

Date Palm Research Center of Excellence King Faisal University

Research Program

Advance Precision Technologies For Date Palm (APT)

Duration: Five Years

Funded by: Ministry of Education, and KFU

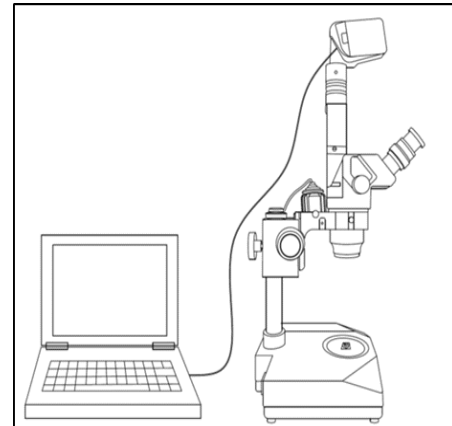
Starting date: 2015

Overview

The program strives to be a pioneer engineering-oriented research program by blending a multidisciplinary national and international scholarly collaboration to generate date palm related knowledge. This will be realized through utilizing several agricultural engineering sciences, machine vision, and electronics to improve and develop devices, software, and processes for the welfare of the date palm and dates sector by conducting applicable research according to the stakeholders' needs and priorities.

The program aims at achieving objectives related to: (i) developing user-friendly software for automatic processing and control; (ii) designing, developing, and optimizing hardware, including electronic systems for nondestructive operations and machines for serving date palm; and (iii) developing new methods for attaining water conservation, utilizing solar energy in date palm cultivation, and quality control of dates.

The program plans to address date palm stakeholders problems/issues by mobilizing all its resources to perform necessary tasks within five research areas, namely, (i) machine vision and automatic control, (ii) irrigation engineering, (iii) date palm service machinery and equipment, (iv) dates postharvest processing, and (v) farm applications of solar energy.



Scope

It is rational to initiate and extend program interventions with granting full recognition to the stakeholders' needs, priorities, and market actual demands.

Research Strategy

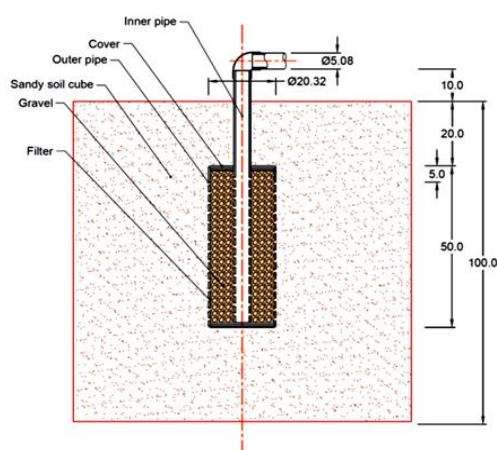
The program research strategy emphasizes on engineering-based problem solving approach.

Mission

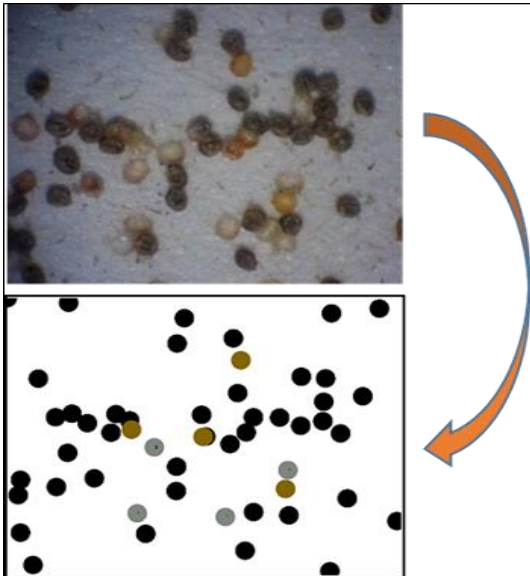
Conducting applicable research according to the stakeholders' needs and priorities to improving and developing devices, software, and processes for the well-fair of the date palm and dates sector through

- To develop user friendly software for automatic processing and control.
- To design, develop, and optimize **hardware**, including electronic systems for nondestructive operations, and machines for serving date palm.

To design, develop, and optimize hardware, including electronic systems for water conservation, solar energy utilization in date palm quality, and marketing ability.



Research Themes and Subthemes



Available Resources

1. Machine vision and automatic control

- 1.1 Early detection of insects and plant diseases.
- 1.2 Automatic assessment of performances (efficiency and effectiveness).
- 1.3 Quality control of dates.

2. Irrigation Engineering

- 2.1 New water conservation techniques.
- 2.2 Precision agriculture application (e.g. manipulating root zone soil environment for optimization purposes).

3. Date Palm Machinery

- 3.1 Tools for serving date palm trunk, crown, and fruit.
- 3.2 Sensing characteristics of date palm trees under stress .

4. Postharvest Processing

- 4.1 Handling and preparing dates and their products for manufacturing and marketing purposes (e.g. washing, drying, sorting, grading, processing, packing, packaging, and waste recycling etc).
- 4.2 Dates contamination control.

5. Solar Energy Applications

- 5.1 Energy generation for farm applications.
- 5.2 Pest control for protecting date palm trees and dates (e.g. electronic traps, sterilization, ... etc.)



Machine Vision Laboratory:

- Two digital CCD color cameras with adjustable

- stand and platform,
- Illumination system,
- Frame grabber,
- Microscope fitted with a color camera,
- T3i Termatrac device,
- Data loggers for automatic recording of temperature,
- MatLab software.

Electronics Laboratory:

- STORAGE, 250 MHz, 2GS/S, COLOR OSCILLOSCOPE
- Oscilloscope Peaktech
- Micro Voltmeter
- Function Generator 6 MHZ
- DC Power Supply
- DC - Constant 0.....12 V
- Tesla Meter
- H.V Power Supply 0-200 Dc 0-220 Ac
- Power Supply Digital 30 - 60 V 5 A
- Soldering station Kada
- Clamp Meter
- Digital Luxmeter
- Digital multimeter KYORRITSU

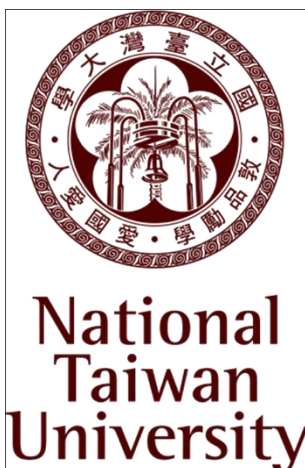
International collaboration

The APT has established international research collaboration with **Kansas State University** in USA, and is in the process of establishing a second one with the **National Taiwan University** in Taiwan.

National

The APT has established several research collaboration activities with the Agricultural Engineering Department at the Faculty of Agriculture and Food Sciences, KFU.

Research Collaboration



Graduate Students

Student Name	Yuqi Song		
Degree Sought/Date	M.Sc. / May 4, 2016		
Department/University/Country	Biological and Agricultural Engineering (BAE)/Kansas State University (KSU)/ USA		
Major Professor/Dept./Uni.	Naiqian Zhang	BAE	KSU
Supervisor Committee Member	Daniel Flippo	BAE	KSU
Supervisor Committee Member	Mohammed Mozib	DPRCE	KFU
Supervisor Committee Member	Joe Harner	BAE	KSU

Program Principal Team Members

Prof. Mohammed El-Faki Mozib

Dr. Maged Al-Sayed Mohammed

Operational Plan

A 5-Year Operational Plan of the Advanced Precision Technologies for Date Palm Research Program							
Objectives	Interventions/Activities	Expected Outcomes	HR Requirments	Monitoring Progress		Related Expenditure (million SR)	
				Measure	Target		
Produce user-friendly software for automatic processing and control	Develop new algorithms for automating (i) insects/disease detection, (ii) date palm cultivar identification, and (iii) dates quality control processes.	Robust programs	(i) Several international collaborating researchers, (ii) several national collaborating researchers, (iii) one programmer with a MSc or BSc in IT, two engineers with a MSc or BSc in electrical engineering and electronics, (3) two technician (Agr. Eng.), and (4) two farm workers.	Number of international professors involved	6	11.5 (1proj 4.2, 1proj 2.5, 1proj 1, 2 proj 1.5, 1proj 0.5, 1Proj 0.4, 1Proj 0.7, 1Proj 0.2)	
				Number of national professors involved	6		
				Number of required university graduates employed	4		
				Number of technicians hired	2		
				Number of farm workers involved	6		
Design, develop, and optimize hardware .	Design, develop, and test electronic devices for noncontact detection of insects.	Electronic devices, machines, and equipment		Number of ongoing related research projects	4		
	Design, assemble, and test new small scale machines for serving date palm trees and dates.			Number of completed related research projects	4		
Develop new agriculture precision methods and processes	Design, and implement a new irrigation system to attain water conservation in date palm cultivation.	An irrigation system for significant water coservation		Number of software developed	3		
	Develop cheap and applicable methods for using solar energy to support farm operations.	Economically feasible solar systems		Number of electronic devices produced	3		
				Number of service machines produced	2		
				Number of irrigation systems for water conservation produced	1		
				Number of solar systems produced	2		

Research Achievements

#	Title of Research Project	Type and Status of Research Project						If more than one research program involved, specify name(s)	Budget (SR)	Source of Funding	
		Multidisciplinary	Proposed and Pending Approval	Status	Progress	Status	Products				
				Ongoing	Percent Achieved		Completed				Number of Paper(s) Published
1	Developing a multi-sensor system for early detection of date palm infestation by red palm weevil, <i>Rhynchophorus ferrugineus</i>	√	√					-	SPMDP	1,860,000	-
2	Design and manufacture of ladder systems for date palm service with manual and automated lifting mechanisms.	√	√					-	-	636,000	DPRCE and Taiwan National University
3	Developing an Optimized Root Zone Soil Environment for Water Conservation in Date Palm Cultivation: Design and Evaluation"	√	√					-	DPPP	307,400	DPRCE
4	Analytical study for the agricultural machines, equipment, and tools available in KSA for serving date palm trees	√		√	20%			-	DPPP	19,000	DPRCE
5	Design of solar disinfestation system as an alternative to methyl bromide for controlling date moth, <i>Ephestia cautella</i> in Date Storehouses	√					√	-	SPMDP	20,000	KFU
6	Design of a novel solar powered insect trap for IPM program of major date palm insects	√		√	95%			1	SPMDP	192,000	DPRCE
7	Automatic Assessment of Biological Control Effectiveness of <i>Trichogramma</i>	√					√	1	SPMDP	308,800	DPRCE

	<i>bourarachae</i> against <i>Cadra cautella</i> Using Machine Vision										
8	Internal thermal and chemical characteristics of date palm infested by red palm weevil <i>Rhynchophorus ferrugineus</i> (Olivier)	√					√	2	SPMDP	160,000	KFU
9	Image processing system for sorting dates	-					√	1 patent filed	-	98,000	DPRCE
10	Using applications of pulsed electric fields technology to control microbial contamination of dates	√					√	1 paper + 1 book chapter	DFVP	80,000	DPRCE
11	Design of a novel red palm weevil trap supported with Electronic counting system	√		√	70%				SPMDP	66,400	KFU
12	A solar powered disinfestation heating system for postharvest management of pests of stored dates	√		√	10%				SPMDP	35,000	DRPCE