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Cultivation of date palm in Iraq

Uprawa palmy daktylowej w Iraku

Summary. Date palm (*Phoenix dactylifera* L.) is a major fruit crop in most Arab countries. It has been historically connected with sustaining human life and the tradition of the people in the old world as a major agricultural crop. Arab countries possess 70% of the 120 million date palms cultivated in different countries in the world and are responsible for 67% of the global date production. Iraq is one of the major producers of dates. During the past 50 years, date palm plantations in Iraq were subjected to degradation due to an extensive exploitation resulting from the increase in the human and domestic animals population. As much as 30% of the production can be potentially lost as a result of pests and diseases. Technical and socio-economic factors contributed to the decrease of date production. Recommendations for stopping the degradation in the date palm sector and strengthening this industry particularly for cultivation, harvesting, date processing and marketing in Iraq and in other Arab countries have been proposed.

Key words: botanical description, multiplication, nutrition, protection, present status

INTRODUCTION

The date palm (*Phoenix dactylifera* L.) belong to Arecaceae family and it is considered a symbol of life in the desert, because it tolerates high temperatures, drought and salinity more than many other fruit crops [Lunde 1978]. Originates from its fruit 'Phoenix' presumably derived from the Greek word for purple or red fruit, and "dactylifera" from the Greek word "daktulos" meaning finger like appearance of the fruit's form [Zaid

and de Wet 2002]. It is one of the oldest trees from which man has derived benefit, and it has been cultivated since ancient times [Riad 2006]. The only indigenous wild desert plant definitely domesticated in its native harsh environments appears to be the date palm. [Zohary and Hopf 2000]. Date is one of the oldest known fruit crops and has been cultivated in North Africa and the Middle East for at least 5000 years [Al-Bakr 1972, Pieniążek and Pieniążek 1981, Johnson 2010]. The earliest record from Mesopotamia shows that date culture was probably established as early as 3000 B.C. The religious importance of date palm goes back to prophet Abraham, who was living in Ur and loved dates. In Christianity, the palm leafs are used for celebration of Easter Sunday [Zohary and Hopf 2000]. While in Islam, the date palm mentioned more than any other fruit-bearing plant in the Qur'an, is a symbol often associated with the religion and the Muslims [Al-Bakr 1972].

Date palms and their culture are depicted in ancient Assyrian and Babylonian tablets, including the famous code of Hammurabi, which contained laws pertaining to date culture and sales. References relating to date palms are also found in ancient Egyptian, Syrian, Libyan, and Palestinian writings [Popenoe 1973].

Because of the long history of date culture and the wide distribution and exchange of date cultivars, the exact origin of the date is unknown, but it most likely originated from the ancient Mesopotamia area (southern Iraq) or western India [Wrigley 1995].

BOTANICAL DESCRIPTION, IMPORTANCE, AND CLIMATIC REQUIREMENTS OF DATE PALM

Botanical profile

About 19 palm species belonging to the *Phoenix* genus are known. The most important ones are date palm, Canary Island palm (*P. canariensis*), Senegal date palm (*P. reclinata*) and Indian sugar date palm (*P. sylvestris*). The date palm is a monocotyledonous woody diploid (2n = 2x = 36) and dioecious species, i.e. the male and the female flowers are on separate plants [Barrow 1998]. The trees are adapted to arid environment. The date is an erect palm growing 30–36 m high and the diameter of its trunk is growing up to 50 cm. The trunk is clothed from the ground up with upward-pointing, overlapping, persistent, woody leaf bases. After the first 6 to 16 years, numerous suckers (offshoots) arise around trunk`s base. The feather-like leaves, up to 6 m long, are composed of a spiny petiole, a stout midrib, and slender, gray-green or bluish-green pinnae, and folded in half lengthwise. One palm tree develops 80 to 120 leaves. Each leaf emerges from a sheath that splits into a network of fibers remaining at the leaf base. Small fragrant flowers (the female whitish, the male waxy and cream colored), are borne on a branched spadix divided into 25 to 150 strands. One large inflorescence may embrace 6000 to 10 000 flowers. Some date palms have strands bearing both male and female flowers, others may have perfect flowers. As the fruits develop, the stalk holding the cluster may elongate 1.8 m, while it bends over because of the weight. The fruit is oblong, dark-brown, reddish, or yellowish-brown when ripe with thin or thickish skin, thick, sweet flesh (astringent until fully ripe) and a single, cylindrical, slender, very hard stone grooved down one side. From the time of pollination, it takes 150−200 days for the fruit to reach fully ripened stage (Tamar stage). A fully productive palm can support 8–10 bunches weighing as much as 60–100 kg [Pieniążek and Pieniążek 1981, Zaid and Arias

2002]. The palm tree develops roots up to 10 m long which help to bear the drought, salinity and contributes to the maintenance of the soil from erosion. The date palm tree lives up to 100 years and more. Usually it starts fruiting 3–4 years after planting, up to the top of palm production in the second decade of life and continuing at the same rate to the age of 50 years [Ali 2010].

Distribution of date palm

Today the date palm is found in both the Old World (Near East, North Africa, Spain) and the New World (Australia and American continent) where dates are grown commercially in large quantities [Johnson 2010]. The date belt stretches from the Indus valley in the east to the Atlantic in the west. In order to have a clear picture on the geographical distribution of date palm, it is worth looking at it from the following aspects: (A) distribution according to latitude, (B) distribution according to altitude and (C) number of date palms in the world [Sawaya 2000].

The distribution of date palm according to latitude for both northern and southern hemispheres are between 10°N (Somalia) and 39°N (Elche/Spain or Turkmenistan). Favorable areas are located between 24° and 34°N (Morocco, Algeria, Tunisia, Libya, Egypt, Iraq, Iran). In USA date palm is found between 33° and 35°N. Because of climatic factors, the date palm will grow, but will not fruit properly outside the above defined geographical limits [Zohary and Hopf 2000].

Altitude is very important since it imposes the availability of water and the temperature limits which largely determine the distribution of date palm in the world. In fact, date palm grows well from 392 m below sea level to 1500 m above with an altitude range of 1892 m [Al-Bakr 1972].

Iraq may be considered the date palm country, apart from the northern part of the country, date palm trees grow every where. Its growth extends between 35° N latitude which passes through Tickret on Tigris and Ana on Euphrates, down to the Fauo on the Arabian gulf, 30° N latitude. It is estimated that the number of palm trees in Iraq exceeds 22 millions tree which cover an area over 120 000 hectares [Al-Dekaili and Al-Dejaili 1989]. According to recent statistics, the date palm trees concentrated in Basra governorate are considered the largest date palm forest in the world. It is estimated that the number of date palm trees in this governorate exceeds 13 millions and that they cover an area over 50 000 hectares [Jaradat 2003]. Detailed data on the number of date palm trees, the total fruit production and the tree productivity by governorate in Iraq in 2001 is presented in Table 1.

Climatic factors

The date palm has adapted to areas with long dry summers and mild winters. It has a unique characteristic to thrive in desert and oasis where temperature could be high but with underground water close to the surface [Al-Bakr 1972]. Under these situations the date palm is described as having its feet in the running water and its head in the fire of the sky. Date fruit production is dependent on the availability of certain heat requirements according to cultivars. Most dry cultivars are found in the dry areas whereas soft and semi dry ones are confined to the humid and semi dry areas. During winters, temperatures below 0°C are also endured. The zero vegetation point of a date palm is 7°C

and above this level its growth is active and reaches an optimum at about 32°C. Than the growth will continue at a stable rate until the temperature reaches 38 to 40°C when it will start decreasing. When the temperature decreases for a certain period to below 0°C, it causes metabolic disorders which lead to partial or total damage of leaves. At -6°C pinnae margins turn yellow and dry out. Inflorescences are also heavily damaged by frost. When frost periods are suspected, inflorescences should be protected with craft paper bags immediately after pollination. In the temperature ranging from -9 to -15°C, leaves of medium and outside canopy will be damaged and dry out. If these low temperatures are maintained for a long period (12 hours to 5 days) all leaves will show frost damage and the palm will look as if it was burnt [Dowson 1982]. The date thrives in sand, sandy loam, clay and other heavy soils. It needs good drainage and aeration. It is remarkably tolerant of alkali. A moderate degree of salinity is not harmful but excessive salt will stunt growth and lower the quality of the fruit [Al-Bakr 1972].

Table 1. Number of date palm trees, total fruit production and tree productivity by governorate in Iraq in 2001 [Amer and Hussain 2006]
Tabela 1. Liczba palm daktylowych, produkcja daktyli ogółem i plon owoców z palmy, z podziałem na jednostki administracyjne Iraku w roku 2001

Governorate Jednostki administracyjne	Tot. no. of trees Całkowita liczba palm	No. of fruiting trees Liczba palm owocujących	Production (tons) Produkcja (w tonach)	Yield kg/palm Plon w kg/palmę
Tameem	400	-	-	-
Diyala	1.982.400	1.710.300	123.670	72.3
Anbar	680.600	634.400	50.990	80.4
Baghdad	1.506.900	1.347.700	108.830	80.8
Babylon	3.370.800	3.012.500	227.060	75.4
Kerbala	2.079.500	1.894.000	128.840	68.0
Wassit	640.900	540.000	39.600	73.3
Salah Al-din	273.900	231.800	17.160	74.0
Najaf	626.300	604.300	24.170	40.0
Qadissya	822.400	765.300	49.650	64.9
Muthanna	219.800	154.800	7.720	49.9
Thi-Qar	814.500	770.600	47.050	61.1
Missan	194.800	168.700	8.770	52.0
Basrah	2.697.600	2.108.600	73.280	34.8
Total – Razem	15.910.800	13.943.000	906.790	65.0

Importance of date palm

The date itself is a high energy food item for both people and livestock. Since ancient times, the date palm has been an important source of food for the inhabitants of the Arab countries. Dates have proved to be the best resource to ensure food security during food shortages and crises [Pieniążek and Pieniążek 1981].

The most commonly used parts of the date palm are its fruits, bark and leaves and they have the many commercial and medicinal applications. Date fruits are high-energy food source with 72 to 88% sugar content at maturity. Dates are also processed into paste and date syrup called 'Dibs' which are used in some recipes [Ahmed *et al.* 1995].

Table 2. Nutritional value of fruits of four Iraqi date palm cultivars [Yousif and Ben Jamin 1982]
Tabela 2. Wartość odżywcza czterech irakijskich odmian palmy daktylowej

Element (mg · kg^{-1}) Składnik	'Hillwai'	'Sayer'	'Khedrawi'	'Zahdi'	Mean Średnio
P	160	130	150	140	145.0
K	8540	8330	8940	8870	8670.0
S	100	200	140	210	162.5
Ca	1840	2030	1330	2070	1357.5
Mg	560	580	600	590	582.5
CI	2600	3120	2660	3420	2950.0
Fe	52.6	32.1	45.0	103.7	58.4
Mn	58.6	52.5	51.4	51.6	53.5
Cu	27.7	28.9	25.4	27.5	27.4
Zn	13.9	18.2	12.9	7.4	13.1
Co	7.6	9.6	9.6	9.5	9.1
F	2.0	1.2	1.4	1.2	1.5
Sugar (% of d.w.) – Cukier (% s.m.)					
Total sugar – Całkowity cukier	87.9	86.1	87.7	86.8	87.1
Reducing sugar – Cukier	82.7	82.6	81.9	73.4	80.2
Sucrose – Sacharoza	4.8	3.5	4.5	12.7	6.4
Glucose – Glukoza	43.7	44.8	44.7	32.8	41.5
Fructose – Fruktoza	37.2	38.0	38.5	39.2	38.23
Vitamins (mg · l00 g^{-1} of d.w.) – Witaminy (mg · 100 g^{-1} s.m.)					
Thiamine (B1) – Tiamina	99.0	130.0	94.0	80.0	100.8
Riboflavin (B2) – Ryboflamina	173.0	135.0	149.0	167.0	156.0
Biotin – Biotyna	4.6	4.7	4.1	5.7	4.8
Folic acid – Kwas foliowy	57.0	70.0	43.0	63.0	58.2
Ascorbic acid – Kwas askorbinowy	3.6	17.5	3.2	2.4	6.7
Other components – Inne składniki					
Moisture (% f.w.) – Wilgoć	7.3	7.5	9.5	8.3	8.1
Total soluble solids (% f.w.) Ogół rozpuszczalnych substancji stałych	84.2	81.3	80.8	82.1	82.1
Total insoluble solids (% f.w.) Ogół nierozpuszczalnych substancji stałych	17.9	10.0	9.5	9.2	11.7
Protein (% d.w.) – Białko	2.3	2.8	2.4	2.2	2.4
Fat (% d.w.) – Tłuszcz	0.5	0.3	0.5	0.4	0.4
Ash (% d.w.) – Piopiół	1.9	1.8	2.1	1.8	1.9
Crude fiber (% d.w.) Włókno surowe	1.8	1.7	2.3	2.5	2.1

The tree is a spectacular palm for landscaping large areas. It provides shade and protection from wind. It also prevents soil degradation and desertification, thus protecting the environment. In fact, the date palm represented an eloquent example of integrated sustainable use of renewable material resources [El-Mously 1998, Ibrahim 2010].

The dates formed part of various ointments and bandages. The sap of leaves is a remedy for nervousness and kidney trouble. Moreover it putrids wounds and calms the effervescence of the blood. Burnt seeds are made in an ointment for ulcers or a collyrium that produce long eyelashes.

The fruit, because of its tannin content, is used medicinally as a detersive and astringent in intestinal troubles. In the form of an infusion, decoction, syrup or paste, is administered as a treatment for sore throat, colds, bronchial catarrh. It is taken to relieve fever, cystitis, gonorrhea, edema, liver and abdominal troubles. The seed powder is an ingredient in a paste given to relieve ague. A gum that exudes from the wounded trunk is employed in India for treating diarrhea and genito-urinary ailments. It is diuretic and demulcent. The roots are used against toothache [Morton 1987].

Detailed information about nutritional value of fruits of four Iraqi date palm cultivars is given in Table 2.

Date palm cultivars grown in Iraq

Over 400 date cultivars are cultivated in Iraq. They can be identified by their characteristic fruit appearance and texture and fall into three types: soft, semi-dry, and dry. The type of fruit depends on the glucose, fructose, and sucrose content. This division is based on the texture or consistency of fruit under normal conditions of ripening.

Soft dates: they are distinguished by a soft flesh, high moisture (> 30%) and high sugar content; following cultivars belong to this type: ‘Khastawi’, ‘Barhee’, ‘Halawy’, ‘Hayany’ and ‘Khadrawy’.

Semi-dry dates: they feature a firm flesh, fairly low moisture (20−30%) and high sugar content; this type includes: ‘Halawi’, ‘Dayri’ and ‘Khadrawy’.

Dry dates: they have a high sugar and low moisture (< 20%) content, their flesh is dry and hard; this type includes cultivars ‘Zahdi’ and ‘Sayer’.

Detailed description of the most important cultivars grown in Iraq is presented in Table 3.

Dates ripen in five stages which can be described as follows:

Hababouk stage − earliest stage of fruit development; it begins from fruits set and continues 4–5 weeks, in this time the content of moisture in the fruit is 85 to 90%.

Kimri stage − it is characterized by rapid increase in fruit size, weight, content of reducing sugars and highest acid activity; the content of moisture in the fruit is 80 to 85%. This stage finish when the fruits start to turn yellow or red, according to cultivar. At this point the date seed can already germinate and the fruit is botanically mature.

Khalal stage − fruit starts to turn from green to yellow (or red, according to cultivar). weight gain is slow but sucrose content increases, moisture content goes down to 50−55%, and tannins start to precipitate and lose their astringency. In some cultivars this latter process evolves rapidly, what makes them already palatable; ‘Barhee’ and ‘Hayany’ are harvested at this stage.

Table 3. Characteristic of the most important date cultivars grown in Iraq [Al-Bakr 1972]
Tabela 3. Charakterystyka najważniejszych odmian palmy daktylowej uprawianych w Iraku

Cultivar Odmiana	Description Opis
'Zahidi'	Dry date from Iraq. Medium size, cylindrical, light golden-brown, very sugary, and sold as soft, medium-hard and hard. Distinguished by its large seed in proportion to the fruit itself. This date lends itself well to processing and softening by steam hydration. This date is known for its high invert sugar level and is widely used to make diced dates and date sugar products. It features a crunchy and fibrous flesh. Industrial uses. Odmiana przemysłowa, pochodząca z Iraku, uprawiana na suche owoce. Charakteryzuje się owocami średniej wielkości, cylindrycznymi, bardzo słodkimi, o barwie jasnej, złotobrązowej, miąższu jednocześnie kruchym i włóknistym. Owoce te są sprzedawane jako miękkie, średnio twarde i twarde. Wyróżniają się dużym udziałem nasion, nadają się do przerobu i uwadniania za pomocą pary. Zawierają dużo cukrów redukujących i są powszechnie stosowane do wytwarzania tradycyjnych potraw.
'Khastawi' or 'Khusatawi'	Leading fresh date in Iraq; it is syrupy and small in size, prized for dessert. For fresh market. Wiodąca w Iraku odmiana uprawiana na świeże owoce, przeznaczone do bezpośredniego spożycia. Owoce tej odmiany są małe i słodkie, cenione jako owoce deserowe.
'Sayer' or 'Sayir'	Dry. Dark orange-brown, medium size, soft and syrupy. Industrial uses. Odmiana przemysłowa, uprawiana na suche owoce. Owoce tej odmiany są ciemne, koloru pomarańczowo-brązowego, średniej wielkości, soczyste i słodkie.
Khadrawy	A cultivar favored by many Arabs, it is a soft, very dark date. Originally from Iraq, it has many desirable qualities. It cures well, it ripens to amber, then cured to a reddish brown, with a caramel like texture and a sweet flavor. Industrial uses for export and fresh consumption locally. Odmiana ceniona przez Arabów, o bardzo ciemnych, soczystych owocach. Pochodzi z Iraku, ma wiele cennych zalet. Dojrzewające owoce mają początkowo barwę bursztynową, która następnie przechodzi w czerwono-brązową. Miąższ jest słodki o teksturze karmelu. Uprawiana dla przetwórstwa, na eksport i lokalnie na spożycie bezpośrednie.
'Halawi' or 'Halawy'	Semi-dry. Extremely sweet, small to medium in size. Thick flesh, caramel taste, and sweet, is somewhat wrinkled in appearance, with a yellow color ripening to a light amber and then to a golden brown. Originally from Iraq. Fresh or industrial markets. Odmiana pochodząca z Iraku, o średnio soczystych owocach. Owoce tej odmiany są małe lub średniej wielkości, mięsiste, o powierzchni lekko pomarszczonej, o smaku karmelu, wyjątkowo słodkie. Podczas dojrzewania zmieniają barwę z żółtej na jasnobursztynową i ostatecznie na złotobrązową. Owoce nadają się do przetwórstwa i bezpośredniego spożycia.
'Barhee'	Nearly cylindrical, light amber to dark brown when ripe; soft, with thick flesh and rich flavor; of superb quality. For shipment needs refrigeration as soon as picked, then curing and special packing. Owoce tej odmiany mają kształt prawie cylindryczny i barwę początkowo jasnobursztynową, która podczas dojrzewania przemienia się w ciemnobrązową. Są soczyste, mięsiste, aromatyczne i osiągają najwyższą jakość. Owoce przeznaczone do transportu winny być schładzane i pakowane w specjalne opakowania bezpośrednio po zbiorze.

Rutab stage − dates become half-ripe, soft, and turn to a light brown color, and the sucrose turns to invert sugars, they contain less tannin than in the Khalal stage and fruit moisture is about 35 to 40%.

Tamar stage − dates become soft and sugar becomes mostly invert; at this stage of development semi-dry and dry dates contain about 50% sucrose and invert sugar and the fruit moisture is 20−25% [Pieniążek and Pieniążek 1981].

Culture of date palm

The off shoots, trimmed back 1/3 or 1/4, leaving some of the stiff outer leaves to protect the inner ones, are usually planted 9−10 m apart each way. The holes should be 1 m wide and deep, prepared and enriched several months in advance, and may be encircled by a watering ditch. If the soil dries out prior to planting, the holes are filled with water at that time.

Planting may be done at any time of the year, but most often it takes place in the spring or in the fall. The base is set vertically in the ground and the curving fronds will gradually assume an upright position, especially if the concave side is set to face south. Most plants will root in 2 months if the soil is kept constantly moist, while some may be delayed for a year or even several years before they show vigorous growth. Formerly, the young plants in nursery rows were wrapped nearly to the top with old leaves, paper or burlap sacks for the first year to prevent dehydration by heat or wind, but it is now held that such wrapping interferes with the proper development of the leaves. The palms are pruned twice a year, dry fronds being removed in the fall and the leaf bases may be taken off in the spring [Al-Bakr 1972].

Propagation

Date palms are propagated by four different methods as follows:

Seeds propagation: propagation by seed is not desirable as it usually produces a differentiated population with no two palm seedlings are alike, and so decreasing the chances of producing quality fruit, with one exception of 'Barhee' cultivar [Pieniążek and Pieniążek 1981, Moustafa *et al.* 2010].

Offshoots propagation: this is the method most used in date palm propagation; palms whether male or female can be propagated using the offshoots which develops from axilary buds on the trunk; cutting date palm offshoots from the mother palm requires a skilled and trained laborer; the offshoots are then replanted in a new plantation orchard [Pieniążek and Pieniążek 1981, Alihouri and Dialami 2010].

High offshoots propagation: box or plastic bag filled with soil or peat moss material is wrapped and fastened around the base of the high offshoot; the soil should be moist until rooting occurs; rooted high offshoot can be removed and replanted in the nursery or in the orchard [Bashah 1999].

Tissue culture propagation: a new technique applied for rapid propagation of date palm; three following methods of tissue culture are used: shoot tips and buds culture (organogenesis), embryo culture (embryogenesis), and highly differentiated somatic tissues culture which includes leaf, stem, inflorescence and root sections [Al-Sakran and Muneer 2006].

Fertilization

Generally 1.5–3.0 kg of nitrogen, 0.5 kg of phosphorus and 2.0–3.0 kg of potassium per tree yearly is recommended to maintain optimum growth of palm tree. Long term trials on the use of chemical fertilizers in different areas are needed. In Iraq, date palms are fertilized once a year with manure at the rate of 20 to 44 kg per tree in dependence on age of tree and fertility of soil [Adlan1994].

Irrigation

Correct and adequate irrigation is very important for date palm trees to ensure good palm growth, high yields and good fruit quality [Bazza 2008]. Generally date fruit production is negatively affected by the lack of adequate level of irrigation water. The availability of the water in the soil varies for each type of soil, according to its capacity and capability to retain water. Most of the date palm orchards in Basra depend on the water tide of the Gulf's water. There are many irrigation systems used in the date palm orchards. The implementation of these systems depend on the water resources and its quality, age of the palm trees and soil composition. The irrigation methods currently in use are furrow and basin. Recently, 'drip irrigation' system was introduced [Al-Amoud 2010].

Pollination

Date palms are dioecious and bisexual, that means the male and the female flowers are born on separate palms. The male flowers produce the pollen and the female flowers produce the fruits. Pollination is one of the essential agricultural practices for date fruit production and quality. The pollen from different male cultivar may have different effect on the production and quality of the fruits. The selection of certain male cultivar has effect on the set, quality, size, and color of the fruit [Moustafa *et al.* 2010]. Some of the factors which play an important role in the pollination of date palm are the receptivity of the stigma for pollen grains and the suitable temperature for the germination of pollen grains which is 35°C. The rain fall and the wind have negative effect on the fruit set. There are many methods for pollination; manual and mechanical. Different devices and equipments are used for manual and mechanical pollination [Zirari 2010].

Pruning

Pruning is an important agricultural practice to remove the palm dry leaves and leaf bases. Pruning also removes the fiber, spines, and high offshoots. This practice eliminates insects and the spreading of diseases. Pruning also facilitates laborers when they maneuver to perform other basic agricultural practices such as pollination, thinning, pulling down bunches, and bagging. Pruning, moreover, will enhance lightning thus decreasing the percentage of the humidity around the bunches. Pruning is carried out once a year after harvesting, along with pollination or when the bunches are pulled down. This operation can be done manually or mechanically using hydraulic lift and/or ladders**.**

Bunches

In date palm management there are three following practices that should carried out on date palm bunches:

Thinning is the first practice which provides more nutrients to a fewer number of fruits. This will increase the fruit size, enhance the quality, prevent delay in ripening, and reduce the weight and compactness of the fruit bunch. Thinning will also decreases fungal infection and mechanical damages. This will benefit both the harvesting and packing operations. There are three different methods of thinning: first method of thinning will reduce the number of strands from the central part of each bunch, the second method reduces the number of bunches per palm',and the third method of thinning reduces the number of fruits per strand. Thinning can be also carried out either by certain chemicals or by using diluted pollen grain [Pieniążek and Pieniążek 1981, Soliman *et al.* 2010].

Bending and pulling down. The second practice for date palm bunches management is bending, which is carried out in most date palm orchards. The bunch bends through the leaves and fruit stalk is tied to the mid rib of one of the lower leaves. Pulling down bunches to release them from the leaves should be done with care to avoid breaking fruit stalks. Bunches should not be pulled down until the fruit stalk is thick and long enough. Bending will facilitate harvesting and bunch bagging.

Bunch bagging is the third practice relying on covering of fruit bunches with certain bags. These bags protect fruit from the dust and sun causing sunburn, while also decreasing the damage from insects or birds [Al-Obeed and Harhash 2010, Kassem *et al.* 2010].

Date palm fruit storage and packing

Date fruit is an important nutritional product as it contains a high percentage of sugars, minerals and vitamins. The date fruit is easy to spoil, good care in handling must be taken during harvesting, gathering, and grading according to their variety. Most of Iraqi date palm varieties are harvested by cutting bunches when the fruits are at the ripening stage. Labourers will cut a bunch of dates and place them on mats on the ground. Dates are then removed from their bunch and carefully packed. Some growers fumigate date fruits while they are in the field to protect them from insects and various diseases. Storage is considered an important factor for marketing to increase sales and profits. Date fruit storage is normally done at the farm, and stored in a centrally cooled storage areas and/or in regular storage areas in the packing house. Usually, as part of the preparation process, date fruits are fumigated to control insect population. Packaging is considered a crucial process in date fruit marketing locally and abroad. Date fruit packaging must be done to international standards making it suitable for consumers and very profitable.

Date palm fruit processing and pressing

Currently, Iraq does not process date fruits using modern techniques. Despite the fact that date fruit processing could be very profitable, Iraqis are still using primitive tools and methodology. Dibis production, alcohol, vinegar, liquid sugar, bread yeast and citric acid are small examples of some of the products that result from processing dates. Previously, Iraq had the largest pressing factories for date fruits and its various products. Different types of packaging were used, including plastic, cardboard boxes and wooden crates. In the 1990, the number of pressing factories grew to 250. Since 2003, this sector has suffered from severe neglect, closing most of the pressing factories. This sector, therefore, should be given priority attention to reactivate this important division of date palm fruit processing.

Pests and diseases of date palm in Iraq

Date palms are afflicted with many diseases and pests, but the nature and severity of the problems vary with cultivar, location, weather, and cultural practices [Zaid *et al.* 2002]. In Iraq in date palm cultivation, the main problem is protection against pests and diseases. The names of the most important date pests are given in Table 4.

Table 4. The most important pests and diseases infecting date palm in Iraq [Al-Jboory 2007]
Tabela 4. Najważniejsze szkodniki i choroby palmy daktylowej uprawianej w Iraku

Name Nazwa	Latin name Nazwa łacińska	Family Rodzina	Kind of agrophag Rodzaj agrofaga	Importance Ważność
Longhorn date palm stem borer	*Jebusea hammerschmidti* Reich (syn. *Pseudophilus testaceus*)	Cerambycidae	Insect Owad	+ + +
Fruit stalk borer	*Oryctes elegans* Prell	Scarabaeidae		++
Frond borer	*Phonapate frontalis* Fahraeus	Bostrichidae		+
Dubas bug	*Ommatissus lybicus* Bergevin	Tropiduchidae		+++
Lesser date moth	*Batrachedra amydraula* Meyrick	Momphidae		++
Greater date moth	*Arenipses sabella* Hampson	Pyralidae		+
Termite	*Microcerotermes diversus* Silvestri	Termitidae		+
Parlatoria date Scale	*Parlatoria blanchardii* Targioni	Diaspidae		+
Gohbar mite	*Oligonychus afrasiaticus* (McGregor)	Tetranychidae		+++
Inflorescence rot	*Mauginiella scaettae*, *Fusarium moniliforme* and *Thielaviopsis paradoxa*		Fungi Grzyb	+
Fool disease	*Thielaviopsis paradoxa*, *Chalaropsis radicicola*			+
Diplodia disease	*Diplodia phoenicum*			+
Graphiola leaf spot	*Graphiola phoenicis*			+
Lwading shoot rot (Belaat)	*Phytophthora parasitica*			+
Leaf dieback	*Alternaria* sp.			+
Fruit rots	*Alternaria* spp., *Helminthosporium* sp., *Cladosporium*, *Stemphyllium*, *Macrosporium*, *Citromyces*, *Aspergillus* spp., *Penicillium*, Yeasts – Drożdże			+
Root knot	*Meloidogyne arenaria*, *Meloidogyne hapla*, *Meloidogyne incognita*, *Meloidogyne javanica*		Nematode Nicień	+
Root lesion	*Pratylenchus penetrans*			+
Rats – Szczury				+
Birds – Ptaki				+
Wasps – Osy				+

Present status of date palm in Iraq

According to the report of FAO [FAOSTAT 2009] about 75% of the world production of dates is in Arab countries for 2008; half of these is in Gulf area (including Iraq and Yemen) and the other half is in North Africa countries (including Sudan) [FAOSTAT 2009]. Production of dates in Arab countries stood at 509 699 tones produced from 8 234 608 date palm trees [AOAD 2008]. This clearly indicates that most of the world's date production is concentrated in a few countries in the same region. Date production of Egypt alone represents about 20% of the total World production, while Tunisia, Algeria and Saudi Arabia are among the five leading date-exporting countries [Zaid 2001].

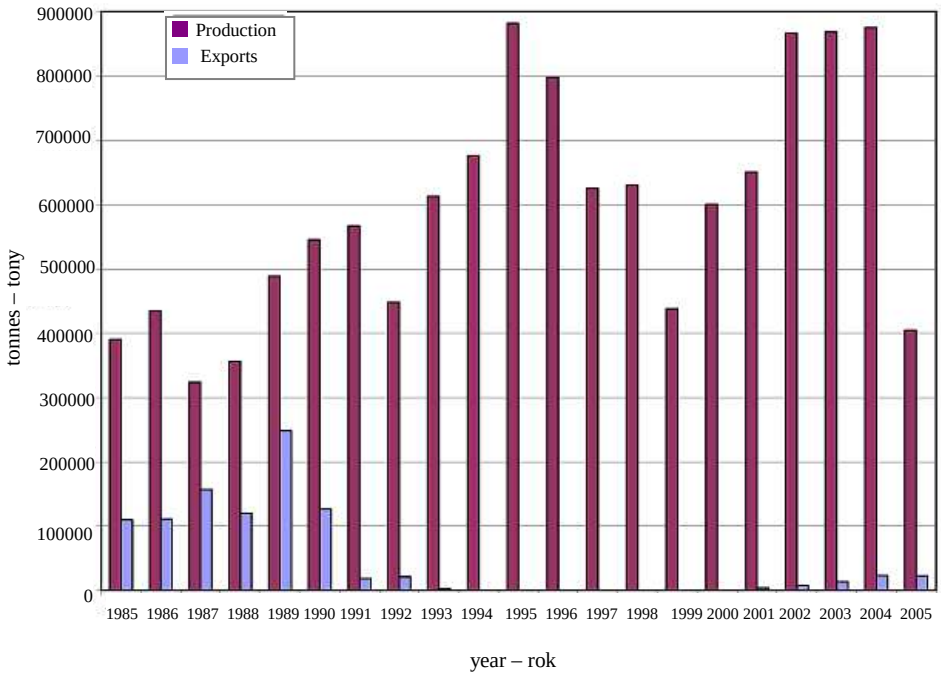

Fig. 1. Date production and exports (tonnes) in Iraq in 1985–2005 [FAOSTAT 2009]
Rys. 1. Produkcja i eksport daktyli w Iraku w latach 1985–2005 (w tonach)

Historically, it is said that Iraq is the tree's birthplace. The date palm has an important status in Iraq as it was the first country in the world when it comes to the number of date palms [Jaradat 2003] reported that more than 30 million date palms existed in the early 1960. In terms of date production, Iraq used to be a major producer of dates but in recent years the amount of dates produced and exported has decreased (Fig. 1). In the 1980 and mid-1990, Iraq was consistently among the top five date-producing countries in the world and often ranked number one in terms of production by volume [Walsborn 2008]. In the early 1980, an estimated 30 million date palm trees were growing in Iraq, but the number has declined dramatically since then [Rahif *et al*. 1988]. The devastation

of the Shatt al Arab area during the Iran-Iraq War hastened the destruction of date palm groves, and in 1985 the government estimated the number of date palms at fewer than 13 million [Jaradat 2003]. During the first Gulf War (1980−1988) and the second (1991), more than 20 million palm trees were completely destroyed in Iraq. The date was considered to be Iraq's second largest national export after oil [Sharif *et al*. 2010]. In 2006, Iraq produced 432 000 tones of dates from 7 878 000 trees [AOAD 2008], while produced 440 000 tones in 2007 and exported 37 063 tones for 9 532 000 $ [FAOSTAT 2009].

INDICATORS AND CAUSES OF DEGRADATION OF DATE PALM PRODUCTION IN IRAQ

Date palm in Iraq was subjected to many agricultural pests and biotic and abiotic factors such as negligence, salinity and overharvesting in addition to the overall economic factors that have passed the country as a result of the wars and the economic embargo [Jaradat and Zaid 2004]. These factors have caused deterioration of the date palm productivity and resulted in revert in scientific research in this field for a period of more than twenty years (1980−2000) [Al-Jboory 2007]. El-Mously [1998] defined the constraints to date palm production in Iraq as drought, high salinity, aged trees, diseases, and genetic erosion. Despite the damage suffered to date palm plantations during the wars, dates continue to be the most important agricultural product.

The main common causes of date palm degradation in Iraq are losses of vegetation cover in some areas due to overgrazing and over-harvesting of wood for fuel, resulting in soil erosion, increased wind velocity and storm frequency resulting in an increase in the levels of suspended dust in the air, decreased infiltration of water into soil due to the increase in runoff and floods and decreased water table levels in some areas, in addition to decline of the quality of ground water resulting in increased soil salinity and loss of fertility. Increased sand drift and the development of new dune fields in some areas also is a considerable cause of date palm degradation. Acute shortage of skilled labour with increased wage demands, resulting in the neglect of many agricultural processes required for proper production. There is a noticeable weakness of government services for the extension and protection of agricultural activity. Increased infestation of pests and diseases resulted in a significant decline in the productivity of trees and contributed significantly in degradation of date palm in Iraq [Amer and Hussain 2006].

On the production side, several date growing countries are still using traditional techniques for this important culture. There is still a great space for improvement in the field of date palm cultural practices, pre- and postharvest, packaging and marketing.

From the propagation side, and while tissue culture is becoming the commercial technique for mass propagation of date palm, several voices are arising against the typeness true of the plants derived using such technology (mainly the asexual also called somatic embryogenesis). Among the abnormalities observed so far with tissue culture-derived plants are the dwarfing, broader leaves with compact growth habit and twisted inflorescences. Seedless fruits and late flowering (up to 7 years after planting) are also commonly observed abnormalities [Al-Sakran and Muneer 2006].

CONCLUSIONS

Date palm cultivation in the Iraq has a long history, yet the efforts exerted by the individual countries on research and development, although significant, is still insufficient and fall below expectations. In general, the product quality is still low, the field and post-harvest losses are high and the date products and by products utilization need improvement. Therefore, the current status of date palm cultivation in Iraq and the enhancement of quality of produce can not be overemphasized [Amer and Hussain 2006]. There are more reasons for decline of the date palms production in Iraq. Majority of the date palm orchards are old and with erratic distances between trees. The existing plantations have difficulties in gaining the implementation of modern agricultural programs, irrigation, fertilization, and mechanization. Considering modern plantation following factors must be taken into account: water source, soil type, selection of the plantation system, orchard land preparation, promising cultivars, and selection of proper offshoots. There is a need of the establishment of date palm nurseries based on modern horticultural practices which can ensure the supply of good quality and healthy offshoots of the required cultivars. Moreover, the nurseries should be located close to the new plantation sites with adequate water resources. In order to utilize existing varieties, facilities are needed to collect, preserve, and manufacture date products. This requires a combination of rural development programs providing technical assistance and properly equipped collection points, coupled with one or more centralized processing plants that meet global quality and phytosanitary standards. This will allow Iraqi date producers and marketers to compete in both the local and global market.

Recently, the Iraqi government has established the General Authority for Horticulture and Forestry, General Board of Date palm and Iraqi Society for Date Palm. The mission of this authority is to develop and extend the planting of date palms into the various regions of the country using modern techniques, as well as to improve existing orchards. Fortunately many of the Iraqi date gardens remain and can be rehabilitated by a series of interventions that will provide appropriate farming, post-harvest and processing, and marketing technology, facilities, and skills to the industry. Marshlands Restoration Program led by the Iraqi Ministry of Water Resources in cooperation with United States Agency for International Development (USAID) and other donors launched in 2004 and aims to improve the ecosystem of marchland in the southern part of the country. Development of a date palm cultivation programme was another project funded by (FAO) and United Nations Industrial Development Organization (UNIDO) for rehabilitation of the date palm sector in Iraq started 2007. Recently, the Iraqi government has established the General Authority for Horticulture and Forestry. It is also working towards the development of harvesting methods and the identification of local and international markets for the yield.

REFERENCES

Adlan H.A., 1994. Date Palm Culture in Sudan. Horticulture Department Report. Ministry of Agriculture, Khartoum, Sudan.

Ahmed I.A., Ahmed A.W.K., Robinson R.K., 1995. Chemical composition of date varieties as influenced by the stage of ripening. Food Chem., 54, 305–309.

Al-Almoud A.I., 2010. Subsurface Drip Irrigation for Date Palm Trees to Conserve Water. Acta Hort., 882, 103−114.
Al-Bakr A., 1972. The Date Palm. Its Past and Present Status. Alani Press, Baghdad.
Al-Dekaili A.A., Al-Dejaili J.A., 1989. Fruits Production. Ministry of Higher Education Press, Mousil.
Ali H.G., 2010. Development of Date Palm Cultivation and Its Role in Sustainability of Agriculture in Oman. Acta Hort., 882, 29−35.
Alihour IM., Dialami H., 2010. Effect of Offshoot Wright on Establishment and Vegetative Growth in 'Sayar' Date Palm. Acta Hort., 882, 755−759.
Al-Jboory I.J., 2007. Survey and identification of the biotic factors in the date palm environment and its application for designing IPM-Program of date palm pests in Iraq. Univ. Aden J. Nat. and Appl. Sci., 11, 3, 3–10 (in Arabic).
Al-Obeed R.S., Harhash M.M., 2010. Effect of Bunch Bugging Colour on 'Succary' and 'Khalas' Date Palm Cultivars: Fruit Chemical Characteristics. Acta Hort., 882, 1213−1217.
Al-Sakran M.S., Muneer S.E., 2006. Adoption of Date Palm Tissue Culture Technology Among Date Palm Producers in the Central Region of Saudi Arabia. Research Bulletin No. 145, Agricultural Research Center, Faculty of Food Sciences and Agriculture, King Saud University, pp. 1−20.
Amer J., Hussain F.A., 2006. Iraqi Date Industry Marketing and Post-harvest Issues. http://www.iraqi-datepalms.net, p. 64.
AOAD − Arab Organization for Agricultural Development, 2008. Arab Agricultural Statistics Yearbook, 28, 2008, Part III: Plant Production, Statistics, Division.
Barrow S., 1998. A monograph of *Phoenix* L. (Palmae: *Coryphoideae*). Kew Bul., 53, 513–575.
Bashah M.A., 1999. Propagation of date palm trees in Saudi Arabia. Agric. Mag., 30, 1, 24−40.
Bazza M., 2008. Irrigated date palm production in the Near East. Proceedings of Workshop on "Irrigation of Date Palm and Associated Crops", in collaboration with Faculty of Agriculture, Damascus University Damascus, Syrian Arab Republic, 2007, FAO/RNE, pp. 15.
Dowson V.H.W., 1982. Date production and protection. Plant Production and Protection Paper 35. United Nations Food and Agric. Org., Rome, Italy.
El-Mously H., 1998. The Date Palm: The Princess of Sustainable Fruits. Newsletter No. 23, INES, P.B. 101707, 44017 Dortmund, Germany Tenner, 1998.
http://www.mindspring.com/~us016262/ines.html
FAOSTAT, 2009. Crop Production 2008, Statistics Division, Food and Agriculture Organization of the United Nations.
Ibrahim K.M., 2010. The Role of Date Palm Tree in Improvement of the Environment. Acta Hort., 882, 777−778.
Jaradat A.A., 2003. Agriculture in Iraq: resources, potentials, constraints, and research needs and priorities. Food, Agric. Environ., 1, 2, 160−166.
Jaradat A. A., Zaid A., 2004. Quality traits of date palm fruits in a center of origin and center of diversity. Food, Agric. Environ., 2, 1, 208−217.
Johnson D. V., 2010. World Wide Dispersal of the Date Palm from its Homeland. Acta Hort., 882, 369−375.
Kassem H.A., Ezz T.M., Marzouk H., A., 2010. Effect of Bunch Bagging on Productivity, Ripening Speed and Postharvest Fruit Quality of 'Zaghloul' Dates. Acta Hort., 882,
Lunde P., 1978. A History of Dates. Saudi Aramco World, 29, 2, 176−179.
Morton J., 1987. Date, in: Fruits of warm climates, publisher Julia F. Morton, Miami, FL, 5–11.
Moustafa A.A., Ibrahim Z.A., El-Yazel S.A.S., El-Anver M.A., 2010. Evaluation and Selection of Some Seedling Date Palm Males Grown in Fayoum Governorate, Egypt. Acta Hort., 882, 69−79.
Pieniążek J., Pieniążek Sz., 1981. Owoce krain dalekich (Fruits of distant countries). PWRiL, Warszawa, 278−285 (in Polish).
Popenoe P., 1973. The Date Palm. Field Research Projects, Miami FL.

Rahif A.H., Hummadi A.M., Said B.T., 1988. The influence of some environmental factors on the yield of date palm (*Phoenix dactylifera* L.) cv. Zahdi in Iraq: the soil. J. Agricult. Water Resour. Res., Plant Prod., 7, 2, 32−46 (Arabic section).

Riad M., 2006. The date palm sector in Egypt. CIHEAM − Options Mediterraneanes, 45−53.

Sawaya W. N., 2000. Proposal for the Establishment of a Regional Network for Date-Palm in the Near East and North Africa. A draft for discussion, FAO/RNE.

Sharif A.O., Sanduk M., Taleb H.M., 2010. The Date Palm and its Role in Reducing Soil Salinity and Global Warming. Acta Hort., 882, 59−64.

Soliman S.S., Ali B.A., Ahmed A.A.A., 2003. Genetic comparisons of Egyptian date palm cultivars (*Phoenix dactylifera* L.) by RAPD-PCR. Afr. J. Biotechn., 2, 4, 86−87.

Soliman S.S., Al-Obeed R.S., Harhash M.M., The Effect of Bunch Thinning on Yield of Fruit Quality of 'Khalas' Date Palm. Acta Hort., 882, 726−731.

Walsborn R., 2008. Date Sector: Report and Value Chain Development Program, Prepared for USAID/Iraq/Inma Agribusiness Program, Agland Investment Services, Inc. www.aglandinvest.com

Wrigley G., 1995. Date palm, in: Smartt J., Simmonds N.W. (ed.), Evolution of crop plants, Longman Scientific and Technical, Harlow, UK, 399–403.

Yousif A.K., Ben Jamin N.D., Kado A., Meh i Al-Deen Sh., Ali S.M., 1982. Chemical composition of four Iraqi date cultivars. Date palm J., 1, 2, 285−294.

Zaid A., 2001. The World Date Production: A Challenge Case Study. Proceedings of the Second International Conference on Date Palms, UAE University, Ai-Ain, United Arab Emirates, 902−915.

Zaid A., Arias E.J., 2002. Date palm cultivation. Rev. 1. FAO Plant Prod. Prot. Paper 156, Rome, pp. 292.

Zaid A., de Wet P.F., Djerbi M., Oihabi A., 2002. Diseases and pests of date palm, in: Zaid A. and Arias E.J. (ed.). Date palm cultivation. Rev. 1. FAO Plant Prod. Prot. Paper 156, Rome, 227–281.

Zirari A., 2010. Effects of Time of Pollination and of Pollen Source on Yield and Fruit Quality of 'Najda' Date Palm Cultivar (*Phoenix dactylifera* L.) under Draa Valey Conditions in Morocco. Acta Hort., 882, 89−94.

Zohary D., Hopf M., 2000. Domestication of plants in the Old World. The origin and spread of cultivated plants in West Asia, Europe, and the Nile Valley. Oxford University Press, Oxon, UK.

Streszczenie. Palma daktylowa (*Phoenix dactylifera* L.) jest bardzo ważną uprawą sadowniczą w większości krajów arabskich. Jest związana historycznie z życiem codziennym i tradycją narodów starego świata, jako jedna z najważniejszych roślin uprawnych. Spośród 120 mln palm daktylowych uprawianych w różnych krajach, 70% rośnie w krajach arabskich, które zapewniają 67% światowej produkcji daktyli. Bardzo ważnym producentem tych owoców jest Irak. Przez ostatnie 50 lat w Iraku plantacje palmy daktylowej ulegały degradacji spowodowanej nadmierną eksploatacją, uwarunkowaną szybkim wzrostem populacji ludzi i zwierząt. Choroby i szkodniki powodowały straty sięgające 30% plonów. Czynniki techniczne i socjoekonomiczne przyczyniły się również do zmniejszenia produkcji daktyli. Proponowane są konkretne sposoby wstrzymania procesu degradacji upraw palmy daktylowej oraz wzmocnienia tej gałęzi ogrodnictwa poprzez doskonalenie technologii uprawy, zbioru owoców, a także przetwarzania i marketingu daktyli w Iraku i innych krajach arabskich.

Słowa kluczowe: opis botaniczny, rozmnażanie, nawożenie, ochrona, aktualny status