

Micro Irrigation in Western Rajasthan: A Water Saving Techniques

Lokesh Kumar Jain¹, HP Parewa², P Pagaria³, Anirudh Choudhary⁴, S.C. Meena⁵

Author's Affiliation: ^{1,2,5}Assistant Professor, ⁴Lab Assistant, College of Agriculture, Sumerpur, Pali 306902, Rajasthan, ³Senior Scientist Cum Head, Krishi Vigyan Kendra (Agriculture University, Jodhpur), Gudamalani, Barmer 344031 Rajasthan, India.

How to cite this article:

Lokesh Kumar Jain, HP Parewa, P Pagaria, et al. Micro Irrigation in Western Rajasthan: A Water Saving Techniques. Indian J Plant Soil. 2020;7(1):21-25.

Abstract

The water resources in the state of Rajasthan are in a crucial stage due to uneven and erratic distribution of rainfall. Due to rapid urbanization, industrialization and increasing population, the pressure on agriculture specifically using groundwater sources is increasing and causes a depletion of surface and ground water availability. Hence, there is an urgent need to explore the possible ways to meet out the irrigation needs in water deficit area for efficient utilization of irrigation water. In the water deficit area, micro-irrigation (drip irrigation and sprinkler systems) has the potential to address problems like water scarcity for agriculture and horticultural crops. Micro irrigation systems realizing the potential for reducing crop water requirement by increasing water use efficiency and address future water scarcity at the regional and national levels.

Keywords

Western Rajasthan; Water scarcity; Micro irrigation; PMKSY.

Corresponding Author: HP Parewa, Assistant Professor, Soil Science and Agril. Chemistry, College of Agriculture, Agriculture University, Sumerpur, Pali 306902, Rajasthan, India.

E-mail: haniparewa@gmail.com

Introduction

Indian stands as one among the countries with high arable land (141Mha), but the share of irrigated area is relatively low (~40 %) in country as well as in Rajasthan. The state faces extremes of temperature and wide variations in rainfall ranging from 150 mm in western Rajasthan to 1100 in eastern parts of the state. Further, the state have a tremendous variation in physiographical conditions of land, land slope, shape of land, soil texture, soil depth, level of fertility and availability of water source in terms of quantity and quality for growing agricultural and horticultural crops. This wide variations makes the state it rich in diversity for flora and fauna. The Rajasthan in general and western part in particular is rich in bio diversity sustained the livelihood of population. More than 75 per cent households of western Rajasthan is dependent of animal husbandry and fulfill their daily needs and other requirements from god gifted scattered natural vegetation during lean period. Forest fruits are unique in quality and staple food of Western Rajasthan to combat the food and nutritional security.

Features in Western Rajasthan

- Most of the crops are cultivated under rain fed condition.

- Harvested water is utilized for drinking purpose and irrigating crops.
- The deep tube wells saline water is used for irrigation through surface and micro irrigation methods.
- The soils are saline in nature results in limitation on choice of vegetation.
- The soils in western Rajasthan are shallow and underlain by impervious layer of gypsum prevent underground water storage.
- The soils having very low water holding capacity and needs frequent irrigations for successful crop production.
- Irrigation is generally practiced through surface irrigation method for the irrigation of field crops such as wheat, cumin, isabgol, mustard, castor etc., on plain lands while through micro irrigation on undulating lands (sprinkler irrigation).

Scope for Micro Irrigation

Irrigated belt are potential area for horticultural and high value medicinal, aromatic and cash crop along with arable crops. To increase the irrigation potential, it is utmost necessary that existing water resources such as harvested water, water in streams and wells should be exploited in such area and can be used to provide assured irrigation round the year. Besides this, the surface runoff stored in the water harvesting tank can be used for supplemental irrigation during dry season for life saving irrigation.

Further, in the current scenario of climate change, farmers hesitate to invest and adopt the improved technologies to produce more from limited resources such as land, water, nutrients and other inputs. To reduce the gaps between potential yield and farmers yield, it is must to strengthen and empower the farmers with knowledge and providing information on technologies assist in improving the productivity and quantity of the agriculture produce particularly in western Rajasthan. Agroforestry and horticulture along with agriculture has emerged as an important sector for effective land use in harsh environment of Rajasthan through the adoption of micro irrigation on undulated topography and in poor quality of water sources of Thar Desert. Considering the fast decline of available water potential and growing needs for irrigation water, various measures have been introduced to increase

the efficiency of water use under surface methods of irrigation (Table 1). However these methods could not bring and substantial improvement in the existing water use efficiency. Agro forestry and horticulture plantation (Ber, Pomegranates, Date palm, Citrus, etc.) are now an important sector for effective land use planning and improving farm income as well as better employment due to technological and policy invention particularly in adoption of micro irrigation. Micro irrigation methods introduced somewhat recently in Indian agriculture and popularized through subsidies in Rajasthan proved to be an effective method in increasing the efficiency of water use (Approx. 1.0 million ha in Rajasthan). Micro irrigation also played an important role in providing more income along with employment generation throughout the year to rainfed farmers in western Rajasthan. Micro irrigation technique would have special advantage in the sense of available gravity head can be used without requiring an additional pumping unit and energy. Micro irrigation supplies water directly into root zone through a network of pipes and therefore, it substantially reduces the losses caused during conveyance, application and distribution from water sources to field. The micro irrigation also increases the efficiency of fertilizers and increase the productivity of crops.

Micro irrigation is the controlled application of water to the plants by addressing three important questions:

- a) when (time when water needed),
- b) where (directly in the root zone of the plant), and
- c) how much (in adequate quantities so as to avoid water logging situations).

Table 1: Comparison of efficiency in various irrigation methods (Bonanomi et al., 2011).

| Irrigation Method | Water Efficiency | Energy Efficiency |
|----------------------|------------------|-------------------|
| Surface Irrigation | 50-65% | Low |
| Level Basin | 60-80% | Low |
| Sub irrigation | 50-75% | Low to Medium |
| Overhead irrigation | 60-80% | Medium |
| Sprinkler irrigation | 60-85% | Medium |
| Drip irrigation | 80-90% | Medium to High |

Status of Micro - Irrigation in Rajasthan

Water is a key factor in increasing agricultural production in western Rajasthan particularly as described earlier. About 78% of Indians water resources are used for agriculture out of this only 50



Fig. 1: A chilli crop under drip irrigation.

% is actually used by plants and the remaining water resources are wasted either as deep percolation or as evaporation. With the increasing pressure of population, this availability of water for agriculture is continuously declining. The popular methods of irrigation like flooding, check basins, furrow and other surface methods deliver water to root zone in the excess quantity. The flooding stress not only reduces crop production and damages soil fertility but also causes ecological losses like water logging, leaching of nutrients and salinity. With competitive use of water and its increasing scarcity it has become imperative to optimize use of water to increase crop productivity which is possible through improved techniques of irrigation.

Micro Irrigation: One such modern method of irrigation water application under micro-irrigation is based on the types of crop, crop age, canopy area and site specific soil and climate. The water is applied as per the crop need at frequent interval. Water soluble fertilizers are also provided to the plants through this system at frequent interval as per the crop growth curve. The application of water in a micro-irrigation system is through an emitter/risers. The amount of water delivered from emitters/risers is usually expressed in liters per hour.

The Centrally Sponsored scheme Pradhan Mantri Krishi Sinchai Yojna Scheme (PMKSY) under Micro Irrigation (Taaqat Ek Boond Ki) was launched in Rajasthan state in the year of 2016-17.

The main emphasis was given to increase the area under improved method of irrigation for enhancing agricultural productivity. From the advent of this scheme a good scope for area under micro irrigation in Rajasthan. The State Government is born 40 % subsidy as state share and 60% will be borne by centre government. The contribution of farmer for drip and sprinklers syeme is different and different for small marginal farmers and rest of farmers. The grant for farmers also varies with DPAP (Drought Prone Area Programme) and Non DPAP or DDP (Desert Development Programme) or non DDP areas. The grant is borne either by farmer from his/her own resources or loan from various financial institutions. The farmer as individual, Cooperative Societies/Self Help Groups, Incorporated Companies/Panchayati Raj Institutions/NGOs/Trusts/Growers Association etc. are eligible to avail assistance under this scheme (<https://pmksy.gov.in>).

Objective of PMKSY: The scheme was launched with following objectives.

- To Increase the area under micro irrigation through improved technologies.
- To enhance the water use efficiency in the country.
- To increase the productivity of crops and farmers income.
- To establish convergence and synergy among on-going Government programmes.

- To promote, develop and disseminate micro irrigation technology for agriculture/ horticulture development with modern scientific knowledge.
- To create employment opportunities for skilled and unskilled person especially unemployed youth.

Drip irrigation: In drip irrigation, water is applied as droplets or trickles. Drip irrigation adopted mostly in areas where water scarcity is very acute and suited especially for wider crops such as ber, pomegranate, citrus, cotton, castor, maize, tomato, brinjal and plantation crops. The emitter is a metering device made up of plastic and delivers a less but precise discharge. These emitters dissipate water pressure through the use of long-paths, small orifices or diaphragms. Some emitters are pressure compensating, in which water emits at a constant rate over a range of pressures. Emission devices deliver water in drip, bubbler and micro-sprinkler modes. Emitters for each of these modes are available in several discharge increments.

Sprinkle Irrigation: Water is sprinkled, sprayed, or misted in the micro-sprinkler mode. Sprinkler irrigation system conveys water from the source through pipes under pressure to the field and distributes over the field in the form of spray of rain like droplets. It is also known as overhead irrigation. Different types of sprinkler systems namely portable, semi-portable, semi-permanent and permanent are in vogue by inhabitants of Rajasthan depends on availability of labour, energy costs, type of crop (arable crop or permanent orchards), distance from water sources etc. The use of foliar application of nutrients directly to the plant leaves is much suitable due to its low cost per unit area as compared to the application to soil.

Advantages of micro/drip and sprinkler irrigation are:

- Enhanced plant growth and yield.
- Uniform and better quality of produce.
- Sprinkler system of irrigation is suitable to undulating lands.
- Micro/drip and sprinkler irrigation suitable to waste lands.
- Possibility of using saline water through the emission devices.
- Water saving due to the precise application of the water at the root zone of the plant.
- It checks the movement of fertilisers to the surface water and restricts pollution of water bodies.
- The labour requirement for weeding and spraying of pesticides for pest control is reduced in this irrigation practice because water is delivered exactly in the required amount and at the precise point leaving very little for other unwanted plants to grow and proliferate.
- It enhances the efficient and economic use of fertilizers (Camp et al., 2001).
- Due to the precise and optimal amount of water directly to the root zone it restricts or control the growth of weeds in the vicinity of the crop which makes the crop grow with vigour and keep its maintenance easy (Moin and Kami, 2018).

Disadvantages of micro/drip and sprinkler irrigation are:

- Initial investment is high.
- Damage due to rodents is more.
- Cause difficulty in intercultural operations.
- Clogging of emitter due to precipitation. This regular clogging and other associated expenditure raises costs of its operation which run against the possibility of its adoption as it puts an additional economic burden on the poor farmers.
- Sometime not uniform application (concentration of the solution decreases as solution dissolve) leading to poor nutrient placement.
- Possible pressure loss in the main irrigation line.
- Sprinkler irrigation may cause foliar burn (with high concentrations of agro-chemicals and incompatibility with certain other agro chemicals) and leaf damage (Necrosis and burning).
- There is a general lack of awareness among the farmers regarding micro/drip and sprinkler irrigation use and advantages.
- The pipes and tubes have shorter lifeline due to clogging, its cracks, breaks and requires regular monitoring and maintenance.

Conclusion

There is enormous potential in the western Rajasthan to adopt and increase coverage under micro irrigation. It is now upon the farmers and various stakeholders of the society to realise its importance and take lead in adopting this practice on a priority basis in the larger interest of the state.

References

- <https://pmksy.gov.in/>
<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=204>
<http://iesmetrix.blogspot.com/2015/06/sprinkler-irrigation-system.html>
1. Pandey, S, Negi, BS 2016. Micro Irrigaation in Utrakhand under on Farm Water Management Scheme of National Mission for Sustainable agriculture. In: procedding- Seminar cum live Exhibition "Sookshm Sinchai Pranaleeki Sthapnaavm Sanchalan): 1-4.
 2. Singh, PK, Singh, CP, Maurya, HK, Chauchan, P. 2016. Seminar cum live Exhibition "Sookshm Sinchai Pranaleeki Sthapnaavm Sanchalan (in: procedding) pp 1-58.
 3. Moin, K, Kamil, A. 2018. Drip Irrigation in India: Prospects, Potential and Challenges. Journal of Geography, Environment and Earth Science International, 17(4): 1-14.
 4. Camp, CR., EJ Sadler, WJ Busscher, RE Sojlkka and DL Karrlin. Experiencing with sprinkler irrigation for agronomic crops in the southeastern USA: (2001).
 5. Bonanomi, G; D'Ascoli, R; Antignani, V; Capodilupo, M; Cozzolino, L; Marzaioli, R; Rao, MA. Assessing soil quality under intensive cultivation and tree orchards in Southern Italy. Appl. Soil Ecol. 2011, 47, 184-194.
-