AN EXPERT SYSTEM FOR MANAGING ON-FARM IRRIGATION WATER OF SOME OIL CROPS

By

KAMEL MOHAMED EL-TOHAMY MOHAMED
B. Sc. Agric. Sc. (Agricultural Engineering), Benha University, 2010

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of
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This thesis for M.Sc. Degree has been approved by:

Dr. Magdy Tawfyk EL-Tantawy ……
Chief of Researches, Agricultural Engineering Research Institute (AEnRI), Agricultural Researches Center (ARC).

Dr. Yasser Ezzat Arafa ……
Associate Prof. of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Khaled Faran El-Bagoury ……
Associate Prof. of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Ahmed Abo El-Hassan Abdel-Aziz ……
Prof. of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Date of examination: 21 / 5 / 2016

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Under Supervision of:

Dr. Ahmed Abo El-Hassan Abdel-Aziz

Prof. of Agricultural Engineering, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University (Principal Supervisor).

Dr. Khaled Faran El-Bagoury

Associate Prof. of Agricultural Engineering, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Mona Ahmed Mohamed Soliman

Research Prof. of Water Relations and Field Irrigation, Department of Water Relations and Field Irrigation, National Research Centre.

ABSTRACT

Kamel Mohamed El-Tohamy Mohamed: An Expert System for Managing On-Farm Irrigation Water of Some Oil Crops. Unpublished M.Sc. Thesis, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University, 2016.

Accurately estimation of actual crop evapotranspiration (ET_a) as a parameter of irrigation scheduling is very critical for efficient use of limited irrigation water resources. The objectives of this study were to (1) build, verify and validate an expert system for managing on-farm irrigation water of some oil crops under Egyptian conditions, (2) evaluate the precision of dual-K_c approach for estimating the daily actual crop evapotranspiration (ET_a) and compare it with the single-K_c approach, and (3) study the effect of the precise estimation of daily actual crop evapotranspiration on maximizing yield and improving water use efficiency.

A rule-based program named IMOC-ES (**I**rrigation **M**anagement for some **O**il **C**rops-**E**xpert **S**ystem) was coded and compiled using Microsoft visual basic 2013 language. The program was verified using two ready-to-use software programs (CropWat-8 and ETo Calculator-3.2) for estimating the daily reference evapotranspiration and a spreadsheet named (FAO56Ax8.xls) introduced by FAO-56 for estimating the irrigation water management parameters. It also was validated by carrying out a field experiment at the Experimental Farm of Agricultural Production and Research Station (APRS), National Research Centre (NRC), El Nubaria District, El-Behaira Governorate, Egypt for a growing summer season of 2014. The experiment included the following factors: a) two approaches for estimating crop

evapotranspiration (single-K_c and dual-K_c), b) two irrigation systems (surface drip irrigation and subsurface drip irrigation), and c) two oil seed crops (peanut and sesame).

Results of the investigation indicated that it is possible to use the IMOC-ES rule-based program for estimating the irrigation water management parameters accurately. In addition, some of the observed results can be summarized as following:

1. The estimation of actual crop evapotranspiration (ET_a) using dual crop coefficient approach was more accuracy compared to single-K_c approach.
2. The seasonal cumulative ET_a estimated by dual-K_c approach overestimated that estimated by single-K_c approach under surface drip irrigation by 13.20 % for peanut and 21.90 % for sesame. While under sub-surface drip irrigation, the dual-K_c approach overestimated the single-K_c approach by 4.42 % for peanut and 17.64 % for sesame.
3. Yield: the highest seed yield of peanut (2.23 ton fed^{-1}) and sesame (0.66 ton fed^{-1}) were obtained with the interaction (sub-surface drip irrigation × dual-K_c).
4. Water use efficiency: the maximum value of water use efficiency for peanut (0.66 Kg m^{-3}) and sesame (0.23 Kg m^{-3}) were recorded with the interaction (sub-surface drip irrigation × dual-K_c).

Keywords: Irrigation scheduling, actual crop evapotranspiration, dual crop coefficient, single crop coefficient, drip irrigation, seed yield, water use efficiency, peanut, sesame.

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