

## MICRO-IRRIGATION FOR AGRICULTURAL GROWTH

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Micro irrigation leads to substantial increase in farm income, larger area of cultivation, low cost of cultivation especially irrigation cost and weeding cost, increased yield of produce, enhanced quality of crops with optimum water use efficiency. It is possible to control water application rate and fertilizer application dosage. Farmers can judiciously adopt the cropping pattern and crop intensity due to improved water availability situation. High valued cash crops can be cultivated easily. Moreover, micro irrigation can be applied to all kinds of lands.

India accommodates more than 17% of world's population, but the country has only 4% water resources and 2.5% land resources of the world. Water is a scarce natural resource and there is a huge demand-supply gap to meet the requirements of various sectors. The highest water demand is from irrigation, a critical input for agriculture production and its current demand in the country is around 80%. Since the demand from agriculture sector and other sectors (industrial demand, public water supply etc) are ever increasing and it is difficult to identify additional sources of water, optimal use of available water is essential. Demand management is the most appropriate strategy to manage the scarce resources and according to National Water Policy (2012) by Ministry of Water Resources, Government of India, water saving in irrigation has been given vital importance to achieve water use efficiency.

Hence, efficient irrigation technologies are inevitable for enhancing water productivity. Micro irrigation is an innovative water saving technology in which water is directly supplied to the crops with very less conveyance and evaporation losses. Saved water can thus, be used more efficiently for meeting other economical or ecological needs. The major advantage of this technology compared to traditional surface flooding method is that micro irrigation reduces non-beneficial evaporation and non-recoverable percolation of water. Hence, this technology boosts up overall water use efficiency.

Micro-irrigation is considered as a prudent irrigation technology promoted nationally and internationally to achieve higher cropping intensity and irrigation intensity through more focussed application of water to crops. Different types of



systems are drip irrigation, sprinkler irrigation, micro-sprinkler, porous pipe system, rain gun etc., where drip irrigation and sprinkler irrigation dominate among all these systems. The major crops cultivated under drip irrigation are sugarcane, banana, cotton, lemon, grapes, oranges, mangoes and wide variety of vegetables. Sprinkler irrigation is mainly used for groundnut, wheat, millet, sorghum, mustard etc.

### Benefits of Micro Irrigation

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), launched by Government of India in the year 2015, considered micro irrigation as its integral part due to enhanced water productivity and water use efficiency through its proximity and focussed water application. As per the survey conducted for Government of India by IAI et al (2016), across 13 states consists of 5892 beneficiaries of National Mission on Micro Irrigation (NMMI), the following advantages are listed as compared to traditional surface flooding method.

- i) **Increase in water use efficiency:** Micro irrigation helps in significant reduction of water conveyance losses, runoff, evaporation losses, and seepage & deep percolation losses. This ensures higher water use efficiency up to 50-90%.
- ii) **Energy Efficiency:** Micro irrigation requires minimum pressure and low flow rate only. Hence, this ensures energy consumption saving up to 30.5%. Even small wells and tanks can also be used as a source of water. Since this system requires very low pressure, off-grid farmers can use solar pumps or diesel pumps.
- iii) **Fertilizer Use Efficiency:** Proper mixing of fertilizers and water, control of optimum dosage and direct application of fertilizers to the root zone result in the saving in fertilizer consumption up to 28.5%.
- iv) **Productivity increase:** The crop yield (quantity and quality) is increased and the enhancement in productivity is estimated for fruits / crops up to 42.4 % and for vegetables up to 52.7%. This ensures good economic return for the better yields.
- v) **Irrigation cost saving:** This technology reduces the overall cost of irrigation due to decrease in labour requirement for irrigation, weeding and fertilizer application. Irrigation cost saving is up to 31.9%.
- vi) **New crop introduction:** 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. Some of the farmers have tried intercropping and crop rotation also.
- vii) **Increase in farmers' income:** The average income of all beneficiaries in all 13 districts was found to be increased up to 42%. More focussed and judicious use of water & nutrients result in good quality produce and increase in farmers' income. Moreover, the reduction in spacing between the plants can accommodate more number of plants.

There are many other benefits of micro irrigation adoption. Mixing of nutrients & water is possible in the drip irrigation system itself and the solution can be directly supplied to the root zone of the plants. Water and fertilizer application efficiency are improved significantly. This has a long term impact to regain land fertility and ultimately increase in land productivity. Crop yield depends upon water availability at the root zone and soil nutrients at different stages of plant life.

Farmers are motivated to use this technology due to various reasons. Pre-monsoon cultivation and early harvest are possible. Hence, the crop will not be affected even if the monsoon withdraws early or an insufficient monsoon. Micro irrigation leads to substantial increase in farm income, larger area of cultivation, low cost of cultivation especially irrigation cost and weeding cost, increased yield of produce, enhanced quality of crops with optimum water use efficiency. It is possible to control water application rate and fertilizer application dosage. Farmers can judiciously adopt the cropping pattern and crop intensity due to improved water availability situation. High valued cash crops can be cultivated easily. Moreover, micro irrigation can be applied to all kinds of lands.

Recently, drip irrigation with mulching is used to prevent evaporation, maintain moisture, reduce weed growth, mitigate soil erosion and improve soil conditions. Mulching can help to improve crop yield and optimize water use. Different materials for mulching can be organic (eg:-straw, shredded bark, wood chips etc) or inorganic (eg:-plastic sheets, gravel etc). Biswas et al. (2015) show that the yield

and yield contributing characters of Tomato in drip irrigation with mulching are much higher than that for only drip irrigation.

### Technology Promotion

Micro-irrigation is suitably applied to irrigated agriculture of water scarce regions of developing countries. Government has initiated micro irrigation in the Tenth Five Year Plan (2002-2007). Since then, keen initiatives are being taken by Central Government, State Governments, some NGOs and some business firms to promote and propagate this new technology. Micro-irrigation has been given special importance in Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) with the aim of extending irrigation cover ('Har Khet Ko Pani') and improving water use efficiency ('Per Drop More Crop') to improve various water development and management activities. These initiatives are in terms of financial support, technical support and institutional supports. Initially, this technology was highly capital intensive and could be afforded by only rich farmers for their large farm holdings. Though it was economically viable, the awareness was also very less. Aga Khan Rural Support program (AKRSP), an NGO is actively working in Gujarat and International Development Enterprises (IDE), a non-profit voluntary organization is actively working in Maharashtra and Gujarat to innovate low cost micro irrigation systems for small and marginal farms and create awareness among poor farmers.

Gujarat is one of the high performing states in India and this State has established 'Gujarat Green Revolution Company (GGRC) Limited' in 2005 for successful implementation of Government schemes for micro-irrigation. GGRC provides all necessary

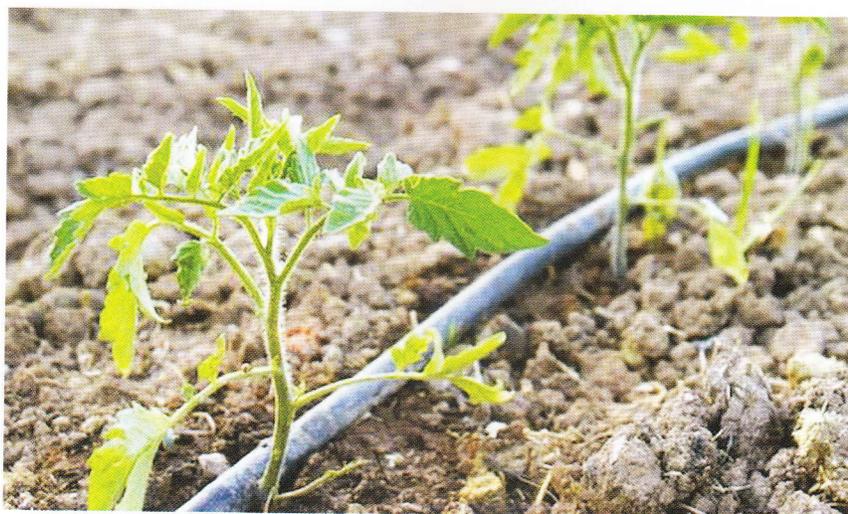
infrastructures for crop cultivation, facilitates cultivation under adverse climatic conditions, and helps to develop market linkage for the produces and to enhance economic conditions of the small and marginal farmers.

Various subsidies are also available from the Government. Small and marginal farmers in India are entitled to get a subsidy up to 55% of the total cost of the system and the same for other farmers up to 45%. Tribal farmers and farmers from dark zone areas are given additional benefits. Region wise benefits are also available. It has been observed that highest adoption of this technology is from medium category farms (2-10 Ha), followed by small farms (1-2 Ha). Farmers of marginal farms (less than 1 Ha) and large farms (>10 Ha) have so far not appreciated it due to subsidy regulations.

### Effective Implementation of Technology

Some reports state that micro irrigation programme implementation is facing some problems. Harsha (2017) reveals that it may be due to the following reasons. (i) Energy crisis due to power outages and unscheduled interruptions across rural and urban India. This problem may be solved by integrated drip irrigation with solar panel system which is considered as the best option for off-grid farmers. In one of the banana fields in Gujarat (Figure), it was estimated that the pressure requirement was only 1-1.5 kg/cm<sup>2</sup> for in line dripper. A solar pump system in this field consists of 12 solar panels each of capacity 250 Watt, can operate a pump of 3 Horse Power (HP) capacity. (ii) Expensive micro irrigation: Most of the adopters are wealthier farmers and poor farmers cannot afford it. This problem is resolved by inventing low cost systems

by different agencies. International Development Enterprises (IDE), an NGO is actively working in Maharashtra and Gujarat innovate low cost micro irrigation systems and create awareness among poor farmers. There are two types of micro irrigation systems: (i) Low cost micro irrigation technologies and (ii) Commercialised state-of-the-art micro irrigation systems. The low cost irrigation technology consists of various affordable designs for poor farmers such as "pepsee", easy drip, micro sprinkler, micro



tube drip systems and different designs by IDE. Second category includes conventional drip and sprinkler systems. (iii) Declining landholdings and farm income: In the Banana field in Gujarat, the spacing required for traditional irrigation (TI) is 6 ft x 6 ft whereas in drip irrigation, it can be reduced up to 5 ft x 5 ft. The area required per plant is approximately 25-30 sq.ft in drip irrigation which is less than the area required in TI (36 sq. ft). It has been estimated that both quality and weight of bananas are increased by 10%. The payback period for the entire system is estimated to be 1-4 cropping seasons. Earlier, grid connected farmers had to pay electricity charges to operate the pumps. Now, farmers can earn money by creating their own micro-grid to sell power. This can be achieved by directing the extra power generated by solar panels to the main grids. (iv) "Per Drop More Crop" Fallacy: This explains whether the real water saving happens through reduction in evapo-transpiration or not. There are additional benefits of optimum irrigation frequency. Proper irrigation frequency and fertilizer dosage can be adjusted at different stages of plant growth. For each plant in the banana field, water is to be supplied on alternate days at a rate of 4 litres per day and it should be increased to 4-6 litres per day during summer months.

The major disadvantage of solar panel enabled micro irrigation system is that farmers have to schedule irrigation during sunshine hours only, which otherwise they would be using the time for other productive works. However, this problem may be solved by constructing large storage tanks and connecting with the system. On the other hand, some of the grid connected farmers are getting electricity alternatively one week during day time and the following week during night time.

### Conclusion

Total water demand from agriculture sector is around 80%, any effort for saving irrigation water will contribute to water use efficiency. There are many benefits of micro irrigation which can be listed as increase in water use efficiency, optimum dosage of fertilizer and proper mixing, reduction in the cost of cultivation, reduce drudgery, conserve water resources etc. Increase in the quantity and quality of crop yield is another notable benefit. Proper mixing and the direct application of fertilizers to the root zone results in the saving in fertilizer consumption. This has a long term positive impact to achieve land productivity. Various research studies show that micro-irrigation is

economically viable. In addition to this, use of solar panels for working of pumps will be more helpful to farmers. More focussed and judicious use of water has resulted in increase in farmers' income. Hence, micro-irrigation has been considered as an innovative technology to accelerate sustainable agricultural growth.

### References

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### Constitution (103rd) Amendment Act, 2019

The President has given his assent to the Constitution (One Hundred and Twenty Fourth Amendment) Bill, 2019. The Act providing 10 per cent reservation in government jobs and educational institutions to Economically Weaker Sections (EWS) among upper castes has come into effect. The Government notified 14th January as the date on which the provisions of Constitution (103rd) Amendment Act, 2019 will be effective. The Act amends Articles 15 and 16 of the Constitution by adding a clause which allows States to make special provision for the advancement of economically weaker sections in the general category.