
A survey on some physical properties of the Date Palm tree

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Results of physical properties showed that there is an appropriate relation between height of trunk based on age while there were no acceptable relations between the lowest green leaves distance till fruit, crown height and circumference of trunk in various sections based on age. The correlation coefficient of height based on age was obtained as $R^2=0.94$. These results can be useful for determining the size, reach and general requirements of a special date palm service machine.

Key words: Date palm, Shahani, Jahrom, Physical properties

Introduction

Date palm (*Phoenix dactylifera* L.) is a tree which is extensively cultivated for its edible fruit. The growth habit of palms is a cylindrical, no branching stem, and relatively tall trunk. The trunk of date palm is composed of vascular bundles held together with connective tissue. Towards the periphery, where the leaf bases are embedded, the tissue tends to become more lignified and tough (Barreveld, 1993). The date palm tree commonly grows to a height of about 10 to 15m and features a slender trunk of more or less constant diameter from the base to the crown. Each year the old leaves are cut off at the base of the leaf stem. If the bases of the leaves are cut off, the trunk becomes smooth, much smaller in diameter, and more difficult to climb (Al-Suhaibani *et al.*, 1988). Date palm lengthwise growth is upward and is provided by means of leaf growth from apical meristem and is a function of fertilization, irrigation, pruning and so on. Overall length of date palm depends on variety and region, and in some cases as Shahani variety in Jahrom becomes 20 meters and more (Hashempour, 1999). The date palm may reach an age of over 100 years. Application and development of suitable methods especially mechanization of date farming is essential to optimize this industry (Albozhar,

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2003). During the past decades, increasing interest in mechanization date palm services has led to the development of date harvesting aids and machines (Perkins and Brown., 1964, 1967; Sarige *et al.*, 1971, 1989; Al-Suhaibani *et al* 1988, 1992; Shamsi, 1998; Loghavi and Abounajmi, 2001). Knowledge of date palm characteristics is necessary for mechanization date palm tree. Therefore, it is needed to have comprehensive information of characteristics of this plant. This comprises physical and mechanical properties.

In order to design a palm service machine, Al-Suhaibani *et al.* (1988) carried out a survey on 19 farms without considering variety and age of tree in Saudi Arabia. They measured the distance between tree, height (to crown), trunk diameter, bunch spacing and ground profile. Ahmed *et al.* (1992) obtained date palm properties as possible for use in date palm mechanization. They obtained age, tree height, srown height, trunk diameter and palm distribution in the field and also cutting resistance of the leaves on some varieties without considering specified varieties. Mazlumzade and shamsi (2003) determined some engineering parameters of some date palm varieties in 9 big orchards without considering age of tree of Bam and Shahdad located in Kerman province of Iran. Some of the recorded parameters were height, trunk diameters at ground surface and under crown, tree spaces and some other parameters. They concluded that any new harvester machine must be able to reach the average height of palm of 10.5 m. Moreover, it must be able to carry a maximum payload of around 1100-1300N and have a length less than 3 m.

The objective of this research was to determine some important physical properties of date palm cv. Shahani based on age of tree. No detailed studies concerning relationship between age and palm physical properties have been performed on a specified variety up to now.

Materials and methods

The physical study carried out in fourteen different gardens in Jahrom which is one of the most important horticultural centers in the south of Iran. The selected palm tree cultivar was Shahani which is the most popular cultivar in Jahrom. Physical parameters including circumference of trunk in various sections, height of trunk, distance between the lowest green leaves and fruit; and crown height (distance between the lowest green leaves and initial point of end leaves at the top) were measured using a scaled tape by an expert man named Mohar; who can climb any tall palm tree and do special operations (Fig. 1.). Data measurements repeated at least five different randomize times for each age category of palms between 10-45 years old.



Fig. 1. Expert man (Mohar) during measuring parameters.

Results and discussion

Results of physical properties showed that there is an appropriate relation between height of trunk based on age while there were no acceptable relations between the lowest green leaves distance till fruit, crown height and circumference of trunk in various sections based on age. This may be due to the different ingredients. There is considerable variation depending on locations like soil, climate conditions and farming practices, particularly irrigation. A summary of field measurements on the related date palm are given in Table1. The data showed wide variations in all the measured physical properties. The coefficient of correlation of height based on age was obtained as $R^2=0.94$ which means that regression line was fitted to data. Regression line between heights of trunk and age of tree is shown in Fig.2. The averages of trunk height were obtained as 1.44 and 10.32m for the first and final categories of palm with 10 and 45 years old, respectively. Al-Suhaibani *et al.* (1988) measured tree height averages ranges from 4.38m to 9.82m with maximum and minimum values of 17.43 and 1.00m in different farms, respectively that without considering the variety and age of tree. Ahmed *et al.* (1992) measured height of palms ranges from 1.1 to 10.2m in different farms while Mazlumzade and shamsi (2003) found that the average of tree height of selected palm varieties range from 6.5 m to 17 m with average of 10.3 m that without considering age. Height is an important factor in designing a machine to lift an operator to perform the crown related operations or importance of using safety equipment in designing robot or a lifter machine that is directly connected to trunk. Result from analysis of circumference of trunk in various sections

showed that there were no significant differences between mid and top circumference of trunk while bottom circumference has a significant difference at 5% level. The averages of bottom circumference without considering age were obtained as 1.94m which its value varied from 1.60 to 2.50m, respectively. The average values of mid and top circumference varied from 1.28 to 2.40m, with average value of 1.72m, respectively. Al-Suhaibani *et al.* (1988) found that averages of circumference vary from 1.30 to 1.80m with maximum and minimum values of 2.56 and 0.90m in different farms. Ahmed *et al.* (1992) found that tree circumference ranges from 1.16 to 1.72m in different farms while Mazlumzade and shamsi (2003) found that diameters of selected palm varieties at ground surface vary from 50-85cm with average value of 63.9cm while average diameter under crown diameter was measured as 44.1cm with maximum and minimum values of 30 and 64cm, respectively. Palm tree trunk can be utilized for the machine support. Values of distance between the lowest green leaves till fruit and crown height varied from 0.62 to 2.14m and 1.32 to 3.09m with average values of 1.29 and 2.01m, respectively. Ahmed *et al.* (1992) found that crown length ranges from 0.68 to 1.2m in different farms.

Table 1. A summary of physical properties of date palm.

Age (year)	Replications	Height (m)	Distance between bottom leaf till Fruit (cm)	Height of crown (cm)	Bottom circumference (cm)	Mid circumference (cm)	Top circumference (cm)
10	15	1.51	90.33	159.40	194.07	-	-
15	5	2.99	104.60	179.40	183.30	194.40	-
16	5	3.21	171.40	236.80	194.00	186.80	-
20	10	4.60	128.50	198.40	185.40	175.40	173.10
22	5	3.86	147.20	226.60	203.60	170.68	162.80
25	5	4.97	180.60	260.60	215.00	189.20	198.00
31	5	7.13	184.00	256.20	175.80	175.80	172.60
40	5	9.45	104.00	146.00	185.40	166.40	134.20
45	5	10.32	107.00	174.60	178.20	169.60	171.60

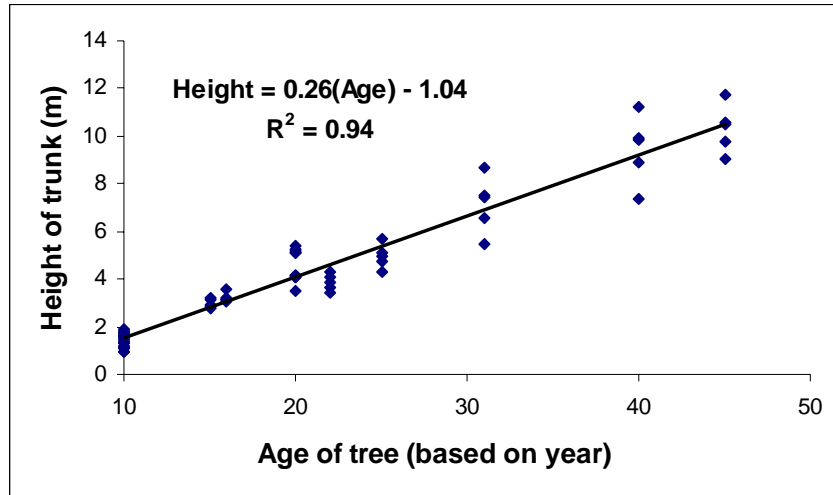


Fig. 2. Regression between height of trunk and age of tree

Conclusions

The physical properties showed that there is an appropriate relation between heights of trunk based on age while there were no acceptable relations between the other measured physical properties based on age. The averages of trunk height were obtained as 1.44 and 10.32m for the first and final categories of palm with 10 and 45 years old, respectively. Circumference of trunk in various sections showed that there were no significant differences between mid and top circumference of trunk while bottom circumference has a significant difference at 5% level. The bottom circumference without considering age were averaged as 1.94 m which its value varied from 1.60 to 2.50 m, respectively. The values of mid and top circumference varied from 1.28 to 2.40m, with average value of 1.72m, respectively. Values of distance between the lowest green leaves till fruit and crown height varied from 0.62 to 2.14m and 1.32 to 3.09m with average values of 1.29 and 2.01m, respectively. There are different ingredients like soil, climate conditions and farming practices, particularly irrigation which affected the results.

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