CHAPTER - 1

INTRODUCTION

1.1 General

Water is the most critical limiting factor for many aspects of life, including economic growth, environmental stability, biodiversity conservation, food security, and health care. It is necessary for growth and development. As life has become more complex and technology more sophisticated, the need for water has increased geometrically.

The main source of water in India consists of the precipitation, which is estimated to be around 4,000 km^3/year, and trans-boundary flows which it receives in its rivers and aquifers from the upper riparian countries.

Out of the total precipitation, including snowfall, the availability from surface water and replenishable groundwater is estimated as 1,869 km^3. Due to various constraints of topography, uneven distribution of resource over space and time, it has been estimated that only about 1,123 km^3 including 690 km^3 from surface water and 433 km^3 from groundwater resources can be put to beneficial use. (Source: Report of National water mission under National Action Plan on Climate Change, Government of India, Ministry of Water Resources, Vol. II, 2008)

As per the report of the groundwater resource estimation committee, (2009), the total annual replenishable groundwater resource is about 43 Million hectare meters (Mham). After making a provision of 7 Mham for domestic, industrial and other uses, the available groundwater resource for irrigation is 36 Mham, of which the utilisable quantity is 32.5 Mham. The utilisable irrigation potential has been estimated as 64 Million hectares (Mha) based on crop water requirement and availability of cultivable land. Out of this, the potential from natural rainfall recharge is 50.8 Mha and augmentation from irrigation canal systems is 13.2 Mha.

In spite of the national scenario on the availability of ground water being favorable, there are pockets in certain areas in the country that face scarcity of water. This is because the ground water development over different parts of the country is not uniform, being quite intensive in some areas resulting in over-exploitation leading to fall in water levels and even salinity ingress in coastal areas. The declining water levels have resulted in failure of wells or deepening of extraction structures leading to additional burden on the farmers. Out of 4,272 blocks in the country (except Andhra Pradesh, Gujarat and Maharashtra where ground water resource assessment has been carried out on the basis of mandals, talukas and watersheds respectively), 231 blocks have been categorized as "Over-exploited" where the stage of ground water development exceeds the annual replenishable limit and 107 blocks are "Dark" where the stage of ground water development is more than 85%. Besides, 6 mandals have been categorized as "Over-exploited" and 24 as 'Dark' out of 1,104 mandals in Andhra Pradesh. Similarly out of 184 talukas in Gujarat, 12 are "Over-exploited" and 14 are 'Dark' and out of 1,503 watersheds in Maharashtra, 34 are 'Dark'. (Source: Report of ground water resources estimation committee "Ground water resources estimation methodology", Ministry of water resources, Govt. of India, New Delhi, 2009, pp. 11-12.)

The population of the country has increased from 361 million in 1951 to 1,130 million in July 2007. Accordingly, the per capita availability of water for the country as a whole has decreased from 5,177 m^3/year in 1951 to 1,654 m3/year in 2007. Due to spatial variation of rainfall, the per capita water availability also varies from basin to basin. The distribution of water resources potential in the country shows that the average per capita water availability in Brahmaputra & Barak basin was about 14,057 m^3/year whereas it was 308 m3/year in Sabarmati basin in year 2000. (Source: Report of National water mission under National Action Plan on Climate Change, Government of India, Ministry of Water Resources, Vol. II, 2008)

It has been said that the next war will be fought over water. Increasing competition for dwindling water resources will continue to pose a greater threat to national and international security. Already, conflicts have arisen between a numbers of South Asian countries and also between neighboring

states within these countries. But, competition for water occurs not only between neighboring countries or states, but also between different user groups within a given watershed. Already, the urban, agricultural and industrial demands for water are more than the available supplies.

The traditional approach to solving competition issues has been to develop further water supplies with the construction of dams, reservoirs or other engineered structures. However, even this is becoming difficult since the remaining water resources are no longer easily accessible and readily developed at reasonable costs. Therefore, there is a need to optimize the use and distribution of the current supplies to meet the needs of all users. This would include implementing conservation measures such as reduced wastage and leakage, demand regulations, advanced method of irrigation, wastewater reclamation and reuse, etc.

As part of advanced method of irrigation, micro irrigation technologies are increasingly seen as a means of addressing the growing demand of scarce water resources. Micro irrigation is one of the latest technologies for applying water efficiently and effectively. It has got dominating advantages over other systems, like increase in yield, judicial use of water, uniformity in distribution of water, less fertilizer wastage, adequate and calculated supply of water as per the crop water requirements.

The major disadvantage of this system is its high initial investment and uncertainty of power. Appropriate low-cost micro irrigation systems are to be developed to have positive effects on yield, incomes, and food security. With the right design, operation and maintenance of these systems farmers can improve water productivity and income.

1.2 Objectives of the Study

The available literature reports that there is 40% to 70% saving in irrigation water and 15% to 100% increase in yield of crops through micro irrigation system over surface 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.

Considering all above facts a study was undertaken to design micro irrigation system using low cost appropriate technology, with the following objectives.

(1) To minimize the cost of micro irrigation system using cost effective technology.
(2) To study the yield response and economics of the newly developed micro irrigation system by the researcher to be known as (ITK MIS) and traditional micro irrigation system as (MIS).
(3) To determine F factor of the lateral of the ITK MIS.
(4) To establish the relationship between inlet pressure - microtube discharge and length of microtubes in ITK MIS.
(5) To determine minor head loss at outlets in laterals of ITK MIS.