

The Blessed Tree

Issue No. 01, March 2009, KHALIFA INTERNATIONAL DATE PALM AWARD

DATE PALMS AND BIOSALINE AGRICULTURE IN THE UNITED ARAB EMIRATES

Effect of Different
Organic Fertilizer Types
on Yielded of Organic
Dates Fruits and Its Quality



JUMAA AL-MAJED

Launching an international date palm award testifies to interest by H.H., the President Shiekh Khalifa in the blessed tree—a source of pride for the UAE.

PLANT-OFF TYPES IN TISSUE CULTURE - DERIVED DATE PALM

(*Phoenix dactylifera* L.)

AL-AIN DATE FACTORY

Initiating the Mechanization of the Date Industry in the United Arab Emirates

KHALIFA INTERNATIONAL DATE PALM AWARD



Photograph by: Nezar Ballout



KHAIFA INTERNATIONAL DATE PALM AWARD

Photograph by: Jack Jabour



جائزة خليفة الدولية لنخيل التمر
KHALIFA INTERNATIONAL DATE PALM AWARD

OUR TREE

Our Gratefulness



Since the beginning of time, a palm, with its height, was and still is a symbol of the pride of the people of the UAE. It also represents a symbol of life and continuous abundant giving. Therefore, our ancestors endeavored to make the UAE a green land full of palms loaded with dates. A large sector of Emirati families worked in farming since old times and passed this activity from one generation to the other. They took great interest in reclaiming the land, but the date palm was the centre of that interest as they exerted their utmost efforts to help in its growth and spread all over the country.

Throughout its long history, a palm date was and still is Man's safe haven which provided him with food and shelter so that he can face the difficulties of life. Now, this tree deserves our utmost care and attention using all the means available to us in an age in which the world has become a small village where we can easily communicate with anyone on the planet. The UAE took the lead in providing all means of support and care since more than 50 years when the late Sheikh Zayed Bin Sultan Al Nahayan – May God bless his soul – was the Ruler's representative in the Eastern Region and his first development initiative was to secure sweet water for the people and the cultivated land, especially date palm oases, by digging new ditches and repairing the old ones. Thus, date palms had the largest share in the vision and thought of Sheikh Zayed – May God bless his soul – for the march of development and building the country.

Today, it is time to show our gratitude to this tree which supported the UAE sons like a loyal friend. Therefore, it was the Head and wise leader of our beloved country H.H. the President, Sheikh Khalifa Bin Zayed Al Nahayan, God protects him, who sponsored the development of date palm sector and encouraged the people working in this field such as the farmers, producers, manufacturers, exporters, researchers and specialists whether individuals or institutions and companies through developing the infrastructure, securing the legal environment and providing the necessary financial support.

Khalifa International Date Palm Award came as a coronation for the vision and the continuous efforts of H.H. the President – May God preserve him – in recognition of this Blessed Tree and the people involved in this sector, whether from the UAE or from any other country around the world. This will enhance the high position of the UAE and its pioneering role in the field of date palms on both Arab and international levels.

Nahayan Mabarak Al Nahayan

Minister of Higher Education and Scientific Research
Chairman of Khalifa International Date Palm Award Board of Trustees



جائزة خليفة الدولية لبخيل النمر
KHALIFA INTERNATIONAL DATE PALM AWARD

OUR MESSAGE



A Well-Deserved Success

For the people of the UAE, a palm tree is a symbol of goodness and giving. They look at it as the secret of their survival and one of the factors of their adherence and loyalty to this land, since it's the palm tree that provided them with food, health and a source of income. From palm trees they acquired all the requirements of their lives such as the tools they used at home, at the farm, at the market and when fishing. That is why a palm tree is justly called a Blessed Tree. The late Sheikh Zayed Bin Sultan Al Nahayan – May God bless his soul – used to encourage taking care of palm trees and growing more of them. This highly esteemed invitation was answered by a wide response from the UAE sons and the number of palm trees in the country reached more than 40,700,000 according to the latest surveys of the Ministry of Environment & Water in 2005 (Ministry of Agriculture and Fisheries, previously).

Consequently, the UAE made a record for the biggest number of date palm trees in the world in 2009 according to Guinness Book of Records which presented the first certificate for the first record of its kind in the world. This appreciation was due to the wise vision of the first Man of the Environment, the late Sheikh Zayed bin Sultan Al Nahyan – May God bless his soul –, and thanks to the wise directives and the continuous unlimited support of the Palm Tree sponsor, H.H. the President Sheikh Khalifa Bin Zayed Al Nahayan – May God protects him, who provided a positive work environment where innovation and excellence can flourish.

Furthermore, the efforts of H.E. Sheikh Nahayan Mabarak Al Nahayan, Minister of Higher Education and Scientific Research / Chairman of Khalifa International Date Palm Award Board of Trustees, had a great effect on developing date palm sector in the UAE, through the sponsorship of the UAE University for date palm compound in Al Ain which includes the biggest scientific, research and production institutions to serve this blessed tree. Such institutions include the international date palm network, the Arab Center for Genetic Engineering and Biotechnologies, Date Palm Friends Society and Date Palm Research & Development Program, in addition to the recently launched Khalifa International Date Palm Award.

Our congratulations to the UAE for making the first record of its kind in growing date palm trees in the world. We also extend our congratulation to the leadership, the government and the people of the UAE, as well as the Ministry of Environment & Water, Department of Municipalities & Agriculture / Agriculture sector, the institutions, societies, authorities, individuals, farmers, producers, manufacturers, researchers, specialists and every one who loves this blessed tree on this benevolent land.

Dr. Abdelouahhab Zaid

Secretary General of Khalifa International Date Palm Award
Editor in Chief.



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Publication criteria in the magazine

1. The articles should be new, dedicated particularly to the Award's magazine, and have not published before.
2. Articles are to be in a soft copy, whether in Arabic or English, and should be supported by specialized sources and references at the end.
3. Researches and studies should be accompanied by the required scientific photographs of high quality (digital / high resolution).
4. Articles and photographs are to be submitted to the magazine by e-mail, or to be sent to the Award's P.O. Box on a CD with a typed and printed hard copy.
5. The magazine is not obliged to return the articles back, whether published or not, to the participants.
6. A writer of an article should enclose a personal photo with his CV including the full name, phone number, email and P.O. Box, in addition to the bank account number in English (Name, Name of the Bank, Account Number and Swift Code) in order to allow sending him the due amount in case the article is published, in compliance with the Magazine's financial system.
7. All Articles in the magazine necessarily reflect the views of their respective authors and do not oblige Khalifa International Date Palm Award.
8. Scientific subjects in the magazine are arranged according to technical considerations.
9. The Magazine welcomes readers from all the date palm lovers around the world, who contribute in deepening the knowledge and building a sustainable society.

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EFFECT OF DIFFERENT ORGANIC FERTILISER TYPES

**Amid Ministerial, Arab, International
and UN Presence**

NAHAYAN MABARAK INAUGURATES

Third International Date Palm Exhibition

**Khalifa's Support for the Blessed Tree an Honor for the UAE
More than 100 participants representing 25 countries**



Al-Ain, special

HE Sheikh Nahayan Mabarak Al-Nahyan, Minister of Higher Education & Scientific Research, Chancellor of the UAE University inaugurated the Third International Date Palm Exhibition in Al-Ain.

The five-day exhibition (October 22-64, 2008) was organized by the UAE University in conjunction

with the Date Palm Friends Society and the Khalifa International Date Palm Award.

Speaking at the opening ceremony, Sheikh Nahayan paid tribute to the great interest in the agricultural sector, and especially date palm cultivation, shown by HH the President, Sheikh Khalifa Bin Zayed Al-Nahyan. He referred to this

interest as a continuation of the strategy that had been introduced by the late Sheikh Zayed Bin Sultan Al-Nahyan who made the palm tree a food source and reserve for generations to come.'

Sheikh Nahayan, who is also the President of the Date Palm Friends Society, further noted with gratification the broad participation in the event by exhibitors from various parts of the world, as well as contribution by researchers and academics specialized in the entire date palm industry in the scientific forum accompanying the Exhibition.

Meanwhile, the Vice Chancellor of the UAE University, Dr. Abdulla Al-Khanbashi, expressed his thanks to all who took part in the Exhibition's third chapter and his appreciation of the role played by sponsors. He particularly noted the presence of more than 100 exhibitors from 25 Arab and foreign countries, as well as participation in the scientific forum by a number of outstanding experts and researchers. He also hailed the extensive participation by national institutions which demonstrated their excellent experience in date production and processing.

On the novel aspects of the third chapter, Prof. Abdelouahhab Zaid, Chairman of the Organizing Committee, also noted the marked growth in the number of participants from within the UAE and from abroad, as well as the increase in sponsors.

He added that the third chapter has introduced



a competition for visitors, an evening dedicated to Sudan Palm, a visit for guests to the Date Palm Development Studies and Research Unit, and another to the Date Factory at Al Saad, an affiliate of Al-Foah Company for the Development of the Date Palm Sector.

Award's Wing

The Khalifa International Date Palm Award has participated in the Exhibition as a principal sponsor and co-organizer. Its wing was up to the scale of the occasion. The wing highlight emblem

of the Award and displayed posters relating to the Award's categories and application procedures. A fine booklet on the Award was also provided for presentation to VIPs. A prospectus was also distributed to all participating wings as well as to the public, together with token gifts bearing the Award's emblem.

The wing was appropriately staffed in order to provide information on the Award, its objectives, categories and monetary value, and to encourage participation in forthcoming chapters.



**Under the Patronage of
Mohamed Bin Zayed Fourth Liwa Festival
for Ornamented Dates: A landmark for the
Western Region**

GUINNESS BOOK OF RECORDS MARKS THE

LARGEST DATE PLATE IN THE WORLD AS A UAE ACHIEVEMENT

Khalifa Award contributes a special wing,
encourages growers to apply for the Award
Participation by 10,000 growers a promising
gesture promoting interest in the blessed tree





Liwa- Special

HH General Mohamed Bin Zayed Al-Nahyan, Crown Prince of Abu Dhabi, Deputy Supreme Commander of the Armed Forces, called for an all-out national ornamented dates competition as of next year (2009) marking a quality shift in the festival and calling for innovation and creativity.

Inspecting the Fourth Liwa Festival for Ornamented Dates on August 1, 2008, HH affirmed that support for the agricultural sector in general, and fruitful crops in particular, are a standing component of the overall development strategy in the country.

"The success achieved by the Liwa Festival testifies to the sound approach taken by the Late Sheikh Zayed Bin Sultan Al-Nahyan for widening the green expanse in all parts of the country, and caring for the palm tree, which is a symbol of life and offering," HH added.

HH also paid tribute to the success achieved by the Liwa Festival for Ornamented Dates over four consecutive seasons.

Unique opening

HE Sheikh Mohamed Bin Betti Al-Hamed, Ruler's Representative in the Western Region, had opened the Fourth Festival on July 17, 2008. Accompanied by guests and organizers, HE inspected the exhibition which included forty wings for producers, 160 wings for companies



specialized in serving the blessed tree, as well as wings for the display of Liwa specialties, including archaeological and heritage acquisitions.

Khalifa International Date Palm Award's Wing

Upon receiving an invitation for participation in the Festival, the Khalifa International Date Palm Award started to prepare for a wing that is up to the scale of the occasion. The wing highlight emblem of the Award and displayed posters relating to the Award's categories and application procedures. A fine booklet on the Award was also provided for presentation to VIPs. A prospectus was also distributed to all participating wings as well as to the public, together with token gifts bearing the Award's emblem.

The wing was appropriately staffed in order to provide information on the Award, its objectives, categories and monetary value, and to encourage participation in forthcoming chapters.

Khalifa International Date Palm Award makes its first appearance at Arab World Level by participating in the

FIRST INTERNATIONAL DATE AND OLIVE EXHIBITION IN TRIPOLI (LIBYA)



المعرض الدولي الأول للتخيل و الزيتون

2008 / 11 / 12 - 8

طرابلس - ليبيا Tripoli - Libya

Tripoli/Libya: Special:

Upon a kind invitation from the Administrative Committee of the General Exhibitions Authority in the Arab Libyan Jamahyria, the Khalifa International Date Palm Award and the Date Palm Development & Research Unit of the United Arab Emirates University, have participated in the First International Date and Olive Exhibition which was held in Tripoli (Libya) from the 8th to the 12th of November 2008.

Two separate wings were organized at a scale compatible with the event, which included effective and interactive demonstrations of the economic, environmental and historical aspects of both the date and olive trees. Participating in the exhibition were major companies specialized in olive and date production and processing as well as those concerned with import/export of date and olive products.

The Award's wing featured the Award's logo and publicity posters and brochures. Nomination forms for all Award's categories categories were also made available. Staff readily replied to visitors' queries.

The Date Palm Development Research Unit, meanwhile, highlighted the tremendous advantages of applying tissue culture techniques for the speedy and effective production of the best date varieties. The wing provided on-

site demonstration of the various stages of propagation of the date palm through tissue culture, ultimately producing true-to-type plantlets. The wing also provided adequate information on the scale of tissue culture based date palm production in the United Arab Emirates, and the ambitious projects The Date Palm Development Research Unit has so far implements.

An important outcome of participation in the Exhibition was the exploration of possibilities for introducing into the UAE of quality Libyan date varieties, such as Barmil, Heloua and Gud, in collaboration with major Libyan companies and farms.



Western Region: Special

Organized by the
Abu Dhabi Culture and Heritage Authority
with more than 500 growers participating

Competition on Packaging Dates at the Dhafra Camel Festival -2009

Emirati Camels won more than 70% of advanced positions in the Camel Decoration Competitions organized in Dhafra from December 23, 2008 to January 1, 2009.

Emirati Camels were particularly outstanding in the Asayed and Majahim Categories, while Camels from Saudi Arabia and Qatar shared the rest of the 44 rounds.

Held under the patronage of HH Sheikh General Mohamed Bin Zayed Al-Nahyan, Crown Prince of Abu Dhabi, Deputy Supreme Commander of the Armed Forces, and organized by the Abu Dhabi Culture and Heritage Authority, the second chapter of the Dhafra Festival was staged on an area of several square kilometers at Zayed City in the Western Region. It included several innovative ideas at both the organizational and media levels. Particularly outstanding was the competition on packaging dates.

More than 500 date growers took part in the competition, displaying the Khlass, Shishi, Majdul and Debas varieties.

The Director of the competition, Eng. Mabarak Al-Qusalli Al Mansouri, said that the aim is to promote awareness of the importance of packaging in date marketing, and thus raise marketing standards. The competition would also kindle rivalry between growers to display their best. Another objective is to enhance marketing skills, and raise the standards of local dates.

The competition, he added, was confined this year to local growers and producers. But this was only by way of testing and assessing. A Committee of high-level referees was formed representing several prestigious bodies such as the Faculty of Food and Agriculture (UAE University), the Abu Dhabi Food Control Agency, and Al Foah Company for Date Packaging.

Criteria adopted for referring included the following:

- 2008 production – a single variety at a suitable maturation stage.
- Dates free, from apparent defects
- Dates free from pests and dead insects.
- Dates free from any unnatural odor or taste, and impurities.
- In case of using fumigation or sterilization materials, these have to be stated.

Criteria pertaining to packaging and materials used therein included:

- Healthy compact packing and maintaining safety of the product.
- Package should contain but a single variety.
- Package weight: 1-3 Kilograms.
- Using packaging materials with no negative impact on human health, or the environment.
- Packages should be transport-proof (i.e not affected by transport)
- Packages should be attractive.

Criteria regarding identification card included:

- Information to be written in Arabic, or Arabic and English together.
- Name of variety to be well-marked.
- Name and address of packaging company should be stated clearly.
- Net weight of package should be included.
- Date of Production/ Expiry to be stated (month/year).
- Nutritional Value of package to be highlighted.
- Name of the country of origin must be mentioned.



مهرجان
Al Dhafra Festival
Madinat Zayed - Western Region



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PLANT-OFF TYPES IN TISSUE CULTURE- DERIVED DATE PALM (*Phoenix dactylifera L.*)

Abstract

Organogenesis and asexual somatic embryogenesis are the two techniques currently used in various laboratories in the world for in vitro mass-propagation of date palm (*Phoenix dactylifera L.*). To determine the efficient commercial use of these two techniques to avoid somaclonal variation, the true-to-typeness of tissue culture-derived plants is of a prime importance.

This present article provides information on the observed field performance of tissue culture-derived date palms. Identified

abnormalities and variations of these plants are presented and discussed. Special focus in this outline will be on the phenomenon of abnormal morphology and structure such as twisted inflorescences and broader leaves, excessive vegetative growth, leaf variegation, dwarfing, leaf whitening, bastard offshoots, delayed flowering time, pollination failure, abnormal fruiting, and the appearance of seedless fruits.

Appropriate techniques for verification of plant conformity are proposed along with a few recommendations on how to limit the appearance of such abnormalities.



Key words:

Date palm, *Phoenix dactylifera*, somaclonal variation, tissue culture, in vitro, true-to-typeness, off types.

I. Introduction

Palms are a much neglected plant group in terms of understanding their development and propagation potential. Furthermore, progress in the field of breeding, crop improvement, and expansion of commercial planting for palms has been restricted by the habit and long-lived nature of these monocotyledonous trees.

Seed propagation is by far the easiest and quickest method of date palm propagation. Date palm is a dioecious species and consequently half of the seed progeny are males and half are females, with no easy and reliable way of determining at an early stage the sex of the progeny, nor fruit or pollen quality prior to flowering. Attempts to detect the sex at early stage of several plant species were successful using molecular markers (Ainsworth et al., 1998; Ainsworth 2000). Furthermore, female plants originating from seedlings usually produce late maturing fruits of variable and generally inferior quality compared to established clonal trees. Seedlings also differ considerably with regard to production potential, fruit quality and harvesting time, making them very difficult to market as one harvest. The dioecious nature of date palm, and the lack of males as pollinators, means that seedlings from the same female trees show wide phenotypic variation. Selected varietal characters which were there may be lost in the progeny of sexual crosses. Taking the above into consideration, seed propagation, also called sexual propagation, is not a viable method of date palm propagation.

Offshoots develop from axillary buds on the trunk of the mother plant and consequently the fruit produced will be of the same quality as the mother tree. The life span of the date palm is divided into two distinct developmental phases: vegetative, in which buds forming in the leaf axils develop into offshoots; and generative, in which buds form inflorescences and offshoot production ceases. The time that the axillary bud of a leaf has differentiated into an offshoot until the time it grows outwards, can be up to three years (18 – 36 months), with another three



Figure 1a ▶ Abnormal morphology and structure of a two-years old date palm plant of the variety Medjool produced via somatic embryogenesis.

to four years before it reaches the desired size for its separation and planting (Hilgeman, 1954). An average of three or four offshoots are suitable for planting out in one year and these must still go into the nursery for 1 to 2 years before field planting (Nixon & Carpenter, 1978).

Offshoot propagation is true-to-type technique but is not commercially practical for the following reasons:

- Offshoot production is limited to a relatively short vegetative phase of about 10 to 15 years;
- Only a limited number of offshoots are produced during this short phase (20 to 30 offshoots, depending on the variety);
- Some varieties produce more than others (some do not produce offshoots at all);
- Planting survival rate is low;
- The use of offshoots will enhance the spread of date palm diseases and pests;
- Offshoot propagation is difficult, laborious, and therefore expensive.

As presented above, seed and offshoot propagation of date clones and cultivars are

impractical means for large scale multiplication. In contrast, the application of tissue culture to date palm, has many advantages and enables the following:

- Large-scale multiplication.
- Production of genetically uniform plants.
- Propagation of healthy selected female cultivars (disease and pest-free), or males having superior pollen with useful metaxenia characteristics.
- No seasonal effect because multiplication is under controlled conditions in the laboratory throughout the year.
- Easy and fast exchange of plant material between different regions of a country or between countries without any risk of the spread of diseases and pests.

Organogenesis and embryogenesis are the two major techniques currently used world-wide to mass-propagate date palm.

II. Date palm organogenesis and somatic embryogenesis

Date Palm organogenesis is based on the use of the naturally existing potential at the

meristematic areas (meristems, axillary buds and the base of young leaves) to produce meristematic buds when the nutrient media and the incubation conditions are suitable (Zaid and Arias, 1999). The advantage of the technique is that organogenesis avoids callus formation and does not use an often-excessive amount of an auxin-type growth regulator, such as 2,4-D.

In general the technique of organogenesis consists of four steps: i) initiation of meristematic buds, ii) multiplication, iii) elongation and iv) rooting (which includes a swelling step). The success of the overall technique depends strongly on the success of the initiation step.

Somatic (also called asexual) embryogenesis is based on the production and multiplication of callus as an initial step on an auxin-containing medium followed by the germination and elongation of somatic embryos on an auxin-free medium. Once callus is transferred onto an auxin-free medium (or to a very low auxin containing medium), a reorganization and formation of embryoids and embryos occur (Kohlenbach, 1978). The success of somatic embryogenesis has been shown to be mostly genotype-independent with a high rate of multiplication and a high survival rate upon transfer to soil.

One of the major weaknesses of mass propagation using plant tissue culture techniques is the appearance of undesired plant off-types caused by somaclonal variation. Plant somaclonal variants are clearly different from the mother plant. The production of genetically stable plants in plant tissue culture is, therefore, of prime importance determining the efficient use and



Figure 1c ▶ Excessive growth pattern of a Barhee date palm plant (source Ref. B14 – Block 2, Naute project, Namibia).



Figure 1b ▶ Seven-years old date palm plant of the variety Barhee derived from somatic embryogenesis showing morphological abnormality (source Ref. G12–Block 2, Naute project, Namibia).

success of the *in vitro* mass-propagation process. Understanding the nature of and mechanisms underlying somaclonal variation is consequently a vital prerequisite for developing new methods to control its occurrence.

More than 500 already published scientific articles have described the existence of genetic variability in plant tissue culture (Orton, 1983). The terminology used for plant off-types has been diverse. The name "Phenovariant" was the first given by Sibi (1971) and then Sibi (1989) proposed "Vitro Variants" and "Vitro Variations" as new general and practical terms for this type of variation. The term "Somaclonal Variation", which has been commonly used until now, was proposed by Larkin and Scowcroft (1982).

Somaclonal variation can be an epigenetic or genetic change, sometimes expressed as a new trait, resulting from *in vitro* culture of higher plants (Pierik, 1987; Zaid et al., 1999). Generally, variations in plant tissue be:

- Epigenetic variation, which is a variation of physiological processes (non-hereditary variation).
- Genetic variation affecting the plant genome (hereditary variation). A heritable change appearing in an individual plant can be the result of a change in the structure of a gene (gene mutation), changes in the structure of chromosomes (chromosome mutation), or in the number of chromosomes (genome mutation) (Zaid et al., 1999). The change of chromosomes number as a variation includes change of the ploidy level such as polyploidy with an even number of chromosomes (4n, 6n, 8n, 2xn) or of aneuploidy nature with an uneven number of chromosomes (3n, 5n, 7n, 2xn-1). Other variations can affect the chromosome structure including mitotic abnormalities, such as inversion, translocation, deletion, or duplication.

An easy differentiation between the two types of variation can be carried out by the study of offspring. In comparison to epigenetic variation, genetic variation follows the Mendelian segregation rule with a ratio of ¼ and ¼. Variation phenomenon have been already described in about 150 different plant species (Pierik, 1987) and for date palm Zaid and Arias (1999) and McCubbin et al. (2000) reviewed the causal factors of variation in plant tissue culture and summarized them as:

- Use of technique for plant mass propagation specifically applying plant callus production as an intermediate production step;
- Genetic instability of mother plant material including chimeras. For example, the date palm mother plant should have a proven production record and originate from a date palm orchard where appropriate technical practices have been applied;

Type and concentration of growth regulators, such as auxins and cytokinins, used in the tissue culture process;

- Type of explant used for propagation, because a possible ploidy gradient might exist from the apex down to the roots of a plant;
- Number of *in vitro* subcultures used for propagation including age of cultures. A prolonged culture on media containing



Figure 1d ▶ Abnormal large leaf size of a Barhee tree (right: abnormal Barhee, left: normal Barhee leaf).

growth regulators for example might disrupt the normal hormone metabolism of cultivated cells.

- Composition of the nutrient media used;
- Culture conditions applied such as culture on solid or liquid medium.

Regarding the true-to-typeness of organogenesis-derived plants, the question about the origin of meristematic buds is important. If buds are pre-existent then plants will be conform, but if they are neo-formed a probability exists for plant variation. For date palm, Aissam (1990) clearly showed using electron microscopy that pre-meristematic cells are comparable in structure to the meristematic ones by having the same unique cytoplasmic and cytologic organization. This might ensure that pre-meristematic cells maintain their genetical stability during the in vitro cells divisions.

However, the original explant, which is taken from the apical dome area, increases in size up to 50 fold during in vitro culture within a three months period. Drira (1985) outlined that such proliferation can easily be accompanied by plant variability and that bud initiation results from a direct neo-formation (Drira, 1988). But histological studies have shown that such bud initiation is not preceded by a callus phase. Despite avoiding a callus phase, genetic variation can, however, easily occur from an excessive use of growth

regulators by over-exploitation multiplying cultures to gain maximal shoot formation, applying a very low subculture frequency and from a sudden variation of incubation conditions (Bhojwani and Le Razdan, 1983).

Although genetic abnormalities, such as change of chromosome numbers, have been found using somatic embryogenesis, in oil palm the progeny obtained via somatic embryogenesis did not show any genetic abnormalities (D'Amato, 1978). Indeed, chromosome abnormalities were not observed while producing 13,000 oil palms from different clones and only on clone did show a variation about 1.8 percent (Corley et al., 1979). Callus derived from oil palm, which developed from meristematic cells, did not contain any polyploids and the system appeared to be self-regulating and preventing any genetic variation (Brackpool et al., 1986). In addition, these meristematic cells, which derived from callus, did not require any exogenous application of cytokinins known to favour genetic variation (Corley et al., 1981).

However, genetic variation obtained while using somatic embryogenesis was found for several plant species including palms (D'Amato, 1978). Zaid (1987) detected intraspecific variations for several Arecaceae species. Regenerated callus of oil palm (Pierik, 1987) and also date palm (Tisserat, 1988) have further shown morphogenic and genetic heterogeneity. Furthermore, three different types of oil palm abnormal developments have been observed, two of which concern the sex of flowers (Corley et al., 1986; McCubbin et al., 2000). Other important variations included for example the production of abnormal albino plants (Sharma et al., 1984).

Scientists, who are cautious about the application of the somatic embryogenesis technique, often express the two following concerns:

- The use of a callus phase: This passage is considered as a possible major source of variation, because the callus is a group of non-organized and non-differentiated cells in which cytological abnormalities are often observed.
- The use of 2,4-D for callus initiation: In monocotyledonous plants, such as palms, the obtention of callus requires a relatively high concentration of an auxin-type growth regulator like 2,4-D (2,4-Dichlorophenoxyacetic

acid), which is a herbicide used to control dicotyledonous plants and the compound is also mutagenic. 2,4-D is further a very potent compound with auxin activity and might cause, when inappropriately applied, undesirable features on cultured callus including loss of differentiation ability with prolonged subcultures, chromosomal aberrations, mutations and endo-reduplication resulting in polyploidy and possibly sister chromatid exchange (Loubster, 1980; Omar and Novak, 1990). Further, unlike various other plant growth regulators, 2,4-D is not broken down and is continuously recycled by the plant. It has also been found that the 2,4-D effect is cumulative and, since it remains in the tissues of the plants for long periods, the effect is long lasting (Loubster, 1980).

III. Assessment of date palm abnormalities

True-to-typeness of tissue culture-derived date palm plants is always a necessity. Consequently, any reports about plant abnormalities observed in tissue-culture-derived plants are a serious concern for both the tissue culture industry and the purchaser of such plants (Zaid and Arias, 1999; Al Wasel, 2000; McCubbin et al., 2000).

Appearance of abnormalities is seemingly not region-specific and concerns all date growing

Figure 2a ▶ Dwarf Barhee date tree in comparison to a normal grown Barhee tree.



areas, such as the Gulf region, Near and Middle East, and also the Southern African subcontinent, where abnormalities in certain varieties might severely affect date growers (with an exceptional case of 100,000 Barhee plants in the KSA).

Abnormalities so far found in tissue culture-derived date palms include changed morphology and structure, excessive vegetative growth, leaf variegation, dwarfism, a higher susceptibility to diseases, such as black scorch, leaf whitening, production of bastard offshoots, delayed flowering time, pollination failure and abnormal fruiting as well as abnormalities of minor importance, such as seedless fruits.

1. Date palm morphology and structure

Morphological abnormalities, which can be clearly detected at the hardening phase (nursery level) of date palm plants, are characterized by the following (Figure 1a):

- Absence of an onion (or pear)-like basis;
- Thin stem with leaves being juvenile and weak;
- Date palm phytohyalaxy not respected;
- Very low growth of the root system with no more than three to four thin roots per plant (about 2mm in diameter).

However, occurrence of abnormalities seemingly depends on plant producers and their respective production / selection processes. For example, abnormalities at a rate of up to 63% and 100% in two date palm nurseries containing 2000 and 1000 hardened *in vitro* plants of the variety Medjool were observed. In contrast, a new orchard in Namibia contained only 5% of Medjool plants with abnormal characteristics. Unfortunately, if these abnormalities are not detected and the plant is planted it will produce a specimen with low or no commercial value being greatly different to the original date palm tree (Figure 1b).

2. Excessive vegetative growth

Another abnormality frequently appears in date growing areas is an excessive vegetative growth of plants represented by broader leaves, compact growth and different spine structure of the plant (Figures 1c and 1d). Zaid and Arias (1999) found out of 2000 Barhee palms surveyed, which



Figure 2b ▶ Dwarf Oum Dahn date tree showing also a variegation abnormality.

derived from asexual somatic embryogenesis, only two plants that showed this abnormal vegetative growth (a ratio of

0.1%). In contrast, McCubbin et al. (2000) found a much higher ratio of 1.4% in a survey carried out in South Africa on the Medjool variety. Medjool plants with broader leaves and a different spine structure were found scattered in a South African date palm orchard in which Medjool plants have been planted from three separate tissue culture laboratories using somatic embryogenesis as a technique to mass-propagate date palm.

3. Leaf variegation

Variegation as an off-type is common among tissue culture-derived plants and can, for example, also be found with plant species such as banana (Robinson, 1996). Variegation might depend on factors such as virus / microbial contamination, *in vitro* media nutrient deficiency or genetic variation (McCubbin et al., 2000). A ratio of 0.005% of date palms that showed variegation of leaves in the greenhouse (5 plants among 100,000) was reported by McCubbin et al. (2000). Leaves had a creamy coloured stripe running parallel to the leaf margin, which should not be confused with the general yellowing of leaves caused by iron deficiencies. The abnormality occurred on all leaves but in different forms of stripes with some wider than others. Although the plants were seemingly healthy and green,

these plants did not grow at the same rate as normal plants.

4. Dwarfism

The dwarfing phenomenon in tissue culture-derived plants is defined as a severe restriction in growth. Dwarf date palm plants are less than one meter in height after four to five years in the field in comparison to a normal date plant of the same age with an average of 3m in height (Figure 2a). Dwarf plant might be detected at the nursery level and already removed before planting. However, most of dwarf date palm trees are only detected during the first to the second year after field planting when stem elongation occurs (Figure 2b). The old leaves (the ones on the outside) are sometimes normal and dwarfism starts affecting the younger leaves (Figure 2c), but sometimes the opposite occurs and dwarfing only affects the outer (older) leaves (Figure 2d). Dwarfism affects the leaf length (up to 2/3 shorter than a normal leaf) and also the leaflets, which are severely reduced in size (Figure 2f). This reduction in size of the leaf structure and canopy affects leaf function resulting in a low photosynthesis and consequently in a greatly reduced growth. Dwarfism also severely weakens the date palm plants and negatively affects offshoot production. While the root system appeared normal (Figure 2g), the authors personally never observed a dwarf tree reaching a fruit production stage.

Dwarfing percentage might vary from 0 to 30% depending on the variety (Al Wasel, 2000). Both dwarfing and weak growth has been mainly observed with *in vitro* derived plants of the date palm varieties Sukkari, Khlass and also Barhee. For example, Sukkari plants produced



Figure 2c ▶ Dwarfing effect on a four-year-old Barhee plant derived from somatic embryogenesis.



Figure 2d ▶ Dwarfing effect on a four-years old Barhee plant derived from somatic embryogenesis.

via somatic embryogenesis by two commercial tissue culture laboratories did show a 15% dwarfing phenomenon (Dr. Shabana, personal communication). In contrast, the varieties Khlass and Barhee are less affected and 20 out of 5000 plants were detected in a survey as dwarf plants. In addition, dwarfing also affects Ajoua (Al Wasel, 2000), Sultana and Nabt Saif (Abo El Nil, personal communication).

In a recent further survey conducted by Zaid and Al Kaabi (2001), date palm varieties, such as Sukkari, Barhee, Sultana and Oum Dahn, showed abnormal dwarfing with Sukkari as the most sensitive date variety. In one orchard, 20 dwarf trees were among 50 Sukkari plants (40%); while at another orchard 15 plants out of 42 were affected by dwarfism (35%). Plants of the variety Barhee and Sultana were less affected and only 17 out of 300 Barhee plants showed dwarfism in one survey (5.6%) and only 2 out of 200 Sultana plants showed dwarfism (1%). Dwarfing is an abnormality with a very high rate in Sukkari but low in Khlass, Nabt Saif and Sultana, which has also been found by Dr. Abo El Nil (personal communication).

While the cause(s) of the dwarfing phenomenon is (are) not known yet, it is of an extreme importance to differentiate dwarfism symptoms from the symptoms of the black scorch disease (Figure 3). Black scorch, also called Medjnoon or Fool's disease is caused by the pathogen *Ceratocystis paradoxa* (Hohn), which is the

perfect form of *Thielaviopsis paradoxa*. According to Djerbi (1983), black scorch has been observed on 17 date varieties. Thoury, Hayani, Amhat, Saïdy and Halawy varieties are highly susceptible. Medjool and Barhee varieties are also susceptible to the disease (Zaid, personal observation).

When a dwarf tree of Oum Dahn variety was taken out from the ground and dissected, its root system as well as the meristematic area were found normal and no pathological symptoms were found (Zaid and Al Kaabi, 2001). It is therefore important to differentiate between dwarfing abnormality and black scorch symptoms. An immediate proof of such differences is that dwarf plants will not recover after planting into the soil and remain dwarfed even after 3 consecutive years of chemical treatment while black scorch affected date trees can recover from the disease after a repeated chemical treatment. Tissue culture-derived date palm plants seemingly are more susceptible to this disease than offshoots and immediately after the attack the meristem of tissue culture-derived plants appears to be blocked / restricted (Figure 3).

Besides being more sensitive to the black scorch disease, tissue culture-derived date plants are also very sensitive to the diplodia disease (*Diplodia phoenicum*). The main symptom of this disease is the yellowish-brown streaks, which extend along the leaf base (Zaid and Al Kaabi, 2001). Diplodia is further severe with plants still carrying offshoots.

This causes a higher humidity and enhances diplodia attack. Clearing all offshoots is therefore a vital demand. Some physiological disorders that are characteristic for tissue-cultured date palm plants are also comparable with symptoms of biotic and abiotic stresses (Amira et al., 2000). Furthermore, diseases such as mildew and gray mold have been identified under the new cultivation conditions, such as drip, bubbler, micro-sprinkler irrigations, and under certain environmental conditions (Elad, 1999).

relative

5. Leaf whitening

Al Wasel (2000) reported the whitening of leaves of certain varieties, such as Khlass and Ajoua. Recently, Zaid (personal observation) also observed similar symptoms on the date palm varieties Sultana, Barhee, and Nabt Saif (Figure 5a). Whitening of leaves can be explained by a partial or total loss of chlorophyll in the affected leaves. Usually, there are 2 to 4 white leaves per affected tree. However, this abnormality is rather rare in an orchard and therefore of no great economical significance. Normally, the affected tree grows out of this problem and recovers producing normal new leaves. This abnormality should not be confused with a typical fertilization injury, where fertilization itself is not the cause but rather how close to the stipe the fertilizer is applied. If this damage is severe, it could cause the death of the young date palm.

6. Bastard offshoots

It is well known that tissue culture-derived date palm plants have a better growth habit and produce uniform date orchards (Al Wasel, 2000). They also produce much more primary and secondary offshoots. However, this fast growing habit and the abundance of offshoot production are accompanied by the appearance of abnormal offshoot / inflorescence specimens. Deformed growth of date palm vegetative buds and their conversion to floral buds (Figure 4) are also commonly known as twisted inflorescences.



Figure 2f ▶ Dwarfing effect on young fronds of a one-year old somatic embryogenesis- derived Medjool plant.

Carrying out a literature search, Zaid and Arias (1999) found that this bastard condition can be caused by an infestation with the date palm bud mite (*Makiella phoenicis* K) or be due to a reduction in growth caused by an inequilibrium of endogenous growth regulators accumulated during *in vitro* propagation. A better knowledge is needed of the cytokinin and auxin levels within the plant and at what level plant growth regulators are needed to induce a response required for *in vitro* propagation (McCubbin et al., 2000).

7. Delayed flowering time

Although tissue culture plants are known for their faster growth compared to offshoots, there is an increasing concern about a possible delay in their first fruit production. In one instance, in an orchard of 10 hectares of Barhee date palm trees (about 2420 plants) derived from somatic embryogenesis it took more than 7 years for trees to reach the floral stage. Planted in August 1991, these Barhee trees did show the first inflorescences in June 1998 and only 50% of the tree produced their first fruits in February 1999. However, it can not be excluded that the observed delayed flowering timewhen compared to the flowering time of offshoots has been caused by the prolific vegetative growth

Figure 2g ▶ Uprooted dwarfism in a three-year old Sukkari plant with an abundant root system.



as a result of juvenile vigour in tissue culture-derived plants. But high fertilization inputs can also disturb the balance required between vegetative and reproductive phases.

8. Pollination failure and abnormal fruiting

Pollination failure and a very low fruit set have been mainly observed with plants of the variety Barhee. Djerbi (2000) and also McCubbin et al. (2000) reported lack of pollination as the major abnormality in somatic embryogenesis-derived Barhee plants. This failure has been found in several Barhee date palm orchards around the world including Namibia, South Africa, Kingdom of Saudi Arabia, and the United Arab Emirates.

According to Djerbi (2000), pollination failure has been observed mainly in the Kingdom of Saudi Arabia in the Al-Zifri, Al-Qassim and Toubcar areas with plants of the variety Barhee and to a lesser extent with plants of the varieties Khlass and Deglet Nour. Pollination failure was found with more than 100 000 date palm trees planted in early and in the middle of 1990s. All pollinated bunches showed 80 to 100% of parthenocarpic fruits and sometimes the development of more than 3 carpels. This problem increased considerably in intensity on imported trees in 1994–1995 when all date palm trees showed abnormal fruiting. It has been reported that all these plants have been propagated by the technique of somatic embryogenesis (Djerbi, 2000). Similar results with plants of the variety Barhee produced via somatic embryogenesis were reported by McCubbin et al. (2000) after carrying out a survey on field performance of plants in the Southern African subcontinent (Namibia, RSA and Zimbabwe). A similar result was also found for plants of the variety Hayani (Dr. Shabana, personal communication).

So far, there is, however, no scientific evidence that pollination failure is based on any changes in the DNA composition or has derived from lack of an optimal pollination procedure. Therefore, possible explanations should always consider that:

- Pollination problems occurred mainly with plants of the variety Barhee;
- Pollination problems occurred during the first two to three productive years of the Barhee plantation and this phenomenon decreased



Figure 3 ▶ Black scorch disease on a four-year old Medjool plant.

annually;

- Pollination methods applied for Barhee did not differ from the ones used for other date palm varieties within the same plantation, which were indeed successfully pollinated;
- Abiotic stresses, such as drought, chilling and lack of sufficient microelement application including copper, zinc and boron, have not been studied so far as possible contributing factors on Barhee pistil development and fruit set;
- Tissue culture-derived date palms might require heavier pollination than offshoots.

9. Seedless fruits

McCubbin et al (2000) found in their survey on field performance a single "seedless-fruit" date palm among 1,000 Medjool date palms. In general, a "seedless-fruit" date variety is currently not available. This plant was further different in appearance from all other Medjool date palm trees and produced seedless dates that were small in size but with a very sweet taste. This tree went through an identical pollination and cultural practices as all other trees of the orchard.

IV. Techniques for verification of plant conformity



Figure 4 ▶ Bastard offshoot on a somatic embryogenesis-derived Barhee plant.

The assessment of genetic stability of in vitro-derived clones is essential for rapid micropropagation of true-to-type date palm clones, for in vitro germplasm conservation, biotechnological improvements of plants and for commercial planting of high quality date palm material.

In a commercial laboratory where thousands of plantlets are generated from a single explant, genetic stability is therefore critical. Unfortunately, should an off-type plant be produced with modified fruiting characteristics, such plant will only be detected four to five years after purchase of the plant from the laboratory whereby the plant has subsequently incurred substantial development costs for the farmer.

Commercial laboratories always try to ensure the true-to-typeness of produced date plant material. For that, various techniques have been applied to certify the conformity of plants. This includes histocytological examination, isoenzyme analysis and also recently DNA finger printing techniques such as RFLP (restriction fragment length polymorphism), RAPD (random amplified polymorphic DNA), microsatellites, RDA (representational difference analysis), and microchip technologies. However, since these molecular techniques are still in the development stage for date palm, morphological field verification is currently the only reliable way to confirm if date palms derived from a tissue culture process are identical to the mother plant.

1. Morphological identification

Identification by morphological markers

represents the easiest and least complex technique (Kunert et al., 2003). Especially small tissue culture companies rely on this technique as the only quality assurance procedure, because of its simplicity and avoidance of the establishment of an expensive analytical laboratory setup. In morphological identification, an experienced examiner identifies plant varieties, often subjectively, predominantly in the nursery via description and visual monitoring of easily detectable plant characteristics, such as form and structure. Unfortunately, these characteristics may vary widely with the environment and the growth stage of the plant. Some characteristics, however, which change through somaclonal variation, are obvious once plants are established in the nursery. This includes a significantly changed plant structure of leaf discoloration and deformation.

Overall, morphological characterization, although economically attractive, has severe limitations for date palm especially when either for correct cultivar identification or the detection of underperforming date palm off-types at the immature or juvenile stage is screened for.

2. Histocytological examination

Cytological studies of palm cell cultures are few, and even these are briefly reported (McCubbin et al., 2000). It would seem useful, particularly in view of the commercial potential of the date palm, to build up an understanding of their chromosomal cytology in relation to such factors as clonal origin, growth rates, capacity for differentiation and media components (Paranjothy, 1982).

Caryotypic variation, such as aneuploidy, as well as ploidy changes have been detected by chromosome counting at the root tips of regenerated plants. Cytological studies conducted on vitro plants of oil palm produced via somatic embryogenesis, confirmed that these plants had identical chromosome numbers ($2n = 32$) when compared to the mother plant and no genetic mutation was found (Lorley et al., 1976; Loiret, 1981).

Tissue culture-derived date palm plants obtained from inflorescence cultures were found to be morphologically identical to plants produced via organogenesis and chromosome counting

showed that these plants were strictly diploid (Loutfi, 1989). Since floral tissues involved in gamete production are controlled by processes controlling DNA duplication, plants derived from these tissues are very likely regarded as true-to-type. Mitotic analysis of male and female date palms showed identical chromosome numbers for both ($2n = 36$) (Selbi, 1988) and embryos were always diploid (Jones et al., 1982). Offsprings are possibly true-to-type, when chromosomes are counted at the level of the second date palm generation to confirm true-to-typeness.

3. Iso-enzyme analysis

Iso-enzyme analysis is based on the comparison of gene products (enzymes) and not on the comparison of genes themselves. The difficulty to successfully repeat an iso-enzyme analysis by electrophoresis mostly on polyacrylamid gels is the constant detection of several iso-enzyme forms, which might greatly vary due to environmental conditions to which plants have been exposed.

The first iso-enzyme study on date palm somatic embryogenesis-derived plants was conducted by Tisserat (1981) where no variation of iso-enzyme pattern was found. Several enzymes have been studied by Baaziz (1991) where also no variation in iso-enzyme pattern was detected between organogenesis-derived date palms of the varieties Bousthami Noire, Tademant and Bou Fegouss. Only plants of the variety Jihel had intra-clonal variation of between 10 and 30% (Baaziz, 1991). Iso-enzyme analysis has been further used by Abed Al-Jusim et al. (1988) to study conformity of the date palm varieties Zahidi, Khasawi, Barhee, Kahdraoui and Hilali

Figure 5a ▶ Abnormal white leaves on a three-years old Barhee plant.



and also by Jabouri (1980) for the varieties Zahidi, Khastawi, Braim and Barhee.

Eventhough, isozyme analysis has demonstrated potential in date palm cultivar identification and analysis of laboratory or nursery-derived plants, such as a protein marker technique lacks a direct assessment of any genomic variation at the DNA level, and as such is not highly adequate to detect off-types based on genome changes (Kunert et al., 2003).

4. Potential of molecular markers

DNA analysis using the RADP technique has been carried with date palm to distinguish between varieties and to seek conformity of plants (Saker and Moursy, 1998; Letouze et al., 1998). Polymorphism was found and grouping associations among different date palm varieties was achieved with 43 date palm varieties grown in Morocco (Hassan et al., 1998). However, since the RADP technology covers only an extremely small portion of the genome and might be further based on a single nucleotide change, it is difficult to verify whether any mutative variation is ultimately applicable for detection of true-to-type plants with this technique.

Boojj et al. (1993) found no variation at the sugar and the amino acids levels between offshoots when compared to organogenesis-derived date palms of five different varieties (Medjool, Thoory, Deglet Nour, Zahidi and Bousham). In contrast, they found a degree of variation among somatic embryogenesis derived date palm plants, most prominently with Deglet Nour.

5. Field verification

Since biochemical, enzymatic or DNA-based techniques currently serve only as a supportive measure, field verification is, in the opinion of many, currently the only reliable and established technique to confirm if tissue-culture-derived date palms are true-to-type and identical to the mother plant. Verification should be done by monitoring tissue culture-derived date palms until fruiting and directly compare their vegetative and floral characteristics with the mother palm.

V. Conclusions and recommendations

Currently observed abnormalities should

not prevent the use of in vitro techniques to mass propagate date plants, because in vitro propagation has clear benefits and date growers should be aware of the current risks of a still modern technology.

Production of true-to-type plants should be ensured in the future by commercial companies. Methods used in the tissue culture laboratory should be assessed and type of variants determined using traditional and modern detection techniques to verify true-to-type and to limit plant variation, which can easily result in massive financial losses for farmers and embarrassment for commercial laboratories. Furthermore, genetic and environmental factors causing the appearance of abnormalities should be clearly identified and investigated in research projects.

The date palm variety Barhee is more susceptible to pollination failure and abnormal fruiting when compared to the varieties Medjool, Khlass and Deglet Nour. The variety Sukkari is more susceptible to dwarfing when compared to the varieties Khlass, Barhee, Sultana, Nabt Saif and Oum Dahn. The frequency of abnormalities is generally, with the exception of the Barhee pollination failure, about or below 5% and is in the range that the date growers would accept.

Since somatic embryo-derived plants have been produced and extensively evaluated for many years, all reported / published abnormalities are so far found in this type of plants. Twelve years ago, and in order to minimize the variator's risk, Zaid (1991) did propose the following recommendations:

- Preferential use of an organized explant for in vitro culture initiation;
- Possible avoidance of the use of 2,4-D for callus induction;
- Shortening of callus phase;
- Decrease of number and of concentration of used growth regulators;
- Frequent subculturing;
- Annual renewal of explants;
- Avoidance of sudden variations of incubation conditions, such as temperature and light;
- Avoidance of the use of liquid cultures.

Most of the currently available finger printing screen a small portion of the genome, and might not verify whether the variation is a result of a genetic mutation. Although, the use of several techniques to verify the conformity of tissue culture derived-date plants (i.e: histology, iso-enzyme, fingerprinting,...) might be of advantage coupled with a close field follow up. However, such a procedure might be extremely costly and will increase dramatically the cost of a date palm.

Since date palm is not among the crops with a high scientific input by developed countries, collaboration among developing / date growing countries should be encouraged to investigate causes of and limit abnormalities in date palm, which should include both existing commercial companies and academic institutions.



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Eng. MANAL FADHIL
Technical Manager

Al-Ain Date Factory

Initiating the Mechanization of the Date Industry in the United Arab Emirates

The palm tree has a special place for the people of the Arabian Peninsula and Mesopotamia. Archaeological excavations are a great indication of how far in time this region has grown palm trees. In modern times, the instructions of His Highness Sheikh Zayed Bin Sultan Al Nahyan, the founder of the UAE, on the necessity of taking care of this tree, which he called the "tree of life", had a great impact on the development of this agricultural sector in such a way as to be able to compete with the most advanced date-producing countries through introducing the latest technology in the field of date production.

His Highness Sheikh Khalifa Bin Zayed Al Nahyan, the head of the state, has followed in the footsteps of his father in the care he has bestowed on the agricultural sector generally and on the palm sector in particular. Due to the increase in date production, it was necessary to introduce a date factory using the most advanced mechanical and hygienic methods applied in the countries



most advanced in this field.

Al-Ain is regarded as one of the biggest palm tree oases in the world. For this reason, it was chosen to be the site of the first modern date factory in the country, under the supervision of the agricultural consultant to his Highness, the head of the state, Mr Zuhair Abu Al-Adeeb, in 1986.

The first step in the process of any food industry is the provision high quality raw material. The consultant, therefore, supervised the process of providing the best conditions for obtaining high quality products, starting with the processes of irrigation, fertilization, and pest elimination, ending with implantation through the use of the most potent pollination seed. This was done through utilizing the results of the latest experiments for the production of some of the rare species, as happened in the species (Fahl



Al-Ain), which was obtained lately through the tissue agricultural technology and with great success.

The factory currently receive more than 150 types annually, most of them in such a quantity and of such a quality as to make them fit for industrial production. This has encouraged the Emirati farmer to make use of these results, which have been exhibited internationally, in order to concentrate on the more promising types and substituting them for the lower types. Research is continuing for improving existing types and introducing new ones, such as the (Nadera) the seedless type. The products of the Al-Ain Date Factory have been used as basis for scientific research conducted by specialists in the United Arab Emirates University and in the Ministry of Waters and Environment.

Several distinguished new types of dates have been introduced such as Majhool, Saq'y, Sultana, Umm Al-Dihn, Ajwa, Khiyara, 'Hillawi, D'qla Noor, Dkheny, Umm Kubbar, Nadra, 'Anbara, and others.

All the stages of the agricultural process of growing dates have to be carefully supervised and monitored. In order to avoid problems on the way, applying the industrial drying operations developed by us, which accompany the stage of fruit development, is one of the most important steps followed, which have contributed to a great extent towards obtaining high quality dates of those types that would adapt with difficulty to the environment and climate of the UAE.

The quantity of dates received annually increased inevitably due to these developments and to the addition of new units of refrigerated storage rooms to keep all received dates throughout the year and under ideal conditions of temperature



and humidity.

As for the main industrial units, these include units for the packaging of dates in various types, boxes, and weights, a unit for the production of date juice, using the latest technology, and another for the production of date paste, in addition to one for the treatment of date seeds, which are considered to be one of the most natural and utilizable animal fodder due to their high nutritional value.

The Stages of Preparing and Packaging Dates

One of the features that distinguish the technologies applied in Al-Ain Date Factory is the completion of the processes of division and gradation before and after the process of washing, which is difficult to do in most commercial factories as it needs skilled labor and time. This is a feature, however, which helps to upgrade the quality of dates to a very high level, as well providing the final product with a strong aesthetic appeal.

Washing and Drying

During the process of washing and drying clean water that is treated with special filters to remove undesirable odors is used. Excess water that remains attached to the dates is removed through drying in a special tunnel (an air-conditioned room) especially built for this purpose. So that when the stage of packaging begins, the various packages used depend on the principle of air evacuation for most of the products. The factory has various boxes that weigh from 100 grams

to 3 kilograms all of which are manufactured by heat sealing and air evacuation machines. In addition to these lines there are packages of varying sizes as containers for individual dates, some of the most common types of which include: Barhy, Bu'Man, Jabry, Khalas, Sukry, Sultana, Razeed, Sheeshy, Shbeebiy, Fardh, Saq'ay, Majhool, Maktoumy, Nabta Saif, Umm Al Dihn, Dkheny, Safry, Sheikhha Khalas, Anbara, and others. In addition, certain types of dates are packaged for special uses, as in the sweets and nut-filled or chocolate-covered dates, and in high quality packages.



Date Juice (Dibs)

Large quantities of date juice (Dibs) are manufactured annually using the most advanced mechanical techniques that are known internationally. Dibs, which is concentrated date juice, is one of the oldest and most important sugar products that enter into many dietary



prescriptions due to its high nutritional value and its high and easily absorbable sugar content in addition to basic mineral elements needed by the body.

The process of manufacturing Dibs goes through several stages beginning with the necessary cooking stage, done for a sufficient period of time and under controlled temperatures and prescribed amounts of water, in order to extract the sugar located in the date fibers and to destruct the Pectin element of the date , so that the final product comes out pure and clear. This is followed by the filtration process that removes the celluloid fibers remaining in the juice, where the latest and most efficient technologies of centrifuge are used in order to bring the juice up to the highest levels of purity. Finally, the process of concentration begins, to lift the percentage of the solid material dissolved in the juice from

14% to 76% through the use of pressure and high temperature, whereupon it is packaged in packages of various sizes and weights.

Date Paste

Date paste is used in a variety of nutritional prescriptions as it is used very widely in sweets and chocolate. The dates are prepared through the process of washing, dampening, and drying, and the choice of an ideal humidity, as these are factors that have a direct effect on the quality of the product, all of which are followed by the manufacturing steps of removing the seeds, cutting, classifying, and finally packaging the



product in its final form.

Date Seeds

Date seeds take up about 13% of its weight, as they weigh from a half to four grams. As a by-product, date seeds can be exploited in a variety of industries, especially as they contain some basic minerals like potassium, phosphate, iron and zinc, in addition to their high content of oil

and other elements. From classical times, the ancient Egyptians used date seeds for a variety of purposes, just as the Bedouins used them in some food recipes. Their use as a substitute for coffee has been demonstrated in a number of scientific research papers, just as they have a number of medical uses. Date seeds are also considered a good source for the production of the important element, Formaldehyde. The most widespread use of date seeds, however, is as animal fodder, as they contain important mineral elements and a high percentage of fiber. Accordingly, in the factory we perform the washing, the drying, and finally the grinding of these seeds, in order to determine the degree of the softness of the final product on the basis of the animals that consume them, before their packaging in sacks especially prepared for this purpose.



PRODUCING 150,000 DATE PALM TREES ANNUALLY USING TISSUE CULTURE TECHNIQUES

**UAE University Date Palm Development Research Unit
A landmark on the Road to Progress and Prosperity**

The Date Palm Development Research Unit, an affiliate of the United Arab Emirates University (UAEU), was established in 1993 to develop and expand the Plant tissue Culture Laboratory, already in existence since February 1989.

As of 2000, the unit has witnessed marked developments covering facilities, equipment and functions, and also production which reached 150,000 nursery trees per year, thanks to the limitless support rendered by HH Sheikh Nahayan Mubarak Al-Nahayan, Minister of Higher Education and Scientific Research, Chancellor of the UAEU

In 2000, a 4-year program was initiated by the UAEU and the United Nations Development Program (UNDP) for the development of date palm research and studies. The UNDP delegated a prominent expert to supervise the implementation of the project.

In view of the remarkable success achieved by the Unit, it was decided to extend the project to another 4-year term ending in June 2012, so that the development of the vital palm date sector may continue, especially as it represents heritage, economic and social values for the UAE and the region at large, and also in view of the prestigious international status gained by the





Unit which has now become one of the largest laboratory for the commercial propagation of date palms in the world.

In view of the accomplishments realized by the Unit, it was necessary to establish a marketing department to undertake the marketing of the Unit's various products of quality date palm nursery plants such as Sukkari, Sultana, Barhi, Khalas, and Nabtet Seif, at various stages of growth as per buyer's request.

Meanwhile, the remarkable success achieved by the Unit was well-received in scientific and academic circles interested in palm and dates. The Unit was eventually selected as the HQ of the Global Date Palm Network, and also of the Arab Center for Genetic Engineering and Biotechnologies, and the Date Palm Friends Society of the UAE.

At the academic level, the Unit launched the International Date Palm Conference series, of which three chapters were so far held (2000, 2003, 2006) with hundreds of scientists and others interested in the date palm industry attending. Moreover, proceedings of the three conferences have been published and disseminated.

In conjunction with the Date Palm Friends Society, the Unit has also launched the series of Date Palm Exhibition of which two exhibitions were so far held, the first in the city of Al-Ain and the second in the capital, Abu Dhabi. Participating in both exhibitions were major local, regional and international organizations and companies concerned with the various aspects of date palm



cultivation and industry.

Likewise, the Unit hosts several seminars and workshops to debate the most up-to-date developments in the field of palm and dates.

In recognition of the excellent endeavors exerted by the Unit, it was awarded the world quality award ISO 9001:2000. The Unit is the only

institution of its type to earn that prestigious global recognition.

Benefits of date palm propagation through tissue culture technologies include the mass production of nursery plants true to the variety required in a very short time. The plantlets produced are free from diseases and pests, and have the ability to tolerate unfavorable environmental conditions. The tissue culture techniques, moreover, all the production of plantlets around the year as it is undertaken under controlled conditions within the laboratory. Additionally, tissue-culture derived plant materials can be easily and safely exchanged within the state and between states.

A recent outstanding accomplishment of the Unit is the propagation through tissue culture of a rare male inflorescence which came to be known as 'Al-Ain City Male' as the experiments in this connection were conducted within the Al-Ain orchard of the palace of HH the President, Sheikh Khalifa Bin Zayed Al-Nahayan.

For more information, please access the following websites:

<http://datepalm.uaeu.ac.ae>
<http://dpgn.uaeu.ac.ae>
<http://dfta.uaeu.ac.ae>
<http://citrix.uaeu.ac.ae/dates3>

You may also contact the unit at:
 Tel: 03/7832334 - Fax: 03/7832472
 E-mail: zaid@uaeu.ac.ae



Objectives of the Network

General Objectives

- ▶ To increase technical co-operation among all (new and traditional) date producing countries in the relative aspects to the development and improvement of the date palm industry as well as to mobilize the collection efforts of the date producing countries towards achieving self-sufficiency in food, enhancement of the quality of life of their people, conservation of the eco-system and natural resources and development of the date palm agro-industry.
- ▶ As a general outcome, the DPGN will contribute to achieve the following development objectives: Food security strengthening environmental protection and supplementary income generation in arid and semi-arid areas of the date growing countries.

Specific objectives

- ▶ Collection and dissemination of information on production and planting, marketing, research, post-harvest and processing technologies of dates and date palm by-products and residues.
- ▶ Promote collaboration in the collection, conservation, evaluation, propagation and utilization of date palm germplasm.
- ▶ Create awareness at various policy making and technical levels within member countries on the importance of the development of the date palm through an integrated approach.
- ▶ Promote of the ecological and social benefits of the Date Palm as well as undertaking promotional activities to promote the



nutritional, social and ecological benefits of date palm.

- ▶ Encourage joint programs to be developed for the exchange of experiences, expertise, and information as well as organize training courses, workshops and meetings of experts for the effective use and sharing of transferable technical information and skills.
- ▶ Contribute to the formation of national networks in each country to increase collaboration among national institutions as well as the NGOs and private sectors, and particularly propitiating increased communication between institution and growers.
- ▶ Promote the analysis of common problems, their study and search of solutions, particularly through the elaboration of joint research/development project
- ▶ Develop common technical standards and specifications, as part of an overall quality system for the marketing of date fruits and date products, in local and international markets.

Technical working groups

Specific tasks were identified to be addressed by the DPGN forming the technical working group for each working group, specialized institutions in different countries were identified to participate. Participation in the working groups is open to any interested scientists, organizations and associations as well as to the private sectors.

The profile and arrangements for the 4 working groups were established as follows

Germplasm/Propagation

- ▶ Promotion of collection, characterization, conservation (in situ and ex situ) exchange and utilization of the genetically variability in different geographical regions, and preparing germplasm catalogues.
- ▶ Encourage genetic materials exchange among participating countries to the DPGN and promote the establishment of tissue culture units in different countries and develop the technology for the molecular identification of date palm varieties.

Production

- ▶ Promotion of research concerning all technological objects to the cultivation and production.

- ▶ Definition of breeding strategies for date palm using both classical methods and biotechnology tools, oriented to overcome limitations for adaptation (e.g. drought, salinity), productivity (e.g. insect pests and diseases) and fruit quality.
- ▶ The reinforcement of basic physiological studies in order to support the work of agronomists and horticulturists, in aspects related to orchard management, fruit quality and post harvest.

Pests and diseases management

- ▶ Collection and exchange of technical information and experience of current pests and diseases. Which limits yields and quality of fruit. The relevant aspects include biology, incidence, and severity of damage and current methods of control
- ▶ Promotion of researched on integrated Pests management (IPM) and develop models to be used by date growing countries.
- ▶ Publication of a specialized date palm poster or manual for the practical identification in the field of the major pests and diseases in Addition to publication of news letters.

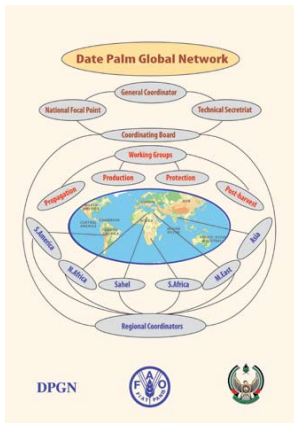
Post harvest technologies and marketing

- ▶ Study post-harvest quality of fruits in relation to varieties, stages of maturity at harvest and storage conditions.
- ▶ Develop useful techniques to control post-harvest decay on fruits.
- ▶ To improve the collection and dissemination of economic information retarding international trade and future development, current plantings, expected supply, internal demand and world demand.

- ▶ Conduct marketing surveys to assess market needs and supply to study marketing problems and explore potential for future demands expansion.
- ▶ Adoption and/or development of standards and specifications for date products that are compatible with that of the WTO and other international organization and economic blocs.

Immediate Activities

- ▶ An important task for each of the focal points should be to diffuse in his/her country the benefits and importance of date palm and motivate where applicable, concerned government officials of the value of this crop.
- ▶ Organize meetings of the technical working groups to propose a work plan and initiate activities.
- ▶ Promote inter-country agreements and the establishment of joint projects between countries and regions that share common



problems related to date palm.

- ▶ Established close relations and agreements with FAO technical co-operation networks, national and international institutions that carry out activities in arid zones.
- ▶ Publication of a periodical newsletter with information provided by members of the DPGN.
- ▶ Explore potential national and international donors.
- ▶ Preparation of a directory of date palm research and development work currently being carried out, including list of researchers and kind of available facilities, in the individual institutions.
- ▶ Creation of a diffusion system oriented to increase the consumption of dates giving information of their importance as a source of carbohydrates and vitamins. This efforts must involved leaders in commercial areas of the food industry.
- ▶ Develop a website for the DPGN. Duplication of the site in French, Spanish and other languages would further facilities communication.
- ▶ Create an electronic discussion list.

Network Coordination Strategy

- ▶ Four technical working groups were defined to undertake the scientific and technical work of the DPGN. A coordinator will lead each working group, while the General Coordination will provide the overall co-ordination of the DPGN.
- ▶ The DPGN will be guided by a Coordination Board which will be chaired by the Coordinator General of the Network and will include the coordinators of the technical working groups, regional coordinators and representatives of the different regional and inter-regional date palm networks. Interested countries/leading institutions that are not involved in regional or inter-regional networks are encouraged to attend and participate in Cordoning Board meetings.
- ▶ The general meetings of the networks will be convened every 4 years, preferable in coincidence to international events (congress, symposia, etc) related to date palm.
- ▶ Working groups will be encouraged to

organized meetings on specific technical topics. Associating these meetings with other national and international workshops symposia or conference will be pursued as a means of facilitating participation

- ▶ The designation of coordination responsibilities will be subject to periodic review at each meeting of the coordination board and revision whenever necessary with the view to ensuring that the DPGN and its working groups continue to receive all the support and leadership required. In this regard questions related to the functioning of the network will be referred to the coordinating board; which will take interim measures as necessary to ensure efficient operations.
- ▶ The DPGN will operate with the support of three regional coordinators: South Africa, Middle

East/Asia South America. Additional regional coordination may be created as countries join the network i.e. Sahel and North America.

Terms of reference for each level of coordination together with the role of the country focal points are in Annex I

The structure of the DPGN is expressed thought a diagram (Annex II)

The names of the proposed institutes for the Coordinating Board and working group coordination are given in Annex 111)

National Focal Points
Coordination General Technical Secretariat

Coordinating Board
Technical Working group coordination





IRAQI DATE PALM STILL GOING STRONG ON THE INTERNET

<http://www.iraqi-datepalms.net>

The palm tree is tantamount to the identity of Iraq and a symbol of this country's ancient civilization and present steadfastness. It is reported that the date palm had originated in Iraq millennia BC. It is mentioned in Sumerian, Babylonian and Assyrian records, as well as in Holy Codes and biographies. In the Holy Quran, it is mentioned 21 times while in the Hadith (the Prophet Mohamed's Tradition) it is frequently referred to. The Prophet himself urged Muslims to look after the palm tree because it is a lifeline providing not only food but also medicine, clothing, shelter and building materials.

In view of such advantages, and because of the lack of documented literature regarding the Iraqi palm tree (in spite of its richness), Dr. Ibrahim Gadou' Al-Jabbouri, Director of the Iraqi Date Palm Network, has established a distinguished and comprehensive web site dedicated for it. The site includes articles and information related to the history of the date palm industry in Iraq, including pioneer palm tree enthusiasts such as the late Abdul Jabbar Bakr, and Dr. Ali Abdulhussein.

Jabbouri has indeed delved deep in books, archives and electronic sites for material connected with the Iraqi date palm, and set forth the material he managed to collect on the site: <http://www.iraqi-datepalms.net>

Included in the site are biographies of scientists and researchers who have contributed to the historical growth and development of the Iraqi date palm industry so that the younger generations may follow their example as Iraq strives to restore its old status as a major date producing and exporting country.

The site is particularly intended for date palm growers and researchers to help revive interest in the blessed tree that has seriously suffered from the scar of war and hard times.

On December 1, 2008, the Iraqi Date Palm Network marked its first anniversary. It is credited for having brought together scientists and researchers, growers and processors as well as lovers of the tree that has been honored by God Almighty in his Holy Quran.



KHALIFA INTERNATIONAL DATE PALM AWARD

The Award was established under the patronage of His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of UAE (God Protect Him) with a presidential decree, Number 15/2007, dated on 20 March 2007 and on the Presidential Decision Number 02/2007 dated 07 July 2007, which defined the members of the Award's Board of Trustees. His Highness Sheikh Nahayan Mubarak Al Nahayan, Minister of Higher Education and Scientific Research, President of Board of Trustees, has attended the Launching Ceremony of the "Khalifa International Date Palm Award" which was held on April 7, 2008 at Emirates Palace Hotel in Abu Dhabi. The launching ceremony of the award has attracted regional and international attention toward dates palms tree and the strategic future of dates as a balanced food product, and considers it as

an essential part of the sustainable development operation that His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of UAE (God Protect Him) leads.

The Message

Khalifa International Date palm Award has been created as an appreciation from His Highness Sheikh Khalifa Bin Zayed Al Nahyan, President of UAE (God Protect Him) to the blessed tree and to the people who works in the field of date palm, either in United Arab Emirates or any other country around the world, in order to recognise the outstanding efforts made to develop the field of date palm for sustainable development of us and the coming generations.

Mission

To encourage people involved in the cultivation



of date palm: researchers, growers, exporters, whether individuals or institutions.

To honour figures engaged in the date palm industry at the local, regional, and international levels.

Vision

To enhance the prestige of the UAE in the field of date palm research by virtue of its pioneering role in this field.

To support research related to the development of the various aspects of the date palm industry.

To establish and maintain national, regional and international cooperation between the various bodies involved in the date palm industry, particularly in the spheres of production, processing, and marketing, as well as products in which dates constitute a principal ingredient.

To disseminate a date palm culture at local, regional and international levels.

Objectives of the Award

Encourage people involved in the cultivation of date palm: researchers, growers, exporters, whether individuals or agencies.

Support research related to the development of the various aspects of the date palm industry.

Honor figures engaged in the date palm industry at the local, regional, and international levels.

Establish and maintain cooperation between the various bodies involved in the date palm industry, particularly in the spheres of production, processing, and marketing, as well as products in which dates constitute a principal ingredient.

Disseminate a date palm culture at local, regional and international levels.

Nomination categories of the Award

The award has been organized to be held regularly on a yearly base, and the value of the award consists of: appreciation certificate, trophy and financial reward of 2,100,000 (two millions and two hundreds thousand dirham), divided on the Award three categories, beside to the other expenses and services related to the Award. The Award has been divided into three categories:

- First Category: Distinguished Research / Studies

- AED 200,000 for the First Winner.
- AED 150,000 for the Second Winner.

- Second Category: Distinguished Producers

- AED 200,000 for the First Winner.
- AED 150,000 for the Second Winner.

- Third Category: Distinguished Figure

- AED 200,000 for the Winner.

The winners' selection

The selection of the winners' categories of the Award (individuals or institutions or companies or authorities and cooperatives...) should be conducted through international judgement Jury that consist of experts and specialized scientists in dates palms around the world. The judgement committee should take unanimity decisions, and in case they didn't agree unanimity dedicate any



of the candidates, they can take their decision based on attendees members majority of votes.

The Award will be granted to

The award is open for individuals or groups of individuals or institutions or companies or cooperatives or civil organizations of the society and governmental and private authorities, which does distinguishing works with effective and direct results in the field of date palm. It is allowed for any organization to nominate itself

without any recommendation from any other organization or individual. The award can be granted to any (individual, company, authority) only once for same category.

The award valid duration (The award characteristics)

The winner should be granted an appreciation certificate, trophy and financial reward in a luxuriance ceremony held in Abu Dhabi, it is allowed for winners of Khalifa International date palm award to use the logo of the award on their advertisement and marketing materials for maximum 3 years starting from the winning date, it is also authorized for the owners for one of the award's category to nominate themselves for the next cycle, but for different category, meanwhile they can apply for same category after the pass of 3 cycles counted from the winning date. The winners from different categories of Khalifa International date palm Award will be appreciated, and will be introduced positively through different local and international media channels, as long as the award magazine and website.

General conditions

Applications are accepted from all around the world; application can be uploaded through the award website and should be filled in Arabic or English, enclosed with curriculum vitae of the candidate, a photocopy of a valid passport and 3 photographs.

Submit three copies of the original work or the nominated research (one original, one copy and the third electronic soft copy (CD)).

Works submitted for the Award shall not be returned to the applicants, they are to be kept in the head office of the Award at Al Ain city.

It is in the right of supervised attendees to dismiss the Award if the works do not meet the conditions.

Application period from 01 June till 30 September, 2008. The applicants will be informed that their applications has been received and forwarded to the judgment committee. Applications that meet the requirements will be asserted from 01 till 31 October 2008, meanwhile the judgment committee will start to study and select the applications from 01 November till 31 December, 2008. Evaluation of the selection results will start

on 01 till 31 January, 2008. The winners names will be announced on the first week of February, 2009 and the honouring ceremony will be held on the third/fourth week of February, 2008.

Conditions

First category (research/study/techniques):

Creative contribution (research/study/techniques) must have not been published yet in any referred or non-referred journal, or any electronic form anywhere in the world.

Contributions (research/study/techniques) previously awarded any Arab or foreign prize are not eligible.

Works submitted for the award (research/study/techniques) should be new, distinguished with direct and effective results in the date palm cultivation field.

The implementation of the submitted works (research/study/techniques) should be possible within the environment situations of United Arab Emirates and serve the development of the date palm field.

Works submitted for the awards (research/study/techniques) should be authentic, creative and expanding the knowledge in the date palm cultivation field.

The (research/study/techniques) should be cleared in how possible the project can be implemented and transferred to other sectors through reflecting the market needs and how easy can be used.

The effect of the submitted works (research/



study/techniques) should create awareness among society and expand the knowledge in the date palm field.

The second category (Distinguished producers)

Judgement committee should take the productions quantity, distinguishes and uniqueness into consideration.

The third category (Distinguished Figure)

The board committee members should announce the candidates names and the nominated institutions, then select the best. The award can not be rewarded to any person, authority, companies, twice consecutively.

The Scientific Committee

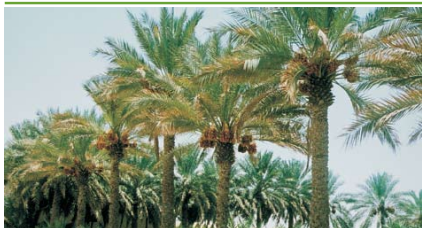
The Scientific Committee consists of eminent scientists and experts in the respective fields of date palm cultivation, who will collectively

decide the recipients in each category of the Award.

Each application will be submitted to the corresponding team of assessors. The Khalifa International Date Palm Award assessors will review each submission, individually and collectively. This will be accomplished according to the Award pre-established selection criteria.

Confidentiality

All information and materials associated with an application for the Khalifa International Date Palm Award will be handled in strict confidence and will not be viewed by any individual or entity not directly involved in the Award's process. Furthermore, all jury members and personnel associated with the Award attribution process will sign a non-disclosure agreement ensuring their confidential treatment of all information and all materials involved.



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In an interview with Lover of the date palm tree H.E. Gumaa Al – Majed.

The late Zayed was the first to serve the date palm tree in UAE



Juma Al Majid Biography:

He was born in Al Shandagah, Dubai, in 1359H. -1930 A.D., in his youth, he accompanied his father on diving cruises that used to take place during summer. These trips have taught him patience and endurance.

He learned reading and writing, in addition to the Holy Quran and Arabic Language, in local schools at that time, (known as Ktateeb) ran by local teachers (known as Mutawa). Since those times he has realized the value and the importance of the book, when books were hardly obtained

during that time.

Juma Al Majid started his professional life with his uncle in trade, afterwards he became a trader.

At the beginning of the fifties, he participated with his colleagues : Mr. Humaid Al Tayer, Abdullah Al Ghurair, Nasir Rashed Loutah, and with consent of Sheikh Rashed Bin Saeed Al Maktoum in the establishment of the first charitable society to help the needy of Dubai, so they established two secondary schools, one for boys in Bar Dubai, called Jamal Abdul Nasser Secondary School, the second for girls in Deira,

Outstanding Zayed achievements: Establishment of the Tissue Culture Lab. in the UAE University.

called Amina Secondary Schools. In 1983, and due to economic and social circumstances, it was difficult for expatriate students to be admitted to the public schools, Mr. Al Majid established the "National Charity Schools" to help the needy expatriate students obtaining free education. The number of students attending classes now exceeds 9000 students, poor students continue enjoying free education, while others are requested to pay cost only.

Deeply understanding the women's need for knowledge and the difficulties they faced in reaching Al Ain University or traveling abroad, Mr. Al Majid established the "Islamic and Arabic Studies College" in 1987 in Dubai. This college which accepts students from The GCC states, is accredited by Al - Azhar University, Dar Al Uloom College and the UAE Ministry of Higher Education. About 3700 students, 2500 females, and 1200 males are now attending the college, till now 4119 students, 3302 females, and 817 males have graduated from the college. There is also post-graduate department for Islamic science and Arabic language, The graduates granted M.A and Ph. D degrees in jurisprudence and Arabic language, the registered students reached 132 females, 23 of them got master degree.

In 1990, Mr. Al Majid, along with other local philanthropists, established "Beit Al Khair Society" a charitable organization aims to aid the poor citizens, needy students, as well as offering cash or commodities to the victims of disasters, moreover, Mr. Al Majid has helped to establish many schools in Arab and Islamic countries, and funded education especially for Palestinians, hence, he gave them priority even in his trade, to enable them providing money for their families.

In 1991, Mr. Al Majid realized the needs of scholars and researchers, especially t

those who are unable to obtain the necessary books, references and manuscripts, so he established a public library, afterwards it was

developed to become a cultural organization ,known as, Juma Al Majid Center for Culture and Heritage.

Mr. Juma Al Majid, accompanied by specialists from the center has visited many countries to collect Arab and Islamic manuscripts (originals and copies), and he found that it was very necessary to develop a restoration machine, known as " Al Majid Restoration Machine" to restore da maged original manuscripts and protect them from corrosion. The machines have been distributed as a gift to more than 14 countries.

After this comes the biography in full but without mentioning names, without titles, such is Gumaa Al Majed, a well-known name in the process of development, a pioneer of national and charity action, a fell of the Zayed and Rasheed generation, a man who has held several key positions and responsibilities, and winner of the highest awards and decorations at local, Arab

and World levels -too numerous to be counted.

However, a particular aspect of this outstanding personality is not known, or little known to the public - his love of the date palm tree. The sheer mention of the tree makes him jubilant and excited. And why not? Was it not mentioned in more than one location in the Holy Quran?

The Blessed Tree in its No.(1) issue hold the honor and pleasure of interviewing H.E. Gumaa Al Majed as a guest of honor for the Khalifa International Date Palm Award.

Here is the text of the interview:

Q: When did your love relationship with the blessed date palm tree start?

A: I remember that as early as my childhood years we had three palm tree farms in Dubai. I used to haunt them in the hot season to carry dates home on horseback. At that time Dubai inhabitants knew nothing about date processing; therefore they used to sell their date crops.

Thanks to encouragement by H.H. Sheikh Nahayan, the UAE is a leading country in Date Palm Propagation and improvement.



Launching an international date palm award testifies to interest by H.H., the President, Sheikh Khalifa in the blessed tree- a source of Pride for the UAE.

Q: What did that tree mean to you in the past, and now?

A: The man who actually served the blessed tree in the UAE was the late Sheikh Zayed Bin Sultan Al Nahyan. He had a tremendous interest in date palm propagation and development. He encouraged citizens to properly nurture their date palm trees. The current status of the entire date palm industry owes much to Him. One of His most outstanding achievements in this sphere is the establishment with the UAE University of a Plant Tissue Culture Lab. He brought in the best varieties so that they may be propagated by the said lab. His successor, HH, The President, Sheikh Khalifa Bin Zayed Al Nahyan, is pursuing the same policy, rendering all care to the blessed tree.

Q: How do you see the UAE position in the date palm production at regional and world levels?

A: With the extensive propagation of the date palm, the UAE has become a leading producing and exporting country. The credit goes to the late Sheikh Zayed Bin Sultan Al-Nahyan, and H.H. The President Sheikh Khalifa, as well as to Rulers of the Emirates. For instance, the late Sheikh Rashid

Bin Said Al-Maktoum established date palm farm in Kharran, Ras Al Khaimah, where potable water is abundant. Having examined the Barhee variety, he ordered specialist to go to Iraq to fetch it, and it was soon propagated in the UAE. With adequate water resources in their respective Emirates, the other Rulers planted date palm trees along the canals (Aflaj).

Q: How do you see the standard of services offered to the date palm cultivation by the agencies concerned at the state level?

A: Thanks to the Tissue Culture Lab, and support by Sheikh Nahyan, thereto, the UAE has become a leading country in date palm propagation and development.

Q: What- in your opinion is required at government, societies and citizens level to further developed the date palm industry quantitatively and qualitatively?

A: All in the UAE love the date palm tree. They exchange date, produce or purchase the best varieties. The best evidence is the periodic date exhibition organized by UAE University which affords valuable opportunities for all to get acquainted with the latest developments in the date palm industry as a whole and to see and taste the best dates from all over the world.

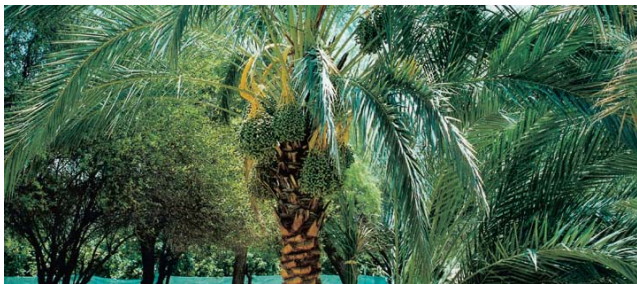
Q: How do you view the Khalifa International Date Palm Award?

A: As I have asserted earlier, the late Sheikh Zayed Bin Sultan Al -Nahyan, and HH The President- Sheikh Khalifa Bin Zayed, are champions of Date Palm Cultivation and Propagation. The Award is but recognition of Sheikh Khalifa's interest in the blessed tree. India for example, has sought assistance from the UAE University in developing date palm cultivation and propagation.

Q: What advice would render to the present and future generations with regard to the blessed tree?

A: Future generations- men and women- must learn all about the blessed tree, and maintain old-time traditions relating to it as one symbol of their homeland.

Future generations must maintain interest in the date palm industry and constant development thereof – a symbol of the homeland.



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DATE PALMS AND BIOSALINE AGRICULTURE IN THE UNITED ARAB EMIRATES

The date palm, *Phoenix dactylifera* L., has been called the 'Tree of Life'. Few plant species have played such a major role in the well being of people living in hot, dry environments. Were it not for the date palm, human habitation would not have extended as far as it has into the hot and barren desert regions of the globe.

Date palms prosper where many other fruit trees could not exist or, if they could survive in such conditions, where they would produce few fruits. Together with camels, date palm have been one of the most sustainable agricultural systems in harsh desert environments.

Date palms have flourished in Arabia and the Middle East for over 7,000 years. Highly valued

for their resilience to harsh desert climates, like the camel, they make very productive use of desert resources and can produce between 100 and 200 kilograms of fruit per tree per year. Dates are a very nutritional food and the palms are long-lived, surviving for up to 100 years. Not only do the palms provide food. Virtually every part of the palm is used by desert dwellers for example, for shelter, fuel, and fibre.

The date palm in the United Arab Emirates and the GCC

The Arabian Peninsula is both a center of origin and a center of diversity of the date palm. Of over 1,500 known date palm varieties, there are nearly 250 varieties in the Gulf Cooperation Council countries and 120 varieties in the



Emirates. One hundred of these varieties have been collected at Al Hammanieh Research Station of the Ministry of Environment and Water and around 120 at the UAE University Farm.

Countries of the Gulf Cooperation Council produce and consume nearly half the world production of dates. More than 50 million of the 105 million productive date palms worldwide grow in the Arabian Peninsula. In the United Arab Emirates in particular, date palm cultivation has expanded dramatically in the last few decades. In the 1970s there were around 1.5 million palms in the Emirates but recent estimates put the current number of palms at over 40 million, covering an area of over 185,000 hectares.

Environmental constraints on date palm cultivation in the UAE

Keen government support and improved cultural and production techniques led to rapid expansion in date cultivation over the last 30 years. As production soared, producers came up against pests and diseases (such as the Red Palm weevil), environmental constraints (such as heat, drought and salinity), and production constraints (irrigation, fertilization, pre- and post-harvest management).

Salinity

Although date palms are amongst the most salt-tolerant fruit-bearing plants, rising salinity levels are seriously affecting date production in the region. Most date cultivation relies on fossil groundwater which is not only being rapidly depleted but is also becoming more saline.

In 2001, ICBA, the Ministry of Environment and Water (MOEW) and Abu Dhabi Municipality (ADM) reviewed salinity problems in date palm production and set up a series of projects on key issues.



Water resources and use in agricultural production in the UAE

Fossil groundwater resources are the main source of water for irrigation in the UAE. But the fossil groundwater scenario is alarming.

In some areas groundwater has been pumped to such an extent that less is available and what is available is much more saline. Farmers used to rely on many inland aquifers for freshwater for irrigation. But over the last three decades, the water table in these aquifers has dropped by 20 to 30 meters and salinity has risen to 3,000 to 5,000 ppm, or even 8,000 ppm in depressions and sub-coastal areas.

In other coastal and sub-coastal areas, and in areas with very high water tables, groundwater can still be pumped in fairly large quantities. But the groundwater is highly or even extremely saline because drawing water from the aquifers by pumping has allowed seawater to infiltrate. To make the problem worse, highly saline water from deeper strata rises to mix with shallower less saline water, again sending salinity levels up.

A survey by ICBA showed the wide extent of the

problem. In more than 50 farms in Abu Dhabi and the Northern Emirates, groundwater salinity was 25 dS m^{-1} , or half as saline as seawater. The survey concluded that, in general, salinity is high in date farms more than 15 years old and that supplies of groundwater of less than 3 dS m^{-1} are very limited. And the situation is getting worse. Where water is relatively more abundant, then salinity is also higher.

When farmers must make do with highly saline water they tend to compensate by over-irrigating the date palms. This causes salts to accumulate in the upper layers of the soil and has a negative effect on the trees. The effects of salt accumulation are further aggravated by poor soil structure, poor drainage, and high evaporation. Planting forage crops as an under-crop and distributing irrigation water in open channels are also common practices which heighten the negative effects of salt accumulation. In some cases the problems become so acute that farms are abandoned.

Strategic research

What can be done to prevent deterioration of date production as groundwater becomes more



saline? To combat the problem of rising salt levels in irrigation water, salt-tolerant date varieties and, equally important, good management practices using salty water need to be developed.

Fortunately, the Arabian Peninsula is home to vast date palm genetic resources and many of these are adapted to local environmental conditions, salinity, extreme heat and drought. This indigenous genebank may hold the key to developing more salt-tolerant date varieties. At the same time, methods need to be developed which will allow farmers to cultivate date palms profitably with the only water available to them, increasingly salty groundwater.

Current projects

Long-term screening for salt-tolerance

Over the last few years, ICBA and MOEW have established a long-term field project at ICBA headquarters to test the salt-tolerance of 10 of the most popular varieties of date in the UAE: Fardh, Lulu, Jabri, Naghal, Khesab, Barhi, Khalas, Khinnazi, Shahla, and Bu Mann. Five replications of each variety are tested at three salinity levels: 5, 10 and 15 dS m⁻¹.

Moreover, ICBA received eight Saudi Arabian varieties of date palm which included in the trials. As time goes on it is hoped that this trial can be expanded to embrace other important date palm genetic material from the region.

Screening of tissue culture varieties

The UAE University Date Palm Tissue Culture Laboratory (DPTCL) is a leader in producing date palms by tissue culture. Palms mass-produced by tissue culture are ideal subjects for salinity screening trials because they can be produced in large numbers and are identical in age, size and stage of development. Screening under

a range of conditions can be done rapidly and gives reliable results. Now that this mass-produced tissue culture material is available, the whole process of finding promising salt-tolerant material has become much quicker. Once the most promising varieties have been quickly identified by screening, then they can move to the next stage which is further testing in experimental plots.

Farm salinity survey

Although salinity is widespread in the UAE, there is little concrete data on the impact of salinity and farm practices on the different varieties of dates. To fill this gap, ICBA, the Ministry of Environment and Water, municipalities and other agricultural agencies in the UAE will make a detailed survey of 50-100 farms. It is a huge task but the survey will provide crucial data for deciding the most important areas for research.

Field genebank

Genebanks do not need to be 'dry academic repositories' but can be living entities for generating and sharing information and

knowledge among the many different groups who have an interest in genetic diversity. Traditional genebanks conserve seeds of crop plants for future research and crop improvement. But there are opportunities to go far beyond traditional agro-biodiversity genebanks to build an invaluable resource for the Arab world. ICBA plans to build a living genebank of date palms as a resource for developing salt-tolerant date palms for the region in the future.

As well as these few projects aimed at managing the problems of increasingly saline irrigation water on date palms, other projects are being discussed which will make a difference to date production in the region. One example is a project to identify salt-tolerant genes and transfer them to commercial varieties of dates. Another is a project to use tissue culture techniques to mass-produce propagules from individual date palms which have naturally adapted to a saline environment. These propagules can be used to study how these individual plants have adapted and become exceptionally salt-tolerant.



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Effect of Different Organic Fertilizer Types on Yield of Organic Dates Fruits and Its Quality



Introduction :

There is no doubt regarding the importance of date tree . It plays a key role in the Arabic nations and enough to gain special attention from governments and scientists.

The date palm tree tolerates relatively harsh climatic and soil conditions under which no other crop may give reasonable returns. In fact, date palm which is an irreplaceable tree in irrigable desert lands, provides protection to under crops from heat, wind, and cold weather, and plays a big role to stop desertification and to give life to desert areas, (FAO, 2002) .

Although economically important, palms are a much neglected plant group in terms of understanding developments and propagation potential thereof .

Fertilization requirements :

Date palm has similar fertilization program at and after transplanting, is to provide in the nutrient needs. In general, farmers don't realize the importance of following a date palm fertilization program. Farmers tend to assure that date palms don't require any nutrients, because of the general view that date palms can survive the toughest conditions .

Table (1) Chemical properties of fertilizers used in the experiment.

Fertilizer type	EC Mmhos/cm	PH	% Humidity	NaCl	N	P2O5 (S)	K2O (S)	C/N	Organic matter
Stable	12.13	6.41	5.2	2.34	1.16	--	1.58	26.96	53.79
Nawaya	10.0	7.2	25.0	0.80	2.70	2.77	3.85	11.00	55.00

The amount of nutrients lost through fruits and pruned leaves as well as the world – wide application of fertilizers were considered as a basis for the calculation of the amount of fertilizers required, by an adult date palm .

El- Nawaya fertilizer which is invented at EBFF as a sole source of nutrients for date palm tree to furnish all required nutrients for the tree, was examined and registered by the ministry of Environment & water .

Our study was based on related literature, experiments and findings in various countries . Date palm tree has a great economic value in the dry areas and desert land , and it has its importance in these areas because it resists the drought and salinity. Date palm tree also, has a high efficiency for the uptake of nutrients under sever soil properties .

Date palm trees play a role in food security of the U.A.E and other Gulf countries during the last

centuries before oil exploitation. Also, date palm trees have environmental roles and this can't be replaced by other trees, it can be used as green belt and wind breaker, you can find date trees in street and gardens for decoration, landscaping and environmental reasons. Also, date fruits have a high economic role because, it is produced mainly in our region and marketed in all over the world .

Recently, the market for organic products has been increased in the last years and is considered for 23 billions US Dollars. Also, organic fruits and vegetables market has been increased by 20% , and the selling value of these organic products have a premium selling price of almost double of the traditional products, therefore we are giving great attention to production of organic dates .

United Arab Emirates started a huge program for organic food and interested in producing organic date fruits as principal program .

Fertilizers have important role in increasing plant



growth and production , but the excess use of chemical fertilizers leads to environmental pollution and soil contamination which is reflected negatively on human health, and increasing the production cost .

Several studies showed that organic fertilization has several positive effects e.g. increment of production and improvement of product quality (Shahein et al., 2003, Patidar and mali, 2002, Ghalleb and Salem, 2001)

This study has been conducted to evaluate the effect of fertilization on production of organic date fruits.

Materials & Methods :

This study was conducted on year 2006, at Al – Dhaid Research Station , Ministry of Environment & Water. a group of identical trees at 10 years old each was selected. All agricultural practices were performed e.g. weeding and regular irrigation .

In this experiment we used three different types of organic fertilizers e.g. Stable manure, which is produced traditionally in the farm. El – Nawaya Organic fertilizer produced at EBFF from natural organic materials and composted for 90 days and subjected to heat treatment, and control treatment (Zero fertilizer) .

This study aimed to evaluate the effect of organic fertilizer on production of organic date fruits of three different cultivars, e.g. khalas , Barhy and

Table (2) Effect of fertilization on product components.

Treatment	No. Rutabe / bunch	No. Bisr / bunch	Total in bunch	% Rutabe / total
1 - Khalas (zero fert.)	577	83	640	87.3
2 - Khalas (stable fert)	568	73	641	88.6
3 - Khalas (Nawaya fert.)	757	51	807	93.8
Average	627	69	696	89.8
1 - Barhy (zero fert.)	910	310	1220	74.6
2 - Barhy (stable fert)	670	544	1214	55.2
3 - Barhy (Nawaya fert.)	793	902	1695	46.8
Average	791	585	13670	58.9
1 - Nabtat Saif (zero fert.)	208	78	286	72.7
2 - Nabtat Saif (stable fert)	134	38	272	86.0
3 - Nabtat Saif t (Nawaya fert.)	255	77	332	76.8
Average	232	64	297	78.5
Average (zero fert)	565	157	722	78.3
Average (stable fert)	457.3	218.3	775.6	59.0
Average (Nawaya fert)	601.7	343.3	945.0	63.7

Fig.1 effect of fertilization on the no. of fruit for Rutab, Bisr, total no. of fruits in the bunch

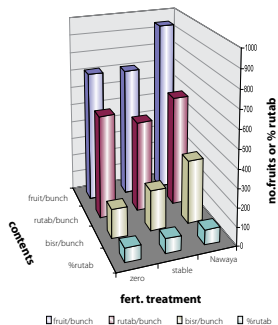


Table (3) Effect of organic fertilization on yield of organic daes.

Treatment	No. bunch /tree	Rutab weight kg/ bunch	Bisr weight kg/ bunch	T. fruits weight kg/ bunch	T. fruits weight kg/ tree
4 - Khalas (zero fert.)	7.0	4.581	0.911	5.492	26.346
5 - Khalas (stable fert)	8.0	4.450	0.795	5.245	36.900
6 - Khalas (Nawaya fert.)	8.8	6.640	0.597	7.237	52.491
Average	7.7	5.220	0.765	5.991	38.579
4 - Barhy (zero fert.)	10.0	6.870	3.350	11.951	86.040
5 - Barhy (stable fert)	9.8	6.911	7.200	14.110	113.678
6 - Barhy (Nawaya fert.)	9.4	6.651	9.720	16.373	138.490
Average	9.7	6.814	6.760	14.14	112.860
4 - Nabtat Saif (zero fert.)	8.1	2.551	1.510	3.060	22.369
5 - Nabtat Saif (stable fert)	7.4	2.770	0.840	3.610	24.070
6 - Nabtat Saif (Nawaya fert.)	7.4	3.080	2.830	5.840	38.908
Average	7.4	2.783	1.393	4.170	28.449
Average / zero fert	8.4	4.750	1.92	6.434	44.918
Average (stable fert)	8.4	4.71	2.95	7.655	58.216
Average (Nawaya fert)	8.5	5.46	4.38	9.840	76.630

Nabtat Saif .

Table (1) shows some physical and chemical properties of fertilizers used in this experiment . Fertilizers were added at 50 kg / tree one time at the month of November 2006 , fertilizers were mixed thoroughly in the 30 cm layer around the tree trunk and covered with a small layer of soil (Neem guard) was applied three times as Bio-insecticide at 20 days intervals starting from first week of May, 2007 .

Fruit yield was evaluated and the following measurements were done :

- Number of bunches / tree
- Fruit weight* yield* / tree
- Flesh and seed weight / tree
- Yield, Bisr, Rutab for bunch & tree

• Yield, Bisr and Rutab / tree

At end of season soil samples were taken at 50 – 60 cm depth and 75 cm around the tree trunk to evaluate the effect of fertilizers on some soil physical and chemical properties .

All analysis were performed at the central laboratory of MOEW.

Results & Discussions :

Table (1) presents the physical and chemical analysis of fertilizer used in this experiment El – Nawaya fertilizer showed better analysis and higher content of its NPK, trace elements and organic matter while, Stable manure showed less moisture (dry) which lead to nutrient losses and less microbial activity also, Stable manure contained high NaCl and C/N ratio which means less quality comparing to heat treated El – Nawaya fertilizer of high quality .

Product specifications:

Table (2) presents the effect of organic fertilizers on the components of three date fruits types under two different organic fertilizers. From the data presented it is clear that treatment received El- Nawaya fertilizer gave higher amount of Rutab and Bisr and Total yield was higher than traditional treatment (stable manure, But Rutab was higher. From this result it is approved and confirmed that fertilization of date palm trees increased the yield but ripening was delayed, while stable manure gave higher Bisr and less Rutab compared to control treatment.

Also, from the results, we can confirm that Barhy has more bunches than other types while in Khalas and Nabtat Saif it was equal number per tree. Also, number of fruits were higher in Barhy for every bunch and reached 2 times of Khalas and 4.5 times for Nabtat Saif , percentage of Rutab in Khalas was higher than Nabtat Saif while the Barhy came afterward .

Comparing the effect of different organic fertilizers on yield quantity and quality we found that El – Nawaya fertilizer gave higher yield of Rutab and Bisr per bunch. While decreased the percentage of Rutab, (fig.1). From this figure we can infer that high quality fertilizers increase chances of fertility and increase fruits and decrease the damaged fruits, which contribute to yield improvement .

Table (3) presents the effect of different organic fertilizers on the components of yield of three

Fig.2 effect of fertilization on the no. of fruit for Rutab, Bisr, total no. of fruits in the bunch

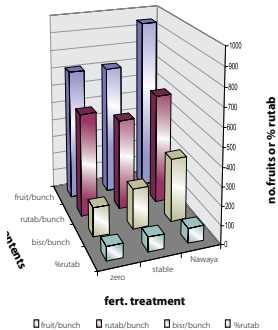


Table (4) Effect of organic fertilizer sources on quality of date fruits.

Treatment	One Rutab weight/gm	One Bisr weight/gm	Rurab Flesh weight/gm	Bisr Flesh weight/gm	Rurab seed weight/gm	Bisr seed weight/gm	% Rurab Flesh / seed	% Bisr Flesh / seed
Khalas (zero fert.)	8.20	10.85	7.24	10.08	772	942	88.93	92.90
Khalas(stable fert)	7.83	10.87	7.60	10.14	730	950	99.62	93.28
Khalas (Nawaya fert.)	8.76	11.41	7.71	10.60	780	970	88.01	92.90
Average	8.26	10.38	7.58	10.27	797	954	91.18	93.03
Barhy (zero fert.)	7.54	10.80	6.70	9.83	800	980	88.86	91.01
Barhy (stable fert)	10.30	13.22	9.37	12.20	870	1001	90.97	92.28
Barhy (Nawaya fert.)	8.39	10.77	7.73	9.70	722	970	92.13	90.06
Average	8.74	11.60	7.93	10.58	797	984	90.65	91.12
Nabtat Saif (zero fert.)	12.23	15.75	12.05	15.32	780	633	98.53	97.27
Nabtat Saif (stable fert)	11.80	16.79	10.98	15.93	788	837	93.05	94.88
Nabtat Saif (Nawaya fert.)	13.65	17.51	12.18	14.49	782	823	89.23	83.75
Average	12.56	14.98	11.74	11.89	783	764	91.60	91.97
Average (zero fert)	9.32	12.47	8.66	11.74	784	852	92.95	94.15
Average (stable fert)	9.97	13.63	9.38	12.76	796	925	94.11	93.62
Average (Nawaya fert)	10.26	13.23	9.22	11.60	761	921	89.87	87.68

date cultivars Barhy , khalas and Nabtat Saif . There was no big difference in numbers of bunches with different fertilizers, but in every cultivar number of bunches were different, and Barhy gave the highest number of bunches, Rutab and Bisr in every bunch . Also, total yield of Barhy gave highest value (138.49 kg / tree).

El – Nawaya fertilizer gave the highest yield over other treatments, for Rutab, Bisr and total yield .

(Fig. 2) showed that it is clear that Rutab yield in traditional manure was less than El – Nawaya manure for Rutab yield, and this is due to delay of ripening in the date fruits .

Fruit specifications:

Treatment received El – Nawaya fertilizer gave higher rate of the weight of Rutab and Bisr compared with traditional and

control. While traditional treatment gave higher flesh of the date fruit, this result are in agreement with the data reported by Shahein et al., 2003.

Nabtat Saif gave higher Rutab and Bisr followed by Khalas and Barhy while the fruit seed was higher in the other cultivars . Also, seeds were higher in Bisr than Rutab in all treatment and cultivars , due to its high content of water. The rate between flesh of Rutab and Bisr to the weight of fruit was variables, while khalas treated with traditional fertilizer gave higher value than the treatment of El – Nawaya .

Soil analysis :

At the end of experiment soil samples were taken to study the changes of the nutrient content. table(5) presents the content of some nutrients and showed that soil fertility and its content improved when treated by

El – Nawaya fertilizer > traditional fertilizers > control , specially for Zn, P, Mg, B and organic matter .

Conclusion :

The results obtained in this experiment to evaluate the effect of different organic fertilization

Table (5) Chemical properties of soil samples after harvest (ppm).

Treatment	Zn	S	P	Na	Mo	Mn	Mg	K	Fe	Cu	B
Zero fertilizer	28	2040	140	2940	0.8	228	5960	3120	5360	18	1480
Stable fertilizer	40	7004	264	11200	0.4	326	14000	4780	6480	16	6980
El-Nawaya fertilizer	116	9890	465	12500	1.2	340	13100	4640	7020	27	9010

on quantity and quality of date fruits of different cultivars showed that, generally, addition of organic fertilizers improved the soil content of plant nutrients and in the same time improved all properties which positively improved the date fruit production yield. The yield of fruits has increased in number of fruits for every bunch, this is mainly due to the improvement of pollination and fertilization and less numbers of bad fruits which was reflected positively on the yield.

This was clear for the treatment of El - Nawaya which gave highest number and weight of fruits in all cultivars. Also, adding El - Nawaya fertilizer increased the weight of each fruit, and the fruit set also increased. El - Nawaya fertilizer increased the weight of Rutab, And Bisir by 0.94 and 0.76 gm respectively.

As a conclusion, we can confirm the importance of fertilizing the date palm trees by adding specific fertilizer, El - Nawaya fertilizer which increased the yield and improved the quality of date fruits.

It seems that there is much room to increase yield and improve fruit quality via fertilization programs. The obtained results enable to provide certain recommendations that benefit date palm growers.

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الشروط العامة

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