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# Micro Irrigation and its Role in Modern Agriculture

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## INTRODUCTION

Water scarcity poses serious threats to rural livelihoods and food security. Studies undertaken by the International Water Management Institute (IWMI) (Seckler *et al.*, 1998; Seckler *et al.*, 1999) have estimated that by the year 2025, one-third of the world population will face absolute water scarcity and amongst the worst hit areas would be the semi-arid regions of Asia, the Middle East, and Sub-Saharan Africa which is home to some of the largest concentrations of world poverty. Absolute scarcity and the tempo-spatial variability in water availability necessitated technological, institutional and policy interventions of various sorts to enable the equitable and sustainable use of water. One of the technological interventions in agriculture espoused to have substantial impact on water use efficiency is micro-irrigation/precision-irrigation technologies. Precision Irrigation refers to a broad range of technologies and water management practices that enable farmers to use their limited water resources in a manner that increases the productivity of water (Sally *et al.*, 2000).

IAI et al. (2016) conducted a study and stated that micro-irrigation is considered as an integral part of Pradhan Mantri Krishi Sinchayee Yojna (PMKSY) and they have listedmany advantages of this technology compared to conventional water application methods due to proximity and focussed application. These are: (i) Micro-irrigation technology ensures water use efficiency as much as 50-90%. This can be achieved due to the fact that micro-irrigation helps to reduce conveyance losses, runoff, evaporation losses, seepage and deep percolation losses significantly. The saved water can be used to increase the area under irrigation or for the reclamation of degraded/ waste land; (ii) Since low flow rate is required, small wells can also be used as a source and it helps for energy savings upto 30.5%. The potential savings in power may be utilized in other sectors.

(iii) The direct application of fertilizers to the roots results in the saving in fertilizer consumption up to 28.5%. This has a long term impact to achieve land productivity; (iv) The crop yield is increased and it was stated that the productivity for crops & fruits is increased up to 42.4 % and the increase in productivity for vegetables up to 52.7%. This ensures good economic return for the better yields. (v) Farmers can judiciously add more new crops due to improved water scenario and it was estimated that as many as 30.4% farmers have done it; and (vi) More focussed and judicious use of water has resulted in the increase in farmers income. In the same study, the impact of micro-irrigation was studied in 13 different districts and it was found out that the highest percentage increase in farmers income was in Gujarat (68%) and the average income of all 13 districts was as much as 42%. Hence, micro-irrigation has been considered as an innovative technology for sustainable agricultural growth.

**What is micro irrigation**

It is a modern method of irrigation by which water is irrigated through drippers, sprinklers, foggers and by other emitters on the surface or subsurface of the land. Sprinkler irrigation and drip irrigation are the commonly used micro-irrigation methods.

Micro irrigation is the slow application of continuous drips, tiny streams or miniature sprays of water above or below the soil surface. In this Session, you will learn about the main features of micro irrigation system and its classification. Micro irrigation system is effective in saving water and increasing water use efficiency as compared to the conventional surface irrigation method. Besides, it helps reduce water consumption, growth of unwanted plants (weeds), soil erosion and cost of cultivation. Micro irrigation can be adopted in all kinds of land, especially where it is not possible to effectively use flooding method for irrigation. In flooding method of irrigation, a field is flooded with water. This results in significant run-off, anaerobic conditions in the soil and around the root zone, and deep irrigation below the root zone, which does not supply sufficient water to the plants. It is, therefore, one of the most inefficient surface irrigation methods. Micro irrigation can be useful in undulating terrain, rolling topography, hilly areas, barren land and areas having shallow soils. According to depth, soil types can be classified as shallow (depth less than 22.5 cm), medium deep (22.5–45 cm) and deep soil (more than 45 cm).

**Benefits of micro irrigation systems**

**Water saving:** Micro-irrigation (MI) is proved to be an efficient method in saving water and increasing water use efficiency as compared to the conventional surface method of irrigation, where water use efficiency is only about 35-40%.

**Increased irrigation efficiency:** The on-farm irrigation efficiency of properly designed and managed drip irrigation systems is estimated to be about 90%. Farmers using a pumping system to irrigate their fields should ensure that the pump and pipe size are fitting with their needs, thus avoiding water and energy overuse and consequent leakages.

**Higher yields:** The yields are higher than traditional flood irrigation. Productivity gain due to use of micro-irrigation is estimated to be in the range of 20 to 90% for different crops. Yields of crops increase up to 45% in wheat, 20% in gram and 40% in soybean.

**Less water loss:** There is also less loss of water due to reduction in loss of water in conveyance and also reduction in loss of water through evaporation, run off, and by deep percolation.

**Energy efficient:** The reduction in water consumption in micro-irrigation also reduces the energy use (electricity) that is required to lift water from irrigation wells.

**Lower consumption of fertilizers**: An efficient drip irrigation system reduces consumption of fertiliser through fertigation.

**Weed and disease reduction:** It helps in inhibiting growth of weeds as it keeps limited

wet areas. Under this condition the incidence of disease is also reduced.

**Cost savings:** There are substantial reductions in irrigation costs and savings on electricity and fertilisers.

**Precision farming:** Emerging computerised GPS-based precision irrigation technologies for self-propelled sprinklers and micro-irrigation systems will enable growers to apply water and agrochemicals more precisely and site specifically to match soil and plant status and needs as provided by wireless sensor networks.

**Classification of micro irrigation system**

Micro irrigation system can be broadly classified into two categories:

(1) Drip irrigation system

(2) Sprinkler irrigation system

However, there are distinct differences in the water flow rate, operating pressure requirement and measurement of the wetted area between drip and sprinkler irrigation systems. Water flow rate means the amount of water discharged in an area at a particular time. It is expressed in litre/minute (lpm) or gallons/ minute (gpm). The system operating pressure must compensate for pressure losses through system components and field elevation effects.

**Climate change and water-use efficiency**

The annual average temperature in South Asia is projected to increase by 1.6°C (with a range 1.0°–2.3°C) under the climate-sensitive scenario, and 2.2°C (range 1.5°–3.1°C) under the carbon-intensive scenario by 2050, relative to 1981–2010 (ref. 7). Agriculture contributes around 20% of India's net GHG emissions annually8. The direct use of diesel and indirect use of electricity in irrigation are major contributors towards this. Under the 'business as usual' scenario, the twin objectives of meeting irrigation water demand with reduced energy foot-prints cannot be materialized. Hence, the water and energy savings will have to come from improvements in water and energy efficiency. With every 1% improvement in irrigation efficiency, GHG emissions reduce by 2.1%.

**Micro-irrigation development in India**

Current status MI in India is popularized with a subsidy component, by both the central and state governments. As on 2017, the area covered under MI is about 8.7 m ha, accounting for only about 13% of the potential. Maharashtra, Andhra Pradesh, Telangana, Karnataka and Gujarat together account for about 85% of total drip-irrigated area (Table 2)17. In case of sprinkler system, Rajasthan and Haryana top the list. Madhya Pradesh, Punjab and Haryana lag far behind compared to their potential. However, ground-water development in these states is more than 100%.

**Government Schemes Available for Micro-Irrigation**

In 2006, Government of India (GoI) started a centrally sponsored scheme (CSS) for MI. In 2010, CSS was enhanced in scope and renamed as National Mission on Micro Irrigation (NMMI), which was subsequently brought under the ambit of the National Mission on Sustainable Agriculture. In 2015, NMMI was brought as a scheme under the Prime Minister's Krishi Sinchayee Yojana (PMKSY). The scheme envisages providing end-to-end solution to irrigation supply chain. The MI development was enhanced through budgetary supports. Un-ion Budget 2017 announced allocation of Rs 7377 crores towards PMKSY. This constitutes an increase of about 42% over the revised estimates for the fiscal year 2016–17. About 46% of this is set aside for the 'per drop more crop' component, which mainly focuses on the development of MI. The government has also proposed to create a MI fund with an initial corpus of Rs 5000 crores, to be mobilized by NABARD through market borrowings. Over and above the subsidy provided by the central government,

the states add their share, taking the subsidy component to more than 80% of the capital costs.

## CONCLUSION

Micro irrigation which include drip, sprinkler, spray irrigation, subsurface irrigation and bubbler irrigation have their own importance. Amongst which drip is most efficient water and nutrient delivery system in drylands, and they obeys the slogan saving water is saving life. Drip have advantages such as saving water as they have good irrigation efficiency, energy, increases crop production, reduces weeds, used if water is saline as reduce its rate ,reduces labour and hence cost of cultivation will be reduced. Sprinkler ( Asset in water scarce and undulating areas) has advantages are good seed germination, less labour requirement, fertilizer application, weedicide and insecticide application, frost protection, cooling of crop. As agriculture require large amount of water micro irrigation should be promoted by government to tackle water crises. Micro irrigation is facing challenges like energy crisis, awareness, affordability and farm income which must be overcome. Thus, by using micro irrigation we can conserve soil and water resources and it is solution to water scarcity in dry areas. Micro irrigation has potential of transforming an agriculture from subsistence farming to commercial enterprise.

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