ABSTRACT

Land and water are the basic needs of agricultural and economic development of any country. The demand for these resources is continuously increasing and per capita availability of these resources in India is much less compared to many other countries. Hence it is necessary to economize the use of water for agriculture to bring more area under irrigation, to reduce the cost per hectare of irrigation and increase the productivity. This can be achieved by introducing advanced method of irrigation like micro irrigation. There is saving in water and increase in yield due to adoption of micro irrigation system. Farmers are convinced of the usefulness of the system, but the adoption is very slow due to the high initial investment cost. To popularize the system it is necessary to reduce the cost of the system. An attempt is made in this study to reduce the cost of micro irrigation system.

The newly developed micro irrigation system named Indigenous Technical Know-how Micro Irrigation System (ITK MIS) consists of combination of polytube, micro manifold and microtubes which is used in place of emitters. Polytubes are inserted in lateral and micro manifold is attached at the end of poly tubes. Microtubes are inserted in to micro manifolds. Micro manifold is prepared from used (scrap) lateral. Traditional drip irrigation system is named as Micro Irrigation System (MIS).

The research work includes indoor micro irrigation laboratory work and experimental field work. Economic analysis suggests that cost of micro irrigation system as per new concept presented in this study is reduced, compared to traditional drip irrigation system.

The objectives of present study are as follows.

1. To minimize the cost of micro irrigation system using cost effective technology.
2. To study the yield response and economics of ITK MIS and MIS.
3. To determine F factor of the lateral of the ITK MIS.

4. To establish the relationship between inlet pressure and microtube discharge and length of microtubes in ITK MIS.
5. To determine minor head loss at outlets in laterals of ITK MIS.

Indoor micro irrigation laboratory is established at Water Resources Engineering and Management Institute (WREMI), Samiala, Gujarat. Experiments are conducted on 12 mm, 16 mm and 20 mm diameter of lateral. Polytubes are of 4 mm, 5 mm, 6 mm, and 7 mm diameter and microtubes are of 1.0 mm, 1.2 mm and 1.5 mm diameter. Experiments are conducted on various lengths of polytubes and microtubes.

To measure pressures along the lateral, at the inlet of polytube, at the end of polytbe and at the inlet of microtubes, 3 data loggers and 48 pressure transducers are installed. These transducers are connected to data loggers and data loggers transfer data to computer. Pressure and discharge data are collected and analyzed. Friction head loss through ITK MIS is determined. Minor head loss at outlets and head loss through polytubes are also determined.

For ITK MIS, F factor derived by earlier researchers cannot be used as exponent of discharge to determine friction factor f is difficult to derive analytically and graphically. This is so because every outlet has polytube of different diameter and length. A micro manifold is attached to the other end of the polytube. To this 1 to 4 microtubes of different diameter and length are attached. Therefore experimental approach is adopted to determine F factor for 20 mm lateral.

To obtain the inlet pressure required in lateral for a desired discharge, relationship of inlet pressure and microtube discharge is established. To determine the length of microtube for desired discharge, relationship is developed for microtube length and inlet pressure.

The MIS and ITK MIS are installed for summer groundnut and cauliflower at Training cum Demonstration (T.C.D.) farm, Water Resources Engineering and Management Institute (WREMI), Samiala. Both the systems are operated in

two blocks. Both the crops are grown for two row spacings and three irrigation depths. Summer groundnut and cauliflower are grown for three years, in 2005, 2006 and 2007.

The results consisting of water requirement of crops, actual water applied to the crops, yield of crops, capital cost, cultivation cost, energy cost, selling price etc. Internal Rate of Return (IRR) is calculated for ITK MIS and MIS for both crops. Crop yield and IRR are analyzed using analysis of variance.

Design of ITK MIS and MIS is carried out for both the crops using the design criteria developed in this study. Regression equations developed to determine head loss at outlets and to determine head loss through polytubes are useful for design of ITK MIS. F factors are developed for each combination of polytubes and microtubes for 20 mm lateral and are now readily available for design of ITK MIS. From the analysis of F factor it is concluded that F factor depends on no. of microtubes attached to polytube in ITK MIS. From the analysis of variance on yield of crop and IRR, it is concluded that from the point of view of IRR, ITK MIS gives the higher IRR and hence it is better than MIS. From the point of view of variance in IRR, it is concluded that variation in irrigation system i.e. MIS or ITK MIS affect the IRR. ITK MIS gives the better IRR. ITK MIS is recommended to the farmers for summer groundnut and cauliflower as IRR is higher by 130% compared to that on MIS for row spacing 0.45 m. The IRR of the ITK MIS is 130 % more than that of the MIS as the cost of the ITK MIS is 40 % less than that of MIS.