Dates production protocol

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Contents:

1. Introduction

Common Name	Scientific name	Family name
Date Palm	*Phoenix dactylifera L.*	*Arecaceae*

The date palm has been known in Jordan for more than three thousand years BC. The archaeological fossils in Tell Al-Khalifi, west of the city of Aqaba, showed the presence of the date palm and its widespread use more than five thousand years ago.

The recent expansion and interest in palm cultivation in Jordan began in the seventies of the last century when *Medjool* and other commercial cultivars were introduced to the country and planted in Jordan Valley. There are several cultivars grown in Jordan such as *Barhi*, *Khadrawy, Khalas, Deglet Noor, Zaghloul, Hayany, Zahidi, Mektour*, and *Ahmar Talal*, but *Medjool* became the dominant cultivar.

The most important palm cultivars grown in Jordan are *Medjool* and *Barhi*, both representing 85 % of the total cultivated palm trees.

Barhi variety has the advantage that its harvest season starts after the end of the harvest season of the other types of dates. While the latter has a short shelf life, the *Medjool* cultivar is worldwide considered one of the best cultivars for its size, distinctive taste and shelf life. In addition, Jordan Valley is recognized as one of the best places for this cultivation: long summer days, medium-high temperatures and mild winters without frost and an adequate moisture ratio, help the trees achieve optimal growth, flowering and fruiting.

2. Agricultural practices

2.1 Irrigation and water management

The shortage of good irrigation water quality (low salinity and neutral pH value) in the main Jordan areas where commercial date palm cultivation occurs, like Jordan Valley, made the date palm sector suffers in a timely manner. In that area the available irrigation water is of medium quality in terms of its salinity (700-1,000 ppm) and relatively high pH (> 8).

According to NARC studies, the average consumption of water, for mature trees using traditional irrigation systems (surface irrigation), is estimated in about 1,000 mm annually in the *Deir Alla* and *Al Karama* regions, which are the most important production areas for growing Medjool dates in the Country.

Most date growers in Jordan use drip irrigation systems for water distribution and fertigation, while other palm growers build circular holes around their palms to collect water and prevent it from running off the tree. Drip irrigation systems allow for better water management, are more efficient and save water in comparison with the surface system.

2.2 Fertilization and soil fertility management

Most palm growers fertilize their orchards with organic fertilizers annually or regularly. Organic fertilizers are usually added at a rate of 100 kg per adult tree using sheep and/or cow dung, while chemical fertilizers based on nitrogen, phosphorus and potassium, as well as micro-nutrients, are needed mainly at the beginning of the growing season and at the beginning of the *kimiri* stage (see fig. 2) when most of the growth in fruit size occurs; some farmers usually stop fertilizing at this stage.

Farmers should consider the following points when fertilizing their date palms:

- Use soluble fertilizers;
- There is a strong relationship between fertilization programs and product quantity and quality;
- The compatibility of fertilizers when preparing fertilizer mixes (in particular in the case of fertigation);
- The right time to add fertilizer;
- The acidity and salinity of these fertilizers and their long-term effect on soil salinity;
- The content of soil and irrigation water of major and minor elements at different times of the season;
- Balancing between watering and fertilizer application to avoid fertilizer washout from the tree root zones.

2.3 Pollination

Date palm is dioecious and naturally cross-pollinated by wind and insects. For commercial cultivation, artificial pollination is required using a compatible pollen source. Therefore, ensuring enough flower pollination in order to obtain a good harvest of high-quality products is a necessary practice (*Taleb R. Abu-Zahraand Mohamad A.Shatnawi, 2019).* If not properly pollinated, false (virgin) fruits are formed without seeds that do not ripen (they are called "*sheaz*"). When fertilized successfully the date palm fruit goes into different developmental stages.

To ensure the success of the pollination process the following conditions should be met and maintained:

1. To use a good and compatible source of pollens from a good male tree; *Al-Ghanami* and *Jarvix* male trees in Jordan are considered suitable for pollinating *Barhi* and *Mejhoul* varieties;
2. A simple test should be performed to ensure good quality pollen with a germination percentage of more than 90%;
3. Dusting dried pollens mixed with talc powder in a cloth by hand is a common practice to perform date palm pollination. Other methods are also used, like inserting male inflorescence in the middle of female inflorescence after removing the centre peduncles, securing it with a piece of string;
4. Weather conditions play a major role in the success of the pollination;
5. The female inflorescence should mature enough and receptive for the pollen to good pollination;
6. To ensure pollination all female inflorescence pollination needs to be done several times;
7. Pollination should be avoided during rain.

Figure 1. Male and female inflorescences on the date palm.(**A**)Two groups of female inflorescences with different stages of development. The inflorescences at the bottom are ready for pollination. (**B**) Male inflorescence (right) outside its spathe (left),in the drying process prior to the extraction of pollen. (**C**) Males trands (left) and a single female strand (right). Source: Images A (Adapted from[16]). B,C (Photos by Ricardo Salomón-Torres).

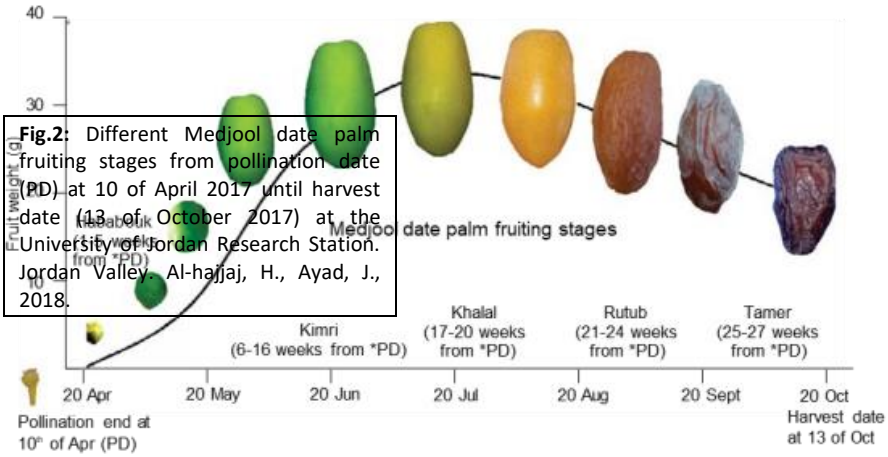


Fig.2: Different Medjool date palm fruiting stages from pollination date (PD) at 10 of April 2017 until harvest date (13 of October 2017) at the University of Jordan Research Station. Jordan Valley. Al-hajjaj, H., Ayad, J., 2018.

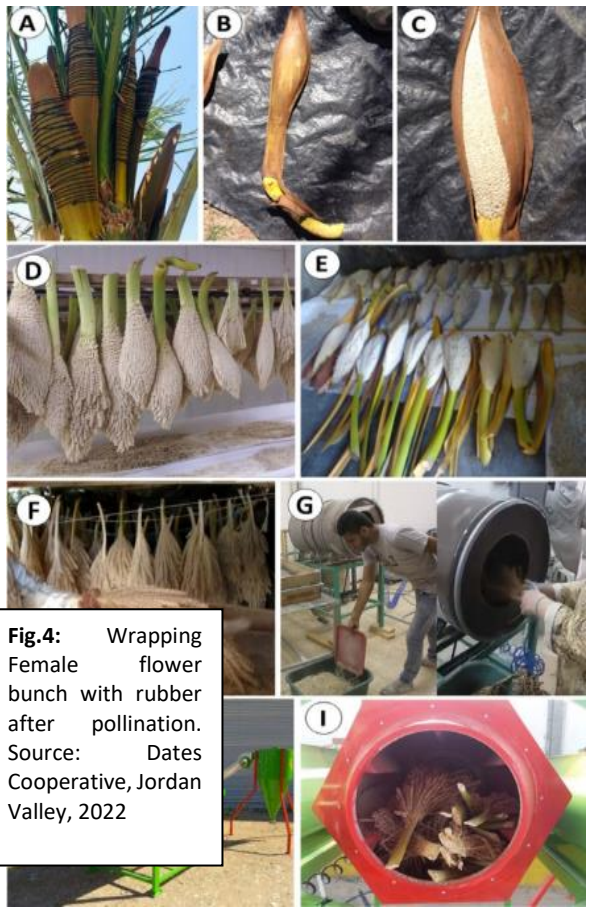


Fig. 3: Date palm pollenex tracti on process. (**A**) Spathe about to open on the palm. It is common to tie and press the spathe with string so that it matures as long as possible on the palm. (**B**) The base of the spathe comes off, indicating that this spathe is ready to be cut. (**C**) The open spathe, ready to dry. (**D**) Hanging spathes, drying and releasing pollen grains. (**E**) Spathes on a layer of paper. (**F**) Lightly striking the inflorescence to release more pollen. (**G**) Pollenex traction machine, hand-crafted. (**H**,**I**) Industrial and automated equipment for the extraction of pollen.

Fig.4: Wrapping Female flower bunch with rubber after pollination. Source: Dates Cooperative, Jordan Valley, 2022

Sometimes, perforated paper bags are placed on the female flowers after pollination to protect them from rain and raise the ambient temperature to ensure the success of pollination.

Fig. 5: Paper Bagging after pollination (*El Bouhssini, M, Faleiro J.R., 2010)*

2.4 Fruit Thinning

Thinning practices are significant procedures for date palms to improve the size, weight and quality of fruits, like pulp weight, total soluble solids, total and sugar contents as just as to decrease the chances of bunch breaking and regulating yearly tree bearing (Shaaban, M., Ahmed E., El-Akkad M. 2019). It also can decrease the incidence of certain insects like Dubas and some fungal diseases. In the other hand, too much thinning will reduce the harvest and income for the farmers. Removal of one-third of their central strands after fruit set has shown better development of fruits and hastened ripening and fruit quality. A balance should be made between the number of stalks on the top of the palm and the number of green fronds provided that the ratio between the stalk and green fronds does not exceed 8:1 or 10:1 at the most.

Fig. 6: Thinning of date fruits. (El Bouhssini, M, Faleiro J.R., 2010)

2.5 Pruning and dethorning:

Date palm trees have a single stem and generally do not branch. Therefore, diseased, dried and damaged leaves must be removed after harvest season. Very old leaves must be removed, as these are less efficient in photosynthesis. Besides the removal of leaves, dethroning is also essential close to fruit bunches as it helps in pollination, thinning of bunches, spraying and harvesting of fruits. After the fruit set, twisting of the bunch is done during April and May, which helps to withstand bunch breakage due to high wind velocity. It is also found that pruning date leaves leaving 6 leaves per bunch and also removal of one-third of strands from the centre have given good quality dates production. Therefore, it is suggested that nearly 70-100 leaves per palm are required for optimum productivity.

Fig. 7: Pruning and dethorning date tree - *El Bouhssini, M; Faleiro J.R.,*(Editors), 2010.

2.6 Bagging of Date Fruit Bunches

Mesh bags are specially made to cover the fruit bunch to protect the fruits from some pests' birds, direct sun and other climate factors and that varies according to the purpose, and the phase of use. The type of the bags differs according to the purpose, if it is used for protection from birds, the bags are placed at the end of the *Khalal* stage (Al-Bisr) and the beginning of the *Rutub* stage. As for facilitating the harvesting process, saving labour and preventing the fruits from falling on the ground, the bags and wrapping of the bunch two weeks before harvesting and the bagging operations help in the early ripening of dry varieties and delay ripening in soft varieties. The bags are often covered in *Mejhool* dates on the fruits after completing the processes of colouring them yellow and before wetting. Bunch covering has been efficiently used to protect the date fruit from hot and dry winds, sun burn, and date bunch disorder (*Aldawood,2013*).

Fig. 8: Bunch Bagging El Bouhssini, M, Faleiro J.R.,(Editors), 2010.

2.7 Bunch lowering and support

In the first few weeks after pollination, fruit stalks grow rapidly, a repliable and bend easily. Once fully

elongated, they become more brittle and can easily break. At this stage, bunches should be gently pulled downwards through the leaves (fronds) and supported by tying the fruits talks to the midrib of one or two of the lower leaves. Bunch lowering also facilitates manual harvesting. This prevents fully laden bunches from breaking from heavy fruit loads and from strong winds and allows easy access for thinning, bagging and pesticide application (*El Bouhssini, M, Faleiro J.R.,2010*).
This operation takes place on the *Mejhool* variety after 6-8 weeks of pollination and before the hardening of bunch stems. At the same time, the tangles of the branches of the fruit bunch are removed and the fruits are freed to hang up freely to protect the fruit from being damaged by the wind as a result of friction with the fronds and wickers.

Fig. 9: Bending and hanging fruit bunches in Deglet Noor dates (Kimiri stage) (*Othmani A. et al,2020)*

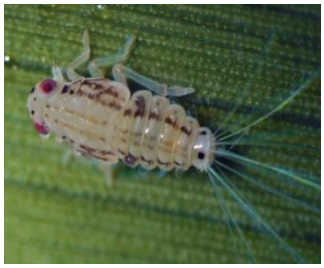
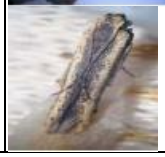
3. Date Palm Pests and diseases and their management

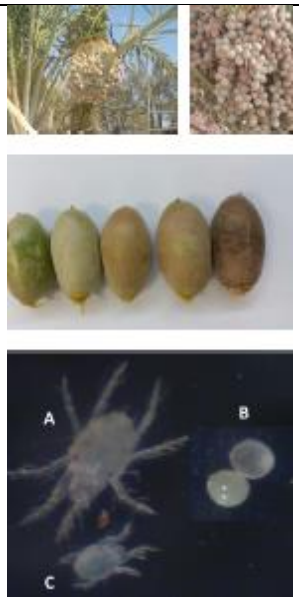
Among the most important pests and diseases that affect palm are the red palm weevil, borers, dubas, pollen worms, scale insects, blights, and fungal diseases, in addition to many physiological damages as a result of wrong agricultural practices or as a result of other factors, that can cause significant damage. Here comes the role of the farmer in the positive and conscious intervention to limit and prevent the spread of these diseases and pests or to limit the causes of damage that can occur during the season. Usually, most palm farmers have preventive programs for these pests, diseases, and weeds, in addition to combating them in case they occur.
One of the recently appears dangerous insect is the ***Red Palm Weevil***. However, controlling it requires a package of measures that work together to eliminate it and limit its numbers and spread.
The most important of these measures against the red palm weevil are as follows:

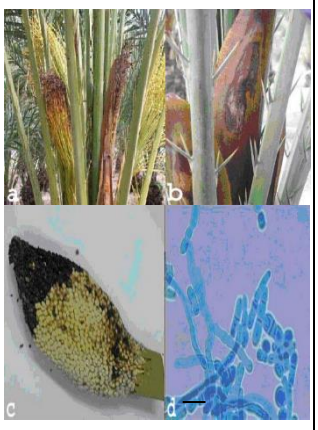
- Early detection of the weevil, whether through expert labor or from the acetate sensors that have recently entered into this control work;
- Using injectors to inject pesticides into the trunk of infected trees, while paying attention to the safety periods of these pesticides;
- Detecting and cleaning the area of injury;
- Reducing pruning, removing shoots and cuttings, and cutting plant parts during periods of weevil activity;
- Using modern control methods and control traps;
- Join the mass spraying campaigns with pesticides for palm weevil;
- Respect the internal quarantine legislation by not moving planting materials from infested areas to non-infested areas.

3.1 Main date palm pests and diseases

English name /scientific name	Arabic name	Damage and symptoms	Control management
Red Palm Weevil (*Rhynchophorus ferrugineus)*	سوسة النخيل الحمراء		Governmental regulated control, destruction of heavily infested trees, internal quarantine measures by preventing movement of planting materials from infested area to non-infested ones; <u>Pest management system approach</u>: Visual inspection for infested trees; Pheromone, Kairomone, monitoring traps; Mass collection and trapping of adult weevils; Attract and kill Pheromone, Kairomone, food baited stations; Microbial insecticides (viruses, bacteria, fungi, nematodes); Authorized insecticides as trunk injection or over whole spraying.
Palm borers (*Oryctes elegans*)	حفار عذق النخيل		<u>Pest management system approach</u>: Population monitoring; Host plant resistance; Biological control; Semi chemical control; Chemical control.

Dubas Bug (*Ommatissus binotatus)*	دوباس النخيل	    	<u>Pest management system approach:</u> Visual inspection of tree leaves; Pheromone monitoring traps; Authorized insecticides as an over whole spraying; Biological control using predatory insects.
Lesser Date Moth (*Batrochera amydraula*)	عثة الحميرة	   	<u>Pest management system approach:</u> Population monitoring: (Monitoring activities are directed towards both adults and larvae); Agricultural and sanitation practices could be implemented to remove the dropped fruits that fall on the ground during the growing season and after harvest, reducing future hibernation sites; Removal of bunches left on the tree in order to reduce the hibernation sites of larvae, which would become the first-generation adults the next year;) Host plant resistance; Authorized insecticides.

Dust Mite (*Oligonychus afrasiaticus)*	حلم الغبار		<u>Pest management system approach:</u> Population monitoring: Proper identification and counting of mite species are essential in setting up monitoring and management strategies; Sanitation by removal of old fronds and fibers and weeds like Bermuda grass; Fruit thinning; Bunch covering with plastic bags to help lessen mite infestation; Chemical control with authorized pesticides.
Black Scorch Disease (*Thielaviopsis Chalara paradoxa*)	مرض اللفحة السوداء		<u>Pest management system approach:</u> Avoid injuries of young palms and the apical region of the tree during pruning and harvest; Avoid removing the spines by pulling which causes injuries to the rachis of leaves; Good sanitation, pruning, collecting and immediately burning of infected palms; Protect the cut wounds of leaves and healing by disinfectant products and especially the leaves of the crown top; Avoid planting the contaminated offshoots and transplanting the infected young palms; Remove and burn severely affected palms; Chemical control with authorized pesticides.

Diplodia disease	مرض عفن الدبلوديا		<u>Pest management system approach:</u> Disinfect all tools and the weaning and pruning equipment of the palms as well as the wounds of the cut and cut places with disinfectant and cleansing treatments; Incinerate fragments of palm trees; Avoid planting infected offshoots and young palm trees; Avoid hurting palms and offshoots during pruning operation, planting and hoeing soil around these offshoots; Host plant resistance: Survey should be conducted in date palm groves to know the behaviour of the date palm cultivars to this disease; Chemical control with authorized pesticides.
Graphiola Leaf Spot (*Graphiola*)	مرض بقع الأوراق الجرافيو لي		<u>Pest management system approach:</u> Follow the appropriate distance (spacing) between palm trees in plantations; Prune and then burn the infected leaves every year to prevent new infections; Host plant resistance; Chemical control with authorized pesticides.
Khamedj-Inflorescences Rot *Mauginiella scaetae Mich.* *Fusarium moniliforme* *Thielaviopsis paradoxa*	خياس الطلع (عفن الطلع)		<u>Pest management system approach:</u> Clean and incinerate infected inflorescences and tissue fragments; Avoid the use of pollen from contaminated spathes or pollen collected from diseased; Male trees in order to prevent the disease spread; Chemical control: Use preventive chemical treatments with authorized general protective fungicides after harvest (September to November), followed by another treatment before or at the beginning of the output spathes next year (December to March).

Fruit Rot different fungi	أعفان الثمار		<u>Pest management system approach:</u> Cover the fruit bunch in the early *Khalal* stage with strong paper bags or wraps in the form of bells to avoid fruit wetting with rain and dew; Prevent fruit injuries and attack by insects and birds; There is a need to sort healthy fruits, to exclude injured and deformed fruits, and to dry the fruits during the postharvest stage; Chemical control: In the field, in the case of fruit infection in the early stages after fruit set, in particular by Alternaria sp. or Thielaviopsis paradoxa, it is possible to spray the fruit with an appropriate and authorized fungicide (used for control of leaf spot disease and black scorch). It is important to also control insects during this period.

3.2 Integrated Pest Management

It is defined as the careful consideration of all available methods of plant protection and the subsequent integration of all appropriate measures to discourage the development of pest populations. The use of plant protection products and other forms of intervention are maintained at levels that are economically and ecologically justified while reducing or minimizing risks to human health and the environment.
When using chemical pesticides, the choice of plant protection products must be very careful. First of all, only those approved for the crop and the target must be chosen, then toxicity (for the environment, users and consumers) and residuality of the individual pesticides used must be taken into account in addition to the aspects just mentioned, also in relation to the maximum residue limits imposed in the countries of production and export.

3.3 Pesticides limits in the export countries

Before exporting the product to a foreign country, it is necessary to be aware of the regulations in force concerning the use of chemicals and maximum permitted residues. In particular, a maximum residue limit is set for each plant protection product approved for use on the crop. It is, therefore, necessary to check, by means of multi-residual laboratory analyses, whether or not the production complies with this established limit. Conversely, if a plant protection product has been withdrawn or not approved in the country to which it is intended to be exported, it will have a predefined maximum limit of 0.01 mg/kg, which is equal to the lower limit of analytical quantification. In practice, there should be no traces of that substance on the product to be marketed. Useful information can be checked on the official EU pesticide

database, in the case of exports to European countries, or on the FAO pesticide database for all those countries that do not have their own regulations.
Websites:
https://food.ec.europa.eu/plants/pesticides/eu-pesticides-database_en
https://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/commodities-detail/en/?c_id=254

Codex standard for pesticide maximum residue levels (MRLs) in food and feed which is amended each year by the Codex Committee on Pesticide Residues (CCPR).

Active Ingredients allowed in EU countries on Dates: type, safety period and EU MRLs

Active Ingredient	Org.	Type	Safety period	MRL	
Pelargonic acid		H P	3		A = Acaricides
Beer	🐞	L			B = Biological auxiliaries
Coniothyrium minitans	🐞	F			C = Adjuvants
Dazomet		H F I N		0,01 *	H = Herbicides
Diammonium Phosfate	🐞	V			F = Fungicides
Iron phosfate	🐞	L			I = Insecticides
Glyphosate		H		0,10 *	L = Limacides
Metam-potassium		H F I N		0,01 *	M = Pheromones
Metam-sodium		H F I N		0,01 *	N = Nematocides
NAA		P	7	0,06 *	P = Phytoregulators
Mineral paraffin oil	🐞	A C I	20		V = Various
Paecilomyces lilacinus ceppo 251	🐞	N			Approved for 🐞
Spinosad	🐞	I	7	0,02 *	
Talco E553B		V			
Trichoderma asperellum	🐞	F			
Trichoderma atroviride ceppo T11	🐞	F	3		
Sulfur	🐞	A F	5		

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