Journal of AgriSearch 1(2): 112-116
Peer Reviewed Quarterly
ISSN : 2348-8808 (Print), 2348-8867 (Online)

Database Management System for Design and Layout of Pressurized Irrigation System

MANIBHUSHAN*, ASHUTOSH UPADHYAYA AND ANIL KUMAR SINGH

Division of Land and Water Management, ICAR Research Complex for Eastern Region, Patna 800 014 (Bihar)

ARTICLE INFO

Received on	: 16.03.2014
Revised received on	: 20.04.2014
Accepted on	: 05.05.2014
Published online	: 03.06.2014

ABSTRACT

The proposed Database Management System will be useful for farmers, researchers, planners, designers and policy makers as it will be user friendly and facilitate interaction in selecting the appropriate PIS. Pressurized irrigation methods provide opportunity to achieve higher water use efficiencies through controlled water application. But the selection of appropriate Pressurized Irrigation System (PIS) and its proper design layout is very essential. This Database Management System (DBMS) is basically a decision support system (DSS) that will facilitate to take decisions considering technical as well economic aspects of different PIS under different conditions. This DBMS will facilitate information about different PIS such as drip and sprinkler in different conditions such as user need and choice, etc. Then this DBMS is useful in selection of an appropriate Pressurized Irrigation System. Use of this system can facilitate selection of a suitable system considering various aspects of user's need.

Keywords **:** Drip, Sprinkler, database, database management system

INTRODUCTION

Water plays an important role in the production of different crops because it is a vital and integral component of crop. It is responsible for crop growth, crop production, and it also ensures the efficiency of other inputs like seeds, fertilizers and pesticide. Adequate, timely and assured availability of water is critical to agriculture for ensured yields. Pressurized Irrigation Systems has been introduced as one of the major solution to enhance the water use efficiency. PIS in the form of drip, sprinklers are most common systems which not only save the water, energy, fertilizer and labour but also reduce the disease and pests, and increases crop production as well as quality of produce. Design of PIS is complex but it can be operated easily and it saves water, energy, labour, time, etc. in comparison to surface irrigation. Applied technology to irrigation systems is the appropriate method to offer sustainability to agricultural production, considering the rational use of the available water as a central variable (Flores and Holzapfel, 2009). The water use efficiency under conventional flood method of irrigation, which is predominantly practiced in Indian Agriculture, is very low due to substantial conveyance and distribution losses. Automation in irrigation is needed to save water by reducing consumption to the essential minimum and also to guarantee the regular supply. Irrigation methods such as sprinkler and drip irrigation offers the means to maintain soil water at nearly constant levels and thus minimize water stress to crop, thereby resulting in 20-30% increase in yield (Kumar, 1999) along with 50% saving in water as compared to surface irrigation(Singh *et al.*, 2000). Though both drip and sprinkler irrigation are treated as method of irrigation. There are distinct characteristics differences between the two in terms of flow rate, pressure requirement, wetted area and mobility (Kulkarni, 2005).While drip method supplies water directly to the root zone of the crop through a network of pipes with the help of emitters, sprinkler irrigation method (SIM), sprinkler sprinkle water similar to rainfall into the air through nozzles which subsequently break into water drops and fall on the field surface. Drip method of irrigation in crop cultivation not only increases water saving and productivity of crops but also reduces the cost

***Corresponding Author E-mail :** mani_patna2000@yahoo.com

of cultivation and weed problems. Database Management System is a specific class of computerized information system that supports business and organizational decision making activities. It is an interactive, flexible computer based information system, which helps decision makers to utilize data, data base and models to solve different types of problems. Hence, DBMS is a computer based tool to incorporate different features of the system and its components to provide ready information to take decision under varying conditions. DSIRR "Decision Support System for Agricultural Irrigation" was developed to conduct an economic environmental assessment of agricultural activity that focuses on irrigation (Bazzani, 2005).

DSIRR was implemented in General Algebraic Modeling System (GAMS) Brooke *et al,* (1992). Dynamic Decision Support System (DDSS) is an improvement over DSS (Flores *et al.,* 2008). Lilburne *et al,* (1998) developed a DSS which integrates the simulation model SWIM (Wang *et al.,* 1996). A DSS was developed to provide assistance to the planning management of irrigation at large scale (Da Silva *et al*, 2001). Meteos *et al* (2002) developed the DSS SIMIS (Scheme Irrigation Management Information System) for managing schemes. A multi objective DSS called MULINO (Multi- Sectorial Integrated and Operational Decision Support System for sustainable use of water resources at catchment scale (Giupponi *et al.*, 2004). EVALUWET (European Valuation and assessment tool supporting wetland ecosystem legislation) was developed for management policies for swamp areas. So there is a wide gap in the development of DSS related to Pressurized Irrigation System. The present research entitled **"**Decision Support system for design, layout and cost estimation of Pressurized Irrigation System" will fill some gaps in the field of development of DSS in irrigation system. In this DSS, We have to calculate total fixed and operational cost of system components, cost-benefit ratio, water use efficiency, energy use efficiency, savings in agricultural inputs, layout and design of Pressurized Irrigation System for different crops. First an Excel based DSS was developed for the design, layout and cost estimation for selection of suitable PIS. Then it was again developed into user interactive Graphical User Interface in Visual Basic to make it easy to use. A suitable database was also created to store necessary data in MS ACCESS. Finally this DSS will be tested and validated in the farmer's field. So this DSS will facilitate to take decisions considering technical as well economic aspects of different PIS under various conditions. This tool will be useful for farmers, researchers, water users, planners, and designers as it will be user friendly and facilitate interaction in selecting the appropriate PIS.

Figure 1: User login and password interface.

Figure 2 : Excel sheet based Decision Support System for drip irrigation system for layout

MATERIALS AND METHODS

The traditional approach of DBMS/ DSS development is based on the assumption that the information requirements of a system can be predetermined. Traditional methodologies are typically used in situations where information requirements are reasonably well defined with detailed specifications. Translated into system designs, this approach is typically used for large, structured applications, requiring significant investments of time and resources to reach desired levels of details (Meador and Rosenfield,

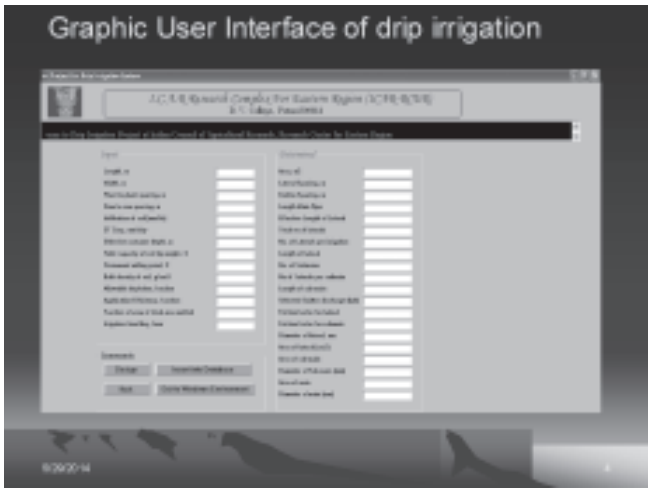

Figure 3 : Graphic User Interface of layout of drip irrigation system

1986). Involving very structured situations, information requirements are determined by logical analysis. Through the System Development Life Cycle (SDLC) has many versions, it can be generalized into six basic phases (Turban, 1990) that are system analysis and planning, design, construction and testing, implementation, operation and maintenance and evaluation and control. In this research, we have tried to fill the research gaps and to develop a new type of DSS for design and layout of Pressurized

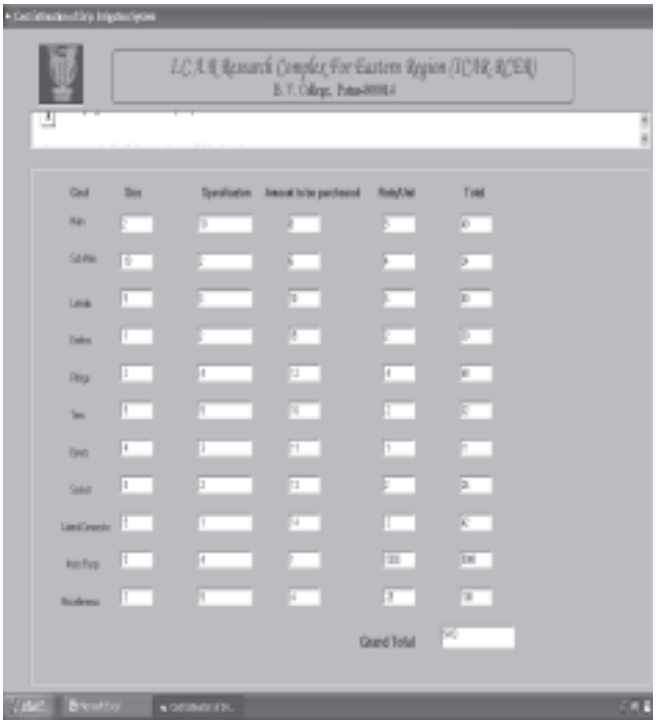

Figure 4 : Graphic User Interface for cost calculation of drip irrigation

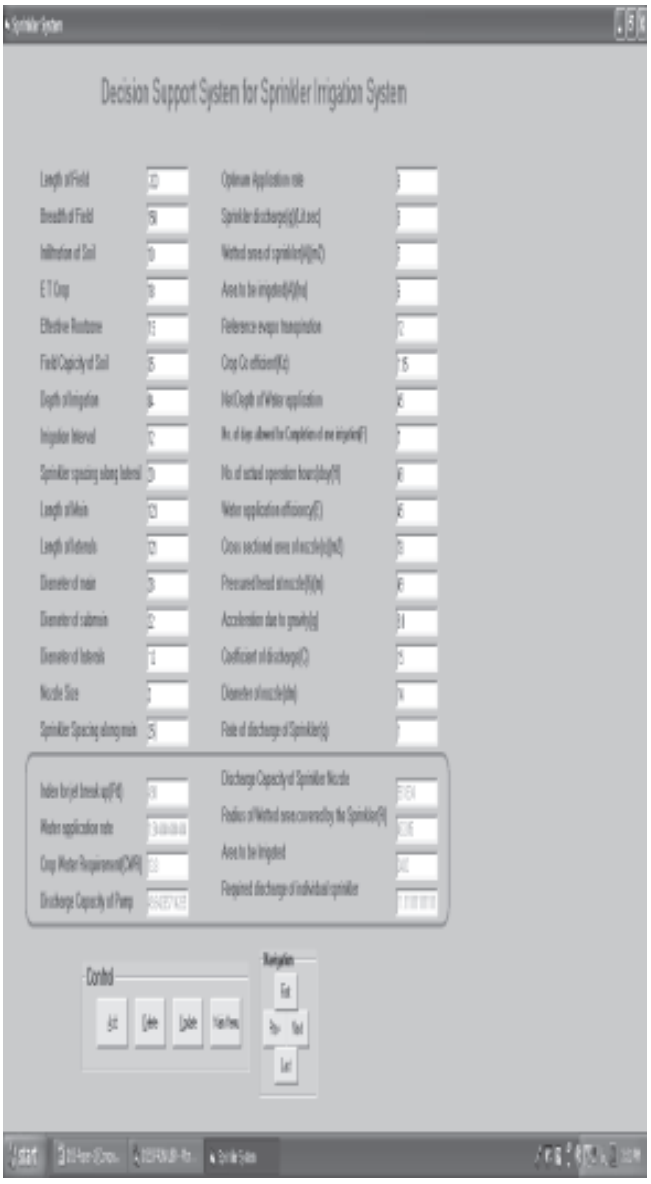

Figure 5 : Graphic User Interface for layout of sprinkler irrigation.

Irrigation System for different crops which will be very user friendly for users and having very useful information for design and layout of Pressurized Irrigation System for different crops. DSS is password protected and a login name is also required to access it. User login and password interface is created in Visual Basic (Figure 1). First Excel sheet based information system has been created and there after it has been designed using MS ACCESS and Visual Basic.

RESULTS AND DISCUSSION

An Excel sheet based Decision Support System for drip irrigation system (Figure 2) has been designed. This Excel sheet based DSS gives

decision about the total material such as main pipe, sub-main, laterals, drippers, etc. It also provides what is the capacity of motor pump and how the horse power of motor pump can be reduced to reduce the total cost of system. Further it will calculate the total cost of system for required plot and it will also provide decision that the system is technically suitable and economic viable or not.

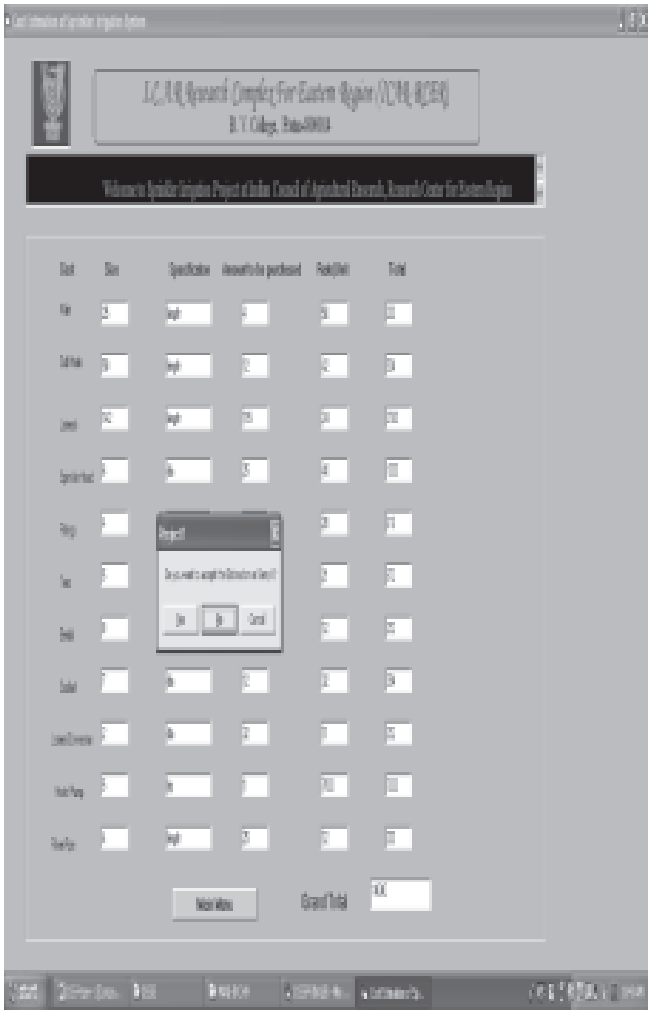

Figure 6 : GUI for cost estimation of sprinkler irrigation.

If system is not economically viable then this DSS will also suggest how it can be made economically viable or cheaper and is suitable to users. Then it has been developed into user interactive Graphical User Interface mode in Visual Basic to make it easy to use for drip irrigation (Figure 3).

Total system layout cost has been calculated using form which has been developed in Visual Basic in user friendly mode for drip irrigation (Figure 4). Finally this DSS will be tested and validated in the farmer's field.

Then again a user friendly Graphic User Interface has been developed in Visual Basic for easy use of DSS for system layout and system cost estimation for sprinkler irrigation (Figure 5 and 6).

Graphic Use Interface (GUI) system asks about system is acceptable for user or not and if not acceptable then cost of system is recalculated till it becomes acceptable.

This DSS will facilitate to take decisions considering technical as well as economic aspects of different PIS (drip and sprinkler) under various conditions. This tool will be useful for farmers, researchers, water users, planners, manufacturers, designers and policy makers as it will be user friendly and facilitate interaction in selecting the appropriate PIS. The proposed DSS is useful to design the layout of Pressurized Irrigation System (PIS) according to different field size. In this DSS, different designs of system are available, so a user can select the right option of designed system according to his requirement and budget which are cost effective and technically suitable.

CONCLUSION

This DSS is able to select which Pressurized Irrigation System (PIS) is suitable in an efficient and effective manner. So there is a wide gap in the development of Decision Support System related to Pressurized Irrigation System. Pressurized irrigation mainly includes drip and sprinkler irrigation system. We have designed the Excel sheet based DSS for the design of layout of drip irrigation system and it gives decisions for the selection of irrigation system which is technically suitable economically viable for users as well as farmers. Flow charts have been designed for the above Decision Support System. Now this DSS on drip irrigation system provides layout of system and provides decisions which system are technically suitable and also provides different options of the design of drip irrigation system. We have developed Graphic User Interface design of drip irrigation system for system layout and cost estimation. After that an Excel sheet based design of layout and cost estimation for sprinkler irrigation system and then user interactive Graphic User Interface of sprinkler irrigation system has been designed. Graphic User Interfaces have been designed in Visual Basic 6.0. A suitable database has also been designed for data storage in MS-ACCESS. This DBMS used as DSS, different designs of system

are available, so a user can select the right option of designed system according to his requirement.

REFERENCES

Bazzani G. 2005a. A decision support for an integrated multi-scale analysis of irrigation: DSIRR. *Environ. Manage*, **77:**301-314.

Bazzani G. 2005b. An Integrated decision support system for irrigation and water policy design: DSIRR. *Environ. Modell. Softw*. **20**:153-163.

Brooke A, Kendrick D, Meeraus A. 1992. GAMS A user's guide. The Scientific Press, Redwood City, California (USA).

Da Silva M, Park JR, Keetinge J and Pinto P. 2004. II The use of the DSSIPM in the Alentejo region of Southern Portugal. *Agr. Water Manage*. **51**:203-215.

Flores C and Holzapfel E. 2009. Dynamic Decision Support to assist the suitable water management of an orchard under furrow irrigation. P.100. The International Conference Science and Information Technologies for sustainable management of Aquatic Ecosystems, 8th International Conference on Hydroinformatics, concepcion, Chile.12-16 January 2009. Universidad de concepcion, concepcion, Chile.

Giupponi C, Mysiak J, Fassio A and Cogan V. 2004. MULINO-DSS: a computer tool for sustainable use of water resources at catchement scale. *Math. Comput. Simulat*. **64**:13-24.

Kumar S. 1999. Drip Irrigation for precision farming. *Agriculture Today* **3**:67-69.

Liburne L, Watt J and Vincent K. 1998. A prototype DSS to evaluate irrigation management plans. *Compt. Electron. Agr*. **21**:195-205.

Mateos L, I Lopez- Cortizo and Sagardoy J. 2002. SIMIS: The FAO decision support system for irrigation scheme management. *Agr. Water Manage*. **56**:193-206.

Meador CL and Rosenfield WL. 1986. Decision Support Planning and Analysis: The problems of getting large- scale DSS started, "MIS Quarterly, June, 1986.

Singh HP, Samual JC and Kumar A. 2000. Micro-irrigation in horticultural crops. *Indian Horticulture* **45**:37-43.

Turban and Efrain.1990. Decision Support System and Expert Systems: Management Support Systems, 2nd ed., Macmillan.

Wang F, Richardson A and Roddick F. 1996. SWIM: A computer model for solid waste integrated management. *Comput. Environ. Urban Syst*. **20**: 233-246.

CORRECT CITATION

Manibhushan, Upadhyaya A and Singh AK. 2014. Database Management System for Design and Layout of Pressurized Irrigation System. *Journal of AgriSearch* **1**(2) : 112-116.