MANAGEMENT OF MODIFIED SURFACE IRRIGATION SYSTEM FOR SOME FIELD CROPS USING AN EXPERT SYSTEM

By

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ABSTRACT

Basma Nasr Abd El-Tawab Mohamed: Management of Modified Surface Irrigation System for Some Field Crops Using an Expert System. Unpublished M.Sc. Thesis, Department of Agricultural Engineering Faculty of Agriculture, Ain Shams University, 2019.

It is very difficult to find an expert at the desired time and place to give guidance about irrigation scheduling or good management of water and irrigation system .In this study, this problem was tried to be solved by designing, verifying and validating an expert system for a modified surface irrigation system. A rule-based program named as MSIS-ES (Modified Surface Irrigation System Expert System) was coded and complied using C#.net programing language. The expert system was designed to support users with information about irrigation scheduling (irrigation operating time and irrigation interval) and the gated pipes as one of surface irrigation modification tools (gate opening/expansion ratios). The developed expert system database is obtained from **Allen et al. (1998)** FAO irrigation and drainage paper No.56 for lengths of crop development stages for various planting periods and climatic regions, single crop coefficient (Kc) for non-stressed well managed crops in sub-humid climates, ranges of maximum effective rooting depth and soil water depletion fraction for no stress for some field crops . Results obtained by the program were compared with a personally designed spreadsheets and hand calculation as verification step. Two different experiments were held to validate the purpose of the program. The first one was a field experiment to validate the irrigation scheduling part by cultivating a three field crops (Grain maize, Sweet maize and Sorghum) to make a comparison between the crop yield and water productivity after applying the program's and the farmer's scheduling. The second one is to make a comparison between the fully opened gates situation and when the resulted gate opening/expansion ratios were applied. The First experiment results indicated that the crop yield increased by 19.08 %, 10.49% and

11.66% after using the MSIS-ES rule based program for grain maize, sweet maize and sorghum, respectively, and also, the crop water productivity increased by 20.24%, 47.87% and 46.43% for grain maize, sweet maize and sorghum, respectively. The second experiment results indicated that there were slight variations between outlets flow rate after using the expert system except the last four outlets, the flow rates were having higher values because of the superimposed pressure near the closed end.

Keywords: Expert systems, Irrigation scheduling, Gated pipes, Modified surface irrigation system, Grain maize, Sweet maize and Sorghum.

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INTRODUCTION

A huge concern has to be given to the agricultural field especially with water shortage problem. This has led to find new solutions by using new technologies in the irrigation. In order to apply those technologies, the agricultural guidance service has to be improved and enhanced with the agricultural expert systems.

Expert systems are a computer programs that can imitate human experts intelligence by giving advices and providing guidance on a specific domain such as medicine, engineering, agriculture, etc. and it is expressed as one of artificial inelegance (AI) applications that can solve problems by imitating human reasoning. It also can be defined as software that uses a knowledge base of human expertise for problem solving or clarifies uncertainties were normally one or more human expert needs to be consulted.

Expert system can help people to make decisions about a specific field more timely and effectively than the human expert. It is less expensive than consulting the human expert displays unbiased judgements and considers all possible alternatives. The expert system applications in agricultural domain were developed to give high technology for higher profitability and to preserve resources.

Irrigation water management have many difficulties and the majority of farmers don't have the desired level of experience and make decisions using incomplete information in this particular field, so, using the expert systems is considered to be the best solution due to its availability anywhere and all the time and its ability of giving guidance about irrigation water scheduling, calculating the right irrigation requirement and operating times based on data entered from the user and/or stored in its knowledge base and providing information about the good management of the used irrigation system to give the heist possible efficiency.