of deformation when using bubbler or flood irrigation as a result of the cases which observed when irrigation was applied directly by hand at the water cease. It was found through some studies that the use of bubbler irrigation method gave increase in vegetative growth of the date palm trees more than the other methods of irrigation [7, 9]. Bacha *et al.* [9]

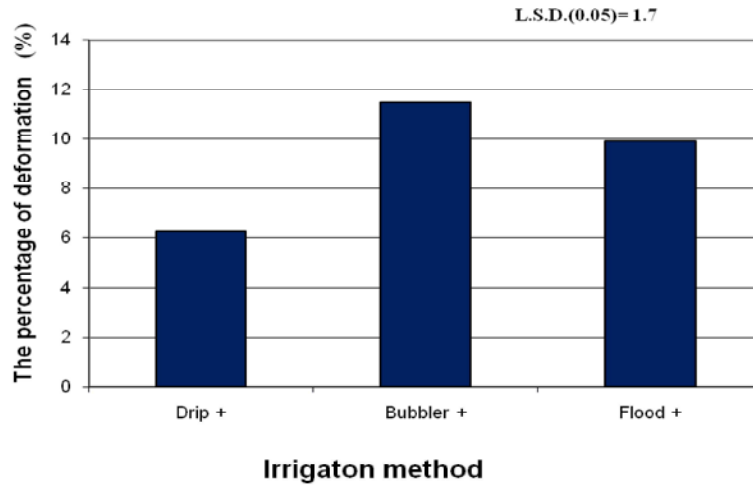


Fig. 2: The percentage of deformation (length of deformation area/ length of trunk) according to the observed irrigation method used for date palms.+Additional irrigation applied by mobile water tanks at water cease



Fig. 3: The beginning of the deformed area (separation of leaf bases) at the soil surface



Fig. 4: Two deformed areas on the trunk, first at the soil surface and the other one up the trunk

explained that drip irrigation had led to increase the yield of date palm trees. Al-Amoud and Sharf [10] showed that the drip irrigation was the most suitable method for date palm trees. It works to save water, limits the growth of weeds, improves the quality of roots and reduces the attack of diseases. On the other hand, the bubbler irrigation method leads to accumulate the water around the trunks of the date palm trees and be exposed to runoff, where it requires placing circular soil barriers around the palm trunk to prevent loss of water. It is observed that the most cases of the trunk's deformity of date palm trees appeared at the soil surface (Fig. 3). It is also observed that the deformations on the trunks appeared at different heights of soil surface (Fig. 4). This study showed that the apparently case of deformation on the trunks of date

palm trees resulted from excess moisture at the area of leaf bases, which leads to the increased growth of lateral roots under the leaf bases, pushing and causing the separation of the leaf bases and then inflation of the trunk in this area. When there is lack of moisture and no contact of roots to the soil surface, death occurs to the formed roots. In the case of the exposure of this area to moisture for another time, new groups of roots will grow under the dead layer of roots resulting in pushing the dead roots causing their separation from the trunk. Repeating death of root groups and the growth of the other new groups from the inside will push dead roots until they separate from the trunk [13]. So, each time the perimeter of the trunk at the separation area of leaf bases reduces where occurs corrosion in this area lead to scraggy trunk and

thus weak palm. Results of the investigation of leaf bases samples taken from the infected rot deformed areas on the trunks which were isolated, purified and defined showed the presence of the following fungi species (*Fusarium oxysporum*, *Fusarium solani* and *Macrophomina phaseolina*). It was observed that growth of the various fungi species on the deformed areas of leaf bases resulting from excess moisture which lead to rot occurrence and expose to decomposition, causing the separation of the leaf bases from the trunk [12, 14].

CONCLUSIONS

The case of apparently deformation on the trunks of date palm trees is a result from excess moisture on the leaf bases area because water reaching directly to the trunk, leading the lateral roots to grow strongly under the leaf bases, then they push the leaf bases causing their separation from the trunk. Deformation occurs also as a result from drought of the roots which were grown at the leaf bases area and the continuity of exposing the trunk to periods of high moisture and drought lead to the growth of the roots. The drought of roots and their drops out the trunk lead to corrosion and scraggy trunk. The increase of moisture creates an appropriate environment which helps the growth of different fungi species on the trunk causing rot of the leaf bases and facilitating the separation of the leaf bases on the trunk. The reason for reaching the water directly to the trunk is because of the damage caused the used irrigation system especially the bubbler irrigation method. In some cases, as the result of this damage and water reaching to the trunks, deformation occurs at various heights from the soil surface. Also the deformation occurs when using hand irrigation (by water hoses) and the water spray reaches directly to the trunk through the water outlets fixed in median islands of the streets or by irrigation with water mobile tanks. The results show the importance of using appropriate methods in irrigating the date palm trees and the need for following-up and running properly so that the water spray do not reach directly to the date palm trunks. It should take care of maintenance of irrigation systems used for the date palm trees planted in the streets at various districts in Riyadh region. The irrigation systems should be designed in a way that water never contacts the trunks of date palm trees especially when using spray irrigation for turf grasses planted on the street median islands at the same location with date palm trees. It is advised to avoid the conventional irrigation (water hoses) where water reaches directly to the trunks of date palm trees, keeping

them away from the exposure to moisture and preventing the separation of leaf bases from the trunk and the occurrence of the deformation.

REFERENCES

1. Ministry of Agriculture, Annual Report. 2009. The Annual Agricultural Statistical Book. Department of Studies, Planning and Statistics. Vice Ministry for Research Affairs and Agricultural Development, Ministry of Agriculture, Riyadh, Kingdom of Saudi Arabia, No.22 (In Arabic).
2. Sayan, M.S., 2001. Landscaping with Palms in the Mediterranean. Palms, 45(4): 171-176.
3. Al-Mana, F., 2007. The use of date palm in landscaping. The Fourth Symposium on Date Palm in Saudi Arabia, King Faisal University, Al-Hassa, Saudi Arabia (In Arabic).
4. Ibrahim, A.M. and M.N. Kholeaf, 1998. Date Palm, Plantation, Care and Production in the Arab World. Monshaat Al-Maaref, Alexandria, Egypt, pp: 756.
5. Albaker, A., 2002. Date Palm- Past and Present. Second Edition, Aldar Al-Arabia for Encyclopedias, Beirut, Lebanon (In Arabic).
6. Zaid, A. and E.J. Arias-Jimenez, 2002. Date Palm Cultivation. FAO, Rome- Italy.
7. Amiri, M.E., M. Panahi and G. Aghazadeh, 2007. Comparison of bubbler, sprinkler and basin irrigation for date palm (*Phoenix dactylifera*, cv. Zahdi) growth in Kish Island, Iran. International J. Food, Agriculture and Environment, 5(3 and4): 185-187.
8. Aldakheel, Y. and H. Sheikhan, 2004. The effect of different irrigation system and watering regimes on date palm production and fruit quality. J. Agric. Sci. Mansoura Univ., 29(7): 4115-4123 (In Arabic).
9. Bacha, M., A. Al-Amoud and A. Al- Darby, 1997. Response of seleg date palm trees to basin, bubbler and trickle irrigation systems using different irrigation regimes. The Scientific Symposium of the First Saudi Conference for Agricultural Sciences, Volume II, College of Food and Agricultural Sciences, king Saud University, Riyadh, Saudi Arabia (In Arabic).
10. Al-Amoud A. and M. Sharf. 1997. Date Palm Irrigation. The Extension Book for Date Palm Trees. Agricultural Extension Center, College of Food and Agricultural Sciences, king Saud University, Riyadh, Saudi. Arabia, (In Arabic).

11. Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics. McGraw-Hill, New York.
12. Rashed, M.F. and N.E. Abdel El-Hafeez, 2001. Decline of date palm trees in Egypt. 2nd Int. Conf. Date Palm, Al-Ain, UAE, pp: 401-407.
13. Maki, M., A. Hamuda and A. Al-Abri, 1998. Pomology of Horticulture- Date Palm. Vol. II, New Color Press. Sultanate of Oman (In Arabic).
14. El-Meleigi, M.A., A.A. Al-Rokibah, Z.M. Hassan and G.H. Ibrahim, 1993. Vascular wilt of the date palm (*Phoenix dactylifera* L.) caused by *Fusarium oxysporum* in Al- Gassim Region, Central Saudi Arabia. Proceeding of the Third Symposium on the Date Palm in Saudi Arabia, King Faisal University, Al-Hassa, Saudi Arabia, Vol. II, pp: 67-76.