Development of user Friendly Software for Drip Irrigation System Design

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***Abstract*— Drip irrigation systems are the most efficient method of irrigation. Drip irrigation systems are a sophisticated and complex one, in which each component plays a very important part. The efficiency of drip irrigation systems is a function of appropriate design. Appropriate design of drip irrigation systems helped the farmers to bring more area under irrigation. The efficiency of drip systems typically is reported to be 90% or higher. It means, much less water wasted as compared to other systems of irrigation. Many farmers growing vegetables and fruits in India and abroad preferred drip method of irrigation. Drip irrigation has other benefits also which make it useful almost anywhere. It is easy to install, easy to design, can be very inexpensive, and can reduce disease problems associated with high levels of moisture on some plants. Drip systems are simple and pretty forgiving of errors in design and installation, there are some guidelines that if followed, will make for a much better drip system. The aim of present study was to develop a computerized programme for design of drip irrigation systems for different horticultural crops. In order to design economical system of drip irrigation, a computer software has been developed in the Department of Soil and Water Engineering, Faculty of Agricultural Engineering, IGKV, Raipur with objective to facilitate the students, officials of Department of Agriculture/Horticulture Government of Chhattisgarh, NGOs and farmers for easily designing the drip irrigation system. User friendly computer software was developed to design drip irrigation system for different locations for horticultural crops. This computer program was named "Drip Irrigation System Design (DISD) software" and written using visual basic (Version 6.0). The method of complete enumeration was used to find the optimum sizes and numbers of main line, sub-main lateral pipelines, drippers along with water requirement of different crops and pump size. The software provides useful information in the design and optimization of drip irrigation systems for small areas. The DISD software requires only few data and it can calculate large number of data output for the design of drip system for small as well as large area of land.**

The developed DISD software tested and found to be satisfactorily. The DISD software which was developed in the Department of Soil and Water Engineering, IGKV, Raipur, can be used for designing the drip irrigation systems for almost all the horticultural crops grown in the different locations of the Chhattisgarh state. The Department of Soil and Water Engineering, IGKV, Raipur has been accepted to this software and ready to distribute for use.

I. INTRODUCTION

Efficient water management plays an important role in the irrigated agricultural cropping systems. The demand for new water saving techniques in irrigation is increasing rapidly. In order to produce more crops per drop, growers in arid and semi arid regions currently explore irrigation technique. In the modern drip irrigation systems, the most significant advantage is that water is supplied near the root zone of the plants drop by drop due to which a large quantity of water is saved. Presently, most of the farmers in India are using manually control irrigation technique, in which they irrigate the land at the regular intervals. This process sometimes consumes more water and sometimes water reaches late due to which the crops get dried.

Looking to the need of efficient design a computer programme have been developed for the design of drip irrigation system for small, medium and large area of land. This software was developed in the Visual Basic 6.0. Visual Basic program is a computer language in Visual Basic Studio. There have been a number of reports on the success of software development using Visual Basic. Visual Basic has been used widely by researchers to develop various applications including drip irrigation system design (Narayanan *et al.*, 2002; Kumar and Pande, 2009; Laosiritaworn and Bunjongjit, 2010; Bombale *et al.*, 2011).

This software helps operators in quantity control division to install drip system in the field and analyze size of different component of drip system, calculate area and water requirement of crops etc. The software also provide warning if the process is out of control. This software is capable to provide useful information in the design and optimization of drip irrigation systems for an area.

II. METHODS AND MATERIALS

In drip irrigation system small diameter plastic pipes are used. Numbers of emission points are provided at regular intervals for applying water to the plant near the roots. The diameter of plastic pipes is decision making process based on numerous factors. These factors are hydraulic principles, emitter flow characteristics, row length, elevation, energy

cost and some criteria of water application uniformity. The relationship between these factor is rather complex. The design of drip system is essentially a decision regarding emitters, laterals, manifolds, sub-main, main and size of required pumping unit.

The design criteria and formulae for the drip system of irrigation were selected as suggested by Howell *et al.* (1983), Karmeli *et al.* (1985) and Michael (2008). Various factors such as economic, topographic (location, elevation, field boundary, shape/slope, area, location of pumping unit etc.), soil (type, soil moisture holding capacity, depth and intake rate), water supply (quantity, quality, temporal variation) and crop factors (crop, row-to-row and plant-to-plant spacing) were consisted while developing the DIS D software for designing the drip system of irrigation.

Appropriate design of Micro Irrigation System (MIS) is very essential to obtain proper performance and benefits. The software is a user-friendly interactive computer program executable directly on Window system. The input parameters required for DISD is designed for operator use. DISD software requires a few inputs for the design of drip irrigation system. As the aim is to achieve precise quantity and uniform application of water for each and every plant. Collection of data is a prerequisite for designing of an efficient micro irrigation system. The input/output parameters such as length of plot (m), length of lateral (m), length of sub-main (m), length of main (m), slope (%), pan evaporation (mm/day), pump discharge (lps) and head (m) were considered in this study for developing the DISD (Fig. 1).

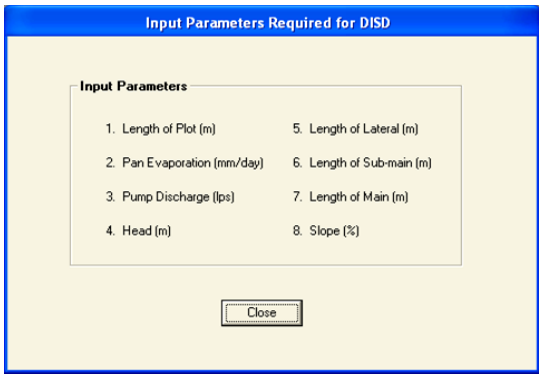

Fig. 1: Input parameters required for DISD

It is necessary to design a suitable and economically viable system to deliver a predefined amount of water at the root zone of each plant at regular intervals. This is to ensure that the plants do not suffer from stress or strain of less and over watering. Prime objectives of design should be, (i) to achieve higher water application and conveyance efficiency (ii) to optimize initial as well as operation cost (iii) to design the system for long term and high performance and (iv) to satisfy and fulfillments and requirements of the farmer.

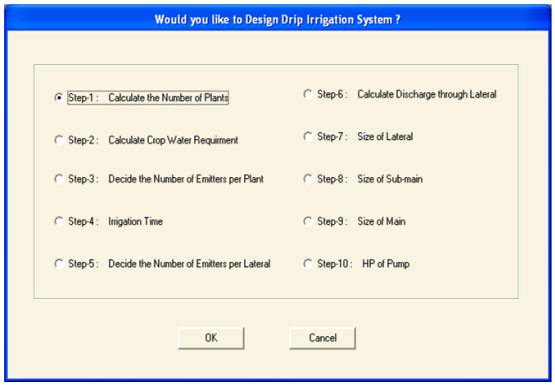

Fig. 2: Steps involved in design of drip irrigation system

Effective design should be reflected in its operation as far as flow variation is concerned. There should be minimum variation in emission of drippers. Overall irrigation efficiency should be more than 90 %. The design of drip irrigation differs from crop to crop, plot to plot, soil to soil and climatic conditions. In general, following steps are involved in design of drip irrigation system. Steps such as (i) calculate the number of plants (ii) calculate crop water requirement (iii) decide the number of emitters per plant (iv) irrigation time (v) decide the number of emitters per lateral (vi) calculate discharge through lateral (vii) size of lateral (viii) size of sub-main (ix) size of main and last step is HP of pump (Fig. 2).

III. RESULTS AND DISCUSSION

The results of drip irrigation system design for the model example of papaya is obtained using DISD software shows in the farm of table shown in Fig. 3., which can be printed for further use. The developed DISD software tested for different crops and found satisfactorily. On the basis of results obtained in the case of model example it can be said that DISD Software could be applicable/useful for design of the drop irrigation system satisfactorily for almost all the horticultural crops grown in the different locations of the Chhattisgarh state.

Fig. 3: Screen short of results of DISD software

IV. CONCLUSIONS

The DISD software which was developed in the Department of Soil and Water Engineering, IGKV, Raipur, can be used for designing the drip irrigation systems for almost all the horticultural crops grown in the different locations of the Chhattisgarh state. The Department of Soil and Water

Engineering, IGKV, Raipur has been accepted to this software and ready to distribute for use.

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