Water Conservation For Sustainable Agriculture In Maharashtra

Dr. Dheeraj Singh
Assistant Professor
Tilak Maharashtra Vidyapeeth, Pune-37
Email Id: dr.dheerajsingh22@gmail.com

Abstract

Maharashtra is India's third-largest state. The state's water supply is both physically and temporally uneven. Irrigation now accounts for about 80% of total water usage, a proportion that is expected to decrease as urbanisation and industry expand. One of the many options for reducing water stress in the state is to improve water use efficiency. The state's average rainfall is roughly 1360 mm.
Maharashtra has a typical monsoon climate, with three distinct seasons and tropical weather. Based on rainfall, soil type, and vegetation, the state is classified into nine agroclimatic zones. Maharashtra is one of the most water-stressed states in the country.
Over the last few years, Maharashtra's rainfall has steadily decreased. This has had a negative impact on agriculture yield in arid areas.
Agriculture is the backbone of Maharashtra's economic development because the majority of the state's population is dependent on agriculture and agricultural-related businesses.
In this context, systematic irrigation planning and development, as well as long-term management of the developed resource, will undoubtedly enhance job creation and raise the population's level of living.

Agriculture is Maharashtra's greatest water user, accounting for more than 80% of the state's exploitable water resources. As a result, groundwater is rapidly decreasing. In these conditions, the State has continuously emphasised the importance of water, and actions should be done to better utilise available water and land resources.
Micro-irrigation systems save up to 40% of water, allowing for increased productivity, better quality fruits, vegetables, and other crops, fewer pests and diseases, and lower labour, electricity, and fertiliser costs.

Keywords: Agriculture, Water, Conservation, Sustainable, Maharashtra

Introduction

The state of Maharashtra has a total cultivable area of 22.5 million hectares (Mha). The ultimate irrigation potential of Maharashtra, according to the Maharashtra Water & Irrigation Commission Report (1999), is 12.6 million ha, with 8.5 million ha from surface water and 4.1 million ha from groundwater. As of June 2017, the State sector (5.037 Mha) and the local sector (1.795 Mha) projects had combined to provide an irrigation potential of 6.832 million ha (Mahajan, G. 2019).

Between June and September, almost 98 percent of the entire average rainfall falls, whereas only around 8% falls between October and December. In all Maharashtra districts except Ahmednagar, Beed, Aurangabad, and Solapur, July is the wettest month; in these four districts, September is the wettest month (Pawar, R., Belsare, S., Kolhe, K. 2019).

About 58 percent of the state's population lives in rural areas, with 80 percent relying on agriculture for a living. The availability of water in the state is highly unequal, both spatially and temporally, with the majority of rainfall falling within a 40-100-day period. The current utilisable water resources would be insufficient to meet all sectors' projected water demands. Because of increased urbanisation and industrialisation, the amount of water needed for irrigation has decreased by around 80%. As a result, the remedy is to improve water efficiency (Surve, A., Belsare, S., & Narvekar, P.2019).

Agriculture is Maharashtra's greatest water user, accounting for more than 80% of the state's exploitable water resources. As a result, groundwater is rapidly decreasing. In these conditions, the State has continuously emphasised the importance of water, and actions should be done to better utilise available water and land resources.

Micro-irrigation, particularly drip irrigation, is critical for ensuring optimal water use by boosting produce quality and lowering cultivation costs. Drip irrigation has grown increasingly popular among orchard producers as a result of these benefits, especially in locations where water is scarce (Pokale, P.N., & Divekar, D. S. 2019).

Furthermore, a number of problems, including a lack of suitable irrigation infrastructure, wide swaths of drought-prone terrain, and shallow and degraded fields, have exacerbated the challenges of agricultural development. As a result, agricultural productivity in rainfed areas has fluctuated during the last four decades. The main cause of this issue is a lack of enough moisture in the root zone depth of the soil during the crop growing season (Dawale, E. 2019).

Over the last few years, Maharashtra's rainfall has steadily decreased. This has had a negative impact on agriculture yield in arid areas. According to the 2011 Census, Maharashtra's overall population is approximately 11.24 crores, accounting for 9.29 percent of India's total population. Maharashtra has a total size of 308 lakh hectares and is divided into 36 districts and 255 talukas. Maharashtra is India's third-largest state in terms of area, but the second-largest in terms of people. With a cultivable area of roughly 75 percent (234 lakh hectares) of the total land, the state is predominantly agrarian (Kushire, S.2019).

Electrical infrastructure is critical for maintaining GDP growth because of the services it provides to the Agriculture and allied activities, Industries, and Services sectors, which in turn support economic growth by increasing labour and capital productivity, lowering production costs and increasing profitability, production, income, and employment. Maharashtra's economic progress has always been aided by its strong electrical infrastructure. Maharashtra's per capita electricity usage is always higher than the national average. In FY 2015-16, the State's per capita energy usage was 1247 units, while the country's was 1075.

Table 1: Per capita consumption (units)

Per capita consumption (units)		
Year	**India**	**Maharashtra**
2008-09	**734**	**969**
2009-10	**779**	**1054**
2010-11	**819**	**1096**
2011-12	**884**	**1204**
2012-13	**914**	**1218**
2013-14	**957**	**1235**
2014-15	**1010**	**1246**
2015-16	**1057**	**1257**

Groundwater scarcity

Groundwater has played an important part in the country's agricultural and drinking water development. Groundwater is used by almost 80% of the rural population and nearly 30% of the urban population in Maharashtra. Groundwater contributes over 60% of the entire irrigated area in the state.

ISSN No- 2581-9879 (Online), 0076-2571 (Print)
www.mahratta.org, editor@mahratta.org

Because groundwater availability in any state is primarily determined by rainfall, topography, and geology, groundwater availability has regional implications. Maharashtra experiences both temporal and spatial rainfall fluctuation, has relatively rugged topography, and hard rock covers almost 92 percent of the state, including volcanic rock, basalt (82 percent), and metamorphic rocks (10 percent). These rocks have a low groundwater yielding capacity (specific yields range from 1% to 3%), limiting groundwater supply (Gaikwad,S., & Bhoyar,C. 2019).

Irrigation prospective in Maharashtra

Agriculture and related activities play a major role in the state's economic development. Agriculture and associated activities sector's proportion of total Gross State Value Added (GSVA) is roughly 12.2% in 2016-17, down from 15.3% in 2001-02, indicating a downward tendency over time, despite the fact that a large section of the population is still dependent on this industry. The agriculture industry in the state is concerned about a reduction in the average size of agricultural holdings, an increase in the number of marginal and small farmers, reliance on the monsoon and weather, and low production.

Even while associated activities account for a small percentage of the Agriculture & Allied Activities sector, their contribution to livelihood is significant.

Because of changing lifestyles, there is significant growth potential for fruits and vegetables, milk and milk products, poultry, meat, fish, and flowers. This potential must be realised to a greater level in order to increase farmer income. The Sustainable Development Goals call for promoting sustainable agriculture and guaranteeing water availability and management. As a result, major initiatives such as increasing crop productivity, improving horticulture and floriculture yield and quality, lowering cultivation costs, promoting group farming, soil and water conservation for moisture security, creating quality infrastructure for storage and processing to control wastage, post-harvest technology for value addition, promoting value addition chain, and promoting agriculture exports have been implemented.

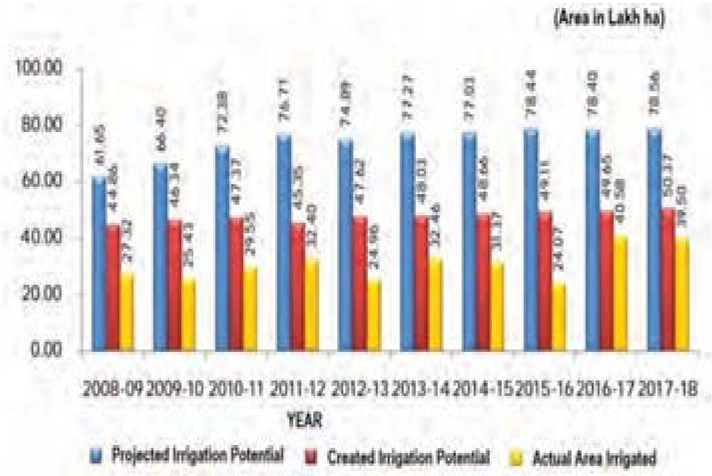

Figure 1: Details of Irrigation Potential Created and Utilised

Maharashtra's overall geographical area is 307.42 lakh hectares. The cultural command area (CCA) is 209 million hectares, and the net sown area is 175 million hectares. Completed and ongoing projects have a total irrigation potential of 74.53 million hectares. Approximately 50.37 lakh hectares of land were irrigated as of June 2018. The following image depicts the anticipated irrigation area, irrigation potential developed, and actual irrigated area over the last ten years (Pawar, R., Belsare, S., Kolhe, K. 2019).

Irrigation Water Efficiency

Water use efficiency refers to how efficiently water is delivered from the irrigation system's intake to the crop root zone for the purpose of beneficial crop evapo-transpiration, taking into account any seepage or other conveyance, distribution, or application losses that may be used by farmers within the irrigation scheme's boundaries. Surface water resource plans often have low water use efficiency, which can be significantly increased. The overall efficiency of a traditional irrigation operation is between 30 and 40%. Any irrigation project's capital investment ranges from 6 lakhs to 15 lakhs. As a result, investing in improving water use efficiency will pay off because there is such a large market for it (Surve, A., Belsare, S., & Narvekar, P.2019).

Table 2- Water use Efficiency of Different Irrigation Methods

Irrigation Methods	Efficiency (%)
Conveyance	
• through unlined canal for surface water	55 – 60
• through lined canal for surface water	70 – 75
Field Application for both surface and groundwater	
• Flood irrigation	65
• Furrow irrigation	80
• Sprinkler	85
• Drip	90
Overall efficiency for surface water system	30 – 65
Overall efficiency for groundwater system	65– 75

Source: - CWC Guidelines for improving water use Efficiency

Micro-irrigation development in the state

Maharashtra has always been a leader in the adoption of modern agricultural practises and technologies. During the last three decades, the state government has undertaken micro-irrigation on a massive scale as a campaign. Micro-irrigation systems save up to 40% of water, allowing for increased productivity, better quality fruits, vegetables, and other crops, fewer pests and diseases, and lower labour, electricity, and fertiliser costs. From 1986 to 1987, the state established its own Micro-irrigation plan with these goals in mind. The state contribution of the Centrally Sponsored Micro-irrigation Scheme has been implemented since 1991.

From 2010-2011 to 2014-15, the National Mission on Microirrigation was implemented. During the 2014-15 fiscal year, the Indian government renamed the "National Mission on Microirrigation" to "On Farm Water Management" as part of the "National Mission for Sustainable Agriculture" proposal. The Government of India (GoI) chose to execute this initiative as a Centrally Sponsored Micro-irrigation Scheme under PMKSY starting in 2014. From 2015-16, the Government of India modified the funding arrangement of centrally sponsored initiatives under PMKSY to 60:40 (Centre: State).

Multi-Disciplinary Journal
ISSN No- 2581-9879 (Online), 0076-2571 (Print)
www.mahratta.org, editor@mahratta.org

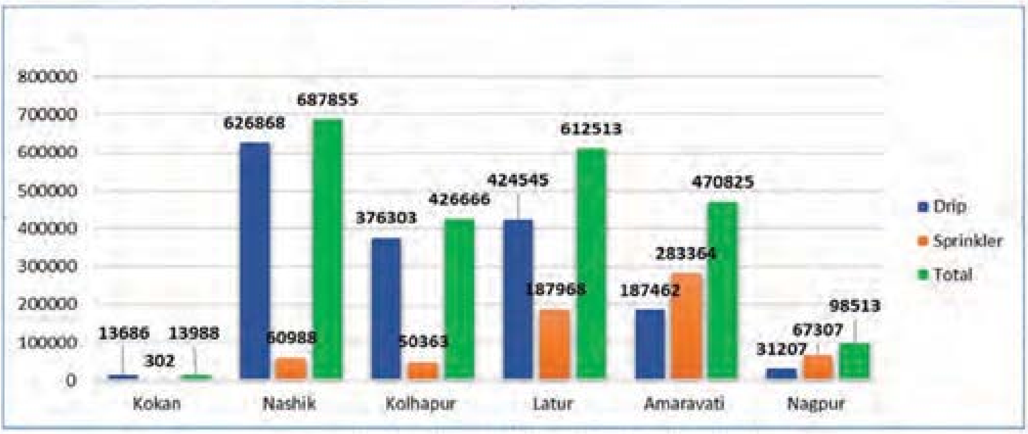

Figure 2: Area Covered under Micro-Irrigation System in the State since 1986 upto March 2018 (in Hectare)

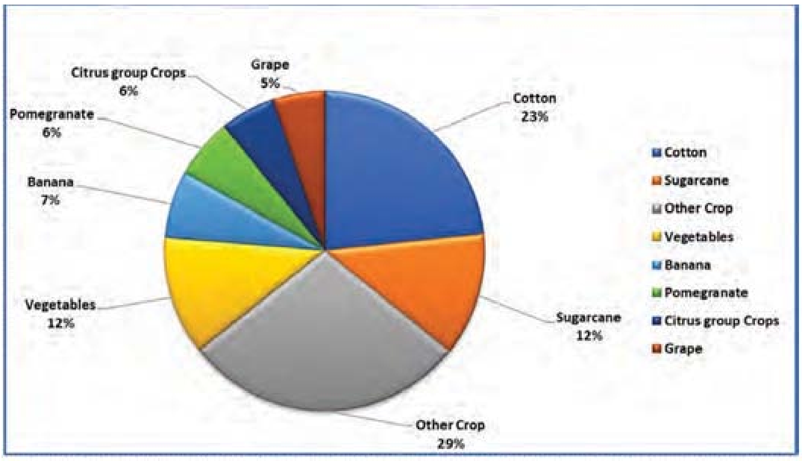

Figure 3: Crop-wise area covered under micro-irrigation system since 1986 up to March 2018

From 2015-16, the Pradhan Mantri Krishi Sinchayee Yojana, a centrally sponsored scheme, will provide financial help for microirrigation (PMKSY). According to the findings of a study conducted by A Narayanamoorthy, water conservation and water use efficiency of different crops farmed by drip irrigation are much higher than those cultivated under flood irrigation. Crop productivity and profit are also proven to be higher when they are cultivated using the drip irrigation method.

This innovative irrigation system also helps to conserve a significant quantity of electrical energy that would otherwise be utilised to raise water from wells. Even without subsidies, benefit-cost ratios with various discount rates show that drip investment in sugarcane, banana, and grape farming is economically viable. In Maharashtra, the total area covered by Microirrigation under the subsidy programme up to March 2018 was roughly 23.10 lakh ha, with 16.60 lakh ha covered by drip irrigation and 6.50 lakh ha covered by spray irrigation.

From 1986-87 to 2017-18, Figure 2 depicts the annual area covered by drip and sprinkler irrigation. Micro-irrigation coverage by crop is depicted in Figure 2. Micro-irrigation systems are now used by practically all horticulture growers, particularly for grape, pomegranate, and banana, and the area of other cash crops such as sugarcane, cotton, and turmeric is also fast expanding (Pokale, P.N., Divekar, D. S. 2019).

Water Management for Sugarcane in Maharashtra

Because water for agricultural irrigation is becoming increasingly scarce, Maharashtra's sugarcane farmers are using micro-irrigation techniques in their crops to save water. These methods not only increase cane productivity, but they also improve water efficiency. Given the importance of micro irrigation systems in sugarcane cultivation, a strategic plan is required to implement this technology across the whole sugarcane area of the state.

Drip irrigation was found to be beneficial in sugarcane crops, saving 50 percent of irrigation water while also increasing cane production by 23 percent, saving 30 percent of N and K fertiliser, increasing sugar yield by 22 percent, and boosting water usage efficiency by 2.5 times.

Table 3: Effect of water application through drip and RGSI on cane and sugar yield and water use efficiency

Treatments	Irrigation systems	Quantity of water applied mm	Cane yield t/ha	Sugar yield t/ha	Water use efficiency t/ha/mm
T1	Drip irrigation	1243	153.25	23.71	0.1233
T2	Rain gun sprinkler irrigation	1731	145.50	22.19	0.0840
T3	Surface irrigation	2496	124.19	19.52	0.0497

Micro-irrigation technique for boosting farm income

According to data on water usage by various sectors, the share of water used by agriculture is rapidly decreasing in emerging countries. In 1990, India's share of water for agriculture, home use, and industry was 92, 5 percent, and in 2000, it was 8.1, 86.5, and 5.5 percent, respectively.

With India's exponential growth of manufacturing and service sectors, agriculture's share of water is already about 80%, and it is predicted to continue to decline at a quicker rate. By 2025, the demand for water for agriculture is predicted to increase by 1.2 times to meet world food consumption. Water availability for agriculture will not increase in the future, necessitating the efficient and sustainable use of land and water resources.

When compared to surface irrigation, the micro irrigation approach has the potential to conserve up to 50% of water while increasing production by 20 to 25%. When compared to traditional surface irrigation systems, the research showed water savings of 35 to 66 percent and an increase in crop output of 9 to 86 percent (Viswanatha, K.P., & Gorantiwar,S.D.(2019).

Table 4: The yield obtained and water applied by drip irrigation methods for different crops

Sr. No.	Crop	Water applied (cm)		Water-saving (%)	Crop yield (q/ha) (%)		Increase in yield
		Drip irrigation method	Surface irrigation method		Drip irrigation method	Surface irrigation method	
1	Tomato	20	37	46	44.78	28.98	54
2	Chilli (dry)	26	78	66	2.82	2.18	29
3	Brinjal	37	84	56	39.72	24.36	63
4	Cucumber	24	54	56	22.53	15.30	47
5	Water melon	24	72	66	50.36	42.23	19

6	Chilli (green)	29	60	52	10.65	7.19	48
7	Potato	25	38	35	27.74	19.83	40
8	Sugarcane	94	236	60	1009.3	892.5	13
9	Summer groundnut	55	87	37	3.06	1.64	86
10	Ladies finger	32	54	40	177	153	16
11	Bitter gourd	24	32	25	215	154	39
12	Cabbage	27	66	59	195	180	9
13	Grape	45	110	59	245	184	33
14	Cotton	42	89	53	30	13	60

Adoption of Technology for small land holders

The average Indian farmer owns 1-1.1 hectares of land. This category includes a significant number of farmers. As a result, if the enterprise was to prosper, small farmers could not be ignored. As a result, the company created small filters (screen filters, sand filters, and hydro cyclone filters), a venturi to apply fertilisers through the systems, and a variety of other components that were appropriate and required for small holders. The company provided the farmers with full technical support, including all necessary services.

The company kept a complete file on each farmer, as well as a detailed history of the farmer's fields, including acidity and chlorination treatments, fertiliser application, irrigation schedule, and soil health cards, among other things. The company was able to achieve success as a result of this because the bottom line was to improve the farmer's net annual income.

Table 5: Division wise area covered under drip and sprinkler irrigation from 1986 to March 2017

Sr. No.	Division	Drip, Ha	Sprinkler, Ha	Total, Ha
1	Konkan	13344	290	13634
2	Nasik	482581	28317	510898
3	Pune	340102	42763	382865
4	Kolhapur	114096	35347	149443
5	Aurangabad	194611	41210	235821
6	Latur	186827	116283	303110
7	Amaravati	169444	253337	422781
8	Nagpur	27321	61275	88596
	Total	**1528326**	**578822**	**2107148**

Mass adoption of Micro-irrigation

The federal and state governments' agriculture and water resources ministries, financial institutions, NGOs, agriculture universities, research institutions, farmers, and micro irrigation system manufacturers are the primary stakeholders in the promotion and use of micro-irrigation systems. The government's support in the form of subsidy allocation to growers has been critical in the adoption of technology. With the use of research findings from agriculture universities and research stations, transparency and governance have greatly aided in speeding up the adoption rate. Banking institutions play a critical role in delivering timely and adequate financial assistance.

Small and marginal farmers have benefited from NGOs' assistance in adopting micro-irrigation systems, which has improved their livelihoods. The ecology as a whole is interconnected and mutually beneficial. As a result, strong coordination and cooperation among all stakeholders will undoubtedly aid mass adoption of MIS, resulting in a win-win situation for everyone.

Conclusion

Irrigation is an important part of the agriculture economy. Although portion of it is restored periodically by rainfall, groundwater is not an unlimited resource.

However, groundwater extraction is growing exponentially faster than the annual replenishable supply, resulting in a steady fall in groundwater levels in many of the state's watersheds. As a result, it is past time to handle this resource wisely.

The goal is to bring as much land under irrigation as possible, to stimulate the use of micro-irrigation, and to improve water use efficiency and crop yield. One option for dealing with the developing challenge of water scarcity is to improve water use efficiency. Irrigation is a big user of water and so has a lot of room for improvement in terms of efficiency.

Aside from saving water and increasing production, the trials on micro irrigation technologies demonstrated significant savings in fertilisers, increased net benefits, and labour and energy costs.

Drip irrigation was found to be beneficial in sugarcane crops, conserving 50 percent of irrigation water while increasing cane production by 23 percent, saving 30 percent of N and K fertiliser, increasing sugar yield by 22 percent, and improving water usage efficiency by 2.5 times.

References

- Pawar, R., Belsare, S., Kolhe, K. (2019). Irrigation Development in Maharashtra: Achievement, Plans and Challenges. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 8.
- Mahajan, G. (2019). Boosting Rural Economy through Irrigation. *Minister for Water Resources, Maharashtra, Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 12.
- Surve, A., Belsare, S., & Narvekar, P.(2019). Policy, Reforms and Measures towards Enhancing Water Use Efficiency in Irrigation. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 32.
- Pokale, P.N., Divekar, D. S. (2019). Micro-irrigation Development in Maharashtra. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 38.
- Dawale, E.(2019). Jalyukta Shivar Campaign to Tackle Water Scarcity in Maharashtra. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 54.
- Kushire, S.(2019). Present Scenario of Water Conservation and SmallScale Irrigation Schemes in Maharashtra. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 66.
- Rokade, S.B., & Ambekar,R.(2019). Demand and Supply Challenges of Energy for Irrigation Water Pumping in Maharashtra. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 84.
- Gaikwad,S., & Bhoyar,C. (2019). Groundwater for Irrigation in Maharashtra: Availability and Challenges. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 90.
- Deshmukh, S. Shinde, P. P. (2019). Water Management for Sugarcane in Maharashtra. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 152.
- Viswanatha, K.P., & Gorantiwar,S.D.(2019). Micro-Irrigation for doubling farm income : An MPKV initiative. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 110.
- Arun Deshmukh, A.(2019). Up scaling Micro-irrigation Technology in Maharashtra. *Aurangabad, India 16 Jan-18 Jan 2019 Publishers: Water Resources Department*, 190.