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Date Cultivation in Arizona and the Bard Valley

Glenn C. Wright

Abstract

Dates have been grown for several thousand years, and are suited to the harsh climate of the desert. They have several botanical characteristics that are uncommon, such as the fact that they are dioecious and exhibit unusual phyllotaxy. While date palms were first propagated as seed in the United States, by the turn of the 19th Century, extensive numbers of offshoots were imported from the Middle East and North Africa. The Arizona date industry was first established in the central part of the state, but it eventually failed due to adverse weather conditions and urbanization. Meanwhile a small industry, based on the 'Medjool' date, was founded in Bard, California. This industry has now expanded and returned to Arizona and is modernizing rapidly.

Date Botany, Taxonomy and Origin

In Arabic, the word for date is "Nakhl", while the Latin nomenclature for the tree is *Phoenix dactylifera L.* Some sources attribute the genus to the mythical Phoenix bird, which lived for 500 years, only to throw itself into the fire and be reborn (16, 28). Other sources state that the date is named after the Greek translation of the Phoenician word for date palm and the Greek word for finger (22). A date palm is said to live with its "feet in Heaven and its head in Hell" (2), which means they must have plenty of groundwater yet thrive in the high heat to produce fruit. "No summer heat is too great for it, but it will also tolerate severe frost in winter; it is easily satisfied as regards soil, if the water supply is sufficient" (17).

Dates have no taproot; most roots extend 2 m down into the soil and 2 m out from the trunk. Palm trunks grow about 0.3 m per year and they can be up to 30 m tall. Palm fronds or leaves are pinnate and have spines. There are 120 to 240 pinnae per frond, with 13 groups of leaves; trees have right or left phyllotaxy. Date palms are also dioecious, they exhibit metaxenia and their fruit are borne on rachillae (strands). There are more than 3000 varieties (11, 29).

Dates belong to the Class Monocotyledonae; order Arecales and family Aricaceae (Palmales). There are 14 species of *Phoenix* palms; they are native from the Canary Islands east across northern and central Africa, the extreme southeast of Europe including Crete, and further eastward across southern Asia from Turkey to southern China and Malaysia (9). Mineralized date stones have been found in Pakistan dating from 6000 BC (3). Today, date palms are grown across the globe (Fig. 1).

The Beginnings of the Date Palm Industry in the Southwest USA

Dates were carried from North Africa to Spain by the Arabs, then to the New World by Spanish explorers. They were introduced to California and Arizona by the Jesuit priests in the 18th Century. Seedling dates were planted at the Spanish missions "wherever the climate was favorable for its (their) growth" (25). There were nine missions established in Southern Arizona from 1687 until 1781.

In the late 1850's, two date seedlings were planted at the farm of J. R. Wolfskill, near Winters, California [where they still exist, see (12)] and again by Wolfskill in 1862 in the San Francisco Bay area. Date seedlings were planted in Sonoma County as early as the 1870's. Date offshoots from Egypt, Algeria, and the Persian Gulf were planted at a University of California station near Tulare in 1888. Lack of heat units in all these areas lead to an inability of the fruit to mature before killing frost occurred each December. This was also the case with dates planted at the

Yuma Mesa Agriculture Center, University of Arizona. 6425 W. 8th Street, Yuma, AZ 85364. (gwright@ag.arizona.edu)

Spanish mission in San Diego. First imported offshoots were planted in the Coachella Valley of California in 1898. Fruit produced here was so superior that more northerly and westerly regions were never seriously considered for large-scale commercial date production again (6).

Pioneers who settled in southwest Arizona after the Civil War grew date palms from seed in irrigated areas near Phoenix, Tucson, and Yuma (25). Seedling dates were planted at the Territorial Prison in Yuma from 1862 to 1863. The seedlings began to produce fruit in the 1880's. Seedlings were planted in the Phoenix area in the mid-1880's. The development of a date industry became a major emphasis of the newly-formed University of Arizona (est. 1889), and seedlings were planted at the main campus in Tucson in 1892 (25). However, it soon became apparent that cross pollination produced seedling plants of unknown parentage with a resulting lack of fruit uniformity. Furthermore, half of those plants would be males. These facts presented an insurmountable obstacle if a date palm industry were to be based upon seedling plants:

> "Experience of the centuries, then, has led to the same result in every part of the world where dates can be grown. It has proved that high-grade dates of uniform quality can, under existing circumstances, be produced only by offshoots, and that the plantation of seedlings for such a purpose is not practicable." (17)

The USDA began importing offshoots from the Middle East in the 1890's. (13) Imports were first coordinated by H.E. van Daemon of the USDA. In 1890, 10 palms, from Algeria, Egypt, and Arabia were planted in Phoenix. One died**,** six were females and three were males. Additional palms from the shipment were sent to Las Cruces, New Mexico; Yuma, Arizona; National City, California; Pomona, California; Tulare, California; and Indio, California (25). Thirteen additional palm offshoots were sent to Yuma, but they were

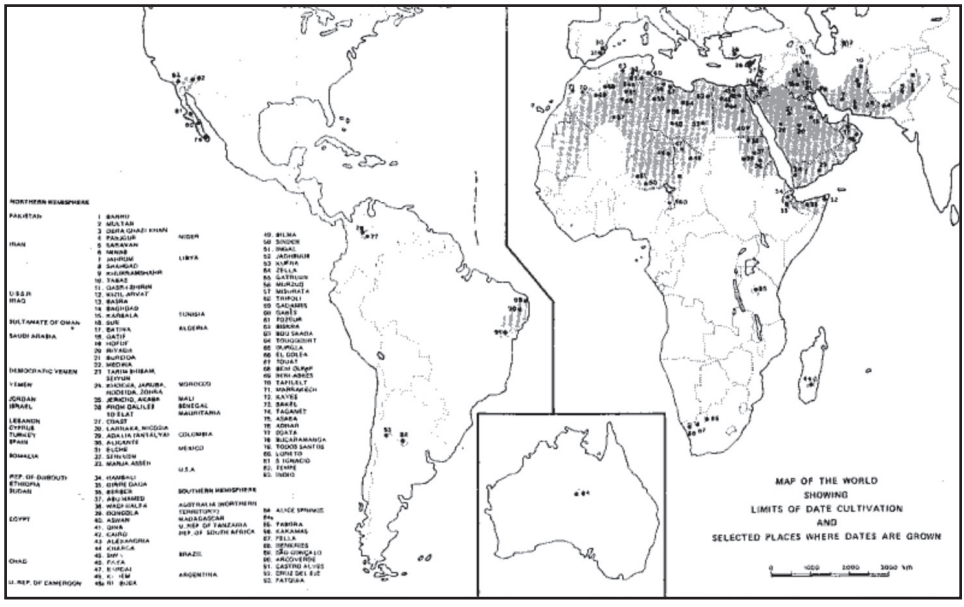

Fig. 1. Map of the world showing limits of date cultivation and selected places were dates are grown. Taken from (29).

Fig. 2. Date offshoots are transported out of the desert using camels. From (19) with permission.

killed by a flood in 1891. Major imports of offshoots to Arizona were initiated by the USDA beginning in 1900, and continued until 1908 (10). Some of the offshoots introduced to Arizona may have come from the collection efforts of W.T. Swingle who travelled to Algeria in 1900, from David Fairchild who travelled to Iraq, Baluchistan, and Egypt in 1901 and 1902, and from the efforts of Thomas Kearney who journeyed to Algeria and Tunisia in 1905 (11, 14). In North Africa, most of the date offshoots were carried out of the desert to the railroads or ports on camels (Fig. 2). It is noteworthy that during his 1900 collection trip, W.T. Swingle was temporarily delayed when the French government seized all of the camel caravans in the Algerian Sahara in response to a potential rebellion by some of the tribes who had not yet accepted colonial rule. He had to rely on local Arab villagers to find 20 additional camels that had not yet been seized. These palms were sent to the University of Arizona Experiment Station in Tempe (21).

A 1908 report stated that 1000 offshoots comprising 234 varieties were imported into Arizona by the USDA. Many of those offshoots were planted at the University of Arizona Agriculture Experiment Station in Tempe (10). An initial planting of dates was established at the agriculture experiment station in Yuma in 1905 (10). Additional USDA importations occurred in 1927 (see below) and 1929 (14).

Meanwhile, commercial importation of dates into Arizona began in 1913 when Bernard Johnson, who planted the first commercial offshoots in the Coachella Valley in 1903, obtained 3000 'Deglet Noor' offshoots in Algeria, and almost all of them were planted near Yuma (Fig. 3). In 1921, the Phoenix Date Company obtained 500 'Hayany' offshoots from Egypt. However, not all trips to collect date offshoots were as successful:

> "It is also recorded that around the turn of the century, two Americans narrowly missed death when they filched some offshoots of the famous

'Khalasa' palm from the prized gardens of King Ibn Saud of Arabia father of the present King Saud. The Americans, accredited as geologists had sought permission to survey the region. By day, assisted by native workmen they dug deep holes to 'study' soil and rock formation. But at night they crept among the palm trees, pilfering the precious offshoots. Ibn Saud got wind of their activities and sent an Arab force swooping down on the American camp one night. Swinging their scimitars they wrecked the tents scattered the equipment and killed most of the occupants. But the two Americans managed to escape on camels, taking with them only five of the 200 offshoots they had gathered. Several weeks later they arrived in Arizona. The offshoots they had brought with them were the parent trees of the many superb specimens of 'Khalasa' date palms which now flourish in this country (7).

The most promising imported varieties planted in Arizona before 1934 were 'Braim', 'Khadrawy', 'Kustawy', 'Nesheem', 'Nazel el Bacha', 'Maktoom', 'Hayany' and 'Deglet Noor'. However, between 1908 and 1918, of the 536 offshoots distributed to 134 growers, 98% had died, thus propagation research was emphasized beginning in about 1920. Parlatoria scale [*Parlatoria blanchardi* (Targioni Tozzetti)] was a problem – which was solved by pruning off the leaves and burning the leaf bases with a gasoline torch. By 1918, Central Arizona date growers recognized that rain was the most severe hazard to growing dates, and that considerable differences in rain tolerance existed amongst the varieties (10).

Fig. 3. Bernard Johnson, first person to commercially import dates into the United States, in his newly planted date garden near Yuma.

Growth and Subsequent Decline of the Central Arizona Date Industry

The Arizona date industry expanded during the 1920's and 1930's and peaked during the mid-1940's, with approximately 200 ha of palms in the state, producing between 650,000 and 900,000 kilograms of fruit. Ninety percent of the date gardens were in Central Arizona, near Phoenix. Most individual growers had their own packinghouses, and sold their crop directly to the local consumer, to local retailers, or to mail order customers (Fig. 4).

Fig. 4. Advertisement from Gilliland Groves, Phoenix, AZ.

During World War II, date prices were not controlled, date imports were limited and high prices were obtained for the fruit as it was a substitute for the rationed cane and beet sugar. The Arizona Date Institute was formed in 1946 to stimulate interest in date culture, improve packing and marketing programs, and encourage further research (10, 18).

Excessive cold and rain was a continual problem in Central Arizona. Severe freezes occurred in 1937, 1949 and 1950, causing from 10 to 90% defoliation of the trees. Rain, during or just before harvest, caused significant losses. There was a total crop loss due to rain 1951. From 1930 to 1942, yearly average loss of the 14 most popular varieties ranged from 17% in 1930 to 72% in 1939, with an average loss of 34% (10). Following the war, date imports resumed, the price of sugar decreased, and fruit prices fell. Many date growers experienced substantial financial losses. Also in the late 1940's, Arizona experienced a rapid increase in population due to the availability of inexpensive housing, the favorable climate and the convenience of air conditioning. Rapid immigration to Phoenix caused expansion of urbanization so that date gardens could be profitably sold (Fig. 5). Practically all the gardens were subdivided or the palms sold to developers by 1960, and only 81 ha remained (23). Only 26 ha of dates remain in Central Arizona today.

The 'Medjool' Date

While it is commonly stated that the 'Medjool' variety was introduced into the United States in 1927, the truth is that the 1927 event was the first successful introduction of the variety into the country (20). Nixon states that several early attempts were unsuccessful (13) and this author found mention of an earlier introduction in 1912 (26). In reference to the earlier attempt, Swingle writes:

> "This date comes from the Tafilelt (also written Tafilet and Tafilalet) region in southeastern Morocco. It is the finest variety in the Tafilelt

Fig. 5. Advertisement for real estate in a former date garden, Tempe, AZ.

country, but is unknown in America and comparatively little known in Europe, except in England and Spain, in both of which countries it brings a higher price than any other date on the market in spite of the fact that it is almost never put up in attractive form but is sold in bulk. Dates of this variety can be found in practically every grocery in Spain, where they are known as 'Datiles de Berberia.'"

"The fruit is large, from 2 to 2 ½ inches long and from ¾ to 1 inch thick. It is semi-translucent, dark brown in color, and, has flesh rather firm in texture and of a most delicious flavor. It is much darker in color than the Deglet Noor variety and keeps much better. The dates always have the calyx (zentfa) attached to the stem end. The four offshoots comprised under this number were secured for Dr. L. Trabut by Si Mohammed ben Idris Fassi in the Er Reteb region, that part of Tafilelt said to produce the best quality of this well-known date, which has made the whole Tafilelt country famous."

"This gift from the Service Botanique of the Algerian Government to the Department of Agriculture marks an epoch in American date culture. These selected offshoots from the best locality in Tafilelt will not only show how this famous variety succeeds in the New World deserts, but will also make it possible to determine how truly it has been reproduced by the seedlings, some thousands of which are already growing in California."

There is no record of what happened to these offshoots.

In 1927, Swingle imported six large and five small offshoots of 'Medjool' from Boudnib, Morocco (20). He had been delayed while in Boudnib on his way to the Tafilalet oasis while waiting for a French Army escort. In the Boudnib oasis, Bayoud disease (*Fusarium oxysporum* f. sp. *albedinis*) was killing most of the palms, but Swingle found one without any visible symptoms. Due to USDA regulations, the offshoots were first quarantined in a State with no palms in it, thus southern Nevada was an obvious choice. A partially disabled Native American farmer named Johnson, of the Chemehuevi tribe, was found in the area who was willing to care for the offshoots. Johnson's pump, windmill and fencing were soon repaired and the offshoots were planted on a level piece of land (24). Johnson was compensated, but had no title to his land so the Indian reservation was enlarged to encompass his farm (15). After 7 years, nine of the 11 palms survived and produced an additional

64 offshoots. All were moved to the USDA field station at Indio, California in 1935. The two offshoots that died had been dug up by Johnson's dog.

'Medjools' have large fruit, about 45 mm long and 30 mm wide. The fruit is not too soft but nor is it too hard and is of high quality. The tree produces many offshoots. A palm can produce more than 100 kg of fruit when mature. The longevity of a 'Medjool' tree is unknown.

Growth and Development of the Date Industry in the Bard Valley and in Yuma, Arizona

In 1933, Stanley Dillman and Al Collins planted 22 ha of 'Saidi', 'Zahidi' and 'Khadrawy' dates near Bard, California, across the Colorado River from the city of Yuma, Arizona. The Bard Valley has fertile alluvial soil, a high water table, and is now considered ideal for growing dates. However, before Dillman and Collins established their garden, they estimated that the entire region had about 2000 seedling palms whose fruit were mainly used for hog feed (8). Dillman and Collins were innovators. They developed a muslin bag to avoid fruit sweating - common with paper covers, to provide insulation from the cold, to protect from birds, and to heat the bunches at harvest causing earlier maturity. They also cut the center strands and inserted galvanized spreader rings in the bunches to improve ventilation and avoid fermentation (known as souring).

Dillman and Collins obtained 24 offshoots from the original nine surviving 'Medjool' trees and planted them in 1944 in the Bard Valley. By 1971, just over 140 ha were planted in Bard (4). Today 99% of the dates growing in Bard are 'Medjool', and there are about 400 ha planted in the valley. Almost all of these gardens are flood-irrigated. In 1986, several Bard Valley growers joined together to form the Bard Valley Medjool Date Growers Association (BVMDGA) (1) in order to establish a consistent quality standard for their product. Today the group has two cooperative packing houses, and markets 'Medjool' dates internationally.

In 1966, interest in growing dates on the Arizona side of the Colorado River was described as "almost non-existent" (27), but that is no longer the case. As demand increased, growers from Bard ventured across the river to plant date gardens on cheaper land in Arizona. As of 2011, there are about 1400 ha of 'Medjool' date in Arizona and more are being planted (5). Almost all new plantings are on sandy, upland soil. Most are on drip irrigation and all are under 15 years old. For 2011, the entire harvest of 'Medjool' dates for the region (Arizona and Bard) is expected to surpass 5900 metric tons.

Date Production

Growing dates is quite labor intensive. In January and February, depending on the size of the date palm, approximately 800 to 1600 thorns are taken off each tree using large curved knives. In March and April the bunches are pollinated mechanically. It is essential for a palm to be pollinated from both sides to ensure even, complete pollination. One male palm can pollinate 48 to 50 female trees. In April and May, bunches are thinned by hand allowing each fruitlet the room to grow and have the proper ventilation. Later, bunches are tied and secured firmly to the trees to prevent damage from wind and weight. Tying the bunches also allows for spacing and continued ventilation. In June and July, spacer rings are placed in the center of the bunches to allow continued ventilation. Meanwhile offshoots are taken off the mother palm and put into the nursery and then planted to create a new date garden. Bags are placed on the bunches in July and tied firmly to prevent birds from picking at ripe fruit and to keep the dates from falling to the ground. These bags allow for ventilation, protect the fruit from rain and also heat the fruit to help it mature faster. The dates are picked as they mature in September and October. Workers must go up into the towering trees multiple times over the harvest season, each time only picking

the fruit that is tree ripe and re-bagging the bunches to allow the fruit that remains to ripen further. BVMDGA growers are considering mechanical harvesting.

Each date is carefully sorted and graded first by hand and then by machine to ensure premium and consistent quality. Dates are packed in various sized containers to meet the consumer's needs. Paulsen (15) has written extensively about 'Medjool' date production in the area.

Future challenges and opportunities for the date industry include increased production, the need for more consumption, the demands of the landscaping industry, the need for cultural and nutritional research, and the potential for foreign competition.

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