



THE DATE PALM IN SOUTHERN NEVADA

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ORIGIN

Phoenix dactylifera is a palm with a long and interesting history. Its origin goes back to ancient times, well before written history. It is a member of the genus *Phoenix*, which contains about one dozen species of palms. Although other species in this genus produce fruits that are eaten by birds and other animals, *Phoenix dactylifera* is the only *Phoenix* species cultivated for its fruit. The date palm is the characteristic vegetation found in the oases of arid areas in the Middle East. It was regarded by the ancient Egyptians as a symbol of fertility, and considered by others as the tree of life. The Greeks and Romans used it as a symbol of triumph, and the Hebrew and Christian cultures as a symbol of peace. Its name, *Phoenix*, is derived from the Phoenicians who were among the first to describe this plant in their travels. *Dactylifera* is derived from dactylus for “date” from the Greek dactylos, and fero for “date bearing” or “I bear.”

Observations of this plant were first recorded around 5000-6000 BC in Iran, Egypt, and Pakistan. Most likely, these species were wild. The first record of cultivation comes from Lower Mesopotamia around 4000 BC. Later, when the Moors entered Spain, they brought the date with them. Although the Moors were forced out of Spain, the dates stayed and were brought to the Americas by the early Spanish missionaries.

By 1890, the USDA was beginning to look into date production in the United States. However, the test plants proved inferior and it was not until 1900 that newer more desirable dates were imported for trial.

In the United States, the major date growing areas are Southern California and Arizona. However, there are date palms growing throughout California, Arizona, Southern Utah, Nevada, Texas, and most of Florida. Date palms of various species are sometimes found in protected areas in colder states such as the Carolinas, Georgia, Louisiana, Mississippi, Oregon, Washington, and British Columbia. Even though date palms may survive in these areas without the long hot dry growing conditions of the southwest states, fruit production is nearly impossible.

DISTRIBUTION AND ECOLOGY

The date palm requires high temperatures and low humidity to set fruit and ripen to maturity. The date palm grows best in temperatures above 20°F (-7°C). However, they can survive into the mid to lower teens for short periods of time. For pollen germination, a temperature of 95°F (35°C) is needed. As with most palms, research has shown that warm to hot night temperatures also promotes faster growth. A study by Gary Wood of Suncoast Palms in California revealed that greater growth took place between 7 p.m. to 7 a.m. than from 7 a.m. to 7 p.m. Areas with warmer night temperature promote faster palm growth than those that cool off at night. The best growing conditions for palms are deep soils, preferably sand 3 to 5 feet deep, and a good supply of either sub-surface or irrigation water. Date palms grow naturally between 15 and 35 degrees north latitude in the Sahara, and in the southern fringe of the Near East. This area is nearly rainless. The date palm is found throughout the Middle East, and in the northern, eastern, and southern areas of Africa. They are also found in North America, Southern Europe, and Central and South America. It is estimated that there are more than 105 million date palms covering an area of 800,000 ha. (1,984,000 acres), and that there are over 250,000 bearing trees in California and Arizona (1987). Yet with this great distribution, there are still vast areas of the world where this palm could adapt to the harsh climates and provide much needed food crops. The date palm is adaptable to large and small production in arid and semi-arid regions.

IMPORTANCE

Southern Nevada's use of the date palm is mostly ornamental, although edible fruit can be produced here. However, for the rest of the world where the date palm is an important part of agriculture, every part of the tree has a useful purpose. The fruit is not only the most obvious product of this palm, but the main reason that it is grown. The dates are eaten fresh or dried, and are made into paste, sugar, jam, juice, syrup, vinegar, and alcohol. The leaves are used to make rope, baskets, crates, roofing, fuel, and furniture. The very young leaves and heart of the palm are eaten. The sap is tapped and used to make sugar and alcohol. The seeds are used for animal feed. They can also be roasted and used as a coffee substitute, or finely ground to be mixed with flour to make bread. The wood is used for posts and rafters. The fruit, seeds, and sap are used medicinally.

DESCRIPTION

Tree The date palm is an impressive tree producing a slender trunk that can grow on an average from 48 to 80 feet in height. (Figs. 1-2) Maximum heights of 100 to 120 feet can be reached, depending on location and growing conditions. The trunk is covered from ground level to the top with the overlapping persistent woody leaf base, or boot, from old leaves that have died. Near the base of the trunk are



FIG. 1 DATE PALMS PLANTED IN AN URBAN FORMAL GARDEN



FIG. 2 WILD DATE PALMS

what appear to be roots. These are just that, roots. These above ground roots are called adventitious roots. It is thought they evolved as a survival technique in areas where soil levels change from shifting sand. This palm is dioecious, which means that male and female flowers grow on separate trees. Date palms begin to bear fruit at 3 to 5 years, and are fully mature at 12 years. Date palms can live to be over 100 years old. There is a date palm in Spain known to be over 150 years old. Date palms produce fruit for about 50 years, after which their production declines and they are too tall to pollinate and harvest easily. Palms do not form rings like hardwood trees, and it is

therefore difficult to tell the actual age of palms.

Leaves The leaves of the date palm are pinnate, resembling a large feather. They can be as long as 20 ft (6 m). They are composed of a long midrib and slender gray-green or bluish-green leaflets 8 to 16 in. (20 to 40 cm) long. Many date palm leaves have a bluish cast. As with all *Phoenix* palms, the base is armed with 6 to 8 in. (15 to 20 cm) needle-shaped thorns. A healthy date palm should have at least 20 to 30 live green leaves, forming a loose crown with the base leaves recurved. A mature palm can have over 120 green fronds. Although they may live as long as 10 to 15 years, leaves have a normal life expectancy of 3 to 7 years. A healthy, well cared for palm may produce as many as 25 new fronds per year, at the rate of between 1 to 2 new fronds per month. Old dead fronds are not shed and should be removed in cultivation. In the urban setting, they can be a fire hazard and harbor for rodents and other pests. Green fronds or leaves should not be removed, as they produce food for the palm. When palms are over-pruned, less photosynthesis takes place to produce food needed for growth, and the center bud and frond are exposed to heat, wind, and cold damage.



FIG. 4 MALE FLOWERS

Flowers Male and female flowers are borne on different trees and are unlike in appearance. (Fig. 3) Male flowers are waxy and cream colored, and are borne on a branched spadix 6 to 9 in. (15 to 22.5cm) in length. (Figs. 4-6) A large inflorescence can have 6,000 to 10,000 flowers. Female flowers are fragrant and whitish on a spadix 12 to 30 in. (30-75 cm) long. (Figs. 7-8) Male palms normally flower slightly before females.



**FIG. 3 FEMALE FLOWERS (TOP)
MALE FLOWERS (BOTTOM)**

Date palms begin to flower between 3 to 5 years. Pollen from the male flower must be collected by hand and transported to the females mechanically.



FIG. 6 MALE FLOWERS AND POLLEN

In nature, some pollination takes place by wind, but it does not facilitate the production of commercial crops, as fertile fruit set is very poor. In most areas of the world insects do not pollinate dates. The exception is in their native habitat where there is a small



FIG. 5 MALE FLOWERS CLOSE UP

wasp that pollinates date flowers. Attempts to import and use these wasps outside of northern Africa have not been successful. Most commercial operations have one male for every 40 to 50 female trees. In natural date groves, half of all palms are male, producing large amounts of pollen.



FIG. 7 FEMALE FLOWERS



FIG. 8 FEMALE FLOWERS CLOSE UP

Fruit Only female trees produce fruit, and for the fruit to be fully developed and edible, pollination must take place. Pollinated berries are oblong, dark-orange or brown-black when ripe, and have one woody seed. (Figs. 9-10) Unpollinated dates do not develop viable seeds or sugar, and their poor taste is much like chewy cardboard. (Fig. 11) Dates are highly nutritious and are a staple food in many parts of the world. They are low in fat, and high in calories and carbohydrates. They contain calcium, phosphorus, iron, vitamin A, niacin, and ascorbic acid. Trees produce five to ten bunches of fruit each year. A mature tree produces up to 150 pounds annually. Some improved cultivars have yielded over 220 pounds per year.



FIG. 9 BLACK DATES RIPE & UNRIPE DATES



FIG. 10 BROWN DATES RIPE AND UNRIPE DATES

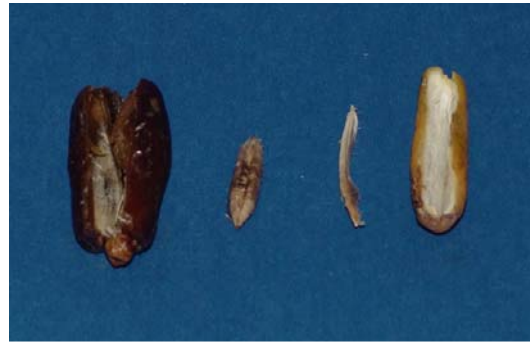


FIG. 11 MATURE POLLINATED DATE AND VIABLE SEED (LEFT) UN-POLLINATED DATE AND NON-VIABLE SEED (RIGHT)

PRODUCTION

For the past few years thousands of mature date palms have flooded the southern Nevada landscape. They are being brought in by the truckload from southern California. Some of these older trees are



FIG. 12a TRUCKING DATE PALMS FROM SOUTHERN CALIFORNIA

40-50 feet high or more. Most, if not all, are retired female palms from producing date groves in California. Each year, beginning in late summer through the fall, there are two frequently asked questions. “How can I stop the palms from producing messy fruit?” and “Can I harvest the fruit to eat?”



FIG. 12 MALE FLOWERS SPATHE JUST OPENING

The answers to these questions are quite simple. The best way to stop the dates from bearing fruit is to prune off the bloom spike (panicle) as soon as it opens from the spathe. (Fig. 12) If a power saw is used to remove the unopened spathe rather than the fully opened bloom spike, the palm and fronds may be damaged. There are several chemicals on the market to stop fruit from forming on various trees and plants, but they are not recommended for date palms. The other alternative is to leave the fruit on. Many people find the fruit attractive. However, if left on the tree, the fruit will take strength from the mother tree that could be better used to grow new leaves. If the palms are in a parking lot or other areas where the dropping fruit poses a hazard, then prune the bloom spikes off before the fruit forms. Birds and other wildlife may find them an attractive food source. However, as with all fallen fruit, it is recommended that they be cleaned up when they fall so they do not attract rodents such as mice and rats. The answer to the second question is, yes the dates can be eaten. However, because they have probably not been pollinated, they do not develop the sugar content that one expects in a date. The taste of this unpollinated fruit has been described as chewy cardboard.

HOME PRODUCTION OF DATES

This section of the publication will show step by step how the production of dates can be accomplished in the southern Nevada area. Within an hour's drive of Las Vegas is a producing date grove called China Ranch. At this grove, dates are being propagated, pollinated, and harvested depending on the time of year.

Selection of trees

To produce fruit, it is important to have date palms that are proven varieties or cultivars. Many of the date palms in Nevada landscapes are proven varieties. However, if they are very tall and old, their production will be limited, and they will be difficult to pollinate. If the trees are of unknown origin they may be seedlings, which means there is a 50/50 chance they are males, and if they are females, their fruit quality may be poor. Female trees alone will not produce edible dates. At least one male tree is needed as a source of pollen. A male tree can be purchased to supply pollen, or pollen can be obtained from commercial date growers. Vegetatively propagated dates can be obtained from local nurseries on special request or at commercial date groves.

Pollen collection

Male trees often flower earlier than females so the pollen needs to be harvested and stored. The male flower's clusters need to be removed as soon as the spathe breaks (Figs. 13-14) to prevent the loss of pollen due to wind or bees. The pollen is then collected and dried in various ways. One way is to use a box with a cone under the wire to catch the falling pollen and funnel it to the catch



FIG. 13 MALE FLOWERS AND POLLEN

container. (Figs. 15-16) Dried pollen and cotton balls the size of walnuts are placed in sealed containers and shaken to infuse them with the pollen. These cotton balls are used later to facilitate pollination.



FIG.14 REMOVING MALE FLOWERS TO COLLECT POLLEN



FIG. 15 REMOVING POLLEN OVER COLLECTION CONTAINER



FIG. 16 COLLECTION CONTAINER

Pollination

Within a short time, the female flowers begin to open and it is time to pollinate them.



FIG. 17 THORN REMOVAL KNIVES AND PRUNER

Pollination of dates is almost an art form. If the armament of large thorns at the base of the fronds near the female blooms has not been previously removed during winter clean up, this is the time to do so. When pollinating the date tree, one should wear protective clothing, especially eye protection. Remove the armament (Figs. 17-18)



FIG. 18 THORN REMOVAL



FIG. 19 REMOVING CENTER OF FLOWER SPIKE

and begin the thinning process by removing the center of the flower spike. (Fig. 19) Once this is completed, either a strand of male flowers or one or two cotton balls about the size of a walnut (Fig. 20) that contain pollen are placed in the center opening of the flower spike that was formed while thinning. (Fig. 21) Next a rubber band or twine is used



FIG. 20 COTTON BALLS CONTAINING POLLEN

to close the spike, forming a cage around the cotton balls. (Fig. 22)



FIG. 21 PLACING COTTON BALLS IN FEMALE SPIKE AND CLOSING WITH A RUBBER BAND

With careful pollination, it is estimated that 50% to 80% of the flowers will set fruit. If a male tree is not available, pollen dusted cotton balls can be obtained from commercial growers. Because most *Phoenix* palms cross-pollinate, another alternative would be to use pollen from other *Phoenix* palms, such as *Phoenix canariensis*.



FIG. 22 CLOSE UP OF COTTON BALL IN FEMALE SPIKE

Thinning fruit

Fruit thinning is necessary because it reduces the size and weight of the fruit bunch, and helps increase the size and quality of fruit. It also assures full flowering each season. Dates, like many fruit bearing trees, will alternate bearing from an over abundance one year to very little the next. Thinning should take place when the fruit is about 6mm in size. The goal for home as well as commercial production is to have the tree produce a moderate crop each year, to prevent the feast or famine scenario.

The first thinning takes place at the time of pollination when the center of the bloom spike is



FIG. 23 SUPPORT FOR DATE CLUSTER TIED TO FROND

removed, allowing more space for the cotton-ball(s) of pollen to be encaged. Bunches should be thinned by one half to three-quarters.

When the fruit has set, the bunches should then be

pulled through the leaves and tied to the mid-rib of a lower frond. (Figs. 23-24) As the dates mature, the weight of the bunch will increase and this support will be necessary. This is the time for the second thinning. There are three ways to accomplish this process. The number of fruit per strand can be reduced, the number of strands can be reduced, or a combination of the two can be used. In long strand varieties such as Deglet Noor, all the strands should be cut back by one third or slightly more. In short stranded varieties such as Halawy, entire strands need to be removed. If too many bunches have set or some bunches are undesirable, they should be entirely removed. Young palms should have only one bunch per ten leaves, five to nine year old trees, one bunch per eight leaves, while mature palms can support one bunch per six leaves. This is the main reason that only dead or dying leaves should be removed from the palm, not the functioning green ones. In areas with summer rains, bags can be placed over the dates for protection (Figs. 25, 25a, and 25b). However, in Southern Nevada rain is not a problem. If birds are a problem, netting can be used to protect the fruit. A commercial grower near Pahrump recycles old dresses as a covering to protect dates from birds and other predators. (Figs. 26-27)



FIG. 24 BENT BUNCH STEM FROM NOT TYING TO SUPPORT

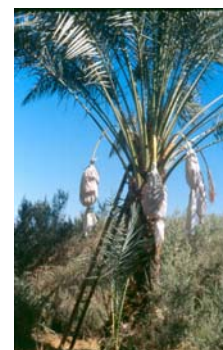


FIG. 25, 25a, and 25b COMMERCIAL PAPER AND PLASTIC MESH COVERINGS FOR DATES –
Photo courtesy of Dr. Dennis Johnson



FIG. 26 CLOSE UP OF DATE WITH RECYCLED DRESSES FOR COVER PROTECTION



FIG. 27 DATES WITH RECYCLED DRESSES FOR PEST PROTECTION

CULTIVARS

Barhi was first introduced into California in 1913 from Iraq. Its fruit is nearly round, light amber to dark brown in color, soft with thick flesh and rich flavor. Picked when yellow, this semi-sweet date is crisp like an apple. It is somewhat tolerant of rain and high humidity, and yields up to 300 pounds of fruit per palm every year.

Dayri is a variety from Iraq. Its fruit is long, slender, dark reddish to nearly black, and soft. These trees require special care. This date is not often grown in the USA. This tree grows well in heavy soils with ample irrigation. It can yield from 150 to 200 pounds per tree annually.

Deglet Noor was introduced in 1900 and is the most frequently grown date in the USA. 75% to 90% of the California crop is this variety. It has not been as successful in Arizona due largely to fruit damage from rain and high humidity. Deglet Noor is a semi-dry date from Algeria. It has a delicate flavor, not overly sweet, with a firm-texture. The color is light red to amber or straw. This palm is a great producer, yielding 200 to 300 pounds of fruit per palm every year. It is not tolerant of rain or high humidity. This tree should be planted in sandy soils, as it does not adapt well to heavy soils.

Halawy (Halawi) is a small to medium sized date from Iraq. It has a soft, thick flesh, and an extremely sweet caramel taste. The dates are yellow, and ripen to a light amber or golden brown. If the palm is not well watered, the dates may shrivel. This date palm is tolerant of higher humidity and occasional rains. The annual yield is from 200 to 250 pounds per palm.

Hayany (Hayani) is the date most often planted in Egypt. It was introduced into this country in 1901. The dark-red to nearly black soft dates are sold fresh. This is one of the coldest hardy of the date palms.

Khadrawy (Kadrawi), an import from Iraq and Saudi Arabia, is grown to some extent in California and Arizona. This is the smallest edible date palm grown in the USA. It has a soft caramel-like texture and sweet flavor. However, because of its dark color, it is not popular here. This palm is tolerant of rain and humidity.

Medjool is an import that came from French Morocco in 1927. It is marketed as the deluxe, or Cadillac of dates. It is a large, soft, sweet date that ships well. The fruit has been only slightly

damaged by occasional rains and high humidity. To produce the uniform extra large dates it is usually heavily thinned by cutting out a large percentage of the center strands. Each palm will produce 150 to 255 pounds of fruit annually.

Thoory (Thuri) is called the Bread Date. It is the driest date variety, and is a staple in the diet of the Nomadic tribes of the world. When cured, it is brown-red with very wrinkled skin. The flesh can be hard and brittle with a good, sweet nutty flavor. It keeps well and is used for food when traveling across deserts. This palm tree is stout with short, stiff leaves. It has very large clusters that bear heavily, yielding 200 to 250 pounds of fruit each year. It is only somewhat tolerant of humidity.

Zahdi (Zahidi) is the oldest known cultivar, and is widely used in the Middle East. Zahdi was introduced into this country about 1900. It is a medium size date that is light golden-brown, semi-dry, and very sugary. It keeps well for months and is used in cooking. It has a very large seed and a crunchy, fibrous flesh. The palm is stout and fast growing. It is drought resistant and a heavy bearer, yielding 200 to 300 pounds per tree annually. It has little tolerance of high humidity.

PROPAGATION

If kept moist, date palms readily germinate from seed. However, the resulting palms are variable with respect to fruit production and quality of fruit. There is only a 50% chance of obtaining female trees (the only ones that produce fruit) from seedlings. There is no accurate way of telling if a seedling is male or female until it blooms. Date palms easily hybridize with other *Phoenix* palms, which means if there are other species in the area the resulting offspring could be very diverse. This may be acceptable if the trees are to be used only for ornamental purposes, but not for fruit production. The most common method of vegetative propagation has been and still is by sucker or offshoot removal from known mother trees. Recently the production of plantlets by tissues culture or in vitro propagations has also been used, although the practice is not yet wide spread.

Vegetative propagation

Offshoot propagation is the most common way to propagate known varieties of dates. This method has been used for hundreds of years. For the first 10 to 15 years of a date palm's life, suckers or offshoots are produced. If left on the mother tree, a multi-trunked tree will be produced. In some cases (Fig. 28) the suckers will snake their way out from the dead and dying fronds (if not removed) of the mother tree forming a most unusual tree. Once the offshoot is 3 to 5 years old, it is ready to be removed. (Fig. 29) If it is growing near the ground, some roots should already be formed. Most of these offshoots will weigh from 40 to 75 pounds and have a trunk 8 to 14 inches in diameter.



FIG. 28 OLD DATE PALM WITH OFFSHOOTS NEVER REMOVED



FIG. 29 YOUNG DATE PALM WITH OFFSHOOTS READY TO REMOVE

When working with date palms, caution must be the by word. If the tree has many offshoots, pruning and tying up is necessary to protect workers from the armament. (Fig. 30) It is best for



**FIG. 30 OFFSHOOTS WITH
LEAVES TRIMMED AND TIED**

the mother tree and the continual development of new offshoots if they are removed at maturity. A large device (Figs. 31-33) that resembles a cross between a shovel and a chisel is used to sever the offshoot. A device called a slammer, which resembles a pipe with handles, is used to force the chisel between the offshoot and the mother tree. (Fig. 34) The slammer fits over the handle of the chisel. The blade of the chisel should be about 4 to 5 inches wide, 9 inches long, and 1 inch thick. The handle of the chisel should be 4 feet long and over 1 inch thick. (solid metal) The slammer is used to force the chisel end between the offshoot and the mother tree. (Figs. 35-36) Some people use a sledgehammer instead of the slammer. However, this is not recommended because the sledgehammer can slip off the chisel and injure the person holding it.

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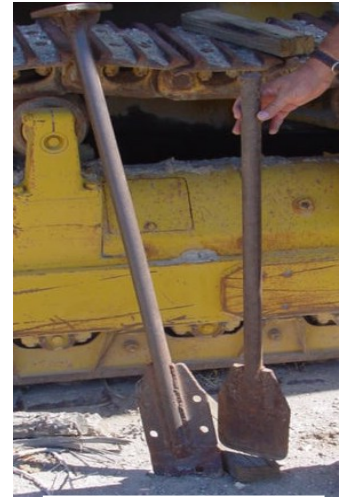


FIG. 31 CHISEL



FIG. 32 CLOSE UP



**FIG. 33 MODIFIED SHOVEL
FOR OFFSHOOT REMOVAL**



FIG. 34 CHISEL AND SLAMMER



FIG. 35 REMOVING GROUND LEVEL OFFSHOOTS



FIG. 36 CLOSE UP OF REMOVAL OF OFFSHOOT

Offshoots should only be removed when soil is warm so that root growth will be stimulated and rapid. The green fronds should not be removed, as the growth of the offshoot will be in proportion to its leaf area. When offshoots are crowded, some leaves will have to be removed, but the number should be kept to a minimum. When severed from the mother tree, several inches of soil should be left around the roots of the offshoot.



FIG. 37 REMOVED OFFSHOOT WITH ROOTS

These roots should not be allowed to dry out. Research at the University of Florida has shown that palms with trunks can regenerate roots if most or all are lost. (Fig. 37)



FIG. 39 OFFSHOOTS PLANTED IN NURSERY CONTAINERS



FIG. 38 NEWLY REMOVED OFFSHOOTS STORED IN A STREAM

These offshoots can be held in moving water such as a flowing stream, or heeled in with soil or mulch and irrigated. (Fig. 38) Never keep the offshoots in stagnant water. They may be wrapped in burlap and kept moist, especially if they are being shipped. It is better to plant the offshoots in the field as soon as possible, or to place them into nursery containers for later sales or planting in the field. (Fig. 39) If planted directly into the field, the fronds should be left tied up for the first year. This helps to conserve moisture and protect the bud. Sometimes a loose burlap wrap is used to protect the leaves. However, this can reduce photosynthesis. Offshoots can be planted in nursery rows 3 feet apart. The rows should be 10 feet apart so they can be accessed for cultivation and mowing. After two to three years, they can be transplanted to fields.

The hole for the offshoot should be dug only deep enough to accommodate it. Most of the trunk should be left above the ground so the plant will not sink deeper into the soil and suffocate. A basin should be created 6 to 12 inches deep and 4 to 6 feet wide, with the offshoot planted in the center. The soil needs to be kept moist at all times, taking care that the water does not reach the loose fiber near the bud. For the first year of its life, the newly planted offshoot needs protection from summer sun and wind and winter cold. Leave the offshoot tied up for protection until new green leaves appear. If the offshoot has been pre-rooted in a nursery container, simply plant it at the same depth as it is in the container. If offshoots are purchased from a nursery, find out how long they have been in the containers. They should be six months to a year old. Plant only from the late spring to early summer. Offshoots taken near the ground with good care have a 95% to 100% survival rate. Those taken higher up seem to have about a 50% rooting rate.

Tissue Culture (In Vitro)



PALMS READY TO ESTABLISH

FIG. 40 TISSUE CULTURED PALMS (PERMISSION TO USE REQUESTED FROM PALM DATE INTERNATIONAL)

Stage 2 is bud initiation, and stage 3 is multiple shoot formation. Stage 4 is plant elongation and root initiation. After this, the plantlets are ready to be hardened off so they can be planted outside. The plants are hardened off in a greenhouse with controlled humidity, temperature, and light. Once they have reached a plantable size, they can then be moved to an outside nursery or field planted. This method of propagation can reduce production time greatly. Within 3 years, one can have a palm the size of a 5-year-old offshoot, and can produce as many as needed. (Fig. 41)

Production of new date palms of selected cultivars can take years and if new varieties are to be developed, crossing and back crossing means that it may take as long as 30 years or more to produce a new hybrid or cultivar. When offshoots are the only propagation method, many more years are required to produce sufficient numbers for field planting and production. Other agricultural crops such as bananas and potatoes are produced by tissue culture. Tissue culture is accomplished by taking nearly microscopic cuttings from apex or terminal buds to assure disease free material. These are taken in a sterile laboratory and placed in containers with growing media under lights in a growing room. The cuttings advance through several stages, (Fig. 40) beginning as an explant.



FIG. 41 MEDJOOOL TISSUE CULTURED TREE 3 YEARS OLD. (PERMISSION TO USE REQUESTED FROM PALM DATE INTERNATIONAL)

CLIMATE AND SOILS

The date palm is an extremely drought tolerant plant. Established trees have been known to survive several years of heat with no irrigation or rain. However, this is not a recommended cultural practice as it stresses the palm greatly. When there is no rainfall or irrigation, fruit production is greatly diminished. The date palm needs to be grown in full sun where the low temperature seldom falls below 15°F to 20°F degrees (-9°C to -6°C). Dates have been able to withstand temperatures as low as 4°F (-15°C) for short periods with only damage to fronds. When fronds are damaged or killed, next year's growth will be retarded until the fronds are replaced. Dates can survive temperatures as high as 120°F (50°C) or more in places such as Death Valley for short periods of time. To produce fruit, the date needs a long hot growing season with little or no rain. Unlike many palms, dates can withstand being in waterlogged soils, but this will stress the tree. Even though dates can withstand some flooding and waterlogged soils, it is critical that the planting site have good drainage. However, dates can grow with their roots in running water as long as the water is oxygenated. Dates are also saline tolerant, and can withstand soil content readings up to 6000 mg/L (ppm) total soluble salts, but for good fruit production readings should never be more than 2000 mg/L (ppm). As the salt concentration increases in the soil, the amount of additional water needed also increases to maintain salt balance.

In natural areas, dates are irrigated by a constant supply of water from the oases that are near, by seasonal flooding, or by high water tables. In production, it is recommended to water established mature palms 15 to 40 times per year. There is an old Middle Eastern saying that dates like their feet (roots) in Heaven and their heads (leaves) in Hell. To make the ground more like heaven the soil needs to be moist, not wet or waterlogged. In southern Nevada and in other similar areas, 70% of the water should be applied between April and September. The irrigation needs of mature dates will be similar to correctly watered turf.

The following watering schedule was developed by the PET (potential evapotranspiration) values for southern Nevada. The graphs (Figs. 42-44) show a low and high median watering schedule. These irrigation schedules use 21,000 to 31,500 gal/yr/tree. It is assumed that the water will be applied in an area 30 ft. in diameter under the canopy of mature established palms. The amounts were taken from the recommended irrigation of producing dates in California. They recommend 8 to 12 acre-feet of water per year per acre of mature trees. In commercial growing areas dates are irrigated every 10 to 14 days in warm weather (April to September) and every 30 to 40 days the rest of the year. The charts give recommended amounts per month applied during the growing season once or twice per week and once or twice per month, in the cool season (i.e. if twice a month every two weeks). What does this mean? One square foot of soil covered by 1 inch of water is equal to .62 gallons. For an area of 706 square feet (an area with a 30 foot diameter) 438 gallons of water are applied per inch of irrigation. In July and August to apply 2,940 gallons each month 6.7 inches of irrigation water must be applied. For December and January the needed 630 gallons requires only 1.3 inches of irrigation. This is best accomplished with bubblers that are measured in gallons per minute or with low spraying overhead sprinklers measured in inches. These two methods are more effective than drippers that only put out one to five gallons of water per hour. However, drip systems are good for establishing small nursery grown palms or un-rooted offshoots. Other plants growing under the palm such as turf, groundcovers, or shrubs will compete for the water, and more water will need to be applied to meet the needs of the palm.

Note: Overhead sprinklers, such as rotary or impact, can promote erosion of stem tissue that cannot be repaired (Pfalzgraf handout).

Fortunately, dates can be grown in a wide variety of soil types. Deep sandy soils with a good moisture supply are best. The main soil requirements are good drainage and aeration. Dates will grow in heavier soils, but care must be taken not to waterlog these soils. Dates will grow in soils that are high in alkali and salt content, but growth and fruit quality will be affected. More sandy soils with their great drainage require more fertilization, as fertilizers are more easily leached out by irrigation.

Monthly % of water use from PET values for Las Vegas, Nevada.

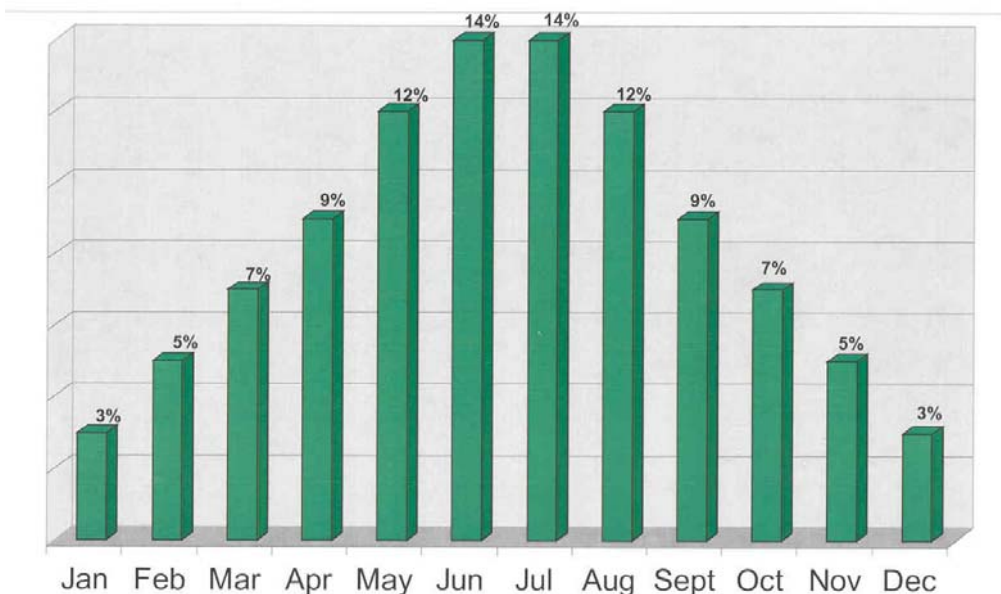


Fig. 42 Monthly % of water use from PET values for Las Vegas, Nevada.

Monthly Water Amounts for a Mature Date Palm Watering an Area with a 30 ft. diameter. Canopy. Low/Medium Water 21,000 gallons per year.

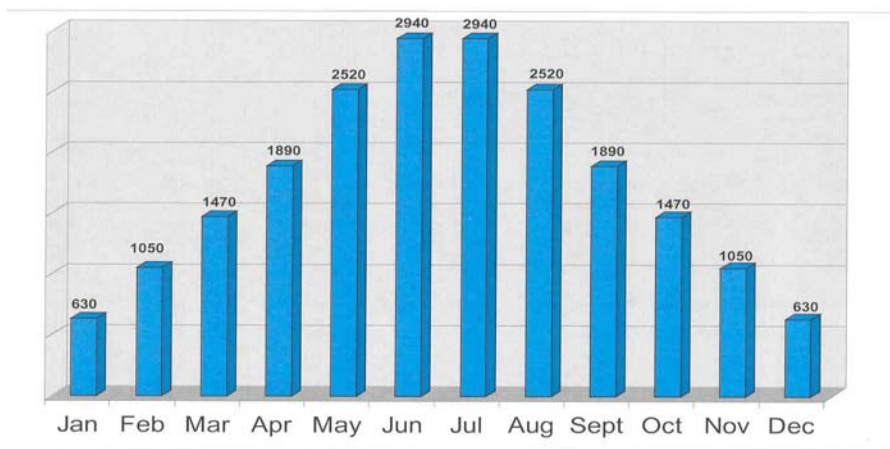


Fig. 43 Monthly Water Amounts for a Mature Date Palm Watering an Area with a 30 ft. diameter. Canopy. Low/Medium Water 21,000 gallons per year.

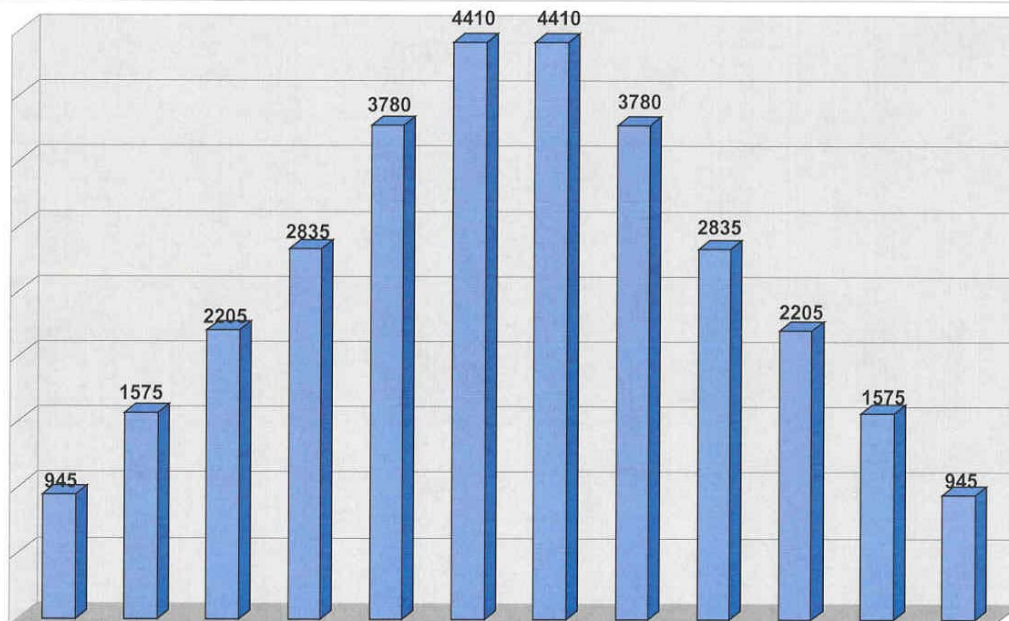


Fig. 44 Monthly water amounts for a mature date palm watering an area with a 30 ft. diameter canopy high median watering with total 31,500 gal/yr.

PLANTING AND SPACING

Commercial growers plant dates from 20 feet by 20 feet apart to 40 feet by 40 feet. The date palm can grow 1 to 1.5 feet per year and have fronds up to 15 feet long. Planting in groups less than 20 feet apart will shade out plants below when the trees mature.

Planting date palms is similar to planting other palms and plants. The planting hole should be at least 2 to 3 times the width of the root ball. If the palm is in a container, simply measure the diameter of the container. The depth of the hole should be the same as the depth of the container or the root ball of a field dug palm. The hole should not be deeper than the root ball, as the soil under the palm may settle causing the palm to be deeper than it was growing before transplanting. This can cause death by suffocation of the roots. It is important to determine the drainage of the area. This is easily done by digging the planting hole, filling it with water, and allowing it to drain. Repeat this procedure and time how long the water takes to drain. If the water drains within a few hours to overnight, then the drainage is adequate. If it takes longer, a consultant should be hired to provide drainage recommendations, or the palm should be planted in a different spot. There are different thoughts on back fills for planting palms in southern Nevada. Because dates do well in sandy soils, some people recommend back filling the planting hole with sand. This has been successful. However, a good grade of sand that will not compact must be used. If the rest of the area is not sandy, a contained area that will restrict root growth will be created. This also happens when a high organic back fill is used. If the existing soil is fairly acceptable, good aeration of the removed soil before backfilling should facilitate establishment with 3 to 4 inch organic mulch on the surface.

Good irrigation is essential for the palm's well being. The existing root ball must be kept moist. Emitters must be placed over the root ball as well as away from it. This will keep the area moist and encourage root establishment into the native soil area. The goal is to have the roots growing out 30 feet from the trunk, all the way under the canopy. If there is no irrigation in the outer area, there will be no roots either. When establishing a newly planted palm, saucers or a berm of soil are needed to prevent the water from running off the root area. If palms are field dug (bare root) they should not be allowed to dry out in transport or while being stored on site. (Fig. 45) Until they are planted, they should be heeled in with soil or mulch and irrigated. Once a large root ball has dried out, it is very difficult to rehydrate.



FIG. 46 DATE PALMS PLANTED TOO DEEP WILL DIE

When transplanting palms, it is important to keep in mind that until a palm has some visible trunk above ground it is not tolerant of the extreme root disturbance that takes place during this process. This does not include containerized palms in which the entire root system is in the container. In this case, little disturbance takes place when planting. Once a visible trunk is developed, palms are among the easiest plants to dig and transplant. The best time to transplant or plant a palm is from spring to early summer. Warm soil, above 70°F (20°C) facilitates root growth. When the ambient temperature falls below 50°F, the palm is basically dormant. (Pfalzgraf. 1999). The worst time for planting palms is from late fall to winter when the soil is cold. This is especially true of transplanted palms that need to replace roots lost during digging.

Always plant at the same depth as the palm was growing in the field or container. Depending on the soil type, very large palms are sometimes

planted deep to help hold them up. In nearly every case, a palm planted too deep will slowly die. (Fig. 46) Occasionally a palm that has been planted too deep will survive and even establish depending on the soil and drainage. This is always the exception, not the rule. Some date growers have been successful in planting large date palms deep when the root ball has been severely damaged. When these palms are planted in well-drained sandy soil they will sometimes re-root along the trunk replacing the damaged root ball. However this is not a recommended practice with palms transplanted palms will take up to will take place in the first year. more susceptible to disease, should be checked frequently for Research at the University of more of older leaves when the are dug ensures the survival of transplanted palms. (Fig. 47) This is only time green fronds should be removed from a palm.

The remaining leaves should be tied together in a bundle around the bud with a biodegradable twine. Once a large palm is planted, irrigated, and correctly staked, the fronds can be untied. When staking a palm, supportive stakes should never be nailed directly into the trunk. (Fig. 48)



FIG. 47 TOP PRUNED DATE PALM FOR TRANSPLANTING

that have a viable root ball. Very large two years to establish. Very little new growth Field transplanted palms are stressed and are nutrient deficiencies, and insect pests. Palms problems until the trees are established. Florida has shown that the removal of 50% or palms

the



FIG. 48 CORRECTLY STAKED PALM

PRUNING



FIG. 49 OVER PRUNED DATE PALM

Pruning is one of the most misunderstood aspects of palm culture. For some reason, people believe they can indiscriminately hack at palms, including periodical removal of most or nearly all of the fronds (leaves), and not harm the tree. (Fig. 49) This is not true. All green fronds produce the food needed to grow properly, producing a healthy palm. (Fig. 50) The reduction of the green leaf area reduces food



FIG. 50 UNPRUNED DATES IN NATURAL SETTING

production, and in turn, the health and growth of the palm is placed in jeopardy. When a date palm loses all or most of its fronds in a freeze, the palm does not produce fruit until they have been replaced. Consecutive freeze damage to a date palm over several years can lead to death. When green fronds are removed on a regular basis, the health and vigor of the palm is compromised. If at all possible, only remove yellow or brown fronds. This will include dead, dying, and broken leaves. Date palm fronds are known to live from 5 to 8 years (with some reports up to 15 years). Under good growing conditions, a date palm may have between 120 to 180 fronds up to 15 feet long. On such well-grown palms, the removal of a few green leaves will not be detrimental. After the leaves are 3 to 4 years old, they slowly begin to die. Once they begin to yellow, it is time to remove them. At least two rows of mature fronds should be left on the palm. Mature fronds are those found below the current year's flowers. (Pfalzgraf. 2000).



FIG. 51 UN-POLLINATED DATES

If female trees are not being pollinated for fruit, it is good to remove the flower spikes between the time they open up and the little green fruits appear. May and June are the months when this should take place. This sterile fruit will not mature, but will take energy from the mother tree. Later in the year, this fruit will drop and make a mess. (Fig. 51) The flower spikes can be removed without removing any leaves. Uninformed pruners may want to remove all of the leaves they think are in the way, but make sure as many green fronds as possible are left. It is not recommended that climbing spikes (similar to those used on utility poles) be used when pruning palms, as they can damage the trunk. Ladders, non-spike climbing gear, and hydraulic lifts (sometimes called cherry pickers) can be used.

Skinning palm trees has become popular in the last few years. This is merely for cosmetic purposes. It is not beneficial to the palm, and is not recommended for dates.

ENVIRONMENTAL STRESSES

Drought: Dates are very drought tolerant, surviving years with little or no irrigation or rain. However, for best results, adequate water is needed. For healthy date palms, irrigate with the amount of water that is recommended in the graphs.

Flooding: In the wild, date palms live in areas that are flooded during certain seasons of the year. As such they can tolerate some flooding better than most palms. This does not mean that they will grow well or even live long in constant, stagnant, flooded conditions.

Cold temperatures: Date palms are very adaptable trees. Their temperature range runs from highs of 140°F (50°C) to 15° to 20°F (-9° to -7°C) with little damage. They have been reported to survive temperatures as low as 4°F (-15°C) for short periods of time with all of the foliage killed. However, they will not survive year after year of such temperatures.

Wind: Palms can survive windstorms well if they are established and well rooted. Palms were among the few trees still standing in south Florida after Hurricane Andrew. They had few if any leaves left, but they were still standing.

Salt: Date palms are salt tolerant and will survive growing in direct contact with salt. They are used in landscapes on beaches near oceans. (Fig. 52) However, salt in both the soil and water will diminish fruit quality and production.

Lightning: Nearly all palms, including dates, have a single growing point. In most cases the palm will die if this is struck by lightning.



FIG. 52 DATE PALMS ON THE BEACH

NUTRITIONAL PROBLEMS AND FERTILIZATION

Nutrient problems persist in most palms, especially those planted in soils that tend to be alkaline. In most cases, regular and correct fertilization will avert these problems. It is important to know the pH as well as the nutrient make up of the soil in which the palms are growing. In other countries, most date palm growers rely on natural nutrients of the native soil and supplement fertilization with natural materials such as barnyard manure at five to ten tons per acre per year. This would be about 162 to 324 lbs. per mature palm spread on a 700 sq. foot area under the canopy of the tree over the course of a year.

Research from the University of Florida of field-grown palms in the more alkaline soils of south Florida reveals recommended amounts of chemical fertilizer for healthy growth. For palms in highly irrigated areas, it is recommended that a granular fertilizer be applied to the soil at a rate of 1.5 lbs. of N/100sq. ft. of canopy area 4 times per year or 1 lb./100 sq ft. 6 times per year. Fertilizer should be applied when the soil temperature is 70°F (20°C) or higher. The amount applied depends on the type of irrigation that is being used. If drip irrigation is the only type of irrigation installed, less fertilizer can be applied, and then it must be watered in by hand or by portable overhead spray sprinklers. Fertilizers should be uniformly broadcast under the canopy of the palm rather than concentrating it in bands or piling it next to the trunk where some roots may be injured and others are never in contact with any fertilizer.

Each soil will have different amounts of naturally occurring nutrients. But most soils lack some of the major nutrients required for healthy growth. In Nevada, levels of potassium found in the native soil are often very high. Generally, little or no potassium needs to be added when planting palms. However, when soil tests reflect low levels of available potassium or palms show potassium deficiency, regular applications of potassium are recommended. A good balanced fertilizer for southern Nevada should have N, P, K, and Mg in a 2:1:3:1 ratio, and should contain sulfur (S), magnesium (Mg), and trace amounts of zinc (Zn), copper (Cu), and boron (Bo). However, remember that as a rule southern Nevada soils have high amounts of potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S). Iron (Fe), manganese (Mn), and zinc (Zn) are the nutrients often found to be deficient in southern Nevada soils.

Most landscapes tend to be a mixture of turf, trees, and shrubs. Although the line of demarcation between turf and ornamental plantings may appear to be distinct above ground, the root systems of palms, trees, and shrubs

extend well into the turf areas and share the soil with turf roots that are also utilizing the moisture and nutrients found there. Turf fertilizers tend to be high in nitrogen relative to potassium, and have controlled release N, but water soluble K. These fertilizers often contain no Mg or micronutrients. When these products are used on turf near palms, they often result in K deficiency being induced on the palms growing nearby because of the high N to K ratio in turf fertilizers. It is recommended that turf grass growing within 30 ft. of any palm or other tree and 10 ft. of any shrub be fertilized only with a palm special landscape fertilizer having a 2: 1: 3 ratio.

It is difficult to diagnose nutrient deficiencies only by visual symptoms. Many symptoms can overlap. In date palms, some deficiencies have similar symptoms, and the only way to diagnose the problem accurately is by tissue analysis.



FIG. 53 NITROGEN DEFICIENCY IN NURSERY PALMS (RIGHT)

Nitrogen: Nitrogen deficiency is not as common in landscape palms as it is in container nursery plants. Symptoms are overall light green color and decreased vigor of the palm. It is corrected by applying a fertilizer with nitrogen. The real problem with nitrogen is that there is often too much rather than not enough. (Fig. 53)



FIG. 54 POTASSIUM DEFICIENCY

leaves of the palms, progressing to newer leaves as the problem becomes more severe. Translucent yellow or orange spots form on leaflets. They may or may not have necrotic spots. Leaflet tips are often necrotic, but the midrib remains alive, and it may be orange instead of green. Once all the K is removed from the palm it will decline (including reduced trunk diameter) and die. Treatment includes soil application of potassium sulfate (sulfur-coated in highly irrigated soils). Foliar sprays are ineffective. (Fig. 54)

Magnesium: Magnesium is another problem in the landscape, especially with date palms. Symptoms show up first on the oldest leaves and progress up through the canopy as the magnesium is relocated from older to newer leaves. Broad light yellow banding shows up along the margin of the fronds, with the center remaining green. In severe cases, leaflet tips become necrotic. This is a common, but not fatal deficiency in date palms. The best treatment is regular application of magnesium sulfate over a long-term period. Affected leaves never recover. (Fig. 55)



FIG. 55 MAGNESIUM



Plate 7. Manganese deficiency of Alexandra palm (*Archontophoenix alexandrae*) showing necrotic streaking on otherwise chlorotic new leaves.



FIG. 56 MANGANESE DEFICIENCY

especially those in high pH or cold soils. The symptoms are only found in new leaves, as manganese is not translocated from the older leaves, as is magnesium. New leaves emerge chlorotic, weak, reduced in size, and necrotic streaked. Eventually they appear scorched. Treatment can be either soil or foliar application of manganese sulfate. (Fig. 56)



FIG 57 IRON DEFICIENCY

Iron: Iron deficiency is found more often in container nursery plants than in the landscape. New leaves will be uniformly chlorotic, often with tip necrosis and reduction in leaf size. The problem is most often found in soils such as those found in southern Nevada, which are low in iron and/or high pH. For short-term treatment, apply foliar iron chelates. Long-term treatment involves correcting cultural problems such as adding organic matter to the soil and decreasing pH. (Fig. 57)

Twisted Deformed New Leaves: The first few leaves of suckers or offshoots on a mother tree may have a twisted deformed look that at first resembles a severe deficiency. Some growers refer to them as birthing leaves. In healthy mother trees, they are soon replaced with normal leaves.

Some growers actually harvest them and sell them for use in floral arrangements. (Fig. 58)



FIGS. 58 MALFORMED BIRTHING LEAVES

PESTS and INSECTS

Palms that are stressed from poor growing conditions, recent transplanting, or other climatic conditions are more likely to have pest problems, including insects and disease. Most pest problems can be traced back to poor cultural practices, or to environmental conditions.

Date palms in southern Nevada are relatively disease and insect free. However, there are a few insects that can be considered problems with palms in southern Nevada. Review of the Department of Agriculture's records for the past few years show reports of 3 insect pests in palms (particularly date palms). They are scales (including coconut and red date scale), the giant palm borer, and scorpions.

Scales Coconut and red date scale are the scales most often found in southern Nevada's palms. Both appear to be introductions from nursery palms imported from other states. Currently, they do not pose a serious problem. Coconut scale (*Aspidiotus destructor*)

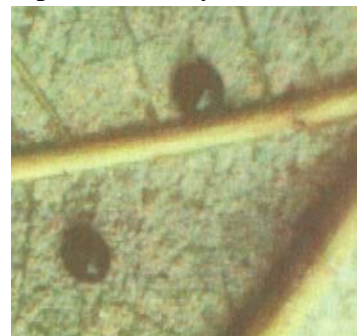


FIG.59 COCONUT SCALE INDIVIDUAL (LEFT) GROUP WITH LADY BUGS EATING (RIGHT)

Signoret) (Fig. 59) is a problem in more tropical areas of the world, but even in Hawaii it is not considered a major threat. It is a small, flat, whitish scale with a semitransparent waxy covering.

Red date scale (*Phoenicococcus marlatti*) is an old world scale found in many date producing areas. This scale attracts little attention as it is found mostly underneath the fiber, behind the leaf bases and fruit stalks, and on underground roots. The individual scale is seldom larger than a small pinhead, is pink to dark red in color, and secretes a white, waxy material, which forms a cottony mass. Red date scale is seldom a problem on established, healthy palms. There is some indication that it might be a problem in newly planted palms in more humid areas. Predators such as ladybugs help control small populations of these scales. Washing with a high-pressure hose, and use of horticultural soaps and oils are effective means of control.

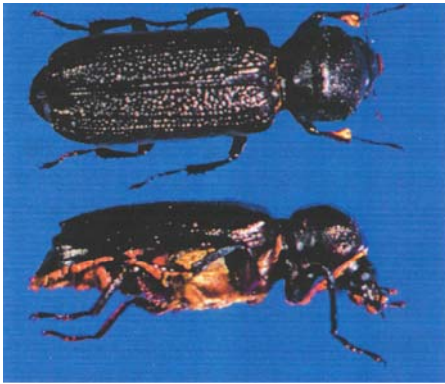


FIG. 60 THE GIANT PALM BORER BEETLE UP TO 3 INCHES LONG

The **giant palm borer** (*Dinapate wrighti* Horn) has been in the Las Vegas area since 1992, when it was first imported with palms. It is known to infest the California and Mexican fan palms, as well as the date palm. The borer is a beetle, (Fig. 60) and begins life as an egg that hatches into a larva or grub in the crown of the palm. (Fig. 61) This is the longest part of the beetle's life cycle, and can last several years. Borers emerge at night from holes in the trunk. Trunks of infested trees have feeding tunnels that are readily visible when the trunk is cut open. (Fig. 62) Control of borers in established palms is difficult. Buy only from reliable nurseries that guarantee clean trees. Remove all infested trees as quickly as possible. Either send the trees to the landfill or chip into ½ to 1-inch chips. No chemical control is recommended. (For more information, call your local Extension office for "The Giant Palm Boring Beetle" publication)

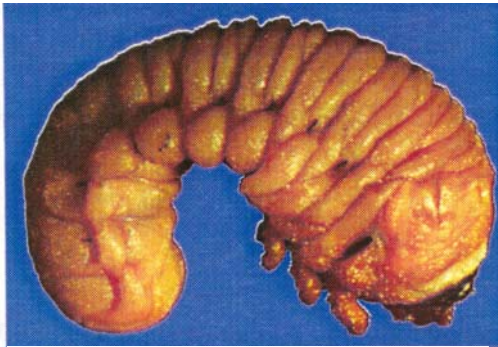


FIG. 61 GIANT PALM BORER GRUB



FIG. 62 GIANT PALM BORE DAMAGE IN TRUNK

The **bark scorpion** (*Centruroides exilicauda*) (Fig. 63) is another pest that has been imported to the southern Nevada area. This pest does not pose any problem to palms, but it does to people and pets. The bark scorpion is the only scorpion that is considered to be extremely poisonous. However, deaths from this scorpion's sting are rare. It is believed to have been introduced to southern Nevada in nursery plants (including palms) and building supplies beginning about 1993. The most effective method of control is to find the scorpions at night with a blacklight. Scorpions fluoresce a light yellow green color when exposed to a blacklight. Once detected, they can be killed by stepping on them or by spraying them with an insecticide. Spraying infested areas for scorpions is a less effective form of control. (For more information, call your local Extension office for "Poisonous Scorpions in Nevada SA/94")



FIG. 63 BARK SCORPION

DISEASE

Most palm diseases are found in nurseries rather than in the landscape. If palms are in good growing conditions, they are relatively disease free. There are a few diseases that have been found in palms growing in southern Nevada. These diseases can pose a problem for date palms as well. Fusarium wilt, which has been found in Canary Island date palms, (*Phoenix canariensis*) can also infect *Phoenix dactylifera* in southern Nevada. This disease was described in North Africa in the 1800's and has caused the death of over 10 million date palms in that region. Other diseases such as ganoderma or butt rot of palms have been reported in the Las Vegas area, but are not yet prevalent. Lethal yellowing has killed 100,000 coconut palms and other species of palms in south Florida and the Caribbean. Fortunately, this disease has not yet been found in the western USA. The Nevada Department of Agriculture has a quarantine on certain palms being shipped from south Florida. This is a disease that is spread by an insect vector that has not yet been identified in southern Nevada, and should not be a great concern at this time. The date palm is considered moderately to highly susceptible.

To prevent disease and other pest problems, it is best to keep palms in good growing conditions, and to implement correct cultural practices. Most diseases are difficult to treat with fungicides. For this reason, once infected, the best control is removal of the tree before the disease spreads to other palms.

The following diseases may or may not have been found in southern Nevada, but do not pose a threat at the present time.

Fusarium Wilt¹

Symptoms: Affected trees have fronds dying on one side of the palm more rapidly than on the other. This produces a lopsided appearance. The dying from older to younger fronds is more rapid than normal. A dark-brown streak often appears on the bottom of the rachis. (Fig. 64)

Prevention and treatment: This disease is both soil and water-borne. In California it has been transmitted by chain and handsaws during pruning. To prevent this disease from spreading, sterilization of tools is necessary. Dip tools in a 0.5% solution of sodium hypochlorite for five minutes. Chain saws are difficult to sterilize. Trimming of only dead fronds also prevents the spread of this disease



FIG. 64 FUSARIUM WILT

¹A. R. Chase and T. K. Broschat (editors). 1991. Diseases and Disorders of Ornamental Palms. APS Press, St. Paul, Minnesota

Ganoderma²

Symptoms: Initially, the older fronds wither and droop. New growth slows, and the palm decreases in size and develops a pale-green to yellowish color. Finally only one or more spears remain in the bud. Death may take 1-2 years depending on age and environmental conditions. Toward the end, a mushroom fruiting body will form on the lower trunk or adventitious roots. (Fig. 65)

Prevention and treatment: In the landscape, avoid the initial establishment of this disease. Space palms adequately to prevent spread of ganoderma. Avoid wounding palm trunks with mowers and weed eaters. When a palm dies of ganoderma remove the roots, stump, and trunk of the dead palm. Don't replant a palm in the same planting area. Always remove the ganoderma mushroom or fruiting body to prevent the spread of spores until the whole palm can be removed.



FIG. 65 GANODERMA

Pink Rot³

Symptoms: This is an invasive rot that can attack the bud tissue, petioles, leaf blades, and trunk. Spots are often associated with gummy exudates on trunks. Older fronds die prematurely. In severe infections, many stems die because of girdling. Removal of symptomatic fronds reveals stem infections which are dark brown and irregularly shaped, sometimes with chlorotic margins.

Prevention and treatment: Wounding facilitates infection. Only completely dead leaves should be removed from palms with this disease. In Florida, applications of fungicide at 7 or 14 day intervals have given good control during the summer months. (call the extension office for more information). In the landscape, maintain the plant's health and avoid wounds.

Thielaviopsis Bud Rot (Stem Bleeding, Bitten Leaf, Black Scorch, Dry Basal Rot, Heart Rot)⁴

Symptoms: This disease exhibits bud rot and associated "bitten leaf" symptoms. Blackish-brown lesions develop on external and internal tissues. Buds are damaged or die. New fronds have a black scorched look. A soft yellow decay of trunk develops into a black scorch on the trunk. Palms eventually defoliate and die with a hollow trunk.

Prevention and treatment: Avoid wounds on palms. Do not let water from sprinklers hit the trunk of the palm. Remove and destroy infected palms. There is some documentation that date palms may have some resistance to this disease.

Power line Decline Symptoms⁵: Leaves near high voltage power lines have chlorotic or necrotic tips in the vicinity of the lines. In severe cases the entire crown will become chlorotic and may die. The electro-magnetic fields around high voltage power lines appear to injure palms. Foliage within 1 to 2 feet or more of a line may be injured (no scientific proof).

Prevention and treatment: Do not plant palms near overhead wires. Palms planted under power lines should be removed.

²Ibid., p.12.

³Ibid., p.24.

⁴Ibid., p.30.

⁵Ibid., p.46.

SPECIAL THANKS TO:

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Jeff Knight Entomologist with the Nevada Department of Agriculture (Reno) Photos 60-63.

Cathy Costa, Former Pathologist with the Nevada Department of Agriculture (presently with the California Department of Food and Agriculture).

Richard Harris, Program Coordinator. Arboretum at Arizona State University, Date Demonstration Garden.

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All photographs and charts/graphs are by authors unless otherwise noted.

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Not recommending any of these control methods but providing information on control methods. It is up to the individual to determine which method will best fit their particular need and situation.