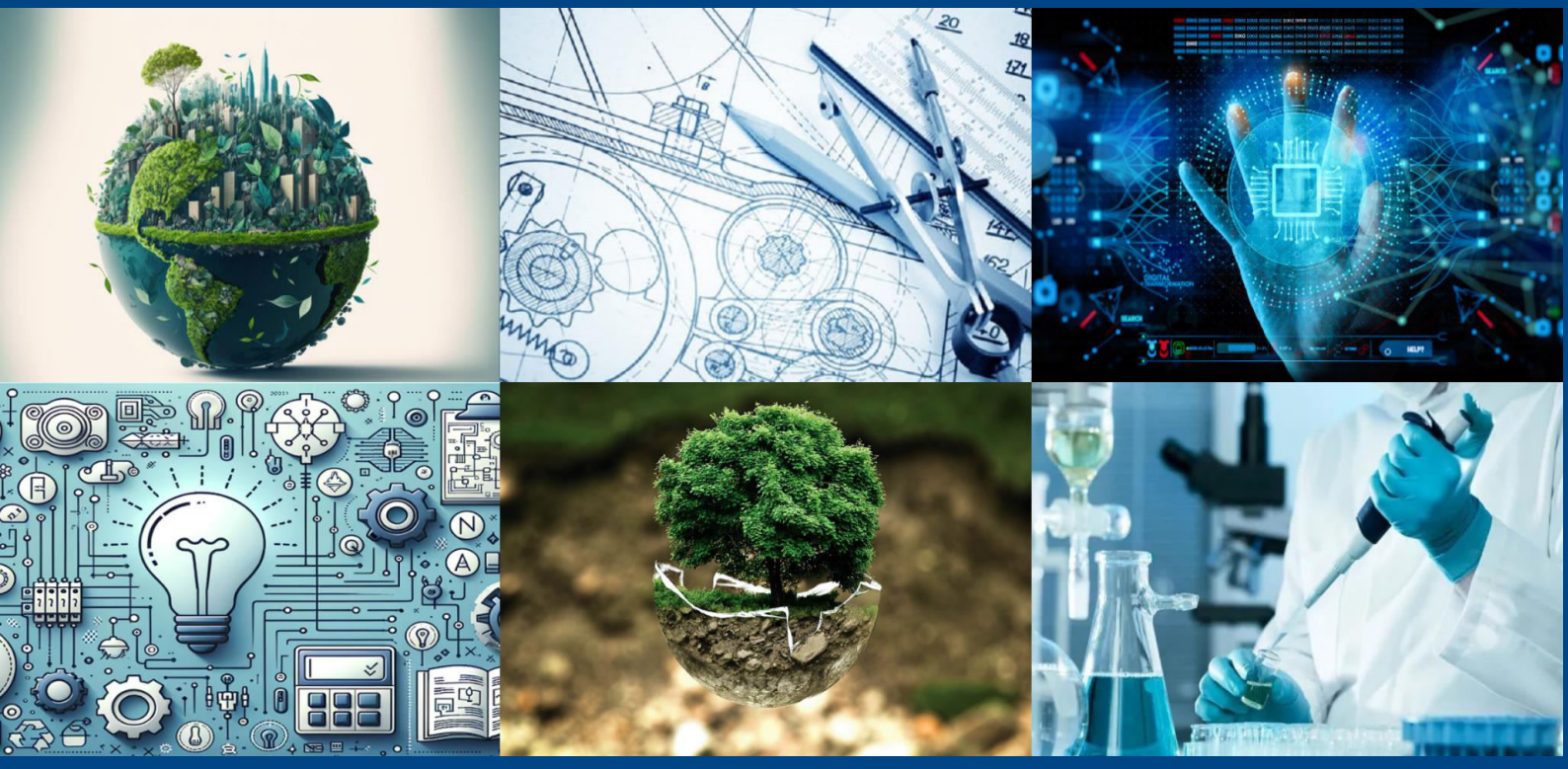
ISSN: 2582-7219

International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 9.864

Volume 9, Issue 5, May 2026

© 2026 IJMRSET | Volume 9, Issue 5, May 2026| DOI:10.15680/IJMRSET.2026.0905013

ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 9.864| ESTD Year: 2018|

International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

A Study on Innovative Techniques of Water Resource Management for Present Irrigation Works in Jalna District, Maharashtra

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ABSTRACT: Water scarcity and irregular rainfall are major challenges affecting agricultural productivity in the semi-arid regions of Maharashtra, particularly in Jalna district. Effective water resource management has therefore become essential for sustainable irrigation and agricultural development. This study focuses on the innovative techniques and practices used in water resource management for present irrigation works in Jalna district. The research highlights the role of small-scale irrigation structures such as percolation ponds, Kolhapur Type Weirs (K.T. weirs), cement nala bandharas, and storage ponds that help conserve rainwater and improve groundwater recharge. These structures play an important role in increasing water availability for irrigation and strengthening local water security.

The study also discusses modern irrigation approaches such as drip irrigation, sprinkler systems, rainwater harvesting, artificial groundwater recharge, and the integration of smart irrigation technologies that optimize water use efficiency. These techniques help reduce water wastage, improve irrigation efficiency, and support sustainable agriculture in drought-prone areas.

Field observations and secondary data indicate that combining traditional water conservation methods with modern technological interventions can significantly enhance irrigation potential in Jalna district. Government initiatives and community participation further strengthen the implementation of these water management strategies. The study concludes that innovative and integrated water resource management techniques are essential for ensuring long-term water sustainability, improving crop productivity, and supporting the livelihoods of farmers in the region.

KEYWORDS: 1. Water Resource Management 2. Irrigation 3. Jalna District 4. Groundwater Recharge 5. Water Conservation 6. Sustainable Agriculture

I. INTRODUCTION

Water is one of the most essential natural resources for agriculture, human life, and sustainable development. In India, agriculture largely depends on rainfall and groundwater resources for irrigation. However, in many parts of Maharashtra, particularly in the Marathwada region, irregular rainfall and frequent drought conditions create serious challenges for water availability. Jalna district, located in this region, experiences semi-arid climatic conditions with limited and unevenly distributed rainfall. As a result, farmers often face difficulties in maintaining adequate water supply for crops, which directly affects agricultural productivity and rural livelihoods.

In recent decades, increasing demand for water and excessive extraction of groundwater have led to a continuous decline in groundwater levels in many areas of Jalna district. Traditional irrigation methods also lead to significant water losses through evaporation, seepage, and inefficient distribution. Therefore, efficient water resource management has become extremely important to ensure sustainable use of available water resources and to support agricultural development.

To address these challenges, several innovative water management techniques have been introduced in recent years. Methods such as rainwater harvesting, watershed management, construction of farm ponds, check dams, and groundwater recharge structures help in conserving water and increasing groundwater availability. In addition, modern irrigation systems such as drip irrigation and sprinkler irrigation improve water use efficiency by supplying water

directly to the crops with minimal wastage. Government initiatives and community participation have also played an important role in promoting these techniques among farmers.

This study focuses on the application of innovative water resource management techniques in Jalna district and their role in improving irrigation efficiency and ensuring sustainable agricultural practices.

II. LITERATURE REVIEW

Water resource management is a major challenge in drought-prone regions like Jalna District, where limited rainfall and overdependence on groundwater affect irrigation sustainability. Conventional irrigation methods often lead to significant water losses and low efficiency. Therefore, the adoption of innovative techniques such as watershed development, micro-irrigation systems, and water harvesting structures has become essential. These methods help in improving water use efficiency, increasing agricultural productivity, and ensuring long-term sustainability of water resources in semi-arid regions

Wani S. P. et al. (2008) emphasized that integrated watershed management significantly improves groundwater recharge, crop productivity, and livelihood security in semi-arid regions by adopting soil and water conservation measures
Narayanamoorthy A. (2007) highlighted that micro-irrigation techniques such as drip and sprinkler systems enhance water use efficiency and reduce wastage, making them highly suitable for water-scarce areas

Rockström J. et al. (2010) suggested that combining traditional water conservation practices with modern technologies like advanced irrigation systems is essential for achieving sustainable water resource management

III. METHODOLOGY

The study is based on primary and secondary data collected for Jalna District. Secondary data is obtained from research papers, journals, and government reports, while primary data includes field observations and farmer interactions. A case study approach is used to analyze innovative techniques such as watershed management, micro-irrigation, pipeline systems, and rainwater harvesting. The data is analyzed qualitatively to assess their effectiveness in improving irrigation efficiency and water conservation.

5.1 Data Collection

Data for this study was collected from both primary and secondary sources in Jalna District. Primary data includes field observations and basic interactions with local farmers to understand existing irrigation practices and challenges. Secondary data was gathered from government reports, research papers, journals, and published case studies related to water resource management. The collected data was used to analyze the effectiveness of various irrigation techniques and their impact on water conservation and agricultural productivity.

5.2 Research Approach

The study adopts a qualitative research approach to evaluate different water management techniques in Jalna District. It focuses on comparing the effectiveness of various irrigation methods rather than detailed numerical modeling. A case study approach is also used to understand practical implementation. Successful examples like watershed projects are considered for analysis. This approach helps in identifying suitable and sustainable techniques for the region

5.3 Techniques Considered

The study considers various innovative techniques used for water resource management in irrigation. These include watershed management practices such as contour bunding and check dams. Micro-irrigation methods like drip and sprinkler systems are also included for efficient water use. Pipeline systems are studied to reduce water losses during conveyance. Additionally, rainwater harvesting methods like farm ponds are analyzed for water storage and reuse

© 2026 IJMRSET | Volume 9, Issue 5, May 2026| DOI:10.15680/IJMRSET.2026.0905013

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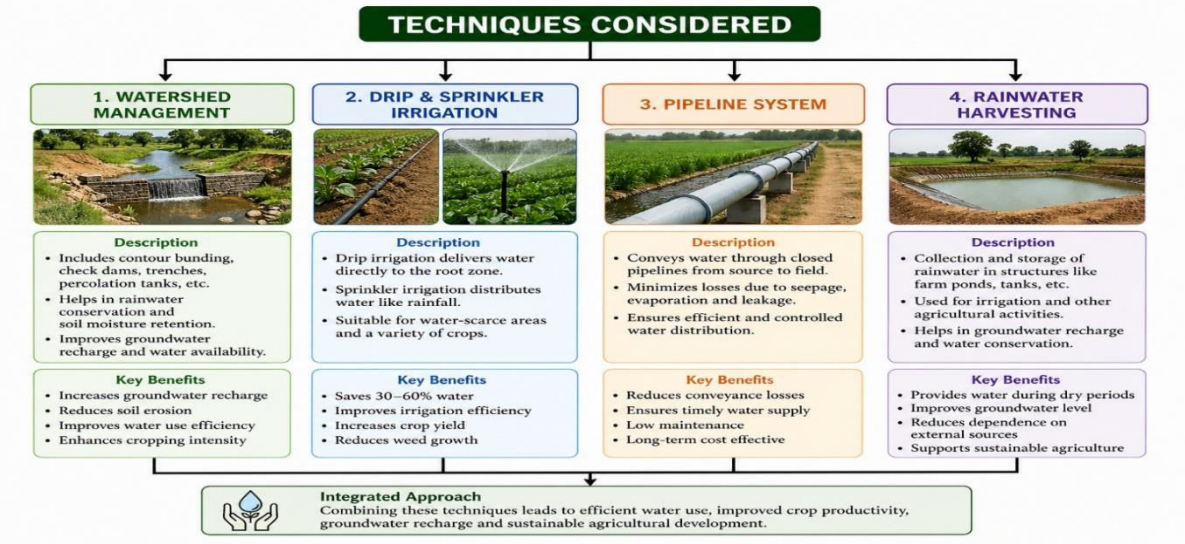

5.4 Parameters / Criteria for Analysis

The performance of different techniques is evaluated based on important parameters. These include percentage of water saving and improvement in irrigation efficiency. Crop yield improvement is also considered to assess agricultural benefits. Groundwater recharge is analyzed to understand long-term sustainability. Cost effectiveness is another key factor to determine practical applicability for farmers.

5.5 Data Analysis Method

The collected data is analyzed using comparative methods to evaluate different techniques. A before-and-after analysis is carried out to understand improvements due to implementation. Simple percentage calculations are used to measure changes in water saving and crop yield. The analysis focuses on identifying the most efficient and sustainable methods. Results are interpreted in a simple and practical manner

5.6 Limitations of Study

The study is limited to a specific geographical area, i.e., Jalna district only. It is based mainly on available secondary data and general field observations. Detailed design calculations and advanced modeling are not included in the study. The findings may vary for other regions with different climatic conditions. Despite limitations, the study provides useful insights for practical application

IV.CONCLUSION AND FUTURE WORK

The analysis of various water resource management techniques in Jalna District indicates significant improvements in irrigation efficiency and water conservation. Watershed management practices, such as contour bunding and check dams, have resulted in increased groundwater recharge and improved water availability, leading to higher cropping intensity. Micro-irrigation systems like drip and sprinkler irrigation have shown considerable water savings and enhanced crop yield compared to conventional methods.

Pipeline distribution systems have effectively reduced water losses due to seepage and evaporation, ensuring efficient water delivery to agricultural fields. Rainwater harvesting structures, including farm ponds, have improved water storage capacity and provided a reliable water source during dry periods. Comparative analysis shows that the combined use of these techniques yields better results than individual methods. Overall, the findings suggest that adopting an integrated approach to water resource management can significantly improve irrigation sustainability and agricultural productivity in drought-prone regions.

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