ENHANCING DATE PALM PROCESSING, MARKETING AND PEST CONTROL THROUGH ORGANIC CULTURE

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Abstract

Although the processing, marketing and pest control challenges of date palm have been discussed in many conferences and symposia, little attention has been paid to the particular challenges for its organic production and handling; especially those affecting conventional producers faced with land degradation, biodiversity loss and pollution and who are in transition to organic systems. Although organic farming is being promoted as an environmentally-friendly approach in most developed countries, there has been little consideration for developing countries, which are the main producers of dates. In this article we will examine the potential benefits, and processing, marketing and pest control challenges, associated with organic date palm production.

Key words: date palm, organic culture, processing, marketing, pest control.

Introduction

Date palm *(Phoenix dactylifera L.)* is one of the oldest cultivated plants (Lee, 1963, Riad, 2006). It was certainly domesticated by 3000 B.C. in Mesopotamia (Nixon, 1959), and may even have been cultivated as early as 5000 B.C. (Popenoe, 1924). Because of its high nutritional value, productivity and long yield-life (100 years), the date palm was referred to as the "tree of life" in the Bible (UN, 2003).

Date palm is a multi-purpose tree, being highly regarded as a national heritage in many countries. It provides food, shelter, timber products and all parts of the palm can be used. Because of these qualities, and its tolerance to harsh environmental desert conditions, areas under cultivation have increased tremendously in recent years. Improvement in marketing and export efficiency are priorities for date palm growers (Alabdulhadi et al., 2004).

Dates are produced in hot arid regions of the world and marketed worldwide as a high value confectionery. It is considered as an important subsistence crop in most of the world's desert areas. Worldwide, date production has increased exponentially over the last three decades from 1.8 million tones in 1963, to 2.6 millions in 1983 and 6.7 million in 2003. This increase of 4.9 million tones since 1963 represents an annual expansion of about 6.8%. In 2001 the top five producing countries - Egypt, Iran, Saudi Arabia, Pakistan and Iraq (FAO, 2003) – were responsible for 69% of total world production. If the next five most important countries (Algeria, United Arab Emirates, Sudan, Oman, and Morocco) are included, then this percentage rises to 90%. This clearly indicates that most of the world's date production is concentrated in a few countries in the same region (Erskine et al., 2003).

During the last 30 years, significant 'modernisation' changes have occurred in date harvesting, packing, processing and marketing, largely because of access to the newly acquired oil wealth in the main areas of production. This, and the increasing access to welfare, has also resulted in the decreasing importance of the date as a staple food. Despite this, the highly traditional nature and close relationship of the date grower to his crop has helped to prevent a decline in date production. New outlets for at least part of the crop were found through better handling and processing methods to cater for more sophisticated

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emerging markets. Modern technologies, mostly imported and sometimes adapted, made it possible to achieve more uniformity and higher quality standards (FAO, 2006).
In spite of the importance and broad culture areas of conventional date palm cultivation, field and post-harvest losses are high, and methods for measuring product quality and use of date products and by-products need improvement. To address these issues, most producing countries in central and west Asia and North Africa have ranked date palm as a high research priority crop. For several decades date-palm groves have been in decline because of pest and disease problems (Erskine et al., 2003).
Major constraints include low quality palm cultivars, poor farm management, pest and disease control (and inadequate IPM: integrated pest management), harvesting, processing and marketing, shortages of national qualified and trained staff and labour, and insufficient research and development. To overcome these challenges, environmental parties are promoting organic cultivation as an environmentally-friendly approach, and are criticising conventional production. There is a growing debate involving date palm growers who are converting their groves to 'organic' (Azadi et al., 2006). In this paper, we will compare 'conventional' and 'organic' cultivation of date palm, its processing, marketing, and pest control.

Conventional cultivation

Processing

Over the past 40 years (initially in the USA) outlets for dates have broadened beyond their use as a table fruit, to include a diverse range of products that include dates as industrial raw materials. Although the ultimate goal of date production remains the production of high quality fruit, the growing demand for industrial dates has provided a welcome market for lower quality fruit.

Improving date quality depends on access to improved cultivars adapted to local climatological conditions, and on the skill and dedication of the date producer. Date research and development, which originated mainly in Iraq and the USA, is increasingly being carried out in other date producing countries in the Old World (FAO, 2006).
In conventional date processing, dry or soft dates are eaten as whole fruit, seeded and stuffed, or chopped and used in a great variety of ways: as ingredients in cereals, puddings, breads, cakes, cookies, ice cream, and confectionaries. The pitting may be done by crushing and sieving the fruit or, more sophisticatedly, by piercing the seed out of the whole fruit. The calyces may also be mechanically removed. Surplus dates are processed into cubes, paste, spread, powder (date sugar), jam, jelly, juice, syrup, vinegar or alcohol. Decoloured and filtered date juice yields a clear invert sugar solution (Morton, 2006). Recent innovations include chocolate-covered dates and products such as sparkling date juice, used in some Islamic countries as a non-alcoholic version of champagne, for special occasions and religious times such as Ramadan (Wikipedia, 2006).
Culled fruits are dehydrated, ground and mixed with grain to form a very nutritious stock feed. In the Sahara desert, dried dates are fed to camels, horses and dogs. In northern Nigeria, dates and pepper are added to the native beer to make it less intoxicating. Young leaves are cooked and eaten as a vegetable, as is the terminal bud or heart, although its removal kills the palm. In India, date seeds are roasted, ground, and used as a coffee extender and substitute. In times of scarcity, the finely ground seeds are mixed with flour to make bread (Morton, 2006).
In North Africa, Ghana and the Ivory Coast, date palms are tapped for their sweet sap, which may be converted into palm sugar, molasses and alcoholic beverages. Edible date palms should not be tapped more than two or three times, as tapping interferes with fruit production. It is wiser to tap *P. sylvestris* (which is not valued for its fruit), or one of the other 20 palm species that are commonly exploited for sugar. When the terminal bud is cut out for eating, the cavity fills with a thick, sweet fluid (called *lagbi* in India) that is drunk for refreshment; but it is slightly purgative. It ferments in a few hours and is highly intoxicating (Morton, 2006).

Marketing

Dates are traditionally marketed all over the world as a high value confectionery, but as fresh fruit they remain an important subsistence crop in most of the desert areas (Erskine et al., 2003). In general, commercial fruit production is possible only where there is a long, hot growing season with daily maximum temperatures of 90°F (32.22°C) and virtually no rain—

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less than 1/2 in (1.25 cm) in the ripening season. The date can tolerate long periods of drought, although for heavy bearing it has a high water requirement. This is best supplied by periodic flooding from the rivers in North Africa and by subsurface water rather than by rain (Morton, 2006).

In the New World (mainly the USA) the most characteristic phenomenon of the conventional date palm has been the gradual change-over of private, individual ownership of the date plantations into large holdings by companies integrated with large-scale packing and processing facilities. There are, however, some notable exceptions to this process and several individual farmers grow, pack and sell their fruit locally in roadside stands. The commercial success of these enterprises is no doubt helped by the fact that date cultivation in the U.S. is now practically restricted to one major area, which has become, also for its favourable climate-logical conditions, a tourist attraction. There is no need for smaller entrepreneurs to have an elaborate and expensive marketing and distribution system as the clients come to them (FAO, 2006).

Another major change that has taken place in conventional date marketing, under the impact of increasing labour costs and height of the palms, has been the mechanization of cultural practices and in particular the timing and method of harvesting. Today, in many instances, the dates are left longer on the palm and are harvested in one operation. Major consequences of the prolonged stay on the palm are the need for more protection against early rain, more chance of infestation on the palm necessitating dusting and reconstituting the dates to the required moisture level after harvesting to prepare them for the market. An advantage of the lower moisture content at harvesting, however, is that the dates are much easier to handle and store better. As for external marketing, there have been marked changes especially over the last decade. Historically, conventional world trade in dates was divided in several sectors each with its own characteristics, briefly described as follows (FAO, 2006). Dates pressed in baskets intended as a low cost popular food are mainly confined to the Persian Gulf area, to other Arab countries and the Far East. Iraq has by far the highest per capita date production in the world and is an exporter by necessity. With a well-organized, centralized marketing organization, the CIF cost of Iraqi dates was practically always lower than locally produced dates in the receiving countries, which has not made it any easier for local date industries to emerge. The size of this market is difficult to estimate, but an impression may be obtained from the import figures for dates in the Arab countries and the Far East (FAO, 2006).

The conventional market for mature date palms from Egypt is very lucrative. It also seems difficult to convince decision-makers and individuals to wait until specimens grown locally became tall enough for landscaping, instead of asking for palms from Egypt. For these two reasons, we think that there is a need to introduce phytosanitary regulations at a European and North African country level to prevent the importation of non-organic date palms. Otherwise, disasters such as the one that has occurred in Almunecar or, worse still, the one that continues to develop in Egypt[2], are probable in other places around the Mediterranean. Such disasters could occur in coastal cities where phoenix palms constitute one of the characteristic landscape elements; from there, it could extend to the important inland date palm groves of North Africa. It could be also a catastrophe in Elche (in Spain) where a date grove has been nominated as a World Heritage Site. We consider also that European research centres should contribute to help all countries affected by red palm weevil to find a solution to combat this date palm pest (Ferry and Gomez, 2002).

Pest control

Date palm feeding by insects produces unique signatures of chemical compounds that often are exploited by natural enemies (Lewis, and Tumlinson, 1988; Turling et al., 1990), and these chemical signatures could be used to locate infested plants in the field (Allen et al., 1999)

[2] In 1995, three years after its first discovery in Egypt, an Egyptian agriculture official considered that the red palm weevil (*Rhynchophorus ferrugineus*) had been eradicated. Unfortunately, this announcement was erroneous. In the two provinces where the pest was first recorded, the red palm weevil continues to infect and kill new date palms year after year, despite all the efforts developed to combat it. In Egypt, as well as in Almunecar, the elimination of infested trees has not been applied systematically as soon as the pest was detected. The possibility of saving these trees and avoiding serious economic consequences as a result of their elimination, and the practical difficulties of carrying out this operation, have unfortunately limited or delayed the destruction of infested trees. The affected trees have then constituted an important focus for further spread of the red palm weevil.

In the conventional cultivation of date palm, fruit beetles such as *Coccotrypes daclyliperda* attack unripe dates, which makes them fall prematurely. . Ripe fruits are often also infested by nitidulid beetles (*Carpophilus hemipterus*, *C. multilatus* (*C. dimidiatus*), *Urophorus humeralis*, and *Heptoncus luteolus*), which cause decay. Control by botanical insecticides is necessary to avoid serious losses. In Israel, the fruit clusters are covered with netting to protect them from such pests as *Vespa orientalis*, *Cadra figulilella* and *Arenipes sabella* as well as from feeding by lizards and birds. In Pakistan, the red weevil, or Indian palm weevil, *Rhynchophorus ferrugineus* bores into the leaf bases at the top of the trunk, causing the entire crown to wither and die. The rhinoceros beetle, or black palm beetle, *Oryctes rhinocerus*, occasionally attacks the date. Its feeding damage may provide entrance-sites for weevils. Scale insects may infest the leaves and the trunk. They have been controlled by trimming off the heavily infested leaves, spraying the remaining ones, and treating the fire resistant trunk with a blowtorch. Two of the most destructive scales are the Marlatt scale, *Phoenicoccus marlatti*; which attacks the thick leaf bases, and the Parlatoria scale, *Parlatoria blanchardii*, which is active in summer. The latter was the object of an eradication campaign in California and Arizona in the late 1930s. The date mite scars the fruits while they are still green. A tineid moth and an anobiid beetle, *Lasioderma testacea*, have damaged stored dates in the Punjab. Dates held in storage are subject to invasion by the fig-moth, *Ephestia cautella*, and the Indian meal-moth, *Plodia interpunctella*. *Fusarium albedinis* causes the disastrous Bayoud, or Baioudh, disease in Morocco and Algeria. It is evidenced by a progressive fading and wilting of the leaves. Over a 9-year study period of 26 resistant varieties in Morocco, Bayoud disease reduced the planting density from 364 palms per acre (900/ha) to 121 to 142 per acre (300-350/ha). It is because of this disease that 'Medjool' can no longer be grown commercially in Morocco and Algeria (Morton, 2006).

As in other palm crops, rats, mice and other rodents may cause damage to the trunk as well as to the fruit. For this reason it is important to support predators such as owls. A mechanical way to reduce fruit damage is to place a ’sleeve’ around the stem to prevent rodents from climbing up the tree (UN, 2003).

Decay of the inflorescence is caused by the fungus *Manginiella scaeltae* in humid seasons. Several brown stains will be seen on the unopened spathe and the pedicels of the opened cluster will be coated with white ’down‘. Palm leaf pustule, small, dark-brown or black cylindrical eruptions exuding yellow spores, resulting from infestation by the fungus *Graphiola phoenicis*, is widespread and often a serious problem in Egypt. Date palm decline may be physiological or the result of a species of the fungus genus *Omphalia*. Diplodia disease is a fungus manifestation on leafstalks and offshoots and it may kill the latter if not controlled. The fungus caused condition called ’black scorch‘ stunts, distorts and blackens leaves and adjacent inflorescences. Other fungus diseases include pinhead spot (*Diderma effusum*), grey blight *(Pestalotia palmarum*) and spongy white rot (*Polyporus adustus*). The date, as well as its relative, *Phoenix canariensis* Hort. ex Chaub, has shown susceptibility to lethal yellowing in Florida and Texas. No commercial plantings have been affected (Morton, 2006).

Even when important and costly means are dedicated to combat the red palm weevil, an effective solution to control it is still missing. However, the main ornamental tall palms planted in the gardens and in the streets of the Mediterranean coast cities are date palms. Thousands of them are imported from Egypt each year directly or indirectly into Spain and other European countries. These palms should have a phytosanitary passport, but in such mature date palms, large quantities of hidden insects and diseases can evidently remain undetected, even after very careful phytosanitary scrutiny. In response to the appearance of the red palm weevil in the south of Spain, the Spanish government promulgated a decree in 1996 forbidding the importation of palms from countries where pests of the group of *Rhynchophorus* have been recorded. Four years later this decree was modified, with one of the consequences being that importation of date palms from Egypt is no longer illegal. This modification to the decree was probably made partly because mature palms were still arriving in Spain from neighbouring countries, with the disappearance of the border controls between European Union member countries (Ferry and Gomez, 2002).

Constraints facing conventional cultivation

Research and development on conventional date palm cultivation by individual countries is still insufficient. In general, product quality from conventional cultivation is still low, field and post-harvest losses are high, and the date products and by-products utilization need improving. To address the above-mentioned constraints, date-producing countries in the

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Central and West Asia and North Africa region have ranked date cultivation as a high research priority. Key problem areas include (Erskine et al., 2003):

- Low quality varieties
- Poor farm management
- Pests and diseases, and inadequate IPM control
- Harvesting, processing and marketing
- Shortage in national qualified and trained staff and labour
- Insufficient research and development

Because of these problems, shifting from conventional non-organic cultivation to organic approach may be regarded as a necessity. Some countries such as Jordan, Algeria and Tunisia have taken this step. In brief, some of the salient technical issues of this shifting process include the following (FAO, 2006):

- Increased use of plastic boxes and crates for improved field handling and storage of dates
- Use of vibrating tables and conveyors during grading for better inspection and bulk packing of dates by vibration instead of pressing
- Increased use of vacuum fumigation also during transit
- Continued consideration for the introduction of insect control by non-chemical methods
- Regulation of moisture content (hydration, dehydration) in the packing plants for better control on product quality and uniformity
- An emerging trend of marketing khalaal and rutab[3] under refrigerated conditions
- Increased automation in date packing plant operations
- Introduction of automatic filling of bags and thermo-form packs and packing under vacuum and nitrogen gas
- Increased use of mechanized pitting and stuffing of dates
- Improved bulk date shipments, facilitated by worldwide spread of containerization
- Intensified production of date products and industrial use of dates.

Organic cultivation

For organic cultivation of dates, soils are fertilized with green and animal manures and compost. Manure may be applied by digging a trench around the tree to bury the manure. Nitrogen can be provided by intercropping with alfalfa (and other appropriate leguminous plants). At least once every four years, compost should be applied around the date palm. Such regular applications of organic material improve water holding capacity, and also the efficiency of irrigation (UN, 2003).

Producers who have shifted to organic production of dates in Israel and Tunisia are exporting certified organic dates to the European countries, especially Germany. In 2000-2001, Tunisia exported 678 tones of organic dates, up 60% from 425 tones in the previous years (Fruitrop, 2001). In this country, its organic date cultivation, processing and packaging project has contributed to the conservation of the region's delicate social and ecological balance. As the company manager overseeing the project noted, "…this…has had a surprisingly significant effect on maintaining the small farming structures as well as protecting the oases from encroachment by the desert (SOFI, 2006)". We will now briefly discuss the processing, marketing and pest control for organic date production.

Processing

After harvesting, organic dates are sorted manually, washed in clean water, air dried (45° C), resorted and packed. During sorting, infested and damaged dates are removed (UN, 2003).

Because of the economic advantages of organic products, processed organic dates are currently more emphasized than conventional ones. It is estimated that over half of the organic processed dates are exported to Europe. In France and Italy, for instance, consumption is evenly distributed between organic and non-organic processed dates. In Germany, Spain and the UK, processed organic dates are prominent, whereas in date-

[3] There are basically four date fruit stages named by their Arabic denominations: kimri, khalaal, rutab and tamr. Khalal dates are still crunchy, like an apple. They then further ripen into the soft rutab stage. Dates distinguish themselves therefore from most other fruit in that they have a botanical maturity and at least three distinct commercial maturation levels, the sweet khalaal, the rutab, and the tamr stages.

producing developing countries processed organic dates are consumed less (Azadi et al., 2006).

There are many different types of packaging in the EU, but the 'ravier' type is most popular. Except for the 5kg bulk container, which is common to every country, various types of packaging and weights can be found: punnets, bags, ravier, tubs, glove boxes, and window boxes. Consumer packages range from 150g to 2kg (Liu, 2002).

Organic date packers are increasingly contracting cold storage companies to disinfest field-harvested dates. The most common method is chilling to a temperature at or near -17.8^{o}C for 10 days. Limited space, time constraints, and high-energy consumption suggest the practicality and cost effectiveness of a rapid low temperature treatment that uses existing technology. Serpentine forced-air cooling is such a method (Thompson, 1997); however, so far it has been used only for cooling products to 0 ^{o}C (Denis, 1999).

Marketing

Organic products are increasingly traded internationally. Although the market contribution is still modest, trends indicate that there is some potential for its expansion. Europe is a primary market for organic products. Currently, Israel, Tunisia and USA (California) export certified organic dates to European countries.

Market development has led to other countries, such as Japan, becoming interested in purchasing organic dates. Japan imported 68,873 tons of dates in 2006. Tunisia and its partners have explored new markets and products for organic dates. An interesting role for this project has been to act as a pump-primer by creating small markets for certain products. The project buys specific varieties to exhibit at diversity fairs. This helps to spread the word and expand the market. They also bought other 'date products', such as baskets made from date palm fronds and used them to display the various date varieties and make them available for tasting. Promoting artisanal activities like basket-making has strengthened the position of women in the oasis communities. Whereas the men control the major cash crops, the women make use of the palm by-products and lesser varieties. Both have further benefited from the introduction of early and late date palm varieties, which have extended the season during which dates can generate an income (CGIAR, 2006).

Yet, much remains to be done to reverse the impact of market concentration on the erosion of date genetic diversity. The project has commissioned crucial studies of regional and European markets for dates and is in preliminary discussions with partners from the private sector to place new products in new markets. In Algeria, for example, pastries based on dates, products made from organic date palm fronds, and chopped date leaves for cattle feed are all helping to boost the income of producers. In Tunisia, and other countries, domestic merchants and consumers are showing an interest in traditional varieties, which suggests not only that the goal of reducing genetic erosion may be achieved, but also that fears about not doing enough to promote public awareness may be misplaced. Already some innovative approaches have been implemented. From the outset, the project has been working with women and NGOs to gather recipes and traditional information about the ways in which different varieties can be used in the kitchen. In partnership with the Association de Sauvegarde de la Médina, an NGO in Tozeur, Tunisia, the project planted more than 1,200 male date palms along 10 kilometres of road. In Algeria, the municipality of Ghardaia is adopting a similar approach, planting endangered date palm varieties in the town squares to boost conservation. This kind of effort has multiple impacts; it improves the urban environment and preserves genetic diversity at the same time as providing a focal point for public awareness activities (Fruitrop, 2001). In Algeria, similar objectives have been achieved by organizing date fairs, where the public, including policy-makers and producers, can experience the diversity of dates and date products and begin to appreciate the importance of making use of more date varieties.

In all three countries, both producers and policy-makers are now more aware of the advantages of organic cultivation (CGIAR, 2006).

Namibia also has a real opportunity to compete on the international market in the future as a major commercial date producer in the southern hemisphere. Since this country can produce dates that are out of season elsewhere, it will be able to produce and supply dates to all major markets during the traditional off-season. The lack of major diseases and pests and the fact that no chemicals are used - the dates are natural/organic products - add value to Namibian dates (Zaid, 1997).

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Pest control

If diseases and/or pests occur in a date plantation, the overall situation has to be evaluated to identify and address the causes. In this way, it will be possible to develop long-term, site-appropriate strategies to prevent the outbreaks. The two main pest-threats in conventional date palm plantations are the Red Palm Weevil (*Rhyncophorus ferrugineus*) and the fungal disease Bayoud (*Fusarium oxysporium*). Outbreaks of both can be prevented by the strict use of non-infested seedlings and strong hygienic precautions. Tissue cultivation propagation of seedlings is the most successful way to achieve this, but it requires sophisticated techniques and expensive facilities. The health status of date offshoots and seedlings from nurseries needs to be monitored to prevent any infestation of the plantation. Consequently, it is of utmost importance to implement the regular disinfection of the tools, and the removal of infected palms, leaves and inflorescences (UN, 2003).

There are also bioacoustic methods for the early detection of disease. Bioacoustics is a developing discipline of biology that has been used mostly to study the behaviour of birds, bats, whales, dolphins, frogs and grasshoppers. Currently it is being used to study other insects, including pests (von Laar, 2004). This approach is also used for other applications such as speech processing, biomedical, and machines diagnosis-prognosis purposes (Al-Manie and Alkanhal, 2004).

There has been a growing interest in finding and using non-destructive methods for detecting the presence of insect pests in the interior parts of plants (Al-Manie and Alkanhal, 2004). For example, Mankin et al., (2000) used acoustic systems with vibration sensors to monitor the activities of insects in soil and within plants, both in the laboratory and in the field (see also Shade et al., 1999; Shuman et al., 1993; and Hagstrum et al., 1996). Lemaster et al., (1997) monitored the acoustic emissions of termites to detect their presence in wood structures. Mankin et al., (2002) similarly monitored termite infestations in trees; and Mankin and Fisher (2002) detected black Vine Weevil larvae in nursery containers.

Unlike traditional methods of pest detection, which are time consuming and labour intensive, bioacoustic procedures do not damage the plant; cost little (once the technique has been developed), save time, and enable early detection.

Acoustic emissions produced by the Red Date Palm Weevil (RDPW), a destructive pest that infests date palms (*Phoenix dactylifera* L.), are recorded with special sensors and analysed using signal processing methods (Al-Manie and Alkanhal, 2004). Acoustic sensor probes are inserted into the trunk to record sounds produced by the insect, especially in its larval stages, which do most damage. Effective detection requires identifying the unique signature of each pest species and stage. Complicating factors include the possibility of other insects living in the tree that produce similar sounds, interference from environmental noise, distortions, and attenuation by the tree trunk[4], which will reduce the strength of the received signal and make it harder to detect (Al-Manie and Alkanhal, 2004).

To help address this, the time-frequency distribution (TFD) of the recorded signals have been analysed and coordinated with visual inspections (Al-Manie and Alkanhal, 2004).

The recorded acoustic signal may need to be processed first to remove background noise through filtering before applying time frequency estimation. A number of trials were repeated by collecting data from different infected trees as well as healthy ones. The lab work was completed in the Computer and Electronics Research Institute (CERI) at King Abdulaziz City for Science and Technology (KACST). The fieldwork was conducted in infected farms in the Al-hasa region in the eastern part of Saudi Arabia. Detection and analysis of the unique sounds of RDPW infection were evaluated in terms of clarity and ease of recognition (Al-Manie and Alkanhal, 2004).

Other biological methods that consider the possibility of using dogs for detecting date palms infected with the RPW were presented in this study (Nakash et al., 2000). Because the existence of plant–insect chemical signatures is well established, it seems reasonable that

[4] Once the sound produced by the pest is available through the usage of acoustic sensors, the next step is to try to find a method for identifying a unique signature of these pests. As it is well known, time series representation of the acoustic emissions is not enough by itself to identify the presence of the pest through visual inspection. Furthermore, many other factors must be taken into consideration such as the possibility of other insects living in the same tree that may also produce similar sounds. Other physical factors include environmental noise, distortions, and attenuation by the tree trunk, which will reduce the strength of the received signal and make it harder to detect. Therefore, it is necessary to devise a procedure that makes it possible to visually recognize the acoustic emissions produced by these particular pests and ultimately identify the infected trees.

dogs could be taught to recognize them. At least one study has demonstrated this; German shepherds were trained to find gypsy moth, *Lymantria dispar* (L.), egg masses and pheromone-marked items (Wallner and Ellis, 1976). Between July and October 1999 the trained dogs were released in date palm plantations where 'oozing balls' had been hidden within a few trees (10 trees in each test). In all cases (four tests) the dogs found the hidden baits very quickly, with 100% success. Between October and December the dogs searched a plantation in which high RPW captures had previously been recorded. The dogs found infected trees that had not previously been detected (Nakash et al., 2000). Some crop consultants have even claimed that they can personally smell mite infestations (Burnhum, 1998).

Advantages of organic cultivation

Organic dates are complete foods (Hinds, 2004). This naturally sweet desert treat is also used to produce a range of products including cubes, syrup, spreads, liquid sugars, sugar powder, alcohols and pastes (Alibaba, 2006).. These must be kept as natural as possible, with minimal use of glucose syrup, sugars, flour, vegetable oils, only added in accordance with the Codex Alimentarius for Dates.

Because of geographical and economical conditions, date is a major agricultural commodity of the dry lands, especially in Persian Gulf countries. The date fruit is dark reddish brown, oval, and about 1 1/2 inches long, with a wrinkled skin that is coated with a sticky, waxy film. Organic dates may also be processed into date juice concentrate (Alibaba, 2006).

Similar to other organic food products like milk, honey and grapes, dates too, rich in a variety of minerals and vitamins are considered as complete foods in themselves. They are used in a variety of food preparations by chefs all around the world, and have a high content of minerals, such as potassium, that are vital for human development. For example, the potassium content of organic dates is 25% higher than that of bananas, while it is free from less favourable components like fats, cholesterol and sodium. As well as being, organic date products also help to keep our calorie count and blood sugar levels in check. Because of this, they may be used in treating obesity and irregular diet syndromes. Its high content of dietary fibres and syrupy substances enable it to be used as a thickening and gelling agent in a range of products, including jams, jellies, soft cheeses, yogurts and various confectionaries such as cookies, cakes, breads and muffins. Rich in various nutrients, from appetizers and main dishes to desserts and beverages, organic dates are today used in a wide variety of food preparations. Along with being used as a chief food ingredient, organic date is also used for making various types of food cubes, syrups, spreads, pastes and even alcoholic drinks. To maximize the production of organic dates, farmers cultivating date gardens often enrich the soils of the cultivation lands with various types of natural fertilizers, and they are allowed to fully ripen on the trees. The mature fruit may then be cleaned, dried, moisturized, polished, and sterilized before being pressed, graded and packaged into units for sale. Boiled and de-seeded dates are further processed for preparing pastes (Mudhar, 2006). Organic dates are one of those alluring substances that one can enjoy without exceeding optimal calorie counts and blood sugar ranges. Date pastes are being used with much success in all types of recipes ranging from appetizers to desserts. Whether it is chopped and put on salads or baked into a delicious date muffin, all over the world chefs are using organic dates to complement a wide variety of menus.

Man had known the natural curative properties of dates from a very long time. Since organic dates have a Low Glycemic Index, they can be easily digested and provide enough carbohydrates to give you the pleasant feeling of a filled up stomach that can last for hours. Organic date sugar is a natural sugar that is gradually becoming a popular alternative to ordinary sugar. Besides this, organic dates provide a good source of health snacks in comparison to junk foods and candy bars, which because they contain lage amounts of hydrogenated oils and refined sugars are an almost guaranteed recipe for diseases such as heart attacks and diabetes. Thus, the presence of a variety of organic date products on health bar menus is to be expected (Mudhar, 2006).

Farmers carefully manage local varieties using organic farming methods. Some have selected varieties adapted to local conditions and resistant to drought and pests (BEDE, 2002). The premium paid for organic produce can significantly supplement the incomes of these small-scale developing country farmers, while also improving the sustainability of their farming systems. In addition, as organic food trade is now the most rapidly growing food sector worldwide due to mounting concerns surrounding food safety and quality, new opportunities

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for global partnerships that aim to reduce poverty through safe-food production in developing countries are rapidly emerging (Vossenaar and Jha, 2007). For instance, Mahmoudi et al. (2007) have shown that organic agriculture could already enable many Iranian small-holders to achieve household food security and gain modest income while regenerating the land, enhancing biodiversity, and supplying quality food to local communities. These diversified and integrated organic farm systems can be economically viable, environmentally sound and supportive of cultural traditions; and, as a consequence, they are essential to rural development in Iran, particularly where they combine modern scientific research with traditional farming techniques in a sustainable and efficient manner. By working with natural processes and making use of available local assets, the small-scale farmers can build up a fertile and productive farming system while avoiding applying (expensive) external inputs. Growing markets for certified products means organic agriculture can provide a unique opportunity for poor farmers to benefit from international trade.

Conclusions

Date palm (*Phoenix dactylifera* L.), a long-living monocotyledon plant, is of economic importance in many countries. It presents a source of income to oases inhabitants and creates favourable conditions for improving secondary crop cultivation of forage crops such as barley, alfalfa and clover (Soliman et al., 2003). Date palms must be understood to exist within complex ecological, economic and social networks. Commercial varieties include a large number of adapted ecotypes. This long-lived dioecious plant is of great socio-economic interest. Date palm is central to oases farming and to the production of various under-cover crops; and it constitutes the principal source of food and finance for oasiens.

Despite these advantages, under demographic pressure and as a result of the intensification of agri-cultivation using a limited number of improved and uniform varieties, organic systems based on diversification are under threat of disappearing. Therefore, it is imperative to develop strategies for evaluating the genetic diversity and the preservation of the date palm germplasm to ensure both resistance to diseases and pests and the production of high quality food. In this article, we have presented organic cultivation of date palm as a valuable strategy to meet these aims.

To produce an organic dates, farmers must ensure that natural fertilizers are used to enrich the sandy soil, and the dated must be allowed to ripen fully on the trees. The process of separation of crown of the seeds, cleaning, drying, moisturizing, polishing, sterilizing, pressing, cooling, grading, and packing must be done in optimal ways to maintain food quality. This requires adequate characterization of the non-chemical composition and textural properties of dates so that the nutrient value of the resultant organic date is not diminished. Accordingly, the producers should consider, when appropriate, the possibilities offered by organically grown dates, as the organic market is growing rapidly in many developed countries. Consequently, as more and more consumers turn to organic foods, retailers will look for a complete range of organic products, including dates.

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