



II. ABSTRACTS OF POSTER PRESENTATIONS

Sifth International Date Palm Conference
Abu Dhabi - United Arab Emirates; 19 - 21 March, 2018.

Conference Proceedings, Conveners, Chairpersons and Committees

I. Registration

- **Sunday – 18 March 2018**

14:00 – 19:00 Registration for early arrivals.

Participants are kindly requested to report to the conference desk (at the three lodging hotels: Emirates Palace, Intercontinental and Rotana); you will receive your conference badge, a kit with full of conference material and program.

- **Monday – 19 March 2018**

08:30 – 09:30 Registration for late arrivals.

II. Summary of the Conference's Program

Etihad Ballroom

Keynote Speech	:	Unique experience of Matrouh governorate in initiating a sustainable development project built around the Date Palm Ecosystem through the partnership between the Governorate of Matrouh, Khalifa International Award and the private sector in West Siwa.
FAO Presentation	:	Red Palm Weevil: <ul style="list-style-type: none">- Follow-up on the International Scientific Consultation and High Level Meeting on Red Palm Weevil. management, Rome, Italy, 29–31 March 2017- FAO The state of the art for the control of the Red Palm Weevil.- Canary Islands, story for Eradication of Red Palm Weevil.- Mauritania, story for containment of Red Palm Weevil.
AOAD Presentation	:	- Date palm value chain development in the Arab countries: key constraints and opportunities.
ICBA Presentation	:	- Real water requirements of date palm in the United Arab Emirates.
ICARDA Presentation	:	- An overview of ICARDA new strategy for the coming 10 years (2017 – 2026).

Tuesday - 20 March 2018

Room A - Session 1	:	Genetic Engineering and Biotechnology / Tissue Culture. 9:00 – 18:45
Room B - Session 2	:	Red Palm Weevil. 9:00 – 13:45
Session 3	:	Pests and Diseases of Date Palm. 15:00 – 20:00

Wednesday -21 March 2018

- Room A - Session 4** : Technical Practices of Date Palm.
9:00 – 18:00
- Room B - Session 5** : General Topics on Date Palm.
9:00 – 19:15
- Room C** : Conclusions and Recommendations.
17:00 – 18:30

- Thursday -22 March 2018** : Post conference tour.

III. Conference conveners

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IV. Conference chairpersons

Tuesday - 20 March 2018

- Room A - Session 1** : Franz Hoffmann /USA & Ibrahim Saqer Mssallem / KSA.
: Harrison Hughes /USA & Salah Eddine Zaid / USA.
: Yvon Martel / Canada & Mukarram Bel Haj Faraj / UAE.
: Bhanu Chowdhary /UAE & Sajed Maqsood / UAE.
- Room B - Session 2** : Abdallah Oihabi / Morocco & Amin Mridha / Bangladesh.
Session 3 : Hassan Shabana / UAE & Abdel Jaleel Cheruth / UAE.

Wednesday - 21 March 2018

- Room A - Session 4** : Jose Ignacio Cubero / Spain & Samir Al Shakir / Iraq.
: Sherif F. El Sharabasy / Egypt & Ahmed Al-Harrasi / Oman.
- Room B - Session 5** : Mohamed Ben Saleh / Oman & Zougari Baulheina / Tunisia.
: Glenn C. Wright / USA & Saleh Mohamed Aleid / KSA.

V. Conference committees

■ High Committee

- H.H. Sheikh Nahayan Mabarak Al Nahayan, Minister of Tolerance and President of the Award's Board of Trustees.
- Prof. Abdelouahhab Zaid, Advisor, Ministry of Presidential Affairs, KIADPAI General Secretary, Chair Organizing Committee.
- Dr. Helal Humaid Saed Al Kaabi, Member of the Award's Board of Trustees, Head of the Award's Financial and Administrative Division.

■ Scientific Committee

- Prof. Ghaleb Ali Alhadrami, Deputy Vice Chancellor for Research and Graduate Studies, Chair Scientific Committee.
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- Prof. Franz Hoffmann, USA, KIADPAI.
- Prof. Harrison Hughes, USA, KIADPAI.
- Prof. Yvon Martel, Canada, KIADPAI.
- Prof. Jose Ignacio Cubero, Spain, KIADPAI.
- Dr. Samir Al Shakir, Iraq, KIADPAI.
- Dr. Ibrahim Saqer Mssallem, KSA, KIADPAI.
- Dr. Fatima M. Al-Ansari, UAE, KIADPAI.
- Dr. Mukarram Belhaj Faraj UAE, ICBA.
- Dr. Mohammed Abdul Muhsen Salem, CFA, UAEU.
- Dr. Ayesha Aldhaheri, CFA, UAEU.
- Dr. Carine Platat, CFA, UAEU.
- Dr. Abdul Jaleel Cheruth, CFA, UAEU.

■ Media Committee

- Dr. Emad Saad from KIADPAI, will be responsible for the media coverage in collaboration with concerned parties.
- Mr. Mohamed Alaidaroos, FAO.
- Mr. Abdumutalib Begmuratov, ICBA.
- Mr. Showkat Rather, ICBA.

■ Organizing Committee

- Prof. Abdelouahhab Zaid, Advisor, Ministry of Presidential Affairs, KIADPAI General Secretary, Chair Organizing Committee.
- Dr. Aisha Abushelaibi, UAEU.
- Dr. Ahmed Hussein, UAEU.
- Dr. Shyam S. Kurup, UAEU.
- Dr. Tariq Chfadi, UAEU.

- Mr. Ghazi Jawad Aljabri, ICBA.
- Mr. Ahed Abdul Halim Karkouti, KIADPAI.
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- Ms. Afra Mohamed Al Kaabi, KIADPAI.
- Ms. Esra Ali Shatnawi, KIADPAI.
- Ms. Yasmine Ali Alantari, KIADPAI.
- Mr. Wazef Al Zeydani, UAEU.
- Mr. Roger Francis, UAEU.
- Ms. Emily Shea Dunn, UAEU.
- Mr. Salem Al Kaabi, UAEU.
- Mr. Jassim Al Harmoudi, UAEU.
- Mr. Mohamed Disawi, UAEU.
- Mr. Abdul Rasheed Ezhikkottayil, UAEU.
- Mr. Jihad Khalil, UAEU.
- Mr. Ali Mohamed Fadil, UAEU.



LIST OF ABSTRACTS



Sixth International Date Palm Conference Abu Dhabi - UAE; 19 – 21 March 2018

Conference Program

Monday - 19 March 2018

- 08:30 – 09:00 : **Registration for late arrivals**
- 10:00 – 12:00 : **Opening Ceremony (Etihad Ball Room)**
- 12:30 – 13:00 : **Visit to the Photo Gallery**
- 13:00 – 14:30 : **Lunch Break**

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SESSION 1

Current Status of Date Palm Cultivation

Assessment of date palm (*Phoenix dactylifera* L.) genetic erosion in Algeria (Ziban region)

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Abstract

Algeria is one of the richest countries in terms of date palm biodiversity with its 940 cultivars (Hannachi et al. 1998). However, the most trade-marketable date cultivar “Deglet Noor” represents more than 51% of total date palm production (M.A.D.R. 2014) and 37% of its area cultivation is located in Ziban region where the monovarietal practice is increasing and resulting in a strong genetic erosion of date palm genetic resources. The aim of this study was to assess the accurate status of date palm biodiversity using some indices based on the data from the surveys conducted from 2013 to 2015 in thirteen districts. The results clearly showed the dominance of Deglet Noor in Ouest region and Ghars, Mech Degla and common date cultivars in the Est. Moreover, the frequency of these latest cultivars was lower. The erosion rate varied from 18% in Biskra to 84.4% in M’choonesh, where the most important varietal richness was recorded (36 cultivars). The Jaccard similarity index was more important between the closest oases due to their geographical proximity, resulting in the exchange of plant materials. In total, only seven cultivars were commonly inventoried in all surveyed regions. Shannon-Weaver index showed there was a more homogeneous structure in some of the Est districts due to the evenness of cultivars, while, the index had the lowest value (0.55) in Tolga region where the famous Deglet Noor cultivar is mostly cultivated. Using this indices, a numerical maps were elaborated to show cultivars distribution. This study showed the usefulness of ecological indices to allow better understanding of the status of the Algerian groves biodiversity.

Key words: Date palm, genetic erosion, ecological indices, Algeria.

**Biotechnological studies on the acclimatization of date palm plantlets
produced *via* tissue culture techniques;
1- effect of some chemical compounds and bio- fertilizers**

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Abstract

The maximum survival (66.67%) of date palm (*Phoenix dactylifera*. L.) cv. Gondella vitroplants were recorded in acclimatization stage in the first part of study. Trails were applied using some chemical compounds in rooting stage *in vitro* to raise plantlets survival percentage in acclimatization as compared with the previous results. Polyethylene Glycol (PEG) at 10 g/L recorded vitroplants survival (73.33 %), Sodium bicarbonate (NaHCO₃) at 3.0 g/L recorded relatively lower growth parameters and chemical analysis, it scored the highest vitroplants survival 73.33%. Salsilic Acid (SA) at the concentration of 20 mg/L was recorded the highest number of leaves (3.13), leaf area (28.80 cm²), number of roots (4) and root length (9.27 cm) and plantlets survival (73.33%) as compared with the control. Nitric oxide (NO) at the concentration of at 500 µM was recorded the highest leaf area (28.87 cm²), number of roots (4.46), root length (9.33 cm) and plantlets survival (80 %). Silver Thiosulfate (STS) at 10 ml/L recorded plantlets survival (86.67 %) and chemical analysis recorded H₂O₂ content (123.65), lipid peroxidation [(MDA) (30.64)] and total soluble phenols contents 4.94 %.

Bio- fertilizers i.e. *Anabaena oryzae* in acclimatization stage at the concentrations of 20 ml/L recorded vitroplants survival (93.33 %) and increased in T. H. Carbohydrate (42.31 %), Total soluble proteins (98.72) and Total Chlorophyll 2.8 mg/g D.W. *Spirulina platensis* at 50, 100, and 150 ml/L obtained positive response in growth parameters without any advanced success in vitroplants survival (86.66 %). Chemical analysis at concentrations 150 ml/L recorded the highest significant difference in T. H. Carbohydrate (51.93 %), Total soluble proteins (120.22) and Total Chlorophyll 3.72 mg/g D.W. Mycorrhizal Fungi at 30 g/L recorded the highest percentage values of vitroplants survival (100 %) and the highest significant difference in T. H. Carbohydrate (59.61 %), Total soluble proteins (136.12) and Total Chlorophyll 4.16 mg/g D.W.

Keywords: *Phoenix dactylifera* L., *in vitro*, micropropagation, adaptation, Bio-Fertilizers.

Expression of some genes in non-pollinated flowers of tissue culture and offshoot date palm trees (cv. Barhee) using qRT-PCR

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Abstract

Date palm conventionally propagates through offshoot but this method has several limitations. Recently micropropagation of date palm through tissue culture was developed and become an importance commercial method. However, in some cultivars the tissue culture derived plantlets show a series of deformation due to the somaclonal variation. In this study we investigated the true to typness of date palm cv. Barhee trees derived from tissue culture through evaluation the expression of some genes coding Ubiquitin (UBQ), Phosphofructokinase (PFK), Poly (A)-binding protein (PABP) and Metallothionein 2A (MT)2a in non-pollinated flowers in different stages based on spathe size (15, 25 and 35 cm long) using Quantitative RT-PCR method and compared with offshoot trees. The results indicated that the level of expression was difference in all genes. The expression of UBQ, PFK and (MT)2a was decreased in tissue culture derived flowers but the expression of PABP was increased. The difference in expression of all tested genes was also observed among three growing stage of the flowers. The expression in UBQ and (MT)2a genes was gradually increased by growing the flowers but the expression of PFK and PABP genes was gradually decreased by growing the flowers of tissue culture derived trees compared to flowers of the offshoot originated trees.

Effect of superabsorbent polymer applying on surviving and vegetative characteristics of tissue culture date palm

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Abstract

Date palm offshoot needs adequate water for establishment and growth in primary years after planting. Therefore irrigation scheduling is very necessary for increasing the establishment and growth of date palm offshoots. An experiment was conducted to study on amounts of superabsorbent polymer applying on surviving of date palm offshoot at date palm and tropical fruit research institute of Iran. The experiment was laid out under Randomized Complete Block Design (RCBD) with split plot arrangement, having three replications in which irrigation rate were kept in main plot and super absorb were in sub plot. Experiment comprised a following treatment combination irrigation based on %60, %80 and %100 class A pan in main plots, superabsorbent in four rates (0, 40, 80 and 120 g for each offshoot) in subplot. The water requirement was calculated based on FAO pan method. The offshoot growth characteristics such as establishment percent, plant height, number of leaves, leaf length and width, number of leaflets, leaflet length and width, trunk diameter and for any treatment were determined. The results showed that irrigation treatments or superabsorbent had no significant effect on establishment of date palm offshoot and other vegetative characteristics. There was significant effect between leaflet length and trunk perimeter in the interaction of irrigation and super absorb treatments. The most suitable treatment was irrigation based on % 60 evaporation and 80 g superabsorbent.

**Effect of some nutrients on *in vitro* pollen germination of date palm
(*Phoenix dactylifera* L.) different cultivars**

Maryam Boroujerdnia

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Abstract

In vitro pollen germination is an effective technique for understanding the basic and applied aspects of pollen biology. In this experiment, effect of different concentrations of boric acid (0, 50, 100, 200 mg l⁻¹), calcium nitrate (0, 100, 200, 300 mg l⁻¹), magnesium sulphate (0, 100, 200, 300 mg l⁻¹) and potassium nitrate (0, 100, 200, 300 mg l⁻¹) were examined on *in vitro* pollen germination of 4 date cultivars (Red Ghannami, Nar Pakhotah, Sabz Parak and Vardi). The results revealed that elements concentration of the medium significantly affected the pollen germination percentage at all date male cultivars used in the experiment. It was found that pollen germination for all cultivars were decreased by raising calcium nitrate concentration up to 300 mg l⁻¹ in the germination medium, whereas germination in different concentrations of boric acid and potassium nitrate was increased up to 100 mg l⁻¹ and gradually decreased again to 200 and 300 mg l⁻¹, respectively. The pollen germination was significantly higher at 200 mg l⁻¹ of MgSO₄ than the other concentrations. Significant differences in germination percentage were found among cultivars in different media. In optimum concentrations of B, Ca, Mg and K, the highest pollen germination was obtained for Nar Pakotah cultivar.

Key words: Cultivar, Date Palm, *In Vitro* germination of pollen, Nutrient elements.

**Effect of sucrose and pH on *in vitro* pollen germination of date palm
(*Phoenix dactylifera* L.) cultivars**

Maryam Boroujerdnia*, Seyyed Samih Marashi

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Abstract

The *in vitro* germination of pollen grains is the most applied technique for pollen viability studies. This study was carried out in order to evaluate the effect of different levels of pH (4.7, 5.7, 6.7, 7.7) and sucrose (0, 6, 10, 14) on *in vitro* pollen germination in 4 cultivars of date palm (Vardi, Red Ghannami, Sabz Parak and Nar Pakotah). The results showed that the pollen germination percentage of date palm cultivars increased with raising pH of the culture medium from 4.7 to 6.7; however, the germination of pollen was prevented in pH 7.7. The lowest and highest pollen germination was observed in Red Ghannami (73.6%) and Sabz Parak (57.3%) under optimum pH condition (6.7), respectively. The effect of concentration of sucrose was significant on pollen germination of cultivars. The highest germination was achieved with 6% sucrose concentration in all cultivars; however, 10% and 14% sucrose resulted in reduced pollen germination. Nar Pakotah cultivar showed highest pollen germination in 6% sucrose medium.

Keywords: Date palm, *In vitro* pollen germination, pH, Sucrose.

Molecular characterization, expression pattern and silencing of vitellogenin gene in almond moth, *Cadra cautella* (Walker), the most serious pest of date fruits

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Abstract

The vitellogenins (Vgs), the major yolk protein precursor, play a critical role in reproduction and proliferation of all oviparous species including insects. To investigate the reproduction strategies of the warehouse moth, *Cadra cautella* (Walker) (Lepidoptera: Pyralidae) at molecular level, the complete *Vg* gene transcript was sequenced, characterized and used for RNAi application. The complete *CcVg* mRNA transcript was of 5,334 base pair (bp) (GenBank, accession number: ALN38805), which encoded a protein of 1,778 residues, including a signal peptide of 14 amino acids. The *CcVg* protein contained all the characteristic motifs found in Vgs of other insects like DGQR and GI/LCG motifs in addition to the nine cysteine residues conserved at the C-terminus. Additionally, sex, stage-specific and developmental expression profile of *CcVg* gene was determined through reverse transcriptase polymerase chain reaction (RT-PCR). It was observed that *Vg* was first transcribed in the late female larvae (22 d old) and the expression increased gradually with insect development. The RNAi-based silencing has revealed that application of *CcVg*-based dsRNA has suppressed the *Vg* gene expression up to 90% on 48 h of post injection in the treated females. The impact of *CcVg*-based RNAi resulted in low fecundity and eggs hatchability in *CcVg*-based dsRNA treated group. The results of *CcVg* gene silencing has confirmed that it plays a key role in reproduction of *C. cautella* and has a potential to be used as a target for RNAi-mediated control of this warehouse pest.

Standardizing the commercial micropropagation method, by means of workflow enhancement: a personal account

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Abstract

Mass vegetative propagation has become the prime tool in assuring sufficient clones of superior genotypes while avoiding industry level infectivity. In – vitro systems provide a rapid clonal pipeline that satisfies the high demand for superior cultivars. Date palm (*Phoenix dactylifera* L.) tissue culture under large scale production necessitates specific practices and procedures that may not be essential in smaller quantity propagation systems to assure its success. In this presentation, the best practices and procedures through workflow – enhancement are presented for the fulfillment of date palm tissue culture facility goals. The inherent slow rates of vegetative propagation by offshoots and the limitation of a seed based system due to variation of progeny is avoided by means of tissue culture of meristematic tissues of date palm crowns. This locks in the specific sought cultivar characteristics of a clone. Facilities using tissue culture have been successful. The methods and procedures for the workflow process may be implemented through the use of workflow forms to facilitate and mitigate problems associated with the commercial production aspect of large scale micropropagation. Many laboratories and facilities have practiced in – vitro propagation by methods of somatic embryogenesis and more recently organogenesis which is now standard for date palm. This summation includes a description of in – vitro regeneration of date palm through organogenesis with detailed guidelines to establishing and running commercial level plant tissue culture facilities suitable for mass propagation of various plant species including the date palm. The workflow - form implementation procedural plan and estimating production structure of the laboratory are specified.

Keywords: In vitro, Micropropagation, *P. dactylifera* L., Organogenesis, Tissue culture, Workflow, Date palm.

Establishment of a microsatellite markers based identification key for Algerian date palm varieties (*Phoenix dactylifera* L.)

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Abstract

The date palm (*Phoenix dactylifera* L., Arecaceae) is a perennial monocotyledon (2n = 36). It is an ecologically, culturally and economically important crop, widely cultivated in arid and semi-arid Mediterranean regions, in the Sahara, and in the Middle East. Date palms are cultivated in Algerian oases in most of the regions south of the Saharan Atlas Mountains. Nearly 1,000 cultivars clonally propagated from offshoots have been inventoried and their distribution shows a very marked breakdown into eastern, central and western parts of the country. Exploring this diversity is a prerequisite for the identification and characterization of the Algerian cultivar to controlling genetic erosion to aid its conservation and protection.

Six microsatellite markers (SSR) and a chloroplast minisatellite were used to study polymorphism and discriminate 135 date palm genotypes. Based on the multilocus genotypes a cultivar's identification key has been established and permitted to unambiguously differentiate between varieties. The chloroplast minisatellite (CpfM12) was used as a first marker, and two major alleles were found in the chloroplast. The most polymorphic microsatellite (mPdCIR78) was used as a last marker.

A chloroplast minisatellite and six microsatellite loci were sufficient to discriminate among all accessions studied, and allowed the establishment of an identification key with a discriminating power of 100%. Therefore, the synonyms and homonyms were confirmed.

The obtained results are discussed in term of establishment and management of an Algerian collection of date palm varieties, conformity checks, identification of homonyms and synonyms, and screening of the local resources.

Keywords: *Phoenix dactylifera*, genetic resources, identification key, microsatellite, chloroplast minisatellite.

SESSION 2

Red Palm Weevil

The use of *Rhynchophorus ferrugineus* sexual pheromone through two different methods: ChemTica International S.A. experiences

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Absract

In Middle East, the Red Palm Weevil (RPW), *Rhynchophorus ferrugineus*, can account for economic losses in date palm to up to US\$ 8.7 million when infestations of 5% are reached. From all the pests and diseases in date palm, the RPW is by far the most devastating. Pheromone lures in combination with food baits have proven to be the most effective way to control this pest, and its use has been widely adopted in the last decades. However, the use of mass trapping involves servicing, meaning labour costs and inconveniences. An alternative method to decrease the dependency on servicing traps is the use of the attract and kill technology (A&K), which consists of pheromone releasing points that are combined with insecticides. In this study, ChemTica Internacional S.A., reports our results using both technologies. We show that eradication (not a single individual detected over a two-year period) of this pest in Canary Islands, Spain, and eradication of a sibling species in California, United States, demonstrates the validity of mass trapping as strategy of control. However, we also show that the use of A&K can lower down the populations of RPW with experiences in India (89% reduction) and Malaysia (100% reduction). We conclude that both technologies represent important tools for control depending on several factors discussed.

Susceptibility of some dry date palm cultivars to *Rhynchophorus ferrugineus* (Oliv.) infestation

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Abstract

Rhynchophorus ferrugineus is the most destructive insect pest of date palm trees, therefore This study was carried out during two successive seasons of 2011&2012, During monthly visits to five orchards Cultivated with dry date palm cultivars (Shammia, Bartamouda and Sakkoti), in Aswan governorate to estimate date palm infestation percentages by *R. ferrugineus*, The results revealed that the most susceptible date palm Cultivar of the tested cultivars to RPW was Shammia followed by Bartamouda and Sakkoti Chemical analysis of Fiber for date palm tissues of the tested cultivars date were taken.

Susceptibility of date palm cultivars and effect of intercrop plantations on infestation by the Red Palm Weevil, *Rhynchophorus ferrugineus* (Oliv.) (Coleoptera: Curculionidae) in Baharia Oases, Egypt

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Abstract

The present work was carried out in Baharia Oases, Giza Governorate, Egypt during January 2013 to December 2014. This work aimed to study susceptibility of different date palm cultivars to *R. ferrugineus* infestation and infestation by this insect at different trunk heights of date palms in addition to effect of intercrop plantations on infestation rate by red palm weevil (RPW). The obtained results showed that the susceptibility of date palm cultivars to RPW is in the order: Seaidy > Kaka > Freahy during years 2013 and 2014. The percentage of lignin in Freahy cultivar tissues was 14.56% higher than each of the other cultivars Kaka (13.81%) and Seaidy (11.22%), this result is inversely proportional to the rate of infestation by RPW. The maximum RPW infestation in date palm stem recorded at height 50-100 cm, while lowest infestation was at 200-250 cm during two studied years. The percentage of infested palms in farm with intercrop plantations was 14 & 12% and without intercrop plantations was 8 & 9 % during years 2013 and 2014 respectively.

Key words: The Red Palm Weevil, date palm, susceptibility, intercrop plantations.

Micro Injection of Emamectin benzoate for long run control of red palm weevil

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Abstract

An experiment was carried out to evaluate the efficacy of the micro emulsifier insecticide Emamectin Benzoate (Revive) of two concentration 4.9% and 9% , in controlling red palm weevil ,RPW,(*Rhynchophorus ferrugineus*) and saving palm trees free from the injury of the RPW for one year, the treatment applied by one single direct micro-injection into the trunk of affected trees, Once Revive became inside the trunk it will be lethal to RPW individuals upon ingestion or direct contact by disrupting neurotransmitters, causing irreversible paralysis..

To conduct this experiment it was selected an infested orchard sited in highly infested zone at north of Jordan valley, almost 60% of the trees were infested by RPW in the orchard which ranged from simple to severe infestation.

The treatments were done on 29, March 2017, by selecting 36 infested trees, 24 trees treated with the two concentrations of revive insecticide. and the rest 12 trees were left with no treatment as control using completely randomized design with two treatments ReviveI(4.5%) and ReviveII (9 %). And twelve replicates under three dates of data gathering (third, sixth and 12 months from injecting date) it was drilled four holes per tree by electric drill bit 8 mm width and 35 cm length in a 20° angle downwards into the base of the stem around the tree at the same level under the revealed symptoms with depth 20-30 cm but not more than 1/3 of stem diameter, it was injected undiluted product (ReviveI: 50ml/ palm & ReviveII: 24ml/palm) through Syngenta TMI 4.1 device. Each hole of the first 12 trees injected 12.5 cm Revive1 with total of 50 mm for one tree and 6 cm of Revive II per hole with total of 24 ml for one tree and then closed all the holes with sterilized plug to protect the tree from contamination and avoid pesticide reflux, the injection was done under low pressure of 2 bar so as not to disturb the tissues of the plant, Revive two spread upward in two weeks while revive one spread upward in four weeks in all tissues.

Observations were taken every two weeks after the treatment application to the end of the experiment. The symptoms of infection as gum, holes, mold, saw dust and soft or dry tissue were recorded, larvae pupa and adult on the treated trunk of the trees from the outside were also recorded whether alive or dead

The result of the observation which the treated trees indicated that most trees treated trees became healthy disappeared symptoms the tissues of the infested holes and the sawdust become dried up but some trees got new soft hole resembled a new infestation that also dried up at the second reading, it was noticed in the first three months many dead adults inside the cocoons were gathered from the infested holes of the trunk outside

The first tree dissection was done on 17/7/2017 for six trees after three months, The results of the injected trees with Revive one indicated that the first tree free from RPW and its symptom, in the second tree only one dead pupa was detected and all the symptoms of the injury were dried, in the third tree it was found 33 lived red palm weevil Of the different stages in huge cavity inside the tree. and 6 dead adult in cocoon upper the

cavity, this negative result was happened because the injection was done under the level of unseen cavity so little insecticide translocated upward and nothing reached the insects which laid inside the rotted cavity.

The results of Revive two indicated that the first tree has got dried rpw symptoms and the presence of the three dead first larval instars inside the tree, in the second tree it was found 4 dead adults on the tree trunk and after the dissection, 6 dead pre- adult weevil were found inside. in the third tree it gathered 95 dead weevils, 92 adults, 2 pre-adult, 1 pupa, and 6 lived adult weevil from trunk inside with highly destructive tissue, many lived long horned larva were detected fed on organic fermented tissues resulted from rpw feeding residues,

The second dissection was done after six months for three trees injected with Revive one only because of the absent of three trees of Revive two that farmer were sold the trees without our knowledge, that new six trees was injected and after six months the dissection will done in February 2018,

The results of the second dissection indicated that The infection has stopped in the first tree with no symptom, also the second tree had no symptom with four soft holes empty from larvae, the last third tree also had no insect inside but in external holes, there was a new soft hole with 20 lived larvae of the first larva instars and two lived 4th larval instars, this new infestation was detected four days before the dissection.

Effect of trap color and stirring of contents of pheromone- baited traps on the capture of the adult red palm weevil in the United Arab Emirates

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Abstract

The red palm weevil, *Rhynchophorus ferrugineus* (Olivier) (RPW), is one of the most destructive pests of date palm in UAE. Field trials were conducted in Abu Dhabi, from May 2010 to April 2011, using a randomized complete block design with four treatments and five replications to evaluate the effect of weekly stirring of water and dates in the red palm weevil pheromone trap on adults captured in brown and white traps. Each trap contained the following materials: (1) a dispenser of the RPW male aggregation pheromone (Ferrolure) containing 700 mg of the active ingredient (4-methyl-5-nonanol (90%) 4-methyl- 5-nonanone (10%) at 95% purity; (2) an Ethyl Acetate (EA) dispenser (Weevil Magnate) containing 40 ml of the active ingredient of EA at 98% purity; (3) 350 g of fodder date fruits; (4) 4 liters of water. The results showed that the mean of adults captured in white traps was 22.5 ± 0.50 and 16.8 ± 0.41 adults/trap/month with and without stirring, respectively, while in brown traps the mean was 39.9 ± 1.31 and 28.3 ± 0.51 , respectively. The overall mean of adults captured was 31.2 ± 6.21 and 22.6 ± 4.81 adults/trap/month with and without stirring respectively. The highest number of weevils captured was in the brown traps with stirring, while the lowest number was in the white traps without stirring. Based on the results of these trials, it is recommended to use brown traps containing aggregation pheromone, 350 g of date fruits, ethyl acetate and water. The results indicate that it is necessary to stir the water with dates in the traps to increase their efficacy.

Key words: *Rhynchophorus ferruginous* , pheromone traps, stirring, trap contents.

The South American palm weevil, a threat to the date industry in the United States and Mexico

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Abstract

The South American palm weevil (SPW) (*Rhynchophorus palmarum*), native to South and Central America, has been found in Northwest Mexico and Southwest United States. The SPW is related to the red palm weevil (RPW), but is slightly larger and is typically black. SPW lifecycle is like that of the RPW, and it can fly several kilometers. Like the RPW, SPW larvae feed inside the palm crown and the damage kills the tree. Additionally, the SPW carries the red ring nematode, *Bursaphelenchus cocophilus*, which has not yet been found in the United States, but is found in Mexico. This nematode can lead to serious economic losses of commercial coconut and oil palm plantations in Central and South America and can also damage or kill ornamental landscape palms.

SPW currently infests Canary Island date palms (*Phoenix canariensis*), and poses a threat to other palms, including the common date palm (*P. dactylifera*) orchards in the region. Citrus, mango and other tropical trees are secondary hosts for the SPW. Estimated SPW populations in *P. canariensis* in San Diego have increased greatly in the past year as there are no control methods being taken, and scores of trees have been killed. Drones will be tested and evaluated to identify infested trees.

Trapping and properly applied pesticides are some of the control measures that can be taken. Semiochemicals are being developed that will attract the SPW to small, but lethal doses of a pesticide that is applied to the tree as a small mass of paste. SPW repellants are also being developed and tested.

Evaluation of *Beauveria bassiana*, *Bacillus thuringiensis* and *Heterorhabditis bacteriophora* alone and in combination against red palm weevil, *Rhynchophorus ferrugineus* (Olivier)

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Abstract

The current studies present laboratory trials conducted to investigate the insecticidal effect of *Beauveria bassiana* s.l. (Ascomycota: Hypocreales), *Bacillus thuringiensis* and *Heterorhabditis bacteriophora* Poinar (Heterorhabditidae) against different populations of *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae). *R. ferrugineus* populations were collected from four districts of Punjab (Pakistan) including Layyah, Dera Ghazi Khan, Muzaffargarh and Rahim Yar Khan. The control agents were used alone and in all possible combinations against *R. ferrugineus* adults. After treatment mortality counts were taken after 7, 14 and 21 days post-incubation at $25\pm 2^{\circ}\text{C}$ and $70\pm 5\%$ RH and 12:12 (D: L) hours. Results revealed that *H. bacteriophora* was more effective followed by *B. bassiana* and *B. thuringiensis* when applied alone, while in combined treatments *B. bassiana* with *B. thuringiensis* exhibited lowest mortality followed by *B. thuringiensis* + *H. bacteriophora* and *B. bassiana* + *H. bacteriophora*. The maximum number of mycosed and sporulated adults were noted where *B. bassiana* was applied alone and same was the case for nematode production. The findings of this study indicate that all three biocontrol agents may provide sustainable and effective control of *R. ferrugineus*.

Field evaluation to the attraction efficiency for the different sources of the red palm weevil aggregation pheromone

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Abstract

Field experiment were conducted during the periods from June 2014 to March, 2015, in three date palm orchards located in Al Ain city, Abu Dhabi, United Arab Emirates, in order to evaluate the attraction efficacy for five sources from the red palm weevil RPW, *Rhynchophorus ferrugineus* Olivier (Coleoptera: Curculionidae), aggregation pheromone by using the standard four window black bucket trap. The three orchards are characterized by having different levels of infestation incidence by red palm weevil. The randomized Complete Block Design (RCBD) with five treatments and three replicates was used in each of the three orchards. The aggregation pheromone sources used in this experiment were: Rhyfer 700, Pherocon RDPW Lure, Ferrugitom 700, Weevil lure, and Ferrulure+.

Collectively in the three farms as well as per each farm, Weevil lure aggregation pheromone trap capture significantly lower average number of RPW than Rhyfer, Pherocon, Ferrulure and Ferrugitom pheromone sources.

Rhyfer pheromone is about 1.12, 1.18, 1.56, & 1.16 more efficient than Pherocon, Ferrugitom, Weevil lure, & Ferrulure, respectively.

Evaluation studies of some extracted substances from date palm tissues on its attracting potential of the red palm weevil, *Rhynchophorus ferrugineus* (Olivier)

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Abstract

The red palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae) (Oliv.) is the most serious and destructive insect pest for date palm trees. The relative weevil-attracting potential of the extracted substances from date palm tissues on the aggregation and trapping the red palm weevil, *R. ferrugineus* Olivier, was evaluated in date plantations of El-Mansoria village, Giza Governorate, Egypt. Results of this study indicated that the amino acids and indols attracted more adult red palm weevils than the phenols. Moreover, results showed that sugars attracted least number of adults compared to other substances.

Keywords: Date palm tree, Red Palm Weevil (RPW), *Rhynchophorus ferrugineus*, Kiromones.

Employment of Metabolomics to Identify New Management Chemicals against Red Palm Weevil (*Rhynchophorus ferrugineus* (Olivier))

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Abstract

Date palm yield is substantially reduced due to the infestation with the red palm weevil (RPW) (*Rhynchophorus ferrugineus* (Olivier)). This insect pest is a very destructive to date trees worldwide especially in the Middle East and North Africa. Integrated management programs include several strategies but the primarily control method rely on the application of tonnes of synthetic insecticides. The RPW developed resistance to most commercial insecticides that require constant development of new chemicals. Therefore, current study aimed to find effective control method based on the tree's immune system. Samples of bark and fruits of Sammany (tolerant to RPW infestation), Zaghlool (susceptible to RPW), and Males varieties were collected. The secondary metabolite profile of each variety was identified using the Gas-Chromatography coupled with an MS system. Moreover, the glucose content, total phenolics content, and total antioxidant activity were estimated using the UV-Vis spectrophotometry. Also, park tissues were image-processed for apparent differences between varieties. Results revealed significant differences between Sammany and Males on one side and Zaghlool in the other side in the secondary metabolites contents. Image processing showed that tissues of Zaghlool dates were thicker and darker. Also, glucose and the antioxidant capacity were very high for the Zaghlool variety, which made it very appealing to the insect. Incorporation of major identified metabolites in Zaghlool variety in the control program would have great potential. The metabolomics approach would be very informative and time-saving in finding alternatives or synergists to available control methods.

SESSION 3

Pests and Diseases

Identification and importance of fungi infecting stored dates in Algeria

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Abstract

The presence of fungal flora in the dates for man food can lead to serious consequences for his health. The quality control during the storage can reduce the loss of product caused by these fungi. It is a means of prevention and risk management of infections by fungi, some of which may be highly toxigenic. The study of fungal contamination of samples stored dates was performed on 12 samples from six varieties of dates (Chars, Deglat Nour, Deglat Beida Tantbouche, Kentichi, Tenissine) collected from two local of conservation in two regions located in south of Algeria (Ouargla and Oued righ). The results showed a wide range of fungal flora contamination. In fact, ten species belonging to eight genus of fungi were isolated (on PDA medium incubated at 25 °C) of 6 varieties of dates in each region. The genera *Aspergillus* is the principal representative of the contaminated fungi of dates studied. This type was represented by two species: *Aspergillus Niger* and *Aspergillus flavus*, followed by genera of *Penicillium* in turn represented by two species: *Penicillium expansum* and *Penicillium isolandicum*. Finally, *Fusarium solani*, *Paecilomyces variotii*, *Candida albicans*, *Cladosporium* sp, *Mucor* sp are relatively less frequent in the samples of dates analyzed. Moreover, this study showed that the fungal spoilage of dates is directly related to the water content and acidity of dates. This study shows the need for quality control in post harvest dates and during storage thereby limit the loss of product caused by fungi.

Keywords: Dates, Storage, Fungi, pH, Water content, *Aspergillus*, *Penicillium*, Yeasts.

Determination of antibiosis and mycoparasitism actions of antagonistic fungi species against bayoud disease of date palm (*Phoenix dactylifera* L.) in Algeria

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Abstract

Fusarium wilt of date palm, also known as bayoud disease, is major disease in Algeria and Morocco. In this work, we studied a biological control of *Fusarium oxysporum* f. sp. *albedinis*, the causal agent of bayoud disease by using of an antagonistic fungi species (AFS), (*Aspergillus niger*, *Fusarium oxysporum*, *Trichoderma harzianum*, *T. aureoviride* and *T. longibachiatum*), for biological control test by antibiosis and mycoparasitism actions. We showed the antibiosis action by the inhibition of mycelial growth and sporulation inhibitions, and the mycoparasitism action by cytological alteration of Foa mycelia. All five antagonistic fungi showed significant effect ($P < 0.05$), of inhibition toward mycelial growth of Foa (60-75%), and its sporulation (80-85% of the control). The mycoparasitism action observed by AFS secretions of the anti-fungal lytic enzymes, chitinase and β -1,3-Glucanase, and also by microscopic observation showed clearly this action by coagulation and alteration of Foa mycelium and appearance of large vacuoles.

Key words: date palm, *Fusarium oxysporum* f. sp. *albedinis*, bayoud, biocontrol, antibiosis, mycoparasitism.

Relationship between adult's flight - eggs laying and infestation rate of date by *Ectomylois ceratoniae* in El Meghaier region (Algeria)

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Abstract

The date moth, *Ectomylois ceratoniae*, infests date both in the field, on date palms and the proliferation continuing during storage. Chemical interventions have failed until today an effective protection of the date production because of the biology and feeding behavior of this pest. The larvae of this moth, feeding and developing, inside the date where they are protected there. This work aims to study the relationship between fluctuations of adult's flight, the eggs laying and infestation rate on three varieties at high market value which are, Deglet Nour, Degla beida and Ghars in El Meghaier region (Algeria) during date campaigns of 2011, 2012 and 2013 years, using pheromone traps, for monitoring fluctuations of adult's flight. For monitoring of laying eggs and infestation rates were performed by park and perring, (2010) method.

The monitoring fluctuations of adult's flight results using pheromone traps, reveals that adults are present throughout the year and are active during a period of 9 months during which two periods of intense activity were recorded; one in spring and other in autumn responsible for the dates attack and other host fruits by *E. ceratoniae*.

The study of the relationship between the level of the imaginal population and level of eggs-laying and infestation reveals that; at Deglet Nour, peaks of infestation and eggs-laying are recorded with or after the peak of the flight while for to others varieties, the peaks of egg-laying and infestation are singled before or with the peak of the flight. The reasons for these variations are established.

Keywords: adult's flight, eggs laying, infestation, date, El Meghaier.

Biocontrol of the date moth *Ectomyelois ceratoniae* (Zeller) using some entomopathogenic fungi

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Abstract

The date palm and its fruits are subject to attacks by several pests that are well adapted to the oasis ecosystem. The damage is considerable and leads to heavy economic losses. The present study was conducted to investigate the efficacy of some Entomopathogenic Fungi (EPF) against the date moth, *Ectomyelois ceratoniae* (Zeller), a major pest of stored dates. Results revealed the isolation of 13 fungal strains belonging to 6 genera: *Aspergillus*, *Beauveria*, *Drechslera*, *Fusarium* and *Metarhizium*. Among them, *Beauveria* sp and *Drechslera* sp showed a considerable effect against *Ectomyelois ceratoniae* (Zeller) with a percentage of 77.78% and 55.83% respectively. Both *Beauveria* sp and *Drechslera* sp. destroy the insect larvae by a variety of means leading to the possibility of their practical use in Integrated Pest Management (IPM) strategies in date palm groves.

Keywords: date moth, *Ectomyelois ceratoniae* (Zeller), *Beauveria* sp, *Drechslera* sp, entomopathogenic fungi, biological control.

Biological aspects and life table parameters of the date palm mite, *Phyllostetranychus aegyptiacus* Sayed (Tenuipalpidae) as affected by different temperatures

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Abstract

The duration of developmental stages and life table parameters of the date palm mite, *Phyllostetranychus aegyptiacus* Sayed were carried out at 20, 25, 30 and 35±1°C under 60-65%R.H. on leaflet date palm. Habitat and behavior, hatching, moulting and mating were also studied. Incubation period at 35°C was the shortest one. Hatching percentage recorded high (93.3%) at 25°C; while at 20°C it recorded very low percent (52.9%). Immatures developmental time decreased when temperature increased from 20-35°C for female and male. Mortality percent of the total immature stages recorded high (37.5%) at 35°C, but with low percent (20%) at 25°C. The shortest life cycle was recorded at 35°C. Adult female longevity averaged 35.8, 29.6, 25.4 and 20.6 days for female at 20, 25, 30 and 35°C, respectively. The duration of the oviposition period was affected by temperatures, being the shortest at 35°C. Fecundity was also affected by temperature; the mean total number of deposited eggs was generally increased averaging 18.5, 20.4, 28.4 and 19.2 eggs at 20, 25, 30 and 35°C, respectively. Temperature also affected the sex ratio as proportion of females increased with increased temperature till 30°C. The net reproductive rate (R_0) varied according to rearing temperature; it reached its highest value at 30°C (11.5 females/female). The mean generation time (T) and generation doubling time (DT) values decreased with temperature increase till 30°C. Daily intrinsic rate of increase (r_m) in relation to rearing temperature. The highest capacity to increase was recorded at 30°C.

**The future of biological control in the effectiveness of mites and their role in
IPM program in the control of red palm weevil,
Rhynchophorus Ferrugineus oliver**

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Abstract

The red palm weevil (RPW) *Rhynchophorus ferrugineus* is the most destructive and dangerous pest attacking palm trees in many countries in Asia and the Middle East .It caused mass destruction in date palm in Egypt and the Gulf countries. So, the role of these natural enemies should be maximized and involved in the integrated control program of these pests. The present study was conducted in Dakhlia governorate, throughout two successive seasons of 2009 and 2010. The seasonal activity of natural enemies; parasitoids associated with the red palm weevil (RPW) *R. ferrugineus* was evaluated under field conditions , in addition to estimated under laboratory conditions. The obtained data revealed that the ectoparasitoids, *Uropodina phoritic*. (Family, Uropodidae) and *Aegyptus rhynchophorus*. (Family, trachyurodidae) were found and recorded on the red palm weevil (last larvae, pupae, adult inside cocoon) and emergence adult had rarely records. In the first season (2009), *U. phoritic* and *A. rhynchophorus*, activity started to attack RPW at the January and then slightly increased gradually till the February which the percentage of parasitism reached 38% and decreased gradually till of the August. The parasitoid activity started at the September as the percentage of parasitism was 11%, increased gradually to end season. While, in the second season (2010), the parasitoid activity started at the January till (March) which the percentage of parasitism reached 84% decreased gradually till the July. Then, the parasitoid activity started at the August as the percentage of parasitism was 5%, increased gradually to end season. Added that the rates of parasitism on red palm weevil stages are very low during summer season, while increase gradually in winter season, during formed of cocoon and malformation of the adults during pupae molting when are wings white colors.

Keywords: ectoparasitoids, naturalenemies, Uropodidae, mites, trachyurodidae parasitism.

Study of the effect of storage temperature on microbial stored dates under vacuum

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Abstract

This research study the effects of different storage temperatures on the microbial load of Khalas cv dates produced in Al Hassa, Saudi Arabia and packed under vacuum at room temperature (25 °C) and under the refrigerator cooling temperature (5 °C) for 12 months. The results showed a fast developed of microbial florae on dates as mixture of bacteria and yeasts and fungus while the aerobic bacteria in samples stored at 5 °C for 12 months significantly decreased, compared with dates stored at 25 °C which showed a small decline.

Also, yeast and fungi significantly decreased in storage at 5 °C compared with those stored at 25 °C. It was observed that a more positive effect cooling to control the level of microbes, concludes that refrigeration is the best way to control microbes. Results showed that the cooling is the best way to control microbes in dates stored and bottled under vacuum and proved that the source of microbial development result mostly from bad post-harvest operation in the field and from washing dates lines in the factories.

Keywords: Saudi Arabia, Palm, packing under vacuum, storage, refrigeration, water activity, microbial load

Effects climatical factors on date palm (*Phoenix Dactylifera* L) bunch fading disorder and the methods of its control

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Abstract

Fading disorder is one of the most important factors that have decreased date's production in Iran in recent years. This disorder occurs very suddenly and rapidly from Khallal to rotab stage conversion, causing fade and eventually drought of date fruits. A study was carried out to determine the effects of climatical factors on dates fading disorder in different parts of Bushehr province in southern Iran. The daily data of three meteorological stations and twelve date gardens near these stations were used in this study. Observations were carried out to determine the time and damage percent through disorder occurrence in the gardens. The diagrams for every weather parameter and fading development were drowning. Results showed that climatical factors affected dates fading disorder by the following effectiveness sequence: weather relative humidity > wind speed and streamline > weather temperature. Also, estimation of fading disorder time occurrence can be done by wind streamline forecasting maps through five former days. As it was concluded that climatic parameters could be the most important factor of fading disorder, three cultural control methods (Intercropping, Bunch covering, Fruit thinning) were used in three different studies. It was observed that applying these methods together could decrease fading up to 70 percent.

Key words: Date palm, fading disorder, climatical factors, Southern Iran.

Date palm disorders caused by *Aphomia sabella* Hampson

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Abstract

Several date palm disorders affected date production and cause economic loss to the dates producers. These disorders in date palm are caused either by environmental factors or by biological agents. Certain date palm disorders such as tree crown bending (Barhee disorder), cross cut or ‘V’ cut, little leaves, white leaf and terminal shoot stunting followed by death were reported as caused by unknown factors. In order to find out the real cause for these disorders, a study was conducted in our laboratory. The main objective of the study was to identify the cause for the above mentioned disorders and find out the remedy. Many affected palms were collected and dissected out in the laboratory or in the field directly for the study. Abnormalities noticed on different parts of each frond while dissection were photographed and recorded. The insects, insect eggs and larvae and insect webbing with brown fecal pellets if any were also collected for identification. Majority of the affected palms showed the presence of same type of insect larvae. This larva was identified as the larva of *Aphomia sabella* Hampson or *Arenopsis sabella* Hampson (greater date moth). Our study confirmed the main cause for the above mentioned date palm disorders was the greater date moth larvae and certain date palm cultivars were more susceptible to this insect larvae. Precautionary measures to protect the palms from these insects and recovery of infected palms were developed. The details of the study are presented herein,

Keywords: *Phoenix dactylifera*, *Arenopsis sabella*, crown bending, Barhee disorder, V cut, cross cut.

tetracycline therapy against phytoplasma causing yellowing disease of date palms in Kuwait

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Abstract

An outbreak of phytoplasma microorganisms was observed in date palms grown in Kuwait. Phytoplasma are widespread prokaryotic microorganisms that infect palm trees, ornamentals and some horticultural crops. It sometimes causes lethal yellowing diseases in palm trees, which also multiplies in the host plant grown in tissue culture and spread infections by insect vectors. The presence of phytoplasma was detected by using both transmission and scanning electron microscopy. Fluorescence microscopy was used to detect DNA contents of the causal microorganism. Tetracycline therapy was carried out as a further evidence for the presence of the phytoplasma and as an attempt to control the disease. Infected young palms treated with tetracycline-HCl at early stages of the phytoplasmal infection showed remission of the yellowing symptoms. We show in this work that by injecting the infected young palm trees with tetracycline antibiotic the treated plants were recovered. The use of antibiotic treatment is valuable for the control of yellows disease in date palms especially in the areas where the pathogen is endemic and causes extreme crop losses. Companies producing date palm trees in tissue culture and growers will especially benefit from this knowledge in the development of control strategies for yellow diseases that are caused by phytoplasma.

Evaluation of the entomopathogenic fungus *Metarhizium anisopliae* var. *anisopliae* against the red palm weevil in Malaysia

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Abstract

The red palm weevil *Rhynchophorus ferrugineus* (Coleoptera: Rhynchophoridae) is an intrusive, invasive, detrimental, concealed, destructive, tissue borer and is a harmful pest of the palm trees around the world. During sampling of RPW at Terengganu state, some of the adult's cadavers were found infected with *Metarhizium anisopliae*. Obtained *Metarhizium* isolates from infected *R. ferrugineus* were subjected to the molecular identification using rDNA-ITS. Four strains were identified and coded with A1, B1, D1 and C1. Strain D1 was found to be more virulent than those of the latter, achieving LT₅₀ 7.20 and 5.20 day at concentration 10⁶ and 10⁷ respectively larval mortality. While at the adult treatment the LT₅₀ of strain D1 was 6 and 5 days at the concentration 10⁶ and 10⁷ respectively. As a result, the mortality caused by strain D1 in larvae and adults treatments at the concentrations 10⁶, 10⁷ was faster than other strains were used in this test.

Keywords: *Metarhizium*, conidia, *Rhynchophorus ferrugineus*, ITS.

Date palm-fusarium oxysporum interaction: strategies of control, limits and hopes

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Abstract

Bayoud is a vascular wilt caused by *Fusarium oxysporum* f. sp. *albedinis* (Foa), it destroyed more than 75% of date palm trees in Morocco and caused considerable economic, ecological and social damage. Currently, it remains the highest threat to all countries cultivating date palm. The pathogen strongly colonizes the roots than progress upwards into the vascular stele to reach leaves. It generates severe host cell alterations, including cell wall degradation and vesicle formation. We investigated different strategies to control Bayoud disease. The first one was the treatment of date palm (*Phoenix dactylifera* L.) with salicylique acide (SA) in order to trigger its defense reaction to Foa. Here, we used the phenolic compounds as indicators of date palm resistance to *Fusarium* in two cultivars, Bousthami noir a resistant cultivar and Jihel a susceptible one. After treatment with SA, the content of root soluble phenolics in inoculated date palm seedlings was higher than that in untreated plants showing disease symptoms. The largest increase was at a SA concentration of 50 µM. In addition, in SA-treated seedlings showing localized necrosis, the pathogen was restricted to the site of inoculation and failed to colonize the root tissues. The histochemical and ultrastructural analyses were carried out in date palm roots pretreated with salicylic acid (SA) then inoculated with Foa. Flavonoids, induced proteins, and peroxidase activity were revealed in root tissues of SA-treated plants after challenge by Foa. These reactions were closely associated with plant resistance to Foa. The second strategy was to inoculate date palm roots with an hypoaggressive isolate of *Fusarium oxysporum albedinis* in order to induce its defense response against the aggressive isolate (ZAG). Here, we investigated the polyphenoloxidase activity. When date palm seedlings were firstly treated by the hypoaggressive isolate and then by the aggressive one, the polyphenoloxidase activity was earlier and reached similar values as obtained by ZAG isolate alone. These results showed that polyphenoloxidase could have an important role in the establishment of date palm resistance against the Bayoud disease. The discovery of soils free from Foa has opened up a new field of investigation relying on biocontrol strategy using microorganismes. Two bacteria, *Bacillus amyloliquefaciens* and *Burkholderia cepacia*, isolated from the rhizosphere of almond trees and one bacterium (*Pseudomonas aeruginosa*), isolated from the pomace compost, were examined for their role to control this disease. Their inhibitory effect on Foa growth and sporulation was evaluated and their ability to trigger date palm defense reaction was discussed. These results add to the promising field of investigation in controlling Bayoud disease.

Use of natural products to control of postharvest spoilage fungi associated with date palm (*Pheonix Dactylifera* l.) fruits during storage

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Abstract

Chitosan - essential oils composite natural coating was applied as fungicide alternatives for control of postharvest spoilage cussed by *Aspergillus flavus* and *A.niger* the main pathogens of rotting and spoilage on dates fruits during storage. *In vitro* ,all tested concentration of chitosan as well as thymol , citral, thyme and lemongrass EOs were significantly reduced the growth and conidial germination of *A. flavus* and *A.niger* , as the complete reduction were recorded at high concentration of Chitosan (6g/l),Thymol(4ml/L) ,Thyme(6ml/L) , citral(4ml/L),lemongrass(6ml/L).Chitosan–Essential oils formula such as chitosan +thymol (4.0g/L+2.0ml/L), chitosan + citral (4.0g/L+2.0 ml/L) , chitosan + thyme (4.0g/L+3.0ml/L) and chitosan + lemongrass (4.0g/L+4.0ml/L)were the most effective treatments in decreasing linear growth and spore germination of the two pathogens compared with individually treatments and control . In storage trials, coated dates fruits after artificially inoculation by spore suspension of each *Aspergillus flavus* and/or *A. niger* by different formula of chitosan – Eos i.e., chitosan + thymol (4.0 g / L+ 2.0 ml/L), chitosan + citral (4.0g/L+ 2.0 ml/L) and/or chitosan + lemongrass (4.0 g / L+ 2.0 ml/L) caused significantly protective effect against rotting and spoilage infection caused by *Aspergillus flavus* and *A. niger* and prevent the development of fruit decay during 20 and 40 days of storage at 20°C. In fruit decay assays coatings based on chitosan incorporating essential oils Eos were able to reduce fungal decay in the range of 58 -74% at after 40 days of storage .Therefore, combination between chitosan and essential oils as fruit coating could be applicable safety for controlling post-harvest spoilage caused by phytopathogenic fungi on date's fruits instead of chemical and hazards fungicidal treatments.

Keywords: Natural products -Essential oil – Chitosan – Date - Postharvest decay-control.

Effects of thermal treatments on sawtoothed grain beetle , *oryzaephilus surinamensis*, quantitative and qualitative characteristics of date palm ‘Zahidi’

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Abstract

Stored product pests are the main problems which decrease post harvest quality. The use of thermal disinfectant treatments (coldness and warmness) are non chemical controlling of pests according to most countries accepted criteria. This study was carried out to investigate such treatments in substitute with chemical treatments as factorial experiment in completely randomized design with 3 replications. The factors were life cycle stages of Sawtoothed grain beetle in larva and adult stages and temperature at (-18, 45, 50, 55, 60° C). The effect of temperature was studied both in pest removal and dates quantitative and qualitative properties. Fruit characteristics such as peeling, TSS, humidity percent and fruit lose weight were measured. Data were compared with MSTATC. Results showed that 55°C temperature could kill 100 percent of larva and adult stage. Also, thermal treatments increased TSS, pH whereas decrease fruit weight and infection degree and had no effect on fruit humidity.

Keywords: Date palm, heat, cold, Sawtoothed grain beetle.

Antifungal activity of Tunisian *Phoenix dactylifera* L. extracts against plant pathogenic fungi

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Abstract

Use of synthetic fungicides for plant disease management has become crucial in the last decades in the agriculture system. Despite their highly effective, the abusive use of such compounds led to many environment and human health problems. Thus development of biofungicides, has become a pressing necessity. The main objective of this study is to evaluate the antifungal activity of *Phoenix dactylifera* L. extracts var. “Deglet Nour” and “Alig” against two pathogens attacking commercial crops: *Fusarium oxysporum* and *Rhizoctonia solani*. Fungicides effects of water, methanol, acetone and hexane extracts of fruits were assessed using agar dilution method with various concentration (1-10%). Aqueous extracts have the least antifungal activity as compared to methanol, acetone and hexane extracts which showed varying degree of growth inhibition of the tested fungi. The methanolic extract of Deglet Nour cv. date palm at 10% concentration (w/v) illustrated the stronger antifungal efficacy on mycelial growth of *R. solani* (80%).

Keywords: Antifungal activity, *Fusarium oxysporum*, *Phoenix dactylifera* extracts, *Rhizoctonia solani*.

SESSION 4

Technical Practices

Storage temperature effects on phenolic compounds in date fruits (*Phœnix Dactylifera* L.)

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Abstract

The purpose of this study was to determine the effect of the storage temperature variation on the content of phenolic compounds in dates of some date palm varieties (Deglet Nour, Ghars, Mech Degla, Degla Baidha).

The fruits of the four varieties have been preserved in varying degrees of temperature. To determine the effect of the varying degrees of storage temperature on the content of phenolic compounds, the total phenols, flavonoids and total tannins were measured. The differences were noted for the vast majority of the parameters studied. We found that there is a conservation temperature influence on the pH parameter which gives the right value (6.17 ± 0.04), and the low effect on conductivity. Determination of phenolic compounds, in particular total polyphenols in dates, showed a great richness of the Degla-Baidha variety stored at 4 ° C. (574.46 mg EAG / 100 g) compared to those of Mech-Degla, Ghars and Deglet (564.46, 554.35, 526.39 mg EAG / 100 g) respectively, and for the same varieties stored in high temperature the total and low polyphenol content. The total tannin and flavonoid content shows a great difference in these date varieties, where the best estimated levels of the two components in the Degla-Baidha variety at 4 ° C (110.43 mg EAT / 100g and 4.51 mg EQ / 100g) respectively. The results revealed that there was little effect of variation in conservation temperatures on flavonoids and total tannins, but the impact was clear, with respect to total phenols. The considerable quantities of these compounds were recorded at a temperature of 4 ° C.

Key words: Date palm, storage, tannin, flavonoid, phenolics, *Phœnix dactylifera* L.

**Architecture and colonization study of adult date palm root system
(*Phoenix dactylifera* L.)**

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Abstract

The aim of this work was to get basic knowledge about the growth, the architecture and the topology of the date palm root system and its spatial colonization in relation with some soil proprieties. This study was carried out for a period of six months, on three trees of Deglet Noor cultivar using as an experimental device, the rhizotron. The measured parameters were roots diameter, number per 10cm layer, density and biomass and soil physico-chemichal components. The data were collected weekly. The results allowed the definition of four topological orders on the basis of the root diameters, distributed in intervals corresponding to each order (first order: 10, 64 - 14, 12 mm; second: 7,16 - 10,64 mm; third: 3,68 - 7,16 mm; fourth: 0,2 - 3,68). A positive correlation was observed between roots diameter and density. The highest number of roots was recorded in the layer between 40 and 50cm. Moreover, the most important root density and biomass values were registered in the intermediate horizon characterized, according to our analysis, by a high rate of minerals nutrients, low apparent density and an important porosity. This leads us to conclude that the soil characteristics, notably the apparent densities and the organic matter richness, influenced strongly the distribution and the architecture of date palm root system.

Keywords: date palm, root system, root architecture, soil properties, rhizotron.

Studies on pollination of saidy date palms with different pollination techniques under el-kharga oasis conditions

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Abstract

The effect of different pollination techniques on fruit set, yield and fruit quality of saidy date palm cultivar were studied during 2013 and 2014 seasons. The experiment was designed to compare the effectiveness of different pollination techniques i.e. Hand pollination as well as artificial methods and their response to fruit setting percentage, yield and fruit quality. The treatments including hand pollination (traditional pollination), dusting of pollens 1.25g plus starch levels namely 1.25, 5, 8.25 and 12.5. Dusters was diluted each at 1:1, 1:4, 1:7 and 1:10 ratios and spraying of suspension pollens was at the same previous levels per L water. Results revealed that different pollination techniques had significantly affected the fruit setting and other quality parameters.

Is worth mentioning that the dusting pollination and spraying water suspension pollen with the use of starch as a carrier are better than the manual pollination to reduce the amount of pollens used as well as pollination process offers a good treatment of horticultural and economic aspects.

It is worth to mention that spraying water suspension pollen was better than dusting because it combines both mechanical pollination, fruit thinning and reducing the quantity of pollen grain.

Medium density fiberboards from the date palm residues a strategic industry in the Arab World

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Abstract

The success of the environmental movements world - wide has led to the decrease of wood availability in the world market, and hence the soaring of wood prices. This in turn has led to the increase of the burden on the balance of payment of the Arab countries, relying on the importation of wood to satisfy the needs of their populations in shelter, furniture, etc. Meanwhile, the Arab World includes the palm belt extending from Morocco in the far West to Iraq in the far East. Therefore, it makes sense to look to the date palm residues, mainly resulting from the palm pruning, as a sustainable renewable material base to locally manufacture wood substitute as, for the example, the composition panels including the medium density fiber boards (MDF) , particle boards , block boards , etc. Within a research project , conducted by the Faculty of Engineering , Ain Shams University with the collaboration of the ministry of environment, samples of the date palm secondary products have been collected in proportion with the available products of palm pruning(palm midribs , leaflets ,spadix stems and coir) , threshed and sent to the laboratory of Dshna MDF factory in Kena governorate .The result of tests confirm that the MDF samples, manufactured from the date palm secondary products, satisfy the mechanical and physical requirements of international standards ,of MDF boards . A technical and economic feasibility study has been conducted on a suggested industrial project to manufacture MDF boards in EL- Bahariah oases. The results of this study show that the profitability indicators of this project are high: the return rate on invested capital is (39.4%), the revenue: cost rate is (1.43:1), the payback period is 3.6 years and the internal rate of return is 36.2%. Thus the MDF industry could be considered a strategic industry in the Arab World.

Design of a quad copter for date palm pollination

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Abstract

Pollination is critical processes in the date palm production, where it affects fruit development, quality and yield. The traditional method of artificial pollination is based on the climbing the date palm trees (Manual pollination) which is a tedious, costly operation and needs much time to complete.

A quad copter has been designed and developed for date palms pollinating. The quad copter consists of three units: flight, pollination and remote control. The flight unit consists of a frame, motors, propellers, electronic speed controller, controller, battery and camera. The pollination unit is a tank for dispersing dust and a container for the dust; it has internal side inclination like a hollow cone. The remote control unit is responsible to control the flight copter, open the tank and monitoring the pollination process.

Some parameters were calculated for the copter: field capacity, pollination time and the pollination cost, the values of parameter were 120 tree/ day, 10.4 hours/ hectare and 23.4 \$/ hectare respectively.

By using the quad copter increased the field capacity to about 5 times, reduced the pollination time to about 80 % and reduced the pollination cost to about 73.2 % compared with manual pollination.

Keywords: Date palm, Mechanical pollination, Quad copter, Pollination cost.

Pioneer method for newly offshoots induction on head of aged date palm tree through injection of cytokinins.

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Abstract

Novel vision in *liliopsida* propagation. It's well known that date palm (*Phoenix dactylifera*, L) trees multiply in numbers by vegetative propagation through either low offshoots or plant tissue culture technique. Aged date palm trees use to stop deliver new low offshoots anymore absolutely. No success was realized related to this topic worldwide before. However, I succeeded in forcing aged date palm trees to give new high offshoots in its top (stipe/trunk growth point) close to canopy area by injection using cytokinins. Suitable crane was used to reach the trunk top. gimlet screw-tip No. 4 was used to make 4 holes reaching 15 cm depth in the trunk top, inserting syringe attached to 25 cm needle and injecting the two cytokinins types in top locations. First cytokinin was zeatin solution at the concentration (1.25 g) divided in two equal quantities and injected to 50 cm depth in two facing opposite locations. Second cytokinin was isopentenyl adenine injected to 25 cm depth using solution (3.25 g) was divided in two equal quantities and injected to 50 cm depth in two facing opposite locations. Unexpected amazing results was observed, fortunately each tree top gave 8 new vigorous offshoots growth after 3 months distributed regularly in its surrounding trunk. Newly formed offshoots after 1.5 years of its growth seemed to be similar to 4 years old traditional offshoots growths which usually grow from the trunk base. Vegetative by Head Injection, it can be considered method No. 4 in date palm propagation.

Keywords: *Phoenix dactylifera* L., growth regulators, vegetative head injection, Propagation.

Effect of using nano-boron versus normal boron on fruiting of barhy date palms

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Abstract

This study was conducted during 2016&2017 seasons to examine the effect of using nano-boron at 0.0125 to 0.1 % versus normal-boron in the form of boric acid at 0.025 to 0.2 % on fruiting of Barhy date palms grown under Minia region conditions, Egypt.

Treating the palms with both nano-boron or normal-boron at the previous concentrations had an announced promotion on growth, palm nutritional status, yield and fruit quality compared to the control treatment.

Using nano-boron at the lower concentrations namely 0.0125 and 0.025 % considerably was Superior than using the higher concentration of normal-boron namely 0.1 and 0.2 % on promoting all parameters. Using nano-boron at concentration higher than 0.025 % failed to show measurable effects.

For promoting yield and fruit quality of Barhy date palms grown under Minia region conditions, Egypt, it is recommended to spray the palms three times with boron via nano system at 0.0125 %.

Keywords: normal-boron, nano-boron, Barhy date palms growth, yield, fruit quality.

Date palm production and water productivity under subsurface drip irrigation system

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Abstract

The majority of date palm cultivation in Oman is irrigated using flood irrigation method and less than 10% is irrigated by bubbler irrigation system. Subsurface drip irrigation (SDI) has been proved as a water saving method that increase both crop production and water-use efficiency (WUE). However, it is not tested for date palm irrigation. An experiment at Al-Kamil Research Station in Al-Sharqiyah North governorate was conducted from 2013 to 2016 to evaluate subsurface drip irrigation system in terms of date palm production and water productivity (WP) for date palm irrigation and compared with bubbler irrigation system which is recomended for date palms irrigation. Four irrigation treatments were 100% ET_c using bubbler irrigation, 60%, 40% and 20% ET_c Subsurface irrigation system. Irrigation scheduling was developed based on crop evapotranspiration ($ET_c = ET_o \times K_c$), ET_o was calculated by Penman-Monteith equation on CROPWAT program using climatic data from nearby weather station. Crop coefficient was taken to be 0.90 (FAO, 1991). The results show no significant differences in fruit production between date palm trees irrigated by 100% ET_c using bubbler system and those irrigated with 60% of the water requirement under sub-surface drip irrigation system. Fruit production was significantly reduced under the irrigation with 40% and 20% of ET_c under sub-surface drip irrigation system as compared to that irrigated with 60% ET_c. The highest WP of 4.7 kg/m³ was obtained at the rate of 20% of the water requirements under sub-surface drip irrigation system. All the results proved that sub-surface drip irrigation system contributes to 40% water saving without reduction in fruit production of date palm trees.

Key words: Date palm, Water productivity, Subsurface drip irrigation.

The effect of mycorrhiza and organic fertilizers on the growth of four date palm seedlings under nursery conditions

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Abstract

Two years' experiments were carried out at Al Hamrania Research Station (UAE) during (2015-2016) to explore the role of Mycorrhiza inoculation and organic fertilizers on the growth of Date palm seedlings under nursery conditions. Uniform seedlings of selected four date palm cultivars (Barhi, Khalas, Sultana and Madjool) were planted into 10-L pots. The Randomized Complete Block Design (RCBD) was used in this study experiments which involved application of: (T1) recommended 100% chemical fertilizer only, (T2) 100% of recommended organic fertilizer only, (T3) Mycorrhiza without any fertilization, (T4) mycorrhiza + 100% recommended chemical fertilizer, (T5) Mycorrhiza + recommended 50% organic fertilizer, (T6) mycorrhiza + 50% chemical fertilizer and (T7) Mycorrhiza +25% chemical fertilizers +25% organic fertilizers.

The results indicated that the use of Mycorrhiza with 100% of recommended organic fertilizers rate were increased significantly by 23% and 25% of the seedling leave growth rate and leave numbers per seedlings, respectively, when compared with the control treatment (without mycorrhiza application). This greenhouse study also indicated that half the amount of organic fertilizers application had similar effects when compared with 100% organic fertilizer when mixed with mycorrhiza for seedling leave numbers for all date palm cultivars.

Key words: Mycorrhiza, date palm, organic fertilizers, compost, seedling, leave growth rate.

Study of the disinfection and soil moisture preservation treatment on establishment and growth of Madjol date offshoots

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Abstract

Medjool date is one of the most important commercial and export date rest of the world. In recent years, several tissue culture seedlings of the date palm imported to Iran and some of them were cultured in Khuzestan province. After 10 years, they had just few offshoots; so in order to increase potential of offshoot stability, this experiment was carried out during 2012 to 2014. This study has been done by using factorial design with two main factors: treatment and control. In treatment field, planting and maintenance of offshoots were carried out based on the disinfection of the offshoots by fungicide *Mancozeb* and *Benomyl* and insecticide *Chlorpyrifos* during plantation of the offshoot, and in control part, no pesticides were used. Subplot was how to preservation of the soil moisture for offshoots with eight treatments: Straw mulch, sorghum intercropping, use of super absorbance polymer with 50,100, 200 gr/offshoot, use of sulfur with 500 and 1000 gr/offshoot and without any treatment as control. For every subplot, there were planted seven offshoots. Altogether, there were cultured 56 offshoots in both main plots. Irrigation was done by babbler irrigation system. After second year, In Feb. and March, there were measured a few various factors of plant growth, including percentage of offshoot stabilization, height of plant, trunk diameter, number of completed leaves, and average of leaf length and termite infectivity percentage. Statistical comparisons between experimental factors were done by using of statistical software SAS. The results showed that there was a significant difference between treated and control plot in some vegetative index Such as trunk diameter, number of completed leaves and average of leaflet. There were no significant differences among treatment of soil moisture preservation. Additionally, there was no significant differences not only between treated and control plot in offshoot stabilization and termite infectivity percentage, but among treatment of soil moisture preservation.

Key words: Medjool, offshoot, disinfection, soil moisture preservation, Khuzestan.

Study of levels and methods of iron fertilization on quantity and quality of date palm ‘Kabkab’

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Abstract

Date palm is one of the most important trees in calcareous soils in southern region of Iran. According to low availability of iron in these kind of soils the evaluation of methods, source and levels of iron fertilizers and their effects on date palm yield and quality are sensed to be essential. This experiment was conducted on Randomized Complete Block Design with three replications in Bushehr province on Kabkab cultivar. The treatments include: iron sulfate injection in four rates (0, 25, 50 and 100 g. tree⁻¹), soil application of iron sulfate in two levels (1000 and 2000 g. tree⁻¹) and soil application of two levels of sequestren 138 (100 and 200 g. tree⁻¹). A treatment without application of iron was considered as blank. Results showed that iron has significant effects on yield, quality and some nutrients concentration in leaves. Maximum yield and quality obtained by injection of 25 g. tree⁻¹ FeSO₄ to the trunk of trees. Also, iron injection to the trunk of trees was more effective in increasing Fe concentration in the leaves. Decreasing in Mn concentration in the leaves by iron injection was showed, too.

Key words: Iron, Injection, Soil application, Sequestren 138, Date palm, Cultivars.

Effects of nitrogen, phosphorus and potassium on yield and quality of kabkab date palm in Iran

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Abstract

Date palm is one of the most important trees in calcareous soils with low organic matter in southern of Iran. Due to low availability of N, P and K in these soils, the evaluation of such nutrients effects on date palm yield and quality are sensed to be essential. This experiment was conducted on Randomized Complete Block Design with three replications on four locations in Bushehr province for two years. Four levels of N (0, 276, 556, and 828 g N. tree⁻¹), four levels of P (0, 184, 368, and 552 g P₂O₅.tree⁻¹) and four levels of K (0, 450, 900, and 1350 g K₂O.tree⁻¹) were the treatments of this experiment. An additional treatment without application of any nutrients was considered as control. Results showed that treatments didn't have any effects on yield and quality of date palm in the first year of experiment. Mean application of N up to 276 g. tree⁻¹ increased yields about 41.8 % in the second year of experiment. Effect of P on yield was influenced by year and location of experiment. Mean application of P up to 368 g P₂O₅.tree⁻¹ increased yield about 55.9 % in the second year. Also pulp to seed ratio and fruit TSS were affected by phosphor. Mean application of K up to 450 g K₂O.tree⁻¹ increased yield about 46.2 % in the second year of experiment. Application of entire nutrients without K proved no significant effects on yield of date palm. Pulp to seed ratio increased from 11.56 to 12.78 with mean application of 450 g K₂O.tree⁻¹. Also mean application of 1350 g K₂O.tree⁻¹ increased fruit TSS significantly.

Key words: Nutrients, Date palm, Calcareous soil.

Study the effect of plant growth regulators on the quantitative and qualitative characteristics of Piarom, Helileh and Shahani dates

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Abstract

To evaluate the effect of plant growth regulators on quantitative and qualitative characteristics of varieties of palm Piarom, Helileh and Shahani in 2015 in one of the trees groves research in factorial randomized complete block design with five treatments and three were repeat . Number of 12 trees palm fruit from the above figures that have the same terms of age, growth, feeding and watering selected and tested with 8 clusters of seed palms male pollen Shahani Pollination and envelopes were tagged. After mark scheme based on random maps, at the 6 week (Hababok stage) and 10 weeks (Kimeri) after pollination of the Palm 5-uniform cluster selection and map-based cluster randomized design (each cluster a random repetition of a random group) were treated. Treatments in this experiment are: Benzil Adenin, Gibberlic acid and Naphthalene acetic acid concentration of 50 milli grams per liter and treated each combination BA, GA3 and NAA concentration of 25 mg / L each and all of them in the end during the period of approximately 23 weeks after pollination influenced Ethefan sprayed with a concentration of 1000 mg/L were also a number of palm trees was examined as a witness. At the time of each of the digits in length, diameter, weight fruit, meat weight, kernel weight, soluble solids, pH, dry weight, harvest index than the core meat and juice of cholera control measures examined respectively. The results of the study showed that treatment with NAA increased length, thickness, weight fruit and meat to the nucleus and nucleus were compared. TSS in the control treatments, the dry weight of the combined treatment more and more acid pH levels in GA3 treatment of other treatments. Percent more than the investigation of all treatments was observed. According to the results, treatments containing NAA and sprayed with a concentration of 1000 mg/ L Ethefan improve the quantity and quality of three varieties were suitable date.

Keywords: Hababok, Kimeri, Ethefan, factorial, randomized complete block.

Study the response of three date palm cultivars (Kabkab, Zahidi, and shahabi) to deficit irrigation in Southern Iran

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Abstract

There are more than 5.5 million date palms in Bushehr province in southern Iran. Proper utilization of water supplies in order to increase water use efficiency and also, identification of more tolerant plants are so sensed according to recent drought in the region. Although, date palm can suffer water shortage for a long time but higher water levels and annual soil temperature between 17 to 45 centigrade degrees would make the highest production. Therefore, a study was conducted to determine the responses of three date palm cultivars 'Kabkab', 'Zahidi' and 'Shahabi' to deficit irrigation. This experiment was carried out on Randomized Complete Block design with three replications during 2004-2007. The irrigation treatments of this study were water depth in four levels (35- 50 -65 percent of IW, which shows the cumulative evaporation of class A pan). Trees responses were evaluated in each year for the following properties: fruits and seeds weight, length and diameter, pulp to seed ratio, TSS, pH and yield. Results showed that cultivar effect was significant in all date palm responses ($p>0.01$) which can prove different inherent qualitative and quantitative characteristics in date palm cultivars. Zahidi cultivar proved to have higher water use efficiency in water stress conditions during drought periods. Irrigation treatments affected only the yield responses. Although, I3 showed to have higher production abut it was classified in the same statistical class with I2. This means that in the situation of water shortage, I2 would be the choice. Also, mean water usages during three years of the experiment were 5497, 7758 and 9822 m³ ha⁻¹ yr⁻¹ in the irrigation treatments.

Key words: date palm, drought, deficit irrigation, yield, water efficiency

Influences of bunches bagging with different materials on yield and fruit quality of “Khalas” date palm cultivar

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Abstract

Date palm trees grown in hot arid zones are facing abiotic environmental stresses. Both of tree productivity and fruit quality characteristics responded negatively especially weight and size of fruits. Bagging is a physical technique commonly used with many crops to protect the fruits from diseases, pests and to improve the micro-climate in which the fruits grown. This study was conducted during 2015 and 2016 seasons at the Research and Agricultural Experimental Station, King Saud University, Riyadh, Saudi Arabia. Different materials of bagging were used to investigate its effect on yield and fruit quality of 10 years old ‘Khalas’ date palm cultivar. Bunches were pollinated by placing 10 ‘Meghal’ fresh male strands among female strands during both seasons. Two bagging materials (polyethylene and grill cloth) were performed on bunches during kemry and khilal stages however bunches without bagging were used as the control. All the bagging treatments improved yield, bunch weight, fruit weight, total and reducing sugars contents as compared to the control treatment. The best results in physical and chemical properties resulted from polyethylene bagging treatments. Generally, bagging with polyethylene application treatment could be recommended to improve the yield and fruit quality of ‘Khalas’ fruits under the current study conditions.

Key words : date palm, ‘Khalas’ cultivar, Bagging, yield, fruit quality, Riyadh.

Response of date palm (*Phoenix dactylifera* L.) cv Majhoul to deficit irrigation strategies

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Abstract

Regulated deficit irrigation is one of the ways to save water in regions with limited water resources, while limiting the impact on crop yields. To test the effectiveness of this approach on the productivity of date palm cv Majhoul, an experiment was conducted in Tafilalet (Morocco) for two consecutive years (March 2012-February 2014). The annual cycle of growth and development of this variety was divided into three distinct periods: the first from November to February, the second from March to June and the last from July to October. During these times, seven water regimes were applied under drip irrigation: farmer regime (T0), 100% (T1), 80% (T2), 60% (T3), 80-100-60% (T4), 150% (T5) and 60-100-80% (T6) ETM. The measures focused on the monitoring of meteorological parameters, the water irrigation and the evolution of date yields of Majhoul variety.

The results at the end of the second year of this trial show that: i. Water regime has significantly affected the average yields and water use efficiency, ii. Water irrigation needs are, on average, 51 m³/tree/year, varying between 30 and 76 m³/tree/year, and iii. Average date yield and water use efficiency by water regime are 31, 61, 46, 39, 43, 45, and 59 kg of dates/tree/year and 0.44, 1.20, 1.13, 1.30, 1.07, 0.59, and 1.36 kg of dates/m³, respectively for treatments T0, T1, T2, T3, T4, T5, and T6. Thus, the water regime T6 has improved the water use efficiency and the conservation has allowed 14% of water irrigation compared to the T1. The regulated water stress strategy contributes to the rationalization of water and sustainability of oasis.

Keywords: Regulated deficit irrigation, date palm, Majhoul, water use efficiency.

Effect of post-harvest hot water dipping treatments on promoting ripening of dates (Cv. Aseel)

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Abstract

The efficacy of Hot Water Dips (HWD) technique was investigated on artificial ripening of cv. Aseel dates. The fruit samples were collected at maturity with 240-260 mm Hg cm⁻² hardness prior to onset of rutab stage. The study is divided into two parts, in first part the fruit samples were dipped in hot water (1 kg/l) at temperature of 35, 70, 90 and 100°C for 5 min. While, the second part comprised of effect of different intervals (1, 3, 5, 7 and 9 min) of hot water at 70°C. The physical and chemical parameters along with ripening percentage and organoleptic tests were measured after 72 and 116 h of drying period. The maximum physical features of date samples were found at 72 h incubation period due to lesser ripening ratio, however 116 h incubation period proven best in full ripening/curing. The maximum ripening% (82%) and overall acceptability (was obtained after 116 hours as compared to 72 hours of drying period on 70°C. The samples treated with 3 & 5 HWD treatments proved best as were not stinging in taste might be due to precipitating of tannins during incubation period. The method advocates that when the significant ripening can be induced at khalal stage at least 2 weeks before the onset of monsoon then the prolonged rutab formation through natural ripening is absolutely unnecessary to avoid post-harvest losses.

Role of silicon in alleviating salt stress in date palm (*Phoenix dactylifera* L.)

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Abstract

The date palm (*Phoenix dactylifera* L.) is the most important fruit crop of the arid to semi-arid regions of the world where salinity is the key factor that threatening the crop productivity. Hydroponic experiment was performed to assess whether exogenously applied silicon could ameliorate the hazardous effects of salt stress on date palm. Two date palm cultivars (Sugai and Amber) were grown under varying levels (Control, 15 mM NaCl and 30 mM NaCl) of salt stress and silicon (5 mM) in sole and combined form. Elevated level of salt stress results in more reduction in morphological attributes, chlorophyll contents, gas exchange parameters, relative water contents (RWC), membrane stability index (MSI), K concentration and increased the hydrogen per oxide (H₂O₂), thiobarbituric acid reactive substances (TBARS) contents and Na concentration in leaves and roots of both cultivars relative to other levels of salt stress. Application of salt stress alone decreases the activities of key antioxidant enzymes (SOD, POD & GR) in leaves and roots, however CAT activity remained almost unchanged in all treatments in both cultivars. Application of Si significantly improved the growth, chlorophyll & gas exchange attributes, RWC, MSI, K / Na ratio, antioxidant enzymes activities and prominent effect was observed at medium level of salt stress (15 mM NaCl). The performance of sugai cultivar was better relative to amber in all treatments. It was concluded that Si alleviates salt stress inhibited growth and photosynthesis through increase in antioxidant enzymes activity, K concentration and decrease in Na concentration in leaves and roots.

Salinity effect of irrigation water on the quality of the Deglet Nour date

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Abstract

Dates fruits and specifically the Deglet Nour variety are a fundamental nutrient for oases people and they present an important source of currency for the country. This variety is an important heritage to the country to be maintained and preserved. In Tunisia, the amount and the quality of water available are becoming increasingly scarce and poor. This problem has a direct impact on the fruits of Deglet Nour variety. For that, the objective of this work is to evaluate the effect of salinity concentration, in irrigation water, on the quality of Deglet Nour fruits.

Three salinity concentrations of irrigation water (2g / l; 4 g / l and 6.5 g / l) are used to irrigate the plots of Deglet Nour's palm. The selected plots have the same planting age (24 years), the same plantation density and the same cultivation techniques are applied. Samples are taken from three different Deglet Nour palms from each plot.

The results revealed a depreciation of date quality under water irrigation salinity above 4g/l. the most affected parameters are mainly the fruit dimensions as well as their weights which have significantly decreased. An increase in fruit firmness was also recorded as a direct result of the water content and the water activity decrease. Also, we observed a decrease of the pH and an increase of the titrable acidity. An increase of the antioxidant activity was determined in fruits under salt stress (4 g / l).

It should be mentioned that these results are very important for the decision-making for the new plantations of Deglet Nour palms.

Keywords: Tunisia, climate change, Date fruit, water salinity, susceptibility.

Technical and allocate efficiency of date palm producer farms in the United Arab Emirates

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Abstract

The objectives of this study are: a) to analyze the economic efficiency (technical as well as allocative efficiency) of date palm farm in the UAE; and b) to investigate factors that underlie efficiency variation among date palm farms. The date palm is a strategic crop of the UAE since it plays a significant role in the country's agricultural and environmental resources management, maintaining the socio-cultural heritage, and contributing to farm income and food and nutrition security. In the UAE's desired national strategic goal of raising agricultural productivity and ensuring sustainable management of productive resource basis (land, human, fresh water, capital and energy), date palm production continues to have a vital role to play. The interest in efficiency studies in agricultural production system emanates from the very fact that productive resources are scarce and, hence, the farm business aims at raising productivity and an efficient use of the scarce resources. Technical efficiency is the ability of a productive firm to obtain maximum output from a given set of inputs used while allocative efficiency is the ability of a firm to use productive inputs in economically optimum proportion. This study uses a cross-sectional primary survey data collected in 2016/17 from 130 date palm farms in the UAE. A two-stage approach is employed in the data analysis. First, stochastic frontier production and cost functions are estimated using Frontier 4.1 and maximum likelihood estimation method to determine technical output and cost efficiency levels of the sample farms. At the second stage, regression models are analyzed to determine the effects of farm characteristics and socio-economic factors on farm efficiency. The average area of the date palm plots is 2.5 hectares and the average number of palm trees owned by farms is 380 out of which 80% are productive. On average, the sample farms produce 7 tonnes of date per hectare while the irrigation water use efficiency of date is 1.9 kg/per cubic meter. The data shows that it costs farmers around 9 Dirhams to produce a kilogram of date which is slightly below the average farm gate price of 13 Dirhams per kg, enabling an earning of gross margin (profit) of 4 Dirhams per kilogram. Analysis of the data reveals that average technical production efficiency of the sample farms is 65% (ranging from lowest 20% to highest 90%). The technical efficiency analysis relates to the level of productive use of land, labour, organic fertilizers and irrigation water in date palm production. The result also shows that 44% of the variation in production is attributed to inefficiency. Some 20% of the sample farms attained only up to 50% technical efficiency while close to 50% have efficiency levels between 50% to 75%. The average cost efficiency of the sample farms is found to be 71% with a range between 21% to 89%. 38% of the variation in the cost of production is attributed to cost inefficiency. These results show that there is a room for improving the productivity of the date palm farms by an average of 35% using the existing resources. Similarly, production cost could be minimized by an average of 30%. Preliminary investigation of the underlying causes of inefficiency shows that with increasing size (area) of the date palm farms technical

efficiency declines. The finding well conforms with the established knowledge that says small farms are more efficient than large farms. On the other hand, with increasing number of trees per hectare and increasing percentage of productive trees out of the total (some trees are not yielding), efficiency increases. Production inefficiency increases with increase in plot area, and the deeper the ground water level of irrigation water well at farms becomes. Inefficiency tends to improve through time as the plantation gets older.

Impact of UVB and elevated level CO₂ on growth and physiology of date palm in open top chambers

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Abstract

Since the date palm is considered as an important subsistence crop in most of the world's desert areas, the study on the effect of day-to-day increasing stress factors on the much important plant. Abiotic stresses such as elevated level CO₂, UVB cause substantial damage to date palm resulting in annual losses estimated in billions of dollars worldwide. The crop, being a desert plant, has evolved strategies to protect itself against most of these stresses. However, the projected changes in climate, weather extremes and interaction among the various abiotic stresses will have profound impact on the date palm adaptation and production. Therefore, it is imperative to evaluate the responses of various growth and biochemical parameters of date palm to the combinations of environmental factors. Major emphasis on the research on date palm has been placed by the UAE government and the Gulf Cooperation Council in the Middle East regions. Most of the previous studies have largely focused on the quality aspects of the date palm fruits and seeds. However, the research on the evaluation of the climate change impacts on the date palm has received little attention, thus far. As mentioned previously, the changes in climatic conditions are inevitable. Therefore, the present emphasizes the evaluation of date palm responses to UVB and elevated level CO₂. As some of the outcomes of this research, the identified date palm varieties and traits tolerant to abiotic stresses will be valuable assets for the growers and breeder for the development of new varieties suited for the UAE growing conditions. The results will also advance our understanding by elucidating the various physiological and biochemical mechanisms responsible for the abiotic stress tolerant characteristics among the date palm varieties.

Response of date palm (*Phoenix dactylifera*) cultivars to the ultraviolet-B radiation

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Abstract

The Ultraviolet-B (UVB) radiation is an integral part of the sun light and adversely affects the growth and development of date palm (*Phoenix dactylifera*) cultivars. Although, date palm is an economically important fruit crop and the majority the world's production is centered in the Arabian Peninsula, studies evaluating, studies evaluation date palm genotypic diversity and response to the UVB radiation are limited. To investigate this, five commercially grown date palm cultivars were exposed to the current (control) and two elevated levels (four and eight hours per day) of elevated UVB (UVB) radiations. The UVB radiation decreased plant height and leaf number by 8-14%, shoot root fresh weight by 66-87% and dry weight by 20-23%, total chlorophyll and carotenoids concentrations by 22-28% while increased the proline and UVB absorbing compounds (phenolics) by 142% and 17.5%, respectively, across cultivars. These changes were more pronounced under the eight-hour UVB exposure. In general, roots tended to have greater concentrations of S and N by ≈ 1.4 folds, Co, Na, and P by 3.3-7 folds than shoots when averaged across cultivars and treatments. However, under UVB, several mineral concentrations were either increased (e.g, Ca, Co, Fe, Mn, P) or decreased (e.g, K, Mo, S, N) consistently in shoots and roots. Exception to this rule was the Na concentration that increased in the shoot (9-45%) but decreased in the roots (8-10%) under UVB. Thus, the response of the date palm cultivars to the UVB was dependent on the measured traits exhibiting decline in the growth parameters despite the increase in the UVB absorbing compounds and the tissue concentrations of several minerals. The principal component analysis (PCA) showed that the cultivars differed similarly in response to a given level of UVB treatments. Based on the PCA cultivars were grouped into two groups as BARHI and FRDWT in one group while KHD, NBSTF, and RFDRD in other group.

Sustainable irrigation management with saline groundwater of three date palm cultivars in the hyper-arid United Arab Emirates

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Abstract

In Abu Dhabi, groundwater is a non-renewable resource. On average, only 5% of what is used annually is recharged through return movement of water to groundwater. Abu Dhabi, and the UAE in general, faces a significant challenge that threatens groundwater security. One of the key strategies for addressing Abu Dhabi's groundwater sustainability includes regulating for the responsible use of available groundwater. In 2017 EAD announced the new *Law No. 5 (2016)*, the Groundwater Organisation Law for Abu Dhabi Emirate. The main objective of this new law is to ensure proper management of groundwater resources in the Emirate. Groundwater-extraction limits and usage allowances will be set under Law 5.

Irrigation of date palms consumes about one third of groundwater use in the UAE. Here we provide initial assessments of the usage allowances that could be considered in regulations for the irrigation of date palms with water of different salinities to maintain date production.

Since 2014, we have been monitoring directly the water use of three mature varieties of date palm trees at the International Center for Biosaline Agriculture (ICBA) near Dubai City (Lulu, Shahlah and Khalas). Current practice is to irrigate the date palms with up to 275 L/tree/day throughout most of the year. The three varieties were selected from a large group of 18 varieties from the Arabian Peninsula, which have been grown under three salinity levels (5, 10 and 15 dS/m) for over 12 years. The three selected varieties represent diverse responses to salinity in terms of growth and yield potential.

Direct measurements of actual tree transpiration by sapflow monitoring have revealed the seasonal pattern of actual water use throughout every day of the year for the three varieties. We have also monitored the changing pattern of rootzone soil-water content, and soil salinity, using time-domain reflectometry. Two levels of irrigation salinity, S1 at 5 dS/m, and S3 at 15 dS/m, have been studied. We have found that the S1 date palms use about 150 L/day of water during summer, and about 50 L/day in winter. The S3 date palms consume about 65% of the water of those of S1 as because of the higher salinity they are smaller trees.

We have suggested that irrigation usage-allowances include a 25% factor-of-safety, plus another 25% to ensure an adequate salt-leaching fraction. Seasonal patterns of daily irrigation are proposed that would enable annual irrigation savings of up to 35% in groundwater extraction, whilst maintaining date production.

Impact of salinity on growth and development of eighteen date palm varieties from the Arabian Peninsula

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Abstract

Date palm species is recognized as one of the most salt tolerant among fruit trees and tolerates high level of salinity, harsh weather, heat stress and the desert environment in general. However, despite the high tolerance, the continued increase in salinity and the multiple stresses the date palm agro-ecosystem are subjected to, have led to severe reductions in yield and general health of date palm stands. Estimation of the impact of salinity on date palm yield, fruit quality, growth, and survival are available through many studies from different part of the world where date palm is growing. However, most are limited in scope due to the nature of the tree slow growth and the fact that salinity has increased gradually and in many cases affected well-established trees. Long-term field evaluation of the impact of three levels of irrigation water salinity (5, 10 and 15 Ds/m) on growth and development of eighteen date palm varieties from seedling stage o maturity was conducted at the International Center for Biosaline Agriculture (ICBA) in the UAE. Five different parameters used to characterize date palm growth in response to salinity stress, namely Plant Trunk Height, Plant Trunk Diameter, Average Old Leaf Branch length, Av Small Leaf Branch length, and No. of leaf branches per plant. Among the five traits, plant height was significantly decreased at all water salinity levels (10, and 15 d Sm⁻¹) when compared with lower salinity or control (5 d Sm⁻¹). The % reduction in trunk height from the varieties from UAE ranged from 21-58% and for the varieties from KSA from 30-61%. Varieties Fardh, Lulu and Barhi were the least affected by the high salinity levels, while Khnizi and Ajwat Al Madinah the most affected and suffered from nearly 60% reduction. Such varietal specific responses will later be seen to correspond to their yield response to salinity. The other parameters where also significantly affected by increase salinity levels but were reduced to a lesser degree than the trunk height. Estimates of total leaf area showed reduction by salinity of up to 58% in salt-sensitive varieties like Shahlah, while in salt-tolerant varieties like Lulu the reduction was in the range of 33%. Variations among the varieties in terms of potential growth under low salinity and the impact on their growth under high salinity were very evident. Variety like Abu Maan exhibited the highest vegetative growth traits at all salinity levels followed by Lulu and Fardh. Shahla has high vegetative growth at low salinity but was significantly reduced at the high salinity making it a highly sensitive variety to salinity. Abu Mann can be considered a good variety for landscaping purposes where the objective is higher growth regardless of salinity. Correlations between the various growth parameters and fruit yield are further elaborated in the paper.

Effect of cultivars, quantity of irrigation water and spray with bio – growth promoter(Delzi)and their interactions on the quality and yield characteristics of date palm fruits *Phoenix dactylifera* L.

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Abstract

Present study has been conducted on the two date palm cultivars Shwethee and Khadrawi To see the effect of the irrigation quantity of water (0, 70 and 140) Liter/ tree / week with spraying the tree with bio – growth promoter ' Delzi' (2 and 4 ml / L) on the quality and yield characteristics of date palm fruits .The cultivar shwethee significantly superior in yield in comparative with cultivar Khadrawi. The cultivar shwethee recorded significant decreased in the percentage of total sugar, non – reducing sugar percentage of fruit ripening and full comparative with cultivar khadrawi. The irrigation treatment (140 L/tree/week) significantly superior in increase the fruit flesh, reducing and total sugar, the rate of percentage of fruit ripening and yield in comparative with control and 70L/tree/week treatments. The findings revealed that spraying with (4ml Delzi /L) significantly superior on other treatment. The results show that the interactions between shwethee cultivar and the irrigation treatment (140 L/tree /week) whereas it gave rise the significantly superior in fruit flesh and yield, moreover less fruits falls and less sucrose, comber with the treatment (khadhraawi cultivar + 140 L/tree/ week) gave rise the significantly increased in reducing sugar and total sugar and percentage of fruit ripening with other interactions treatments. The results show that interactions of shwethee cultivar and spraying with (4 ml Delzi/L) whereas it gave rise the highest significantly superior in fruit flesh, yield, less fruit falls and less sucrose. whereas the interactions of khadhraawi cultivar and (4 ml Delzi /L) gave rise the significantly increased in reducing and total sugar, percentage of fruit ripening comparative with other interactions treatments. The dual interaction between of irrigation treatment and spraying with Delzi (140L/tree/week+ 4ml Delzi/L) shows significantly increased in fruit flesh , reducing and total sugar , percentage of fruit ripening , sucrose in fruit and yield compare with other treatments .The triple interaction treatments (shwethee + 140 L/tree/ week + 4 ml Delzi/L) significantly superior in fruit flesh , percentage of fruit ripening and yield whereas the treatment(khadhraawi cultivar + 140 L/ tree / week + 4 ml Delzi /L) gave rise the significantly increased in reducing and total sugar and percentage of fruit ripening comparative with other treatments .

Improving of yield and fruit quality of "Ajwa" date palm through bunches spraying with potassium

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Abstract

The present study was conducted during the two successive seasons, 2015 and 2016 at the Research and Agricultural Experimental Station, King Saud University, Saudi Arabia, in order to investigate the effects of foliar sprays on "Ajwa" date palm cultivar by Potassium Nitrate (KNO_3) or dipotassium phosphate (K_2HPO_4) at 1 or 2 %. Bunches were spraying at twice 4 and 8 weeks after pollination (mid April and mid May) in both seasons. Yield and fruit quality were studied. Treatments significantly improved yield, fruit physical characteristics (fruit weight, flesh weight, fruit volume, fruit length and fruit diameter) and fruit chemical characteristics (TSS, Acidity and sugar contents (Reducing, Non- Reducing and total sugars), by most tested treatments in both seasons than the control (water only). It can be concluded that foliar application with KNO_3 at 2% recorded the best treatment to obtain the highest yield, fruit weight, flesh weight, fruit volume, fruit length and fruit diameter, while K_2HPO_4 at 2% treatment gave the highest TSS% and total sugar contents in this study.

Key words: Date palm; potassium nitrate; dipotassium phosphate; yield; fruit quality.

Development and performance evaluation of stripper machine for Al-Mabsili dates

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Abstract

Al-Mabsili is one of the famous dates in Oman that harvested before reaching the fully ripen stage and then fruits are separated manually without using any mechanical method. The aim of this study was to design and develop a date stripper prototype with three power sources and to compare mechanical and ergonomic performance of the machine with traditional method. Three power sources used were bicycle, exercise machine and electric motor. Based on preliminary tests, heartbeat and work rate of operators became steady-state after stripping 5 bunches of date and thus tests were conducted for minimum 5 bunches. The results of the human physiological parameters showed in all power sources, significant increase in heartbeat, systolic and diastolic blood pressure, oxygen consumption and body temperature with date stripping activity. The calories burnt and energy expenditure per kg was highest in traditional method (2.3 kCal/kg, 14 kJ/kg) while bicycle and exercise machine had the higher energy expenditure rates (25.7 and 24.3 kJ/min). The stripping efficiency of all power sources was high and above 95%. The working capacity of bicycle method was highest with 804 kg/hr followed by exercise machine and motor (451.2 and 351.2 kg/hr) and lowest in traditional method with 63.3 kg/hr. The electric motor caused most bruises and scratches in dates (4.7%) and lowest (0%) in traditional method. The exercise machine had highest percentage of dates without calyx (19.3%) and traditional method had lowest (3%). Dates thrown by the machine were not significantly different among methods (0.51-0.57% by weight). The Cornell whole-body postural discomfort evaluation showed the exercise machine with highest comfort level while the traditional method was lowest. In Cornell hands discomfort evaluation, right hand was more affected than the left in all methods. The Cornell seat comfort evaluation showed exercising machine is in more comfort zone (66.7%), bicycle in average zone (51.9%) and traditional method in poor comfort zone (9.3%). In adoption justification of the machine, the break-even points between traditional and three power sources were occurred at 6,635 kg for electric motor 6,730 kg for bicycle, and 7,460 kg for exercise machine and time to reach break-even point, the bicycle 1.1 day, exercise machine 2.1 and electric motor 2.4 days. The average NIOSH lifting index was 0.54 which is a very satisfactory condition. The questionnaire survey revealed that the stripping of Al-Mabsili dates were done manually without using any device by mostly from hired labors and family members. Traditional stripping was done by sitting on the ground, 5-10 minutes required to separate each bunch. Ninety percent respondents preferred electric motor as power source followed by bicycle. In general, good trends were obtained in all tests, however it was recommended to conduct tests for a longer period of time.

Key words: Date stripper, performance evaluation, ergonomics, comfort evaluation, lifting index, break-even analysis, efficiency, capacity.

A special machine for Dates

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SESSION 5

General Topics on Date Palm

Antioxidant and acetylcholinesterase inhibitory activities and phytochemical analysis of extracts from *Phoenix dactylifera* L. (Arecaceae)

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Abstract

Phoenix dactylifera L. parts (fruits, leaves, pollen) have traditionally been used for treatment of a range of ailments such as diabetes, hypertension, atherosclerosis, cancer and infertility [1-3]. In the present study, the antioxidant and acetylcholinesterase inhibitory activities of extracts from leaves and pollen of *P. dactylifera* were investigated by 2,2'-diphenyl-1-picrylhydrazyl (DPPH) and acetylcholinesterase assays. Phytochemical analysis was made by TLC using authenticated standards. Dried leaf and pollen were extracted successively by dichloromethane and methanol, respectively. The hot-water and polyphenol extracts were also performed. All the extracts from the different parts of the plant showed antioxidant activity. The methanol leaf extract was the most active extract with the IC₅₀ of 13.48 ± 0.32 µg/mL. In bioautography assay, the methanol leaf extract was also the most active showing several active zones. Only the polyphenol and methanol extracts from leaves showed acetylcholinesterase inhibitory activity with IC₅₀ of 310.58 ± 0.74 and 382.05 ± 10.68 µg/mL, respectively. Two flavonoids (flavan and rutin) were identified by TLC analysis. These results suggested that *P. dactylifera* can be used in the treatment of neurodegenerative disorders such as Alzheimer and as sources of natural antioxidants in food industry. Further investigations are required to characterize the non-identified phenolic compounds.

Keywords: *Phoenix dactylifera* L.; antioxidant; acetylcholinesterase; bioautography; phenolic compounds.

Assessing the application of good manufacturing practices in date factories in baharia Oasis

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Abstract

This paper aimed at assessing the application of Good manufacturing Practices (GMP) against the codex alimentarius standard 143/1985 and the Egyptian standard 357-1/2013 in date factories in Baharia oasis. Ash, moisture, total and reducing sugar in date was estimated in raw material and final product as well. The water used in cleaning the raw material was chemically and microbiologically tested, in addition the Total Plate count (TPC) was performed on date before and after both the washing and thermal process in 4 date factories representing the core processing areas in baharia oasis, namely: Mandisha, bawity, Zabo and kasr. The paper reached some major findings, which are: The study sample violate the international alimentarius standard in terms of personnel hygiene, plant and equipment hygienic design. The chemical and microbiological analysis emphasized the unsuitability of water used in washing. Although all the study sample using ovens to thermally process the date fruit, the moisture percentage did not significantly altered before and after the thermal process due to the improper design of the ovens that is not designed to absorb and get rid of humidity. Finally, the study result revealed that the ash percentage and the insect infections was exceeded the standards limits in the final product, may the later be due to the improper fumigation process that were less the ideal course.

Risk assessment of agricultural practices of date small farms in Baharia Oases

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Abstract

This paper aimed at assessing the agricultural practices related to food safety in date farms in date small farms in Baharia oases in terms of the food safety hazards biologically, chemically and physically that negatively affect consumers' health. A condensed research review was performed to assess the food safety hazard related to the agricultural practices in dates farming in addition to a questionnaire was designed to assessing the agricultural practices in Baharia small farms in specific against the applicable requirements of the United States Department of Agriculture (USDA) Good Agricultural Practices (GAP) and Good Handling Practices (GHP) guide. The GAP and GHP practices in 30 date small farms located at Bawity, Mandisha, Zabo, Elkasr and Elhara areas was evaluated. The descriptive approach was utilized, and some statistical indicators was extracted using the Microsoft excel program, i.e. average, minimum, maximum, standard deviation and variation coefficient. The study reached some major findings, which are: the pesticides residuals used in killing pests are overdosed in the small farms studies, in addition the harvest process in 40% of the sampled surveyed performed before the waiting period that insure that the pesticide has passed according to the manufacturer guide.

Palmpeat as a soilless substrate in compare to peatmoss in tomato seedling production

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Abstract

Seedling quality and the manner of its production are important factors affecting the quality and quantity as well as the cost of vegetables yield. This experiment was conducted to compare different soilless substrates in tomato seedling production as influenced by different nutrient rates. Peatmoss, palmpeat and their mixture with cocopeat, perlite or date palm fibers (DPF) were as different soilless media. Results showed more increase in shoot and root fresh and dry weight, height, torque diameter, and LAI of seedlings in palmpeat than peatmoss containing substrates. Nutrients effects on seedling growth indexes were sever in peatmoss than palmpeat containing media. Cocopeat, perlite and DPF additives reduced seedling growth, but nutrients increased it sharply in these materials containing substrates. Also, cocopeat was more acceptable than perlite and DPF as supplementary material. It was concluded that palmpeat with low requirement of nutrients was able to compete with peatmoss in tomato seedling production .

Key words: Peatmoss, Palmpeat, Date palm fiber, Perlite, Cocopeat.

Date package and storage conditions play a key role in controlling *Plodia interpunctella* and *Oryzaephilus surinamensis* and preserving date quality

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Abstract

Piarom date is considered as one of the most important semi-dried date in Iran which has been highly affected by stored pest. The current study was aimed to evaluate the effects of the modified atmosphere packaging (MAP) and vacuum packaging (VAP) methods on storage pests control and date quality. To do so, Semi-dry dates (Piarom variety) were packed in two pack systems, including packed with passive modified atmosphere and packed under vacuum. The control samples were kept unpacked. The packs were stored under two different conditions at 4° C (with relative humidity of 65-45%) and 25-27° C (with relative humidity of 75-65%) for 30, 60, 90 and 150 days. The number of storage pests (larvae, pupae and adult insect), pH, water activity and fruit color were evaluated. The experiment was carried out based on a completely randomized design arranged in factorial with four replicates. According to the results, Indian mealmoth (*Plodia interpunctella*) and sawtoothed grain beetle (*Oryzaephilus surinamensis*) were found to be the most important storage pests with 87.5 and 12.5% contamination, respectively. The passive MAP and vacuum packing could significantly decrease pest damage in date samples. Over time, and from the second month onwards, pests' damage to the unpacked samples (control) dramatically increased so that at the end of the fifth month, the difference was highly significant. Date packing resulted in better pH compared with control. Changes in water activity in MAP and VAP were almost the same at the two conditions *i.e.*, ambient and 4° C temperatures. The maximum variation was observed in control treatment. By contrast the minimum change was found when MAP or VAP were practiced.

Production of citric acid by *Aspergillus niger* strains isolated from undervalued dates

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Abstract

Citric acid (2-hydroxy-1,2,3-propanetricarboxylic acid) is a non-toxic and biodegradable organic acid, widely used in food, pharmaceutical, paper and textile industries. Biotechnological production of citric acid, using selected strains of *Aspergillus niger*, is economically profitable, since it's based on an ecofriendly process based on undervalued dates and it improves income for farmers in rural area.

The objective of this work is to optimize the production of citric acid by *A. niger* strains isolated from date by-products. 40 isolates of *Aspergillus niger*, isolated from undervalued dates, were screened and selected for their production capacity of citric acid in culture medium (Czapek Medium). The results obtained showed that among the 40 isolates, 07 strains gave larger diameters of yellow zones (53 and 67 mm) around their colonies, due to the acid production in the medium.

The 03 selected strains of *A. niger* were studied for their conditions of production of citric acid, mainly the carbon and nitrogen sources, pH and shaking speed. The results obtained indicated that the strain *A. niger* S7-3 produced the highest concentration of citric acid (56 g/L), after incubation at 30°C for 144 hours under shaking at 200 rpm, in a fermentative liquid medium characterized by a pH 5, brix 12.5%, using glucose as carbon source and ammonium sulphate as nitrogen source.

Keywords: citric acid, *Aspergillus niger*, dates, by-products, fermentation.

Study of an atomical properties of date palm stem (*Phoenix dactylifera*. L) and their uses

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Abstract

Palm trees are a family (Arecaceas) of plants with hundreds of species. Most economically important species are date palm (*Phoenix dactylifera*. L), coconut palm (*Cocos nucifera*), and oil palm (*Elaeis guineensis*). Being monocotyledons, palm trees show distinct differences of the wood structure compared to common wood species. This study aimed to evaluate the anatomical properties 'Tadmament' cultivar of date palm wood such as density, frequency, diameter, and area of vascular bundles (VB) in stem sections/zones (from the peripheral to the inner zone), and at two different stem heights (Top and bottom of the stem).

The results indicated that the density and frequency of vascular bundles increase from the inner to the peripheral zones of the stem, thus the diameter and area of VB decrease from the first to the third zones. The density of VB in peripheral zone also decreases from the bottom to the top of the stem. In addition, it has been increased in the central and inner zones.

In the peripheral and central zones, the VB are numerous and smaller in diameter. The inner zone is the broadest; the bundles reach their highest diameter. The fiber tissue percent is higher in the peripheral and central zones (48.5 % /44.5%, at the bottom and top of stem respectively) than in the inner zone (9% / 11%, at the bottom and top of stem respectively). The results of this study will be used to calculate density of sap flux, also to develop the injection techniques to fight the red date palm weevil (*Rhynchophorus ferrugineus*).

Results for coconut and oil palm are different; the vascular bundles have a constant size throughout the central cylinder.

Keywords: *Phoenix dactylifera* L., vascular bundles, anatomical properties, wood, structure.

Selection of male date palms (*Phoenix dactylifera* L.) in Figuig Province (Morocco)

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Abstract

Date palm (*Phoenix dactylifera* L.) is a monocotyledonous, dioecious, perennial tree that belongs to the Arecaceae family. Date palm has an ancient history of cultivation and utilization in North Africa and the Middle East. The male palm trees locally named “Dokkars” are form heterogeneous populations. They are sometimes identified by the name of the female cultivar which resembles to it phenotypically. One of the best potential tools for increasing date palm productivity is to select pollen grains having cross compatibility with female flowers to improve the yield and fruit quality (Bishr and Desoukey, 2012).

This study was carried out to determine some biometric characteristics and in vitro germination capacities of fresh and stored pollen grains. Forty male date palm trees were selected from different local farms in Figuig region; the collected pollen grains were placed in small glass vials with stoppers. The vials were subjected to the following regimes: room temperature, refrigerator (4°C) and freezer (-20°C) for 2 storage periods (6 and 9 months).

The results indicated that pollen germination percentage decreased with increase in storage duration and the storage in the freezer kept pollen grain viability significantly higher than in the refrigerator. Biometric characteristics of the selected pollen grain were studied. These characteristics included Pollen length, pollen width and pollen diameter.

Key words: male date palm, in vitro germination, pollen biometric characteristics, fresh and stored pollen grains, Figuig region.

Study of microbiological quality of 'Boufeggous' dates commercialized in Morocco

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Abstract

In Morocco, palm groves cover an area of 71 369 ha concentrated mainly in the valleys of Drâa, Ziz, Tafilalet plain, Bani (Tata) and Figuig. The average production of dates in a normal year is estimated to 100 000 t, it is characterized by the existence of a multitude of cultivars including a high proportion of 'Khalts' and other more interesting cultivars such as 'Boufeggous' (12,2 %); which is the most dominant cultivar in Moroccan oasis.

The aim of this work is to evaluate the microbiological quality of the 'Boufeggous' dates that are commercialized in Morocco. All the analyses were conducted on dates sampled before the holy month of Ramadan, from date production areas (Errachidia, Figuig, Zagora and Tata) and from one of the most important marketing areas in Morocco. The results obtained for the physical parameters show that the highest value of arithmetic mean diameter was recorded for 'Boufeggous' dates from Marrakech (22.09 mm) while the lowest value (18.40 mm) was observed for 'Boufeggous' dates from Zagora. The geometric mean diameter, the sphericity and the surface area varied from 15.88 mm to 0.43 and 805.2 mm² respectively for 'Boufeggous' Marrakech while for 'Boufeggous' Zagora, the values did not exceed 12.47 mm, 0.41 and 494.76 mm² respectively. As for pH, water activity, total sugars, reducing sugars shows a significant variation between the different samples. Concerning the Total viable count (TVC), yeasts and moulds are detected in all samples at various levels. TVC ranged from 2.5 10³ CFU/g for 'Boufeggous' Errachidia to 70 CFU/g for 'Boufeggous' Tata. The *Staphylococcus*, *Bacillus*, *Totals and Fecals coliforms* have not been detected in any samples. By microbiological standards, the quality of the dates that were subject to the study respects the international standards applied for the food.

This study has revealed that the microbiological quality of the dates fruits shows no danger to consumer health whether if it is sold in his production dates area or outside.

Keywords: Dates fruit, microbiological quality, Morocco, commercialized.

Assessing technical efficiency of Oman date farms

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Abstract

Under the Oman 2020 development strategy the agricultural sector is expected to grow by 4.5 percent each year so as to achieve a 3.1 percent contribution to the GDP. For the past several development plans, the agricultural sector failed to achieve the required 4.5 percent annual growth. Date industry is one of the main components of the agricultural sector in Oman. According to the 2005 census, there are an estimated 7.8 million date palm trees grown throughout the Sultanate, occupying about 50 percent of the planted area, employing a significant number of Omani people directly and indirectly. Therefore, date farming is very important in the diversification of the Oman economy away from being solely dependent on crude oil export, especially given the recent significant drop in the world market price of crude oil. This study therefore assesses the technical efficiency of Oman date farms.

Assessing technical efficiency will help us understand the factors that influence date farm efficiency. Understanding these factors is fundamental in setting strategies needed to enable the agricultural sector to meet its obligations in the Oman 2020 vision. This study is based on a cross-section dataset of 120 date farms surveyed in 20168. Data is analyzed using both parametric (stochastic production frontier approach) and non-parametric (Data Envelopment Analysis) approaches.

Preliminary results show that efficiency levels are positively related to farm size, level of education, experience of the farm manager, extension service availability, date variety, age of palm trees and the positive profitability attitude of the farm manager.

Impact of climate change on date palm cv. Dhakki and viable options for adaptation

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Abstract

Even though date palm is a thermophile species and can withstand large temperature fluctuations, yet recent climate changes especially prolonged monsoon patterns, starting earlier (end of June) and lasting till September with sporadic changes, has posed multiple threats for Dhakki dates causing spoilage of fruits at early ripening stage, hindering ripening & drying processes at the end. Growers are adapting some alternate options of making 'Chuhara' (dried dates) at Khalal stage instead of processed Rutab dates. Experiments were conducted to find out comparative yield potentials of 'Chuhara' as well as processed dates produced from the fruits collected from trees protected from rainfall. Five treatments including T1 (Control, bunches without any covering), T2 (bunches covered with polythene bags in blue color), T3 (dull paper bags), T4 (art paper bags) and T5 (polypropylene bags) were applied to marked bunches of fruits at Khalal stage on each selected palm tree before the onset of monsoon rains in mid July. All other cultural practices i.e. fertilizer; irrigation and artificial pollination were applied uniformly to all treatments. The parameters focused under study were bunches weight (Kg), fruit ripening (%), fruit moisture (%), fruit weight (g), pulp weight, fruit length (cm), fruit diameter (cm), total soluble solids (%), reducing and non reducing sugars (%). For economic analysis, Benefit Cost Ratio (%) for fresh and dry dates was calculated. The results show that BCR for fresh dates was 2.85, while, it was 1.06 for dry dates. It is depicted that fresh dates give double return as compared to dry dates. It was observed that 1Kg Khalal fruits yields ½ Kg dry dates whereas the same quantity of Rutab fruits on ripening and drying yields ¾ Kg of fresh dates. General evaluation of bunches bagging treatments on fruiting traits was conducted. It was concluded that bunches covered with blue paper bags obtained highest score among all the trials and is recommended to achieve best results under current climate change scenario. In order to cope with the climate change an adaptation of pre-harvest bunches bagging together with date ripening and drying in solar dates processing units equipped with automatically controlled modules is highly desirable. The integrated technology is expected to give economically viable solution to Dhakki date growers convincing them to continue on to date's production instead of 'Chuhara' formation.

Key words: Climate variability, Date Palm cv. Dhakki, Economic analysis BCR, Bunches bagging.

Utilization of date palm leaves as animal feed in the United Arab Emirates

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Abstract

The coarse fodder was produced from palm leaves in a mechanically cut and sliced manner and treated with 3% ammonia or 4-6% urea, aiming to increase the proportion of raw protein in fodder. The mixture placed in nylon bags to provide anaerobic conditions for 1-2 weeks at a temperature of 30 co to improve the level of nitrogen in fodder.

The urea-treated date palm leaves (UTDPL) were used to conduct two experiments to determine their effect on the digestion factor and the lambs' growth efficiency. The lambs were fed on a fully experimental mixed diet containing UTDPL instead of Rhodes grass in the three diets at varying rates of 0, 15 and 30% respectively, for three weeks trial in the digestion experiment, before being placed in individual sheds for 84 days to measure the increase in growth.

The results showed that Urea Treated Date Palm Leaves (UTDPL) increased the amount of crude protein in it, and improved the ability to digest date palm leaves (DPL) as a result of urea processing. The results also showed that high hemicellulose digestion (66.6%) per meal of 30% UTDPL despite the high content of lignin in palm leaves. The experiment also showed the importance of UTDPL as a fibre source for sheep. Processing of date palm trees (DPL) with urea has improved the nitrogen content of the product (up to 13%) to overcome one of the major constraints to the use of DPL as animal fodder.

The results of the lambs feeding experiment (15% UTDPL) showed that lamb growth was faster ($P < 0.001$) during the 22 to 56 days of the feeding experiment, and the food conversion efficiency was similar ($P > 0.05$). This clearly shows that UTDPL can be included in whole-grain mixed diets as an alternative to Rhodes grass without adversely affecting digestion of nutrients.

The results proved that the UDPPL replacement rate of the Rhodes grass at all levels had little effect on the weight of the carcass. Growth and slaughter measurements also showed that the use of UTDPL as a fibre source in the diets of lamb fattening is a viable alternative to the traditional and expensive Rhodes grass.

The results of this work clearly demonstrate the usefulness of Urea Treated Date Palm Leaves (UTDPL) as a fibre-rich source for lambs, with the potential to be used as an alternative to the traditional and expensive Rhodes grass, without negative affecting to the digestion of food ingredients or lambs performance; providing flexibility to the producers in selecting food sources for fibre, as well as ensuring economic returns.

Water saving under date palm: comparison between irrigation techniques in Tunisian oasis zone

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Abstract

The water irrigation resources scarcity, with the problem of poor quality of the most of these resources especially their high salinity, present a great threat for the oasis agriculture sustainability. Improvement of water saving technologies is imperative to assure the better oasis productivity. The main objective of this work is to identify the efficient irrigation technique for date palm trees; by assessment of irrigation technologies which were newly introduced by a few farmers in some Tunisian oasis regions. The three irrigation techniques, which were evaluated by applying the same volume water irrigation under date palm trees, are the bubbler, the mini diffuser and the subsurface drip irrigation systems. The irrigation assessment showed that uniformity water irrigation distribution in the soil after irrigation is around 90% for the three techniques. The water irrigation losses after irrigation were 42mm, 63mm and 72mm respectively by bubbler, by mini diffuser and subsurface drip irrigation. The irrigation water application efficiency is the best for the bubbler irrigation (62%). The water use productivity is also the highest for the bubbler (0.66kg/m³). In addition, the desalination efficiency was the best for bubbler technique, it was 63%. The results of this study showed that the bubbler irrigation system is the efficient technique which will be the best technology practice under date palm trees in Tunisian oasis.

Keywords: bubbler irrigation, mini diffuser, subsurface irrigation, oasis, date palm trees

Calculation of date palms water consumptive use under arid condition: United Arab Emirates case study

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Abstract

Under arid condition of United Arab Emirates (UAE), date palm (*Phoenix dactylifera* L.) is one of the only a few crops adapted to this extremely hot and dry weather and saline desert soil conditions. Date palms water use during different developmental stages depends on evapotranspiration (ET) rate which is a function in many climatic parameters at that particular period. A study using two year old plants of three tissue-cultured cultivars of date palms was conducted between 2016 and 2017 to determine actual water requirements under UAE arid environmental and soil salinity conditions. Currently date palms water use accounts for about one third of all groundwater resources allocated for irrigation of agriculture sector in UAE which is about 600 million cubic meters annually. Recent literature and field investigations suggested that farm owners and farm labors in UAE are applying excessive amounts of irrigation which is three times higher than water consumptive use. More precise and accurate information on date palms water consumptive use is needed to help farmers to improve their irrigation practices by better matching irrigation supply to crop water demand. To calculate the date palms water requirements, a field experiment of mature date palm trees of the three varieties, namely Khalas, Siwi and Lulu were carried out. Tree water use is measured directly using sap flow sensors placed in the tree trunks, and indirectly using TDR (time domain reflectometry) waveguides placed in the root-zone soil, to a depth of 2.0 m. The Sentek (Sentek Sensor Technologies, Australia) multisensory capacitance probe (EnviroScan Diviner 2000) was used to measure soil water content within and below the root zone in the soil profile. Local weather data are being used to calculate the hourly and daily potential evaporation rate (ETO), and derive an appropriate value for the crop factor, KC. Preliminary data assessment shows the water consumptive use of the palm trees in UAE to be less than half the amount suggested by the FAO-56 guidelines. Information from our field experiments are being used to parameterize a decision support tool for Irrigation Allocation that is being developed to better manage the groundwater usage in a sustainable way in UAE.

In-vitro investigation of antidiabetic and anti-obesity properties of date seed proteins and their hydrolysates

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Abstract

Date palm (*Phoenix dactylifera* L.) is an important cash crop for Middle Eastern countries. Date fruits have received much attention worldwide but date seeds generation in thousands of tones have always remained neglected. Date pits have been used for centuries in the Arab world as non-caffeinated coffee, animal feed or is thrown as waste which might lead to environmental problems. The aim of this study was to investigate the potential of date seed protein isolate and date seed protein hydrolysates (DSPHs) for their potential bioactive properties including inhibition of enzymes playing role in diabetes and obesity. For this, 12 different DSPHs were produced using food grade enzymes (alcalase, bromelain, papain and protease) with 2, 4 and 6 h of hydrolysis time. The results revealed that DSPH generated with alcalase were most effective in curbing enzymes (cholesterol esterase and lipase) playing a role in obesity. Hydrolysate A6 (alcalase 6h) displayed least IC₅₀ value of 29.9 μ M and 70.3 μ M protein equivalent against pancreatic lipase and cholesteryl esterase, respectively. However, for antidiabetic properties, bromelain generated DSPH were the most effective. Hydrolysate B6 (bromelain, 6h) was most effective in inhibiting Dipeptidyl peptidase IV (an enzyme responsible for degrading insulinotropic hormones GLP-1) with an IC₅₀ value of 66 μ M protein equivalent. Whereas, hydrolysate B2 (bromelain, 2h) demonstrated maximum inhibitory activity followed by P2 (papain, 2h) against pancreatic amylase an enzyme responsible for starch digestion in human gastrointestinal tract thereby increasing glucose level in blood. Similarly, inhibition of glucosidase, an enzyme responsible for disaccharide hydrolysis in intestine, most potent DSPHs were A2 (alcalase 2h), B6 (bromelain, 6h), Pr2 (protease, 2h) and Pr 4 (protease 4h) with an IC₅₀ value of 25 μ M protein equivalent. Therefore, date seed protein isolates and their hydrolysates could be a potential source of biologically active proteins and could be utilized for incorporation as functional ingredients in various nutraceutical and functional food formulations.

Key words: date seed proteins, DPP-IV, lipase, antidiabetic, functional food ingredeint.

Date palm production status and perspective in qatar for meeting the emerging challenges

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Abstract

Qatar ranks as the sixteenth largest date producing country in the world. There are 581,336 date palm trees growing in an area of 2,407 ha with date production of 28,8771 tons. It is the major fruit tree grown in the country and dates production is 7.2 % of the total agricultural production but there has been no increase in the area under this crop since the last decade. Increasing area is a great challenge. No specialized institution exists for date palm research and development. Average recorded yield for 2016 was 12.0 t/ha, the second highest in the region and higher than the world average of 6.25 t/ha, for the same year. Yield has progressively increased since 1980. It is essential that this status should not only be maintained but also increased to reach a higher production rate like that being achieved in Egypt (35.2 t/ha) and other countries. Good potential exists to expand the area and production of dates if existing agricultural lands and water resources are used efficiently. However, many challenges do exist and still new are emerging like more scarcity of water resources and increasing temperature and evapo-transpiration as result of expected climate changes. Like other countries, the major constraints of yield are scarcity of good quality water, soil and water salinity, low yielding cultivars, poor agronomic practices due to a limited number of knowledgeable growers, insects and diseases and weak research support. Tissue culture is in its initial stages. Many research, and development efforts are required to enhance date palm cultivation in the country to increase yield and economic returns. For this purpose, several research and development projects must be planned and implemented. A date palm-based industry needs to be set up to decrease imports of this commodity. The concerted efforts of all the stakeholders, particularly the state, are required to cope with emerging challenges of traditional and cultural crop.

Effect of mycorrhiza-associated bacteria on mycorrhization, growth and uptake of mineral nutrition in date palm seedlings

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Abstract

Soil micro-organisms, used as bio-fertilizers, have a beneficial effect on plant growth and mineral nutrition. But studies made on these bio-fertilizers remain again very limited and even absent for the date palm cultivation in Tunisia.

This study was conducted to study the effect of inoculation with spores of the mycorrhizal fungus genera *Glomus* (M) and a range of bacterial strains (Bi) intimately linked at the mycorrhizal interface, taken from rhizosphere of date palm trees in the Djerid region, on date palm seedlings grown in a soil of the region under greenhouse conditions. *The results show* that several bacterial strains were found with a dominance of 15 strains.

In this study, the bacterial strain B14 (*Pseudomonas luteola*) presents a great plasticity to overcome the pedoclimatic constraints of the oases. Increases of 33.3%, 86.12% and 34.4% were observed for N, P and K, respectively, from date palm seedlings compared to treatment T. While bacterial strain B4, showed decreases in the order of 14.28%, 8.23% and 10.62% respectively for N, P and K, taken from the date palm seedlings, comparing to treatment M.

The results of the analysis showed that in general, regardless of the nature of the biological combination Bi + M or M, the inoculated date palm seedlings were always larger than those for the treatment T (control).

From these preliminary results, it appears that the use of biofertilizers (mycorrhizal fungi and mycorrhizal helper bacteria) is a promising approach in organic farming.

Keywords: Mycorrhizal fungi, bacteria, bio-fertilizers, rhizosphere, date palm.

Pakistan date industry: status, recent developments and future prospects

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Abstract

Pakistan is the 6th largest producer of dates in the world. Date is the only commercial fruit grown in all four provinces, with maximum production from Sindh and Baluchistan provinces respectively. Dhakki, Aseel and Begun Jangi are the primary cultivars along with Hillawi, Rabbi, Mozawati, Sabzo, Shakri, Haleni, Kush kench, Wash Kong, Abe Dandan, Koherba, Jawan Swore, Zehdi, Khudrawi, Ali Puri Chohara, Sher Shahi, Hussaini, Dhandari and Gulistan. Pakistan currently exports around worth \$78.0 million dates (fresh, 19 M\$, dried 58.91 M\$). Recently, the industry is in a transformative phase, to better compete in international markets. With government support, exotic premium tissue culture date palm plants are being distributed among growers in the southern parts, which are mostly underdeveloped. The varieties include Medjool, Khalas, Barhee, Ajwa and Anbarah. Under this interesting scheme, the beneficiary growers will pay back suckers, over a defined period, to agriculture department for further distribution to prospective registered growers. Such an arrangement like a “date bank” will cascade rapid growth of a modern industry. Efforts are also underway to improve the processing technology and promote fresh dates, and value added products instead of predominant dry date processing. Research on on-farm solar assisted hybrid date dryer and processor will help reduce postharvest losses and increase returns to the growers and other supply chain partners. Based on a recent policy paper studies, a date industry roadmap has been developed including establishment of a date processing and market facility at DG Khan, serving three provinces, and linking it to Pak-China CPEC route for both domestic and international distribution. This special paper presents detailed account of the recent trends and developments in Pakistan date industry along with future prospects.