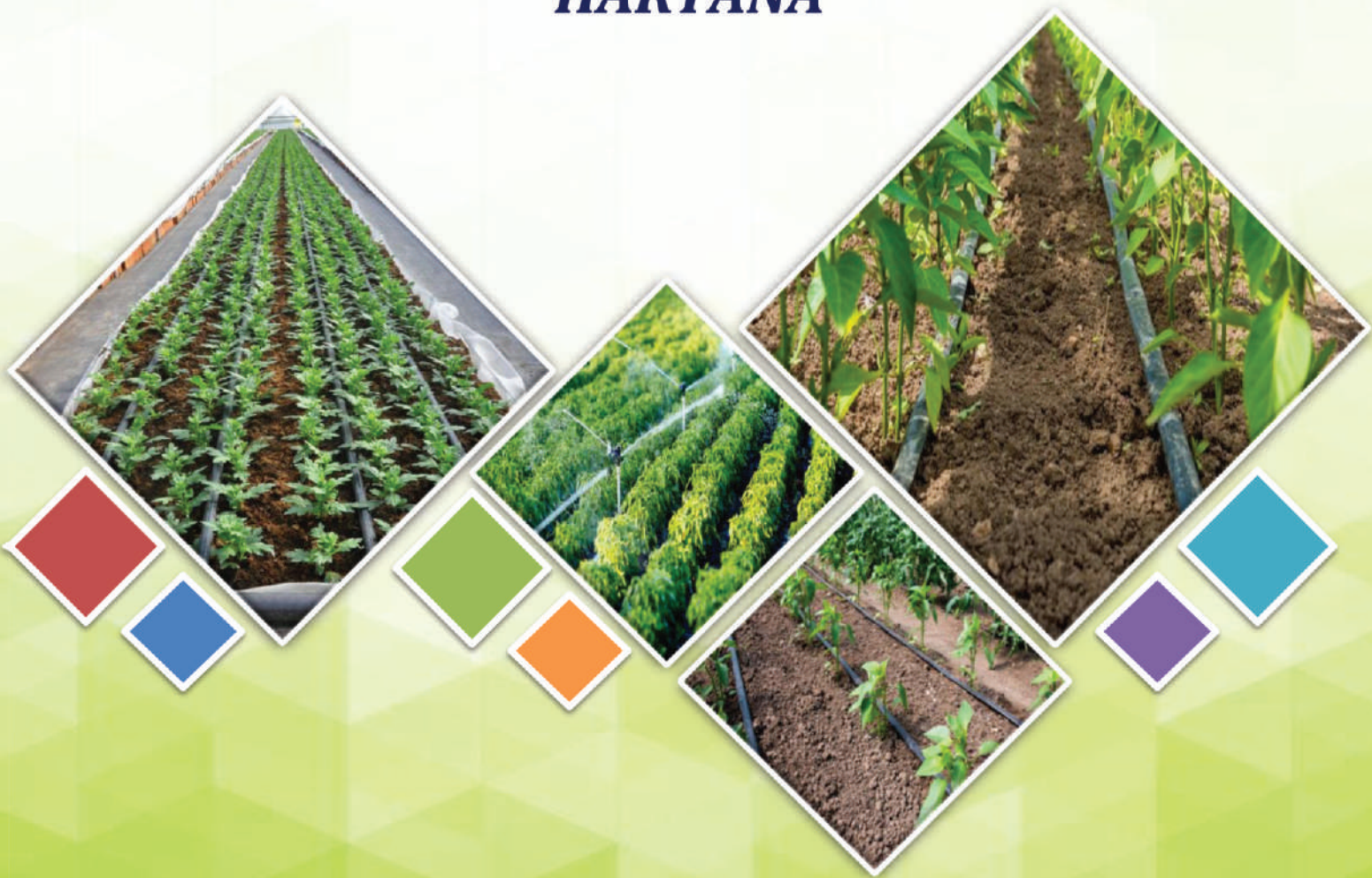




**REPORT OF WORKING GROUP
ON
PROMOTION OF MICRO IRRIGATION IN
HARYANA**



Haryana Kisan Kalyan Pradhikaran
Government of Haryana
2026



Working Group Report
on
**Promotion of Micro Irrigation in
Haryana**



Haryana Kisan Kalyan Pradhikaran
Krishi Bhawan, Sector 21, Panchkula- 134116
Government of Haryana

2026

Report of the Working Group on “Promotion of Micro Irrigation in Haryana”

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मुख्य मन्त्री, हरियाणा
चण्डीगढ़।
CHIEF MINISTER, HARYANA,
CHANDIGARH

Dated 02.12.2025

नायब सिंह
NAYAB SINGH

Message

Agriculture has been the backbone of India's economy for centuries, playing a critical role in ensuring food security, employment generation, poverty alleviation and overall economic development. As we navigate the complexities of modernization and globalization, it's crucial to recognize and appreciate the enduring significance of agriculture in shaping the trajectory of our nation.

Haryana is experiencing a water deficit and the groundwater level is depleting at an alarming rate, therefore, agriculture in the future will not be feasible without proper water management. Precise water delivery through micro-irrigation not only saves water, but also delivers essential nutrients and provides higher & better quality of agricultural produce. Micro irrigation systems can significantly enhance a plant's ability to withstand drought conditions, resulting in healthier, more resilient crops and lower emission of greenhouse gases. MI systems are best suited for all terrains and crops with lower labour cost, providing improved profitability and better livelihood for the farmers.

As we navigate the challenges of climate change and resource depletion, micro irrigation stands out as a perfect system for sustainable agriculture. By embracing this technology and integrating it into our farming practices, we can pave the way for a more resilient, productive and water-efficient agricultural sector. The challenges are huge as the glaciers around the world are melting faster than ever and as a result we are expecting 30% less water in our rivers this year. The 3R's mantra of Haryana government, Reduce, Recycle and Reuse will go a long way in preserving water for the posterity.

It gives me immense pleasure that a working group on "Promotion of Micro Irrigation in Haryana" constituted by the Haryana Kisan Kalyan Pradhikaran, has analyzed the current scenario and various other factors or problems affecting micro- irrigation through a series of meetings with farmers, researchers, field functionaries, policymakers and other stakeholders to bring out such useful recommendations. I believe that this important document will be of immense use to the planners, administrators, researchers, farmers and other stakeholders of the state.

(Nayab Singh)

Shyam Singh Rana
Agriculture Minister, Haryana & Vice-Chairperson,
Haryana Kisan Kalyan Pradhikaran



Message

Haryana had played a significant role in ushering in the Green Revolution. Today, the state is a significant contributor of food grains to the central pool and also generates export revenue through the export of agricultural commodities and products bolstering the country's foreign exchange reserves. As we embark on the journey towards sustainable development and prosperity, let us reaffirm our commitment to nurturing and revitalizing the agricultural sector through conserving water and improving soil fertility.

The state has been facing severe water scarcity issues, exacerbated by factors such as climate change, rapid urbanization, industrialization and inefficient water management practices. This demands immediate attention and concerted efforts from each one of us. It's imperative that we take proactive measures to conserve water and ensure its sustainable use for future generations.

In the face of escalating water scarcity and the urgent need for sustainable agricultural practices, micro irrigation system (MIS) emerges as a beacon of hope. This innovative technique, which includes drip irrigation, micro-and mini-sprinkler systems, revolutionizes the water management in agriculture, offering numerous benefits for both farmers and the environment. By investing in better agricultural practices, particularly in efficient irrigation, empowering farmers, fostering innovation and promoting inclusive policies, we can unlock the full potential of Indian agriculture and pave the way for a brighter, more resilient future for all.

I express my sincere appreciation to the Working Group members, stakeholders and officials of the Pradhikaran involved in the preparation of this report. It contains appropriate suggestions and key recommendations for the benefit of farmers and other stakeholders in the state.



(Shyam Singh Rana)

Pankaj Agarwal, IAS
Principal Secretary to Govt. of Haryana
Agriculture and Farmers' Welfare



Message

Agriculture in Haryana stands at a crucial crossroads where the traditional dependence on water-intensive practices must give way to innovative, resource-efficient technologies. In this context, micro-irrigation emerges not merely as a technological upgrade but as a vital strategy for sustainable water management, climate resilience and enhanced agricultural productivity.

It is a matter of great satisfaction that the Haryana Kisan Kalyan Pradhikaran has taken the initiative to constitute a Working Group comprising domain experts, field functionaries and progressive farmers to study and recommend the way forward for promotion of micro-irrigation in Haryana. This comprehensive report captures the current status, implementation challenges, stakeholder perspectives and practical suggestions based on comparative analyses and ground-level insights.

The report highlights the significant progress in the adoption of drip and sprinkler systems in the state and underscores the need for robust policy support, institutional strengthening, awareness creation and post-installation services to make micro-irrigation accessible and farmer-friendly. It is also encouraging to note the inclusion of best practices from other states and international experiences, which can positively influence Haryana's own roadmap for sustainable irrigation.

I commend the members of the Working Group for their detailed and analytical work and appreciate the visionary approach of Haryana Kisan Kalyan Pradhikaran for steering this important initiative. The suggestions in this report offer practical and actionable pathways for accelerating the adoption of micro irrigation, thereby ensuring improved agricultural sustainability, water conservation and prosperity for our farmers.

I am confident that this report will serve as a valuable reference for all concerned departments, policymakers, researchers and farmer organizations in taking this mission forward.



(Pankaj Agarwal)

Dr. Ravinder Singh Chauhan
Chief Executive Officer,
Haryana Kisan Kalyan Pradhikaran



Message

It gives me immense pleasure to share that the Pradhikaran has brought out a working group report entitled “Promotion of Micro-Irrigation in Haryana”. This report is an outcome of series of meetings, field visits and fruitful discussion carried out with policy makers, scientists, field functionaries and progressive farmers associated with micro-irrigation technology in the state. I extend my thanks to the working group consisting Dr. Samunder Singh, Dr. Ashok Kumar, Dr. Mehar Chand, Dr. M S Sidhpuria and Sh. Suresh Kumar as Members and Dr. Sanjay Yadav for their tireless efforts in preparing the report.

I am highly grateful to Sh. Nayab Singh Saini, Chief Minister, Haryana & Chairperson, Haryana Kisan Kalyan Pradhikaran and Sh. Shyam Singh Rana, Agriculture Minister, Haryana & Vice Chairperson, Pradhikaran for providing valuable guidance and support in preparation of this report. I am thankful to Sh. Pankaj Agarwal, IAS and Principal Secretary to Govt. of Haryana, A&FWD, Sh. Rajnarayan Kaushik, IAS & Director, A&FWD and Sh. Hitesh Kumar Meena, Addl. CEO, HKKP for their necessary support and guidance. I am also highly thankful to Prof. B.R Kamboj, Vice Chancellor, CCSHAU, Hisar for his support and guidance. I am indeed thankful to the Chairman and members of the working group for their tireless and commendable efforts in preparation of this document. The Pradhikaran is thankful to the Regional Directors/Senior Coordinators of CCSHAU for providing infrastructural support/venue for conducting working group meetings.

I am sure this report will receive due attention of the concerned departments and functionaries for its implementation so as to initiate appropriate measures for further promotion of micro-irrigation technology among farmers of the state. Special thanks are extended to Dr. Sanjay Yadav, Nodal Officer, Working Group, Smt. Vandana, Associate Nodal Officer, HKKP and the entire dedicated team at Haryana Kisan Kalyan Pradhikaran for their effective organization of consultative meetings and providing essential logistical support. Finally, I am thankful to all the stakeholders of the state who put forward their views and offered suggestions in the preparation of this report.

Hitesh Kumar Meena, IAS

**Additional Chief Executive Officer,
Haryana Kisan Kalyan Pradhikaran**




Foreword

It gives me immense satisfaction to present the “Working Group Report on Promotion of Micro Irrigation in Haryana”, prepared by the Haryana Kisan Kalyan Pradhikaran. This report is a result of extensive deliberations, consultations and ground-level insights, gathered through collaborative efforts involving experts, policy-makers, field-level functionaries, farmers and representatives from various departments of government of Haryana.

Micro irrigation, as highlighted in the report, is not merely a technological intervention but a necessity for sustainable and climate-resilient agriculture in Haryana. With our state's water table depleting at an alarming rate and the majority of our agricultural land being irrigated through groundwater sources, timely adoption of efficient irrigation practices has become critical. This report underscores that micro irrigation systems offer a viable solution to improve water use efficiency, reduce input costs, enhance crop productivity and increase the income of farmers.

The recommendations and strategies outlined in this report aims to address key gaps in policy, adoption, capacity building, vendor regulation and post-installation support. I sincerely appreciate the dedicated and insightful efforts of the Working Group under the leadership of Dr. Samunder Singh and supported by all members including field experts and progressive farmers. I also extend my gratitude to all stakeholders whose valuable contributions have enriched this report.

I hope the report will serve as a strategic guide for decision-makers, departments and practitioners alike, enabling the state to move towards a future where every drop of water is optimally used for agricultural prosperity.


(Hitesh Kumar Meena)

Dr. Samunder Singh
Chairman
Working Group



Preface & Acknowledgment

The Working Group on “Promotion of Micro Irrigation in Haryana” was constituted by the Haryana Kisan Kalyan Pradhikaran, Panchkula to examine the status of micro irrigation (MI) in Haryana and suggest policy measures to improve its future potential.

In carrying out the work, members of the Working Group gratefully acknowledge the administrative support extended by the Haryana Kisan Kalyan Pradhikaran. We are especially thankful to Dr. Ravinder Singh Chauhan, CEO, HKKP and Sh. Hitesh Kumar Meena, IAS & Addl. CEO, HKKP for providing copious support in all the possible manners including intellectually and administratively. We would also like to take this opportunity to put on record our sincere thanks to other staff of the Pradhikaran for their efficient and effective support to the Working Group.

Our earnest thanks to the Commissioner & Secretary to Government of Haryana; Irrigation & Water Resources Department; Administrator, MICADA; Haryana Water Resources Authority (HWRA); Director General Agriculture & Farmers Welfare, Haryana for providing data related to their department required for this report. Without their contribution, the report would not have been effective.

We sincerely extend our gratitude to the Regional Director/Senior Coordinators of CCSHAU Regional Research Station/KVKs for providing infrastructural support/venue for conducting working group meetings. We wish to express special thanks to the dealers/manufacturers of various Micro-irrigation companies/Vendors and progressive farmers for sharing their experiences.

(Dr. Samunder Singh)

Dr. M.S. Sidhpuria	Dr. Ashok Kumar	Dr. Mehar Chand	Sh. Suresh Kumar

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NOTIFICATION

The Haryana Kisan Kalyan Pradhikaran is pleased to constitute the Working Group on “Promotion of Micro Irrigation in Haryana” to examine the status of micro irrigation (MI) in Haryana and suggest policy measures to improve its future potential.

Dr. Samunder Singh (Retd. Prof. & Head, CCSHAU, Hisar) Director (Agronomy) MICADA, Haryana	Chairperson
Dr. M.S. Sidhpuria Estate Officer-cum-Chief Engineer CCS Haryana Agricultural University, Hisar	Member
Dr. Ashok Kumar Retd. Professor (Agronomy) CCS Haryana Agricultural University, Hisar	Member
Dr. Mehar Chand Professor (Agronomy) College of Agriculture, Kaul CCS Haryana Agricultural University, Haryana	Member
Sh. Suresh Kumar Progressive farmer Village Haripur, Bhiwani, Haryana	Member

Terms of Reference of Working Group were as under:

- To review the current status of Micro-irrigation in Haryana and suggest measures for improvement.
- To analyse the current support system (schemes, policies, technical and infrastructural support) for promotion of Micro-irrigation in Haryana from the state/central Governments and propose measures/methods for further improvement in this area.
- To assess the present status of training programs and extension facilities for farmers and suggest measures for skill development of persons engaged in for promotion of Micro-irrigation in Haryana.
- To review the status of research and development and suggest measures to address current gaps as per the specific needs of the farmers.
- To recommend most appropriate strategies for promotion of Micro-irrigation in the State.

SECTION-1

Status of agriculture, water scenario, water use pattern, water availability and status of ground water table in Haryana

1.1 Introduction

The current population of India is 1.43 billion (bn) and is expected to increase at a steady pace to 1.7 bn by the year 2050 with one birth per seconds and more than one migrant per minute surpassing China (<https://worldpopulationreview.com/countries/india-population>). Even though food grain production has increased significantly over the years, there is a need to increase production and better storage to feed the ever-increasing population. Agricultural productivity depends on many factors. These include availability and quality of agricultural inputs such as land, water, seeds and fertilizers, access to agricultural credit and crop insurance, assurance of remunerative prices for agricultural produce, storage and marketing infrastructure, etc. With 1544 m³ per capita water availability, India is already declared as water-stressed country by international norms and it is predicted this availability will decrease to 1230 kilolitres/year by 2050. Cross country comparison of water use efficiency shows that India uses 2-3 times higher water to produce one unit of major food crops as compared to other major agricultural countries like China, Brazil, and USA. About 71% of the Earth's surface is covered with water but only 3% is fresh water. According to the United Nations, 67% of the world's population experiences severe water scarcity for at least one month per year.

Additionally, 1 billion people in the developing world do not have access to water and spend their entire day searching for water. From 1993 to 2010, 2150 giga tons (2,150,000,000,000 litres) of groundwater has been extracted, mostly in the western US and north-west India (Haryana-Punjab), causing the Earth's rotation to tilt 80 cm to the east on its axis. Melting of arctic ice due to global warming (man made catastrophe) is predicted to further spin the earthy affecting all life. India is the world's largest user of groundwater and uses more of it than the US and China combined, though the country is not as rich in water resources as these countries. Warnings have been issued in the past about depletion of ground water in India and in the world, but the latest warnings have a sense of alarm, or even doom, about them. A United Nations report, released recently, has said that some areas in the Indo-Gangetic basin have already passed the groundwater depletion tipping point and the entire NW region of the country is likely to experience critically low groundwater availability by 2025. Indo-Gangetic Plains (IGP) supports 50% of Indian population in 43.7 m ha with a population density of 851 people/Km² and raising more than one crop cycle in a year will be worst affected by global warming due to water shortage.

India, with 18% of the world's population, has only 4% of global water resources and 70% of surface water resources are polluted. It is estimated that by 2050, half of India's population will live in urban areas and will face serious water problems. More than 80% of rural and urban water supply and 63% of water for irrigation is extracted from groundwater. The total annual groundwater recharge is 438 billion cubic meters (BCM) and 239 BCM is withdrawn, of which 208 BCM is used for irrigation and that too to support 40% irrigated area. India has already been declared water stressed and 163 million people do not have access to safe drinking water and 210 million people do not have access to improved sanitation in India. According to the NITI Aayog, the demand for water will double in 2030 and water shortage may reduce the GDP by 6%. Water conservation, groundwater recharge and reuse of recycled water are essential to maintain development and sustainability. Only 30% of wastewater is recycled in India, whereas 90% of wastewater is recycled in Israel. India urgently needs to devise and adopt water saving technologies for sustainability before the dooms' day arrives.

However, these challenges also provide opportunities to redefine the ways we must deal with stress on limited water resources in the country. India is the second-largest global producer of common cereal grains including rice and wheat. India is the world's largest consumer of ground water, and it is a critical source for regional and global food supply. If the trend continues, the rate of groundwater loss could triple by 2080, further threatening India's food and water security. Reduced water availability due to groundwater will challenge India's food security and threaten the livelihoods of over one-third of India's 1.43 billion people.

Water is considered as the most critical factor for sustainable agricultural development. Agriculture consumes more than 80% of the total ground water use in the country. Therefore, water is a precious and limited resource and must be carefully conserved and managed in the most efficient manner to reduce agriculture's dependence on monsoons. Therefore, it is necessary to ensure adequate water supply for agriculture at different critical stages. Agriculture therefore needs more efficient irrigation methods. Groundwater depletion has emerged as a serious concern because of the substantial reliance on groundwater supplies for irrigation. Water level going down, not only need more energy for extraction, but also the poor quality is becoming health hazard in many parts of the country. According to the CGWB, with 230 bn metre cubes of groundwater drawn out each year for irrigating agriculture lands in India, many parts of the country are experiencing rapid depletion of groundwater and pumping out water with heavy metals and carcinogens. The total estimated groundwater depletion in India is in the range of 122–199 bn metre³. A new study led by an Indian-origin researcher (September 2023) warns that if farmers in India continue to intensify the withdrawal of groundwater for irrigation, we will be losing ground water 3 times faster from 2041 to 2080. This trend threatens India's

food and water security. The study highlights the need for policies and interventions to conserve groundwater and address the challenges posed by climate change. Increased access to bore wells, free or subsidized electricity and a lack of electricity metering have allowed farmers to withdraw groundwater on demand, leading to overexploitation. Majority of the farmers apply flood irrigation. The total potential for micro-irrigation in the country is estimated to be 60 ha. Domestic water requirement in 2020 was 54,000 billion litres, whereas agriculture sector needed >14 times more water that is 776,000 bn litres. Various researchers have reported that conventional surface irrigation provides only 60% water use efficiency, but drip irrigation has nearly 90% efficiency. Given its higher efficiency (on an average overall saving of irrigation water efficiently also helps in saving precious fertiliser by 28.5% and energy by 30.5%) and ease of implementation within months, micro irrigation systems can go a long way in addressing the issues faced by the country and the agricultural sector. Hence, micro irrigation remains the only efficient solution and a low hanging fruit for the government, industry, and farmers to overcome the challenges faced by the agriculture sector.

The country can create micro-irrigation potential in about 60% of its arable land and 40% of the cultivable area will remain dependent on rains because it is not possible to create irrigation networks in certain regions due to hydrological and geographical reasons, according to a document of the Jal Shakti ministry.

The solution is to examine innovative models for their contribution to higher water use efficiency. Given its high-water use efficiency, micro irrigation systems can go a long way in solving the water shortage problems faced by the agriculture sector in the country. A recent report by the United Nations warns that several areas within the Indo-Gangetic basin in India have already reached a critical threshold of groundwater depletion, and the entire North-Western region is on track to experience severely low groundwater availability in the coming years. "India is the largest consumer of groundwater globally, surpassing the combined use of the United States and China. The northwestern region of India serves as the nation's primary food source, with the states of Punjab and Haryana producing 50% of the country's rice supply and 85% of its wheat stocks," the report notes.

Already, almost two-thirds – 63% of India's districts are threatened by falling groundwater levels. The stories of Chennai and Bangalore are eye opening as non-availability of required amount of water is causing population to move and affecting the economy. If current trends persist, at least 25% of India's agriculture will be at risk. Haryana is also experiencing depleting water table at an alarming rate. CGWB has issued revised Block-wise categorization for Haryana as on 31.03.2022 based on the stage of groundwater extraction, 88 blocks fall

under Over-exploited category, 10 blocks fall under Critical category, 09 blocks fall under Semi-critical category and only 36 blocks fall under safe category.

Recognizing the importance of water as a critical input to agriculture, Government of India has taken many initiatives to promote the concept of water use efficiency and realizing the goal of “Per drop more crop.” These are the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) and the Accelerated Irrigation Benefit Programme (AIBP), Har Khet Ko Paani-Surface Minor Irrigation, PMKSY-groundwater projects, special package for Maharashtra, Rajasthan and Srihind feeder and Shahpur-Kandi project and other projects.

To address the twin difficulties of a lack of water and increase crop output, micro-irrigation techniques like drip and sprinkler irrigation are becoming more popular, especially among progressive farmers. To maximize crop productivity, states are also implementing new and improved irrigation techniques. Haryana is implementing the micro-irrigation programme through Micro Irrigation & Command Area Development Authority (MICADA). The Haryana government has decided to restructure and redesignate the Command Area Development Authority (CADA) as Micro Irrigation and Command Area Development Authority on December 13, 2020, for the effective implementation of micro-irrigation projects, especially in the water-deficient areas, along with watercourses work on various canal commands in the state. Moreover, the Government of Haryana has also established the Haryana Water Resources Authority under The Haryana Water Resources (Conservation, Regulation and Management) Authority Act, 2020 with a mandate for Conservation, Regulation and Management of water resources (groundwater and surface water) in the state. Recognizing the importance of micro irrigation, the current government manifesto has talked about *Har Khet Ko Pani*. However, despite the sustained efforts made by central and state governments, the extent of success in adoption of Micro irrigation by farmers needs a review in terms of problems faced by the different stakeholders in implementing and reasons for non-adoption of the micro irrigation and suggesting a new model of micro irrigation system after consultation with the different stakeholders. Misuse of the schemes by some unscrupulous vendors who in cahoots with greedy farmers are cheating the system and need a corrective action enabling proper utilization of subsidy on MI systems to the needy farmers.

1.2 State profile

Haryana is a landlocked state in Northern India with total geographical area of the state as 44,212 km², which is 1.4% of the geographical area of the country located between latitudes 27°39' to 30°35' N and between longitude 74°28' and 77°36' E. The altitude of Haryana is variable and lies between the range of 700 to 3600 feet above the sea level and 1,553 km² area is covered by forest with tropical vegetation. Haryana has four main geographical features.

- I. Shivalik Hills: altitude varying between 900 to 2300 meters. These hills are the source of the rivers like Saraswati, Ghaggar, Tangri and Markanda, parts of Panchkula, Ambala and Yamuna Nagar districts.
- II. Yamuna-Ghaggar Plain: Divided in two parts - the higher one is called 'Bangar' and the lower 'Khadar'. This alluvium plain is made up of sand, clay, silt and hard calcareous balls like gravel known locally as kankar.
- III. Semi-desert sandy plain: Plains to the South-West includes the districts of Sirsa and parts of Hisar, Mahendergarh, Rewari, Fatehabad and Bhiwani and shares border with Rajasthan.
- IV. Aravali hills: This is a dry irregular hilly area in the South of Haryana.

The climate of Haryana is very hot in the summer and cold in the winters. The hottest months are May and June and the coldest being December and January. Haryana is very hot in the summer and freezing cold in the winters. The temperature falls to the lowest in January and reaches up to 50°C during the months of May and June. Rainfall is varied, with the Shivalik Hills region being the wettest and the Aravali Hills region being the driest. The state receives an annual rainfall of about 650 mm. The average rainfall ranges from < 300 mm in the Western and South-Western part of Gurugram, Rewari, Mahendergarh, Sirsa, Hisar and Bhiwani districts bordering Rajasthan state to over 1100 mm in the North-Eastern Shivalik hilly tracts of Ambala, Panchkula and Yamuna Nagar districts along the Himanchal Pradesh border. Of the total annual rainfall 73-79 % is received during the summer monsoon season (July to September), 4-9% during the March to June 2-3% in October –November and 7-9 % during the winter months of December-February. Haryana is administratively divided into 22 districts, 73 sub-divisions, 93 tehsils, and 140 blocks. Haryana is the nation's seventeenth most populous state and the population of Haryana, is 28,900,667 (<https://www.indiacensus.net/states/haryana>). The population density is 573.4 people/km² with sex ratio of 879 and literacy rate of 77.55% where 35% population is urban. Haryana has the highest number of rural millionaires in the country. The state also accounts for the most cars, motorcycles and tractors manufactured in the country.

Major land use in Haryana is agriculture (85%), forest (0.7%), about 7.2% fallow and 5% waste land. Haryana is self-sufficient in food production and the second largest contributor to India 's central pool of food grains. The flora found in the Haryana mainly comprise thorny shrubs, deciduous forests and thorns owing to its dry climate. When the monsoon sets in, few isolated hills and ridges are covered with green grass. You can also find eucalyptus, poplar, pine, mulberry, kikar, babul, peepal, banyan, neem and shisham trees all over the state. The presence of such flora ensure that the state is a pioneer in producing wood. Varieties of succulent herbs with medicinal properties grown in the terrains of the state. The cultivable area is 3.7 m ha, which is 84% of the geographical area of the state out of which 3.64 m ha *i.e.* 98% is under cultivation. The gross cropped area of the state is 6.51 m ha and net cropped area is 3.64 m ha with a cropping intensity of 185.3%. About 91 % of the state has assured irrigation, most suited for rice-wheat production system, whereas rain fed lands (around 1/5th) are most suited for rapeseed & mustard, pearl millet, cluster bean, agro-forestry, and arid-horticulture. The main crops of Haryana are wheat, rice, sugarcane, cotton, oilseeds, gram, barely, pearl millet, green gram, chickpea etc. For better utilization of canal water by proper maintaining the water courses, CADA (Command Area Development Authority) has constituted Water User Association (WUA) of the beneficiary farmers. There is a network of about 4000 km of drains which includes the area of Ghaggar Flood Plains in the districts of Hisar, Fatehabad, Sirsa and some areas of Jind, Jhajjar and Kaithal Districts. As per June 2020 estimate, 3,93,082 ha in the state is affected by waterlogging and salinity problem, out of which about 69,788 ha is under critical condition (water table 0-1.5 m). Most affected areas fall in the districts of Rohtak, Sonipat, Jhajjar Charkhi Dadri and Bhiwani followed by Jind, Palwal, Mewat, Fatehabad, Sirsa which goes on fluctuating depending upon the quantum of rainfall. Thus, about 9% of total geographical area is under waterlogged out of which 1.58% is under critical conditions having ground water table 0-1.5 meter below ground and 7.32 % of area having ground water table between 1.5-3.0 meter below ground.

All community development blocks of Rohtak, Jhajjar, Sonipat are severally affected by the water logging. In areas located in the topographic depression without any access to natural drainage, efforts have been made to excavate drains with their outfalls into canals. More than 120 Pumps-Lifts-Stations on out falls of the surface drains and on canals have been constructed. On these stations, 500 electric and diesel pumping sets with the total discharge capacity of about 2000 cusecs have been provided. Ditch drains of more than 80 km length have also been excavated along canal banks. These measures have helped in solving water logging problems up to some extent. The salient features of the Haryana state are as under (Table 1.1):

Table 1.1: Agriculture and water resources in Haryana

1	Geographical area ('000' hectares)	4421
2	Area under forests ('000' hectares)	33
3	Percent forest	0.7%
4	Cultivable area ('000' hectares)	3694
5	Percent cultivable area	83.6%
6	Net area sown ('000' hectares)	3551
7	Percent net area sown	96.1%
8	Area sown more than once ('000' hectares)	3065.6
9	Gross cropped area ('000' hectares)	6617
10	Cropping Intensity (%)	185%
11	Net area irrigated (Total) ('000' hectares)	3387
12	a) By canals	1231 (36%)
13	b) Tube-wells	2156 (64%)
14	Gross irrigated area ('000' hectares)	6279
15	Intensity of irrigation (%)	185.3%
16	Percent net irrigated sown area	94.8%
17	Average rainfall (mm.) (17 th Oct 2022)	637.0
18	Range of rainfall (mm.) (17 th Oct 2022)	205.0-1008.8
19	No. of holdings (Total) (in lakh)	16.28
20	a) Marginal farmers (in lakh) (Up to 1 ha)	8.02 (49.29%)
21	b) Small farmers (in lakh) (1-2 ha)	3.14 (19.28%)
22	c) Others (in lakh) (Above 2 ha)	5.12 (31.43%)

1.3 Water scenario at global, national, and state level

Out of the total water available on earth, 96.5 % is in the oceans, 0.9 % saline water and 2.5 % water is fresh water. Out of this fresh water, the percent of water present in the glaciers, ground water and surface are 68.7, 30.1 and 1.3 %, respectively (Fig. 1). Of all the economic sectors, agriculture is the one where water scarcity has large relevance as it accounts for approximately 70% of the global freshwater withdrawals and approximately 90% of its consumptive use.

Out of 4000 BCM freshwater resources in India, 1047 BCM is lost in evaporation, 1084 BCM is in unavailable form and hardly 1869 BCM is available water. From 1869 BCM available water, 1123 BCM is useable water and is categorised into ground water (395 BCM) and surface water (728 BCM).

Agriculture segment accounts for 83% of water withdrawal in India, which is well above the global average. Observations made on the source of water withdrawal are really alarming since a third of water withdrawal comes from groundwater. Ground water is depleting very fast and there is no faster recharge mechanism considering it is a very long drawn process. Groundwater, if exploited from greater depths cannot be recharged by rainfall and therefore can no longer be a renewable resource. The Indian sub-continent, with its unique position in South-Asia may face the brunt of looming crisis and as a result, India would be at the centre of it. India has 18% of the world's population with only 4% of the usable water resources where 90%

of the wastewater is discharged into the rivers that does not meet environmental standards, while 65% rainwater runoff flows into the seas, which is a major wastage. (Fig. 2, 3 & Table 1.2). Annual per capita water availability had drastically reduced from 6042 cubic metre (1947) to 1816 (2001), 1545 (2011) and expected 1340 cubic metre (2025).

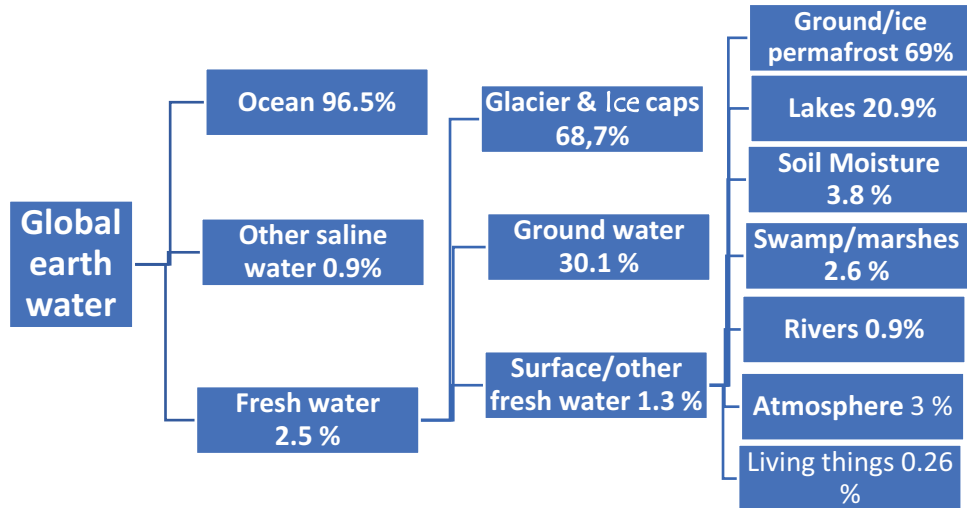


Fig. 1: Global status of water on the earth

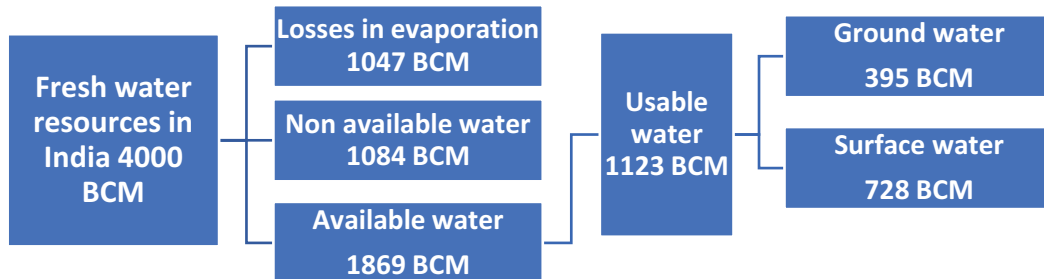


Fig. 2: Status of water in India

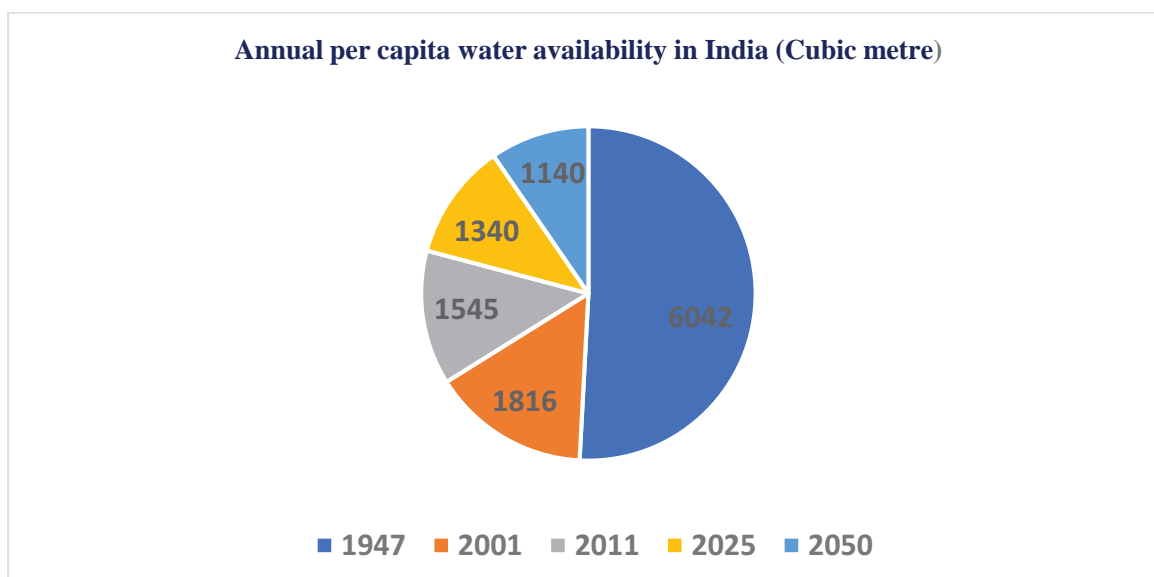


Fig. 3: Annual per capita water availability in India (Cubic metre)

Table 1.2: Water parameters at national level

Component	Quantity	Component	Quantity
Water resources share	4%	Ground water for domestic use (Share)	9 %
Percent ground water fit for use on earth	2.5%	Ground water for industrial use (Share)	2%
Fresh water resources in India	4000 BCM	Annual average water availability	1869 BCM
Water extracted for irrigation	230 BCM	Average annual potential of utilisable quantity of water	1123 BCM
Net annual ground water availability	433 BCM	Total surface water	690 BCM
Annual ground water recharge	449.08 BCM	Annual extractable ground water	407.21 BCM
Total natural discharge	41.89 BCM	Annual per capita availability of water (2025)	1340 cubic metre
Ground water for irrigation use (Share)	89 %	Annual per capita availability of water (2050)	1140 Cubic metre

1.4 Water use pattern at global, national, and state level

Water use in agriculture in India is comparatively higher (83%) as compared to European countries (33%) and global level (69%). Haryana has higher water use (91%) in agricultural activities as compared to national average of 83 percent (Table 1.3)

Table 1.3: Water use pattern (%) at global, national, and state level

Component	World	Europe	India	Haryana
Agriculture	69	33	83	91
Industry	23	54	12	3
Domestic	8	13	5	6

1.5 Exploitation of water resources in India

The situation of depleting ground water is more alarming in Northern India as few states are extracting more ground water in comparison to the annual ground water recharge. Punjab (164.42%), Rajasthan (150.22%), Haryana (134.56%), Daman Diu (113.38%) and Delhi (101.40%) are extracting more ground water as compared to annual ground water recharge (Table 1.4). If the stage of ground water extraction development is more than 100%, it means annual ground water consumption is more than annual ground water recharge. On an average the stage of ground water extraction at national level is 61.60%. The North-Eastern states have very low ground water extraction (0.36 to 5.12 %).

Table 1.4: State-wise ground water resources of India, 2020 (in BCM)

S. No.	States/Union Territories	Total Annual Ground Water Recharge	Annual Extractable Ground Water Resource	Current Annual Ground Water Extraction			Stage of Ground Water Extraction (%)
				Irrigation	Industrial & Domestic	Total	
1	Andhra Pradesh	24.15	22.94	6.60	1.03	7.63	33.26
2	Arunachal Pradesh	3.19	2.92	0.003	0.01	0.01	0.36
3	Assam	27.05	21.97	1.97	0.60	2.58	11.73
4	Bihar	28.05	25.46	10.33	2.69	13.02	51.14
5	Chhattisgarh	12.65	11.55	4.53	0.82	5.35	46.34
6	Delhi	0.32	0.29	0.07	0.22	0.29	101.40
7	Goa	0.40	0.32	0.02	0.05	0.08	23.48
8	Gujarat	26.81	24.91	12.65	0.64	13.30	53.39
9	Haryana	9.53	8.63	10.47	1.15	11.61	134.56
10	Himachal Pradesh	1.07	0.97	0.20	0.16	0.36	36.83
11	Jharkhand	6.15	5.64	0.93	0.72	1.64	29.13
12	Karnataka	18.16	16.40	9.60	1.03	10.63	64.85
13	Kerala	5.65	5.12	1.16	1.48	2.65	51.68
14	Madhya Pradesh	36.16	33.38	17.33	1.64	18.97	56.82
15	Maharashtra	32.01	30.25	15.29	1.34	16.63	54.99
16	Manipur	0.51	0.46	0.003	0.02	0.02	5.12
17	Meghalaya	2.04	1.82	0.03	0.05	0.08	4.22
18	Mizoram	0.22	0.20	0.00	0.01	0.01	3.81
19	Nagaland	2.17	1.95	0.002	0.02	0.02	1.04
20	Odisha	17.08	15.71	5.50	1.36	6.86	43.65
21	Punjab	22.80	20.59	32.80	1.05	33.85	164.42
22	Rajasthan	12.24	11.07	14.37	2.27	16.63	150.22
23	Sikkim	0.96	0.86	0.00	0.01	0.01	0.86

24	Tamil Nadu	19.59	17.69	13.52	1.15	14.67	82.93
25	Telangana	16.63	15.03	7.13	0.88	8.01	53.32
26	Tripura	1.47	1.24	0.02	0.08	0.10	7.94
27	Uttar Pradesh	72.20	66.88	41.29	4.74	46.03	68.83
28	Uttarakhand	2.02	1.85	0.63	0.24	0.87	46.80
29	West Bengal*	29.33	26.56	10.84	1.00	11.84	44.60
30	Andaman and Nicobar	0.32	0.28	0.0001	0.01	0.01	2.60
31	Chandigarh	0.06	0.06	0.01	0.04	0.05	80.60
32	Dadra & Nagar Haveli	0.07	0.07	0.01	0.02	0.03	45.99
33	Daman & Diu	0.03	0.03	0.003	0.03	0.03	113.38
34	Jammu and Kashmir	4.68	4.22	0.20	0.69	0.89	21.03
35	Ladakh	0.12	0.11	0.001	0.02	0.02	17.90
36	Lakshadweep	0.01	0.005	0.00	0.003	0.003	58.47
37	Puducherry	0.22	0.20	0.10	0.05	0.15	74.27
	Grand Total	436.15	397.62	217.61	27.30	244.92	61.60

1.6 Water scenario In Haryana

Irrigation facilities play an important role in the growth of any state. Adequate availability of water is thus very important in the coming years where the freshwater resources are depleting at a much faster rate than ever before. Thus, urgent steps are needed to address the problems of ground water depletion. Haryana has already been declared as water deficit state in terms of surface and ground water resources. A gap of as 14 lakh crore litres water has been recorded after considering the demand of 30,57,298 crore litres and supply of 44,59,976 crore litres. This clearly shows that it is highly critical to conserve for adequate water availability to all the stakeholders. Haryana envisioned to overcome these issues and enacted the Haryana Water Resources Authority (HWRA), Act 2020 which has the mandate of Conservation, Management and Regulation of Water Resources in the State of Haryana. The HWRA formulated "Integrated Water Resources Plan (WRP) 2023-26 with a mandate to fill the gap by 49% in two years by compiling the Block level District Water Resources Plan prepared by the District Water Resources Planning Committees.

Here under are the key objectives of the "Action Plan 2023-25":

- 🚧 Water resources availability assessment including surface water, groundwater, treated wastewater and rainfall.
- 🚧 Determination of demand and supply water gap, reduce use, recycle and re-use water.
- 🚧 Identification of key water issues and threats.
- 🚧 Formulation of an IWRM strategy and approach suitable for Haryana.
- 🚧 Devising block-specific interventions and action plans for two-year period (2023-25).

The water demand for 2025 for different sectors have been calculated with the objective to know the actual requirement in each sector. The total water demand has been computed (crore litres) by adding the water demand of various sectors such as Domestic (135625), Agriculture (3034554), Horticulture (212131), Industrial & Infrastructure (146518), Power generation (22107), Fisheries (32251), Forest & Wildlife (12161) & Establishment and Institutions (14903 crore litres) (Table 1.5).

Table 1.5: Present and future water demand in Haryana

S.N.	Component	Unit (crore liters) (2021)	Unit (crore liters) (2025)
1	Total water demand in Haryana	4459976	
2	Total water availability	3057298	
3	Gap	1402678	
4	Water demand for agriculture	3005514	30,34,554
5	Water demand for horticulture	164838	2,12,131
6	Water demand for Industry and infrastructures	104418	1,46,518
7	Water demand for power generation	19127	22, 107
8	Water demand for fisheries	28265	32,251
9	Water demand for forest & wildlife	11606	12,161
10	Water demand for establishment and institutional	10443	14,903
11	Water demand for domestic purpose	121290	1,35,625

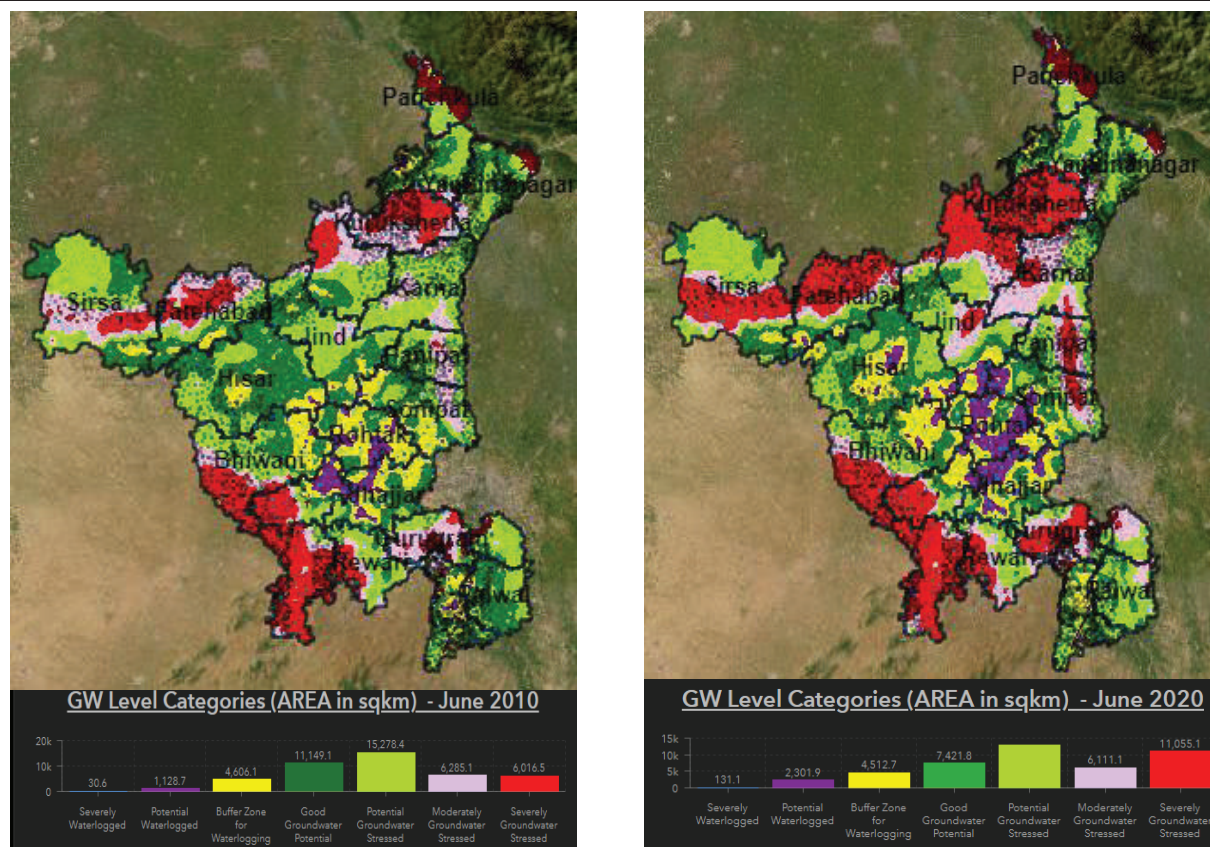


Fig.4: Details of fluctuating ground water table at village level (2010 & 2020)

Haryana Water Resources Authority has enlisted 27 major aquifers in the state and has installed 606 piezometers out of which 349 are in working conditions. Details of fluctuating ground water table at village level has been estimated (https://hwra.org.in/Content/Images/Annexure_C_22April_2022.pdf) which plays a blueprint for future water management (Fig. 4 and Table 1.6).

Table 1.6: Categorization of villages based on ground water level on June 2020
https://hwra.org.in/Content/Images/Annexure-A_22April_2022.pdf.

Sr. No.	Water table depth (m)	Categories	Colour	No. of villages
1	(i) 30.01 & more	Severely Ground water stressed villages	Red	1978
	(ii) 20.01 to 30.0	Moderately Ground water stressed Villages	Pink	1093
2	(iii) 10.01 to 20.0	Potential Ground water stressed villages	Light green	1903
	(iv) 5.01 to 10.0	Good Ground water Potential villages	Green	1304
3	(v) 3.01 to 5.0	Buffer Zone for water logging villages	Yellow	618
4	(vi) 1.51 to 3.0	Potential waterlogged villages	Purple	333
	(vii) 0.0 to 1.5	Severely waterlogged villages	Blue	88
Total				7287

1.7 Water availability from diverse sources in Haryana

Major surface water resources in the state are its share in Beas, Sutlej and Yamuna water as allocated under various inter-state agreements. The contribution towards water availability is in sequence of rainfall recharge (385278.83), ground water irrigation (322743.37), surface water irrigation (132927.09), canal recharge (86632.33), tanks and ponds (10307.87) and water conservation structures (9661.72) with total recharge (947622.47 ha m). The state has annual extractable water resources (860622.17 ha m) and net ground water availability for future irrigation development (104181.00 ha m). Surface water is applied through efficient canal networking consisting of 1521 channel having a length of 14125 km covering the cultural command area of 72.38 lakh acres of Haryana through four canal system Western Jamuna Canal system, Bhakhra canal system, Lift canal system and Agra & Gurugram canal system. Surface water availability of Bhakra and Yamuna water is 817160 crore liters. Availability from other sources Ghaggar, water drain, and farm ponds is only 96312 crore liters. Thus, the total surface water availability is 935596 crore liters (Table 1.7).

Table 1.7: Water availability from diverse sources in Haryana

Sr. No.	Source	Ground water recharge (ham)
1	Rainfall recharge	385278.83
2	Canal recharge	86632.33
3	Surface water irrigation	132927.09
4	Ground water irrigation	322743.37
5	Water conservation structures	9661.72
6	Tanks and ponds	10307.87
7	Natural discharge	87000.30
8	Annual extractable ground water resources	860622.17
9	Net ground water availability for future irrigation development	104181.00

1.8 Status of ground water level in the state

Average state ground water table depth has been calculated as 21.79 m below ground level during June 2023. The worst affected districts are Mahendergarh, Kurukshetra, Fatehabad, Bhiwani, Dadri, Kaithal, Gurugram and Rewari where the depth of water table is deeper than 30.0 m. According to groundwater level data for June 2020, a total of 1,948 no. of villages are severely groundwater stressed. These are villages with a depth range of groundwater level deeper than 30.0 metre below ground level (mbgl). A total of 1,093 no. of villages are moderately groundwater stressed with a groundwater level in the range of 20.01 mbgl - 30.00 mbgl. Out of 141 blocks of Haryana, 30 have been declared safe, 12 as critical, 14 as semi-critical and 85 as overexploited during 2020 (Fig 4, 5 and Table 1.6, 1.8).

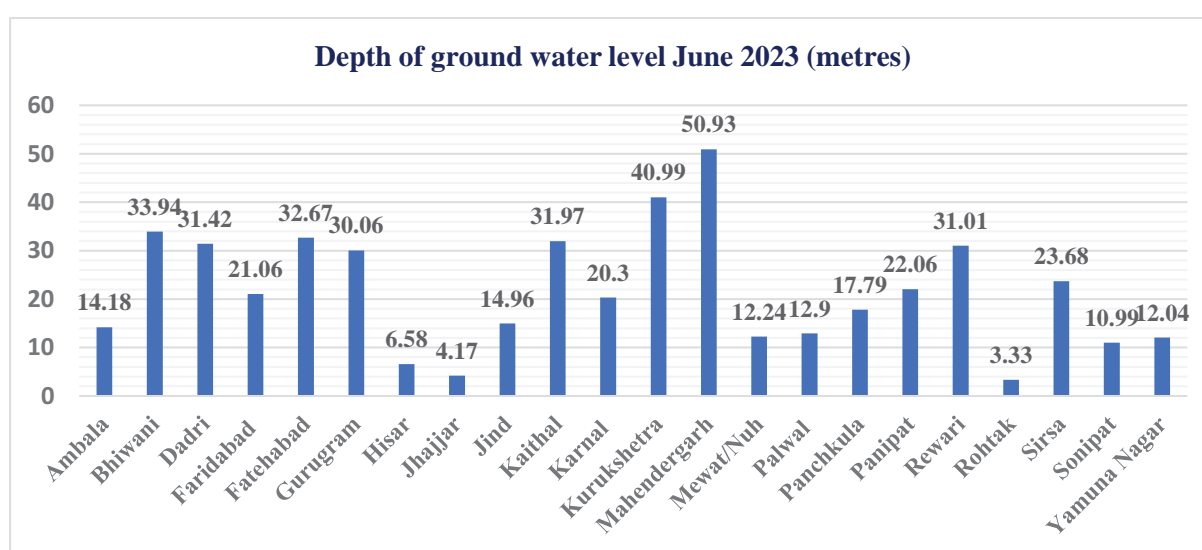


Fig. 5: District- wise ground water level for the period of June 2023

Table 1.8: District- wise ground water level for the period of June 2023 (meters)

Sr. No.	District	Depth of ground water level June 2023 (m)
1	Ambala	14.18
2	Bhiwani	33.94
3	Dadri	31.42
4	Faridabad	21.06
5	Fatehabad	32.67
6	Gurugram	30.06
7	Hisar	6.58
8	Jhajjar	4.17
9	Jind	14.96
10	Kaithal	31.97
11	Karnal	20.30
12	Kurukshetra	40.99
13	Mahendergarh	50.93
14	Mewat/Nuh	12.24
15	Palwal	12.90
16	Panchkula	17.79
17	Panipat	22.06
18	Rewari	31.01
19	Rohtak	3.33
20	Sirsa	23.68
21	Sonipat	10.99
22	Yamuna Nagar	12.04
	State average	21.79

Target areas for water saving under Integrated Water Resources Plan (IWRP)

IWRP aims to save water through demand and supply interventions by various departments. The demand side interventions include micro irrigation, modernization of channel and water course, crop diversification, direct seeded rice (DSR), varietal intervention, conservation tillage, green manuring/dhaincha, vegetables/horticulture and natural farming. The supply side interventions include ground water recharge/pond rejuvenation/check dam/rooftop recharge etc., underground pipeline for water supply, lining of water courses, increasing surface water storage and reuse of treated wastewater. Table 1.9 clearly indicates that IWRP has given the highest priority to the Micro-irrigation system and allotted highest target (17% of total water saving target) under this system of irrigation keeping in view the better water use efficiency with minimum investment.

Table 1.9: Demand and supply intervention for water saving as per IWRP (2023-25)

S. N.	Intervention	Target water saving (crore litres)	Percentage of intervention wise water saving
1	Micro irrigation	119384	17.0
2	Modernization of channel and water course	62194	9.0
3	Crop diversification	105642	15.0
4	Direct seeded rice (DSR)	51762	7.0
5	Reuse of treated wastewater	43687	6.0
6	Ground water recharge/pond rejuvenation/check dam/rooftop recharge etc.	68117	10.0
7	Varietal intervention	47816	7.0
8	Conservation tillage	118115	17.0
9	Green manuring/Dhaincha	35715	5.0
10	Vegetables/horticulture	17675	3.0
11	Natural farming	26958	4.0
	Total	697104	



SECTION-2

Status of micro irrigation, budget utilization, subsidy structure, model of subsidy delivery and market for micro irrigation

2.1. Journey of micro-irrigation at national and state level

The journey of micro irrigation (MI) began in India in 1981 when the National Committee on Plasticulture in Agriculture (NCPA) approved the use of plastics in agriculture. Based on the recommendations of NCPA, the Government of India launched a centrally sponsored scheme on the use of plastics in agriculture in 1991. Under the scheme, farmers were eligible for financial assistance or subsidy for installing MI system on subsidy. Government created the Rural Infrastructure Development Fund (RIDF) under the purview of NABARD in 1995-96 with an initial corpus of Rs. 2000 crore to accelerate spread of MI technologies. Accelerated Irrigation Benefit Programme (AIBP) was launched in 1996-97 for giving financial assistance to states with an objective of expediting completion of on-going irrigation projects. Similarly, the centrally sponsored Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) was launched in 2004 in 14 major oilseeds growing states. Financial assistance was provided for creating efficient irrigation infrastructure through distribution of sprinkler sets or drip system. The launching of National Horticulture Mission (NHM) in 2005 which aimed at creation of water sources, protected cultivation, and precision farming, strengthened the MI activities and accelerated its spread on a large scale. With broad objectives for the holistic growth of horticulture sector, NHM was restructured into a Mission for Integrated Development of Horticulture (MIDH) in 2014-15. In MIDH, adoption of MI is being fostered through the activities of protected cultivation and creation of water sources. Having realized the potential benefits of MI technology in conserving water resources and sustaining crop yield, the Government of India launched a dedicated scheme named Centrally Sponsored Scheme (CSS) on MI on January 20, 2006, with objective to enhance Water Use Efficiency (WUE) in agriculture sector by encouraging farmers to adopt appropriate technological interventions like drip and sprinkler irrigation.

In the flagship scheme, Rashtriya Krishi Vikas Yojana (2007), MI was included as one of the components for ensuring an aggregate growth rate of 4% in agriculture and allied sector. To bring all states, including North-Eastern and Himalayan states, under the purview of MI scheme, the Government upgraded the CSS on MI into National Mission on Micro irrigation (NMMI) in June 2010 and further to National Mission on Sustainable Agriculture (NMSA) in April 2014 and implemented On Farm Water Management (OFWM) programme from year

2014-15 with objective to create additional irrigation facilities through installing MI structures at the field of the farmers.

From the year 2015-16 onward, the Government of India absorbed all existing schemes of irrigation into Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). The main motive of PMKSY is to provide water to every field (*har khet ko pani*), improve on-farm water use efficiency, enhance adoption of precision irrigation and water-saving technologies (*per drop more crop*). The scheme also aims to augment recharge of aquifers and introduce sustainable water conservation practices by reusing treated water for peri-urban agriculture and attract greater private investment. An outlay of Rs. 50,000 crores over a period of five years (2015-16 to 2019-20) were allocated for PMKSY. The scheme provides a comprehensive and holistic view of the entire ‘water cycle’ and proper water budgeting is done for all sectors namely, household, agriculture, and industries. A timeline of development of schemes promoting MI in the country is presented in Figure 2.1.

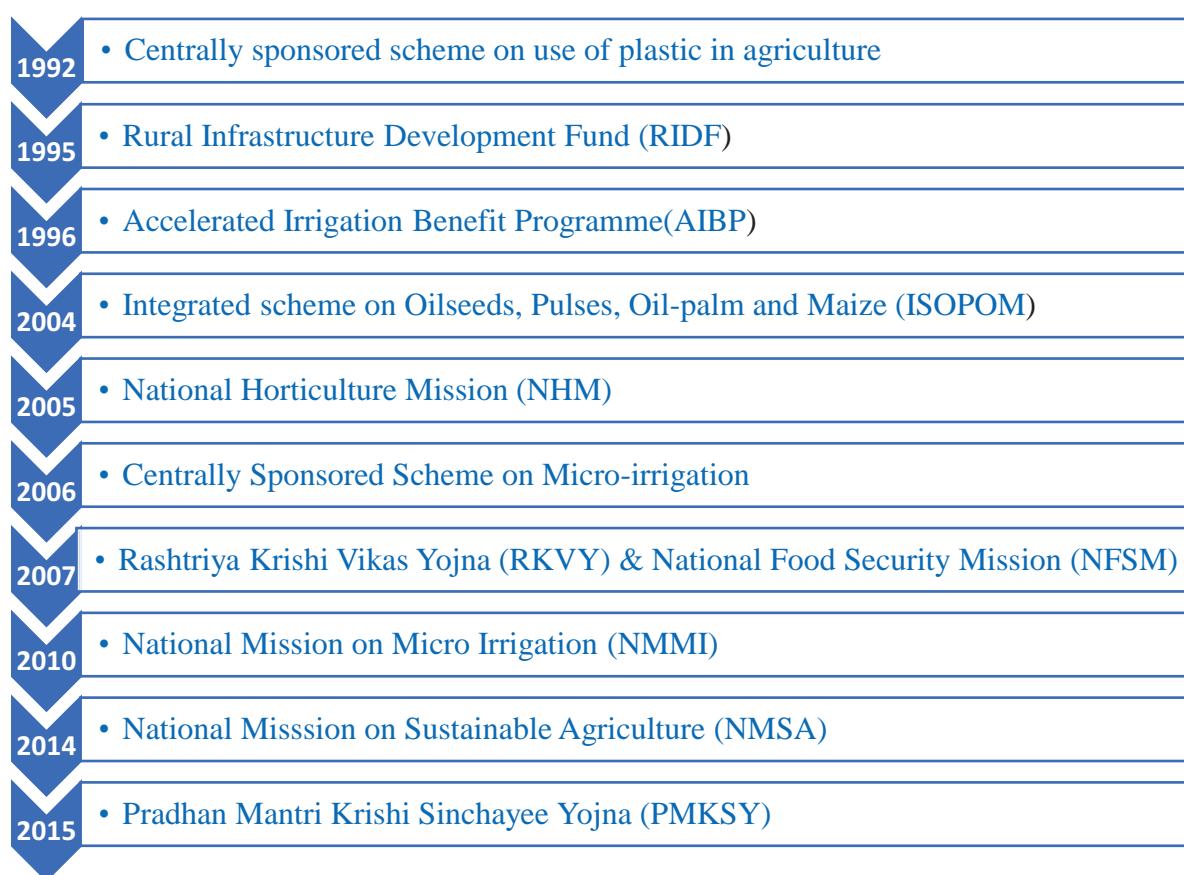


Fig 2.1. Journey of micro-irrigation in India

2.2. Pradhan Mantri Krishi Sinchayee Yojna (PMKSY)

2.2.1. Background, nature, and organizational structure of PMKSY

The Cabinet Committee on Economic Affairs (CCEA), chaired by the Prime Minister gave its approval for the PMKSY scheme for the period 2015-16 to 2019-20 and scheme was launched in July 2015. The objective of the scheme is “to achieve convergence of investment in irrigation at the field level, expand cultivable area under assured irrigation.” The outlay for the five-year period has been slated as INR 50,000 crores (US\$ 7.8 bn), with an outlay of INR 5,300 crores (US\$ 826.6 mn) set for 2015-16. There are a few opportunities that the government is hoping to exploit, which led to the launch of the scheme. These include the fact that only about 20 percent of rainfall is utilised, 10 percent increase in irrigation can bring an additional 14 mn hectares under assured irrigation and 202 bn cubic meters of ground water potential is still to be tapped. To achieve the goal of bringing irrigation water to every farm, the government feels there is a need to converge all ongoing efforts and to bridge gaps through location specific interventions, which is what PMKSY aims to do. A Mission Directorate has been established in the Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India, for implementing PMKSY in mission mode. The mission is responsible for overall coordination and outcome-focused monitoring of all components of PMKSY for achieving its target. Micro irrigation is an integral component of the PMKSY (*per drop more crop*) to amplify WUE at farm level. This component (*per drop more crop*) is being implemented by the Ministry of Agriculture and Farmers’ Welfare (MoAFW), Government of India. Table 2.1. presents the committees and their responsibilities to implement the PMKSY at various levels. District irrigation plan (DIP) provides a holistic irrigation development perspective of the district, outlining medium-to long-term development plans integrating three components viz. water sources, distribution network, and water use applications.

District Irrigation Plan identifies gaps in the existing irrigation plan after assessing available resources, which could be added from ongoing schemes. So, DIP is considered as foundation for planning and implementation of all components of PMKSY. All communications between the MoAFW and State Governments are made through the nodal department. The state agriculture department as the nodal department for implementation of PMKSY. The main motive of PMKSY is to ensure efficient delivery and use of water at every farm for enhancing agricultural production and productivity. However, a state government is free to identify the nodal department based on the established institutional set up and mandate of the department.

2.2.2. Programme components of PMKSY

Components of the PMKSY are as under:

2.2.2.1. Accelerated Irrigation Benefit Programme (AIBP) – to focus on faster completion of ongoing Major and Medium Irrigation projects – being implemented by MOWR, RD&GR.

2.2.2.2 PMKSY (Har Khet KoPani) – to focus on source augmentation, distribution, ground water development, lift irrigation, diversion of water from water plenty to water scarce areas, supplementing rainwater harvesting beyond IWMP & MGNREGA, repair, restoration, renovation of traditional water bodies etc. – being implemented by MoWR, RD&GR.

2.2.2.3. PMKSY (Per Drop More Crop) – to focus on micro level storage structures, efficient water conveyance & application, precision irrigation systems, topping up of input cost beyond MGNREGA permissible limits, secondary storage, water lifting devices, extension activities, coordination & management - being implemented by DAC&FW.

2.2.2.4. PMKSY (Watershed Development) - to focus on ridge area treatment, drainage line treatment, soil and moisture conservation, water harvesting structure, livelihood support activities and other watershed works being implemented by DoLR.

2.2.3. Objectives of Per Drop More Crop (Micro Irrigation)

The main objectives of Per Drop More Crop (Micro Irrigation) are as under:

1. Increase the area under micro irrigation technologies to enhance water use efficiency in the country.
2. Increase productivity of crops and income of farmers through precision water management.
3. Promote micro irrigation technologies in water intensive/consuming crops like sugarcane, banana, cotton etc and give adequate focus to extend coverage of field crops under micro irrigation technologies.
4. Make potential use of micro irrigation systems for promoting fertigation.
5. Promote micro irrigation technologies in water scarce, water stressed and critical ground water blocks/districts.
6. Link tube-well/river-lift irrigation projects with micro irrigation technologies for best use of energy both for lifting and pressurised irrigation as far as possible.

7. Establish convergence and synergy with activities of on-going programmes and schemes, particularly with created water source for its potential use, integration of solar energy for pressurised irrigation etc.
8. Promote, develop, and disseminate micro irrigation technology for agriculture and horticulture development with modern scientific knowledge.
9. Create employment opportunities for skilled and unskilled persons, especially unemployed youth for installation and maintenance of micro irrigation systems.

Table 2.1. Committees involved in implementation of PMKSY.

Committee	Chairperson and Member	Work
National Level		
National Steering Committee (NSC)	PM as Chairperson and Union Ministers from concerned ministries and Vice-Chairman, NITI Aayog as members	To provide general policy strategic directions for programme implementation and overall supervision addressing national priorities, etc.
National Executive Committee (NEC)	Vice Chairman, NITI Aayog as Chairperson and Secretaries of concerned ministries/ departments and Chief Secretaries of selected States as members	To oversee programme implementation, allocation of resources, inter-ministerial coordination, monitoring & performance assessment, addressing administrative issues
STATE LEVEL		
State Level Sanctioning Committee (SLSC)	Chief Secretary of the State as Chairperson	To sanction projects and activities as recommended by Inter-Departmental Working Group
Inter Departmental Working Group (IDWG)	Agriculture Production Commissioner/ Development Commissioner as Chairperson and Secretaries of line departments as members.	Recommend project and activities to SLSC
District Level Implementation Committee (DLIC)	District Magistrate Collector/CEO of Zila Parishad/ PD DRDA as Chairperson, and JD/ DD of line departments and progressive farmers, representative of MI industry, and leading NGO as members	To oversee PMKSY implementation and interdepartmental coordination.

2.3 History of MI in Haryana

Micro irrigation was started in Haryana under mission mode in 2006-07. From the year 2016-17 onward, the micro irrigation programme is being implemented under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) as per the operational guidelines of Per Drop More crop (PDMC) component of PMKSY. The MI programme was being implemented through a web portal namely MI-NET since 2012-13 in the state and Horticulture department coordinated the MI programme. Every process from application submission to release of assistance was being done through MI-NET and assistance of

micro irrigation system was directly credited into the account of beneficiary/farmer and the accounts were linked with Aadhar Card. From the year 2020-21, all the activities of different components of PMKSY are being coordinated by Micro-irrigation & Command Area Development Authority (MICADA) under the administrative control of Irrigation & Water Resources Department. Every process from application submission to release of assistance is being done through Farmer Online Application Web Portal for Micro Irrigation/ MI vendor Login for MICADA portal under MI for Agriculture and MI for horticulture and assistance is directly credited into the account of beneficiary/farmer and the accounts were linked with Aadhar Card.

2.4. MICADA; Brief and organisational set up.

The Micro Irrigation and Command Area Development Authority was set up in Haryana in the year 1974 under a Centrally Sponsored Scheme on sharing basis *i.e.* 50:50 by the State Government and Government of India to bridge the gap between the irrigation potential created and irrigation potential utilized through micro level infrastructure development and effective farm water management, to enhance agricultural production & productivity and to improve socio-economic conditions of the farmers on selected Canal Commands in the state under Command Area Development Programme (CADP). The CADP was restructured and renamed as Command Area Development & Water Management (CADWM) *w.e.f.* 01.04.2004 and since 2008-09 the programme was implemented as a State sector scheme with Central assistance up to 2015-16. As per the latest guidelines issued in December 2016 by the Government of India, Ministry of Water Resources, River Development and Ganga Rejuvenation, New Delhi, the Command Area Development & Water Management (CAD&WM) works shall be covered by the Government of India under Incentivization Scheme for Bridging Irrigation Gap (ISBIG) under the umbrella scheme of “*Pradhan Mantri Krishi Sinchayee Yojana*” (PMKSY) “*Har Khet Ko Pani*” component.

Table 2.2. Organizational set up of MICADA.

With effect from January 2023, the governing body of MICADA, Haryana is as under:

1.	Chief Minister	Chairman
2.	Irrigation Minister	Member
3.	Finance Minister	Member
4.	Rural Development Minister	Member
5.	Agriculture Minister	Member
6.	Chief Secretary	Secretary
7.	Commissioner & Secretary, Irrigation and Water Resources Department	Member Secretary
8.	Additional Chief Secretary, Agriculture Department	Member
9.	Additional Chief Secretary, Finance Department	Member

10.	Principal Secretary to the Chief Minister	Member
11.	Principal Secretary, Development and Panchayat Department	Secretary
12.	Administrator, MICADA	Member
13.	Additional Chief Secretary, Public Health Engineering Department	Member
14.	Vice Chancellor CCSHAU Hisar or his Representative (Rep)	Member
15.	Senior Joint Commissioner CADWM, Govt. of India or his Rep.	Member
16.	Chairperson Haryana Resources Authority or its Rep.	Member
17.	Chairman, Haryana State Pollution Control Board of its Rep.	Member
18.	Director of Central Soil Salinity Research Institute, Karnal or its Rep	Member
19.	Representative of Central Water Commission	Member
20.	Representative of Central Ground Water Board	Member
21.	Executive Vice Chairperson, Haryana Ponds & Water Management Authority	Member

The above body will also work as State Level Monitoring Committee and will meet at least twice a year before *Rabi* and *Kharif* season and monitor/review the performance of CADWM program.

2.4.1. Operational and Administrative procedures for MI in Haryana

Drip and sprinkler irrigation systems were introduced in the state under Centrally Sponsored Scheme (CSS) during the year 1992-93. In Haryana, the Irrigation and Water Resource Department is the nodal department for implementing the centrally sponsored scheme of MI which also assists the state, central government farms, state agriculture universities, ICAR, progressive farmers and NGOs for demonstration of plots. In Haryana, the micro irrigation technology is promoted under the scheme “Micro-irrigation & Command Area Development Authority (MICADA)” which is unique in the country. The land ceiling for subsidy is five ha per beneficiary. The government also introduced a unique scheme for promoting adoption of MI in which the farmers get 70-90% subsidy on different projects (Water ponds, Solar pumps (also through HAREDA) and MI. The scheme has been welcomed by farmers, and has accelerated the rate of adoption of MI. The system of allocating funds and transfer of payment has been made transparent. The different media and platforms are used to motivate and create awareness among the farmers. The MICADA takes the responsibility to conduct various programmes. Farmers who decide to install the MI, can select the firm/vendor for supplying the material that are approved by MICADA (Table 2.13). The selected firm conducts the field survey of the farm and prepare design, which is approved by the farmer and MICADA. Full application process is completed online. Finally works are executed and subsidy is disbursed. The modalities adopted by MICADA seems to be systematic. Despite having a vast potential,

coverage of micro irrigation in Haryana has not reached the desired level. Only 90,898 ha area has been covered under MI from 2016 to 2023, which is about 2.68% of the net irrigated area of the state. This area again needs verification as the earlier MI units may not be working due to wear/tear and farmers use as of today. This is a herculean task to increase at least 25% area under MI system. The state is facing a serious problem of depletion of groundwater resources and conservation of irrigation water is of utmost importance. The entire process of filling and processing of application is online, and App based. This has helped farmers in checking the application status and subsidy amount without visiting the government office. The major issues faced by farmers are enlisted in suggestion to improve adaption of MI system in the state. The operational procedures adopted in Haryana is presented in Table 2.2.

Table 2.3. Flow Chart of On-Farm Water Tank (Other Intervention) implementation with time frame

Interface (No.)	Interface Name	Action to be taken by	Time Frame (No. of days)
1 ↓	Application Submission	Farmer	0
2 ↓	Checking and recommendation	JE-EW	.5
3 ↓	Sanction of Application	DD-EW/Xen	5
4 ↓	1 st Intimation (Earth Work)	Farmer	15
5 ↓	Physical Verification	JE Field	5
6 ↓	Recommendation verification of physical	Xen Field	Xen Field
7 ↓	Checking of MB	JE-EW	JE-EW
8 ↓	Recommendation verification of physical	DD-EW/Xen	DD-EW/Xen
9 ↓	Recommendation verification of physical	DMICADA	DMICADA
10 ↓	Approval of assistance	Administrator	3
11 ↓	Release of Assistance from PFMS	CAO	3
12 ↓	2 nd Intimation (Civil Work)	Farmer	15
13 ↓	Physical Verification	JE Field	5
14 ↓	Recommendation of physical verification	Xen Field	5
15 ↓	Checking of MB	JE-EW	5
16 ↓	Recommendation of physical verification	DD-EW/Xen	5
17 ↓	Recommendation of physical verification	DMICADA	5
18 ↓	Approval of Assistance	Administrator	3
19 ↓	Release of Assistance from PFMS	CAO	3
20 ↓	3 rd instalment (Physical Verification by field staff of MIS)	Xen Field	5
21 ↓	Final checking of all stages	JE-EW	5
22 ↓	Recommendation for final payment	DD-EW/Xen	5
23 ↓	Recommendation for final payment	DMICADA	5
24 ↓	Approval of final assistance	Administrator	3
25 ↓	Release of Assistance from PFMS	CAO	3
	Total		128

2.4.2. Subsidy/assistance pattern for micro-irrigation

The subsidy scheme of MI (borne by the Centre and the state) aims to encourage farmers to adopt innovative irrigation system on a large scale with faster speed. However, with a view to broadening the scope and coverage of MI, Haryana has supplemented the specific subsidy structure with funds from their own resources and prioritized its allocation towards specific regions and beneficiary groups. Further, priority on drip irrigation is higher than mini sprinkler irrigation indicates that the state is encouraging drip system over the sprinkler irrigation. Subsidy on MIS is higher for dark zone than non-dark zone (36 blocks through Atal Bhujal Yojna as it takes care of 15% of farmers share and he has only to pay GST on this amount). The unit-cost of drip irrigation system varies with plant spacing, material used, and location of water resources. Theoretically, subsidy amount is shared by the Centre and State Government in the ratio of 60:40, but actually it comes out to be 30:55:15 for the Central/State Government/Farmer share.

The following activities are undertaken by MICADA at farmers' fields:

- A. **Water Courses.** Lining of water courses and rehabilitation of 20 years old water courses. This will be prioritized based on age of water courses, its present position (loss/damage), area already covered under MI, contribution (1%) by Water Users Association/farmers and priority of MI adoption.
- B. **On Farm Water Pond Policy.** Community water tank receives 85% subsidy, whereas individual farm will get 70% subsidy. Help is provided on 3 to 50 acres land where canal water is available to the farmers (Command area). MICADA is also providing all cost for village community ponds and the farmers association is to monitor and use the facility (pond/Solar pump). Area of water pond will be decided on water requirement of different crops to be raised by the farmers using MI system and water will not be used for any other purpose. Priority will be given according to the area under MI system, farmers numbers for community tank and on first come first serve policy.
- C. **Solar pump scheme.** The scheme is implemented through HAREDA, Haryana Renewable Energy Development Agency established in May 1997 as a nodal agency to implement the various centrally and state sponsored schemes/projects in the area of renewable energy in the State. Subsidy is provided on 3-10 HP sola water pumping motors. MI interested farmers can also apply through MICADA also and can avail 75% subsidy of sola pumps.
- D. **PMKSY scheme.** Subsidy is provided from 1 to 12.5 acres farmers on MI system (drip and mini sprinklers). The subsidy (85% by the government and 15% by farmers plus

12% GST) is provided to all interested farmers (all categories). Interested farmers can log in at www.cadaharyana.nic.in directly to fill necessary information or can take help of any vendors or MICADA staff in different districts for submitting applications, the cost and subsidy is in Table 2.4.

Table 2.4. Based on 2021-22, cost of MI unit (Rs.) along with farmers share and GST.

Sr. No.	MI system and specification	Unit cost/acre	GST @12%	Eligible subsidy	Farmers share	Total amount (FS+GST)
1	Sprinkler system	(not promoted)				
	HDPE 63 mm (3.2 kg)	11693	1403.16	9939.05	1753.95	3157.11
	HDPE 63 mm (3.2 kg)	13709	1645.08	11652.65	2056.35	3701.43
2.	Mini Sprinkler	(priority to drip system)				
	63 mm PVC (4 kg) based (8x8m)	47705	5704.60	40549.25	7155.75	12880.35
	63 mm PVC (3.2 kg) based (8x8m)	46057	5526.84	39145.50	6908.55	12435.39
	63 mm PVC (4 kg) based (10x10m)	38695	4643.40	32890.75	5804.25	10447.65
	63 mm PVC (3.2 kg) based (10x10m)	37047	4445.64	31489.95	5557.05	10002.69
3.	Drip irrigation					
	Closed space for vegetables and other crops (1.2x0.6 m)	50231	6027.72	42696.35	7534.65	13562.37
	Wide space for horticultural crops (12x12) (63 mm pipe size)	19500	2340.00	16575.00	2925.00	5265.00
	Wide spaced for horticultural crops (6x6 m)	23562	2827.44	20027.30	3534.30	6361.74

Based on MI coverage, states are classified into following three categories:

Category A states: States with comparatively better penetration of drip technology have been brought under category “A”. These include Andhra Pradesh, Delhi, Gujarat, Goa, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Rajasthan and Tamil Nadu.

Category B states: All the states except covered under the category “A” and those falling in the Himalayan belt come under category “B”. These include Bihar, Chhattisgarh, Jharkhand, Odisha, Uttar Pradesh, West Bengal and Union Territories. Considering lesser availability of companies and after sale service, the unit cost of MI is considered 15% higher for these states.

Category C states: States with very low penetration of drip technology due to poor infrastructure and difficult terrain have been grouped under “C”. These states include northeastern and hilly regions, namely, Assam.

2.4.3. Pre-Installation Activities

The beneficiary is free to purchase MI equipment from any manufacturer from the approved list of registered manufacturers. The manufacturers need to follow certain processes indicated in Table 2.5.

Table 2.5.: Processes to be followed by the material supplying firms.

Approval
<ol style="list-style-type: none"> 1. Assessment of the crop water requirement and design the system accordingly. 2. Prepare cost estimate and submit it to the implementing agency duly indicating the time frame for installation. 3. The implementing agency will approve the estimate, issue work order, and ensure installation
Installation
<ol style="list-style-type: none"> 1. Quality components with BIS marking are installed at farmer's field. 2. The installed system should match the water requirement of the crop earlier estimated. 3. Necessary orientation and training given to the beneficiary farmers for system maintenance and irrigating the crop. 4. Proper warranty and a user's manual for running and maintenance of system are provided to farmers. 5. A certificate towards successful installation/commissioning of system is obtained from the beneficiary

2.4.4. Post Installation disbursement of subsidy.

The manufacturer/vendor will install the MI system as per the agreement with the state nodal agency and as per procedure for payment. The farmer needs to pay only his share of 15% plus 12% GSD and the subsidy amount will be credited to the account of vendor. After physical verification of MI system with satisfactory certificate from beneficiary, the implementing agency will disburse recommended subsidy amount to the beneficiary bank account electronically.

2.4.5. Irrigation: Importance and type

Application of water to crops is vital to help them grow satisfactorily. It also protects crops from weather vagaries, helps in nutrients uptake, improves yields, suppresses weed growth and prevents soil consolidation. With the large land area, uneven distribution of rain, different water requirements of different crops grown in the tropical climate leading to high evaporation rates, the need for increasing the gross irrigated area in India is of paramount importance. The major forms of irrigation are as under:

S.N.	Type of irrigation	Description
1	Surface irrigation	In this method, water moves over and across the land by simple gravity flow, to make the land wet and infiltrate the soil. Broadly, surface irrigation can be divided into burrow, border strip or basin irrigation.
2	Localised irrigation	The system where water is distributed under low pressure through a piped network. The network is a pre-designed pattern and water is applied as a small discharge to each plant or the area around it. Drip

		Irrigation, spray/micro-sprinkler and bubbler irrigation belong to this category.
3	Irrigation using sprinklers	In this system, water is distributed under low pressure through a piped network. The network is a pre-designed pattern and water is applied as a small discharge to each plant or the area around it. Drip Irrigation, spray/micro-sprinkler and bubbler irrigation belong to this category.
4	Sub surface irrigation	It is also called seepage irrigation. It is used in areas with high water tables. It is a method of artificially raising the water table and allowing the soil to be moistened from below the plants' root level.

2.4.6. Micro irrigation systems and their components

Micro irrigation systems are generally of two types:

1. Drip irrigation.
2. Sprinkler irrigation (Mini or micro sprinklers).

Drip irrigation: This system focuses on irrigating the root zone of the crop, rather than the surface itself. The system allows for application of frequent but small quantities of water and therefore, a continuous supply of water throughout the crop duration from 10 min to 3 hours at one time depending upon crop growth. One key reason for the superior performance of such a system is the fact that such a system can neutralise the nutrients and level of water available to the crops, in contrast to the traditional surface irrigation systems, under which, plants face stress because of feast and famine cycles. It has higher crop yields thanks to increased nutrients uptake (applied through drip system), lower weeds infestation and disease as no standing water in the field, better maturity, and hence improved quality of the produce. Other than saving 40-70% water it also saves 20-30% fertilisers.

Sprinkler irrigation: It is a method of applying water akin to natural rainfall. Water, distributed through a system of pipes, is sprayed on the crops and falls as smaller water drops. This system does not apply water directly to the soil or root zone. There is less water and fertilizers saving and weed infestation is more as the whole soil surface is wetted. Micro-and mini sprinklers are preferred over sprinklers for their lower water use.

<p style="text-align: center;">Components of a Drip Irrigation system include: (but not limited to)</p> <ul style="list-style-type: none"> • Controller/Timer: Controls watering cycle, directing when, how long and how often the system operates. • Backflow Preventer: prevents water from being siphoned back into drinking water. • Valves: Used to turn water on/off. • Filter: Keeps dirt and debris from clogging the system 	<p style="text-align: center;">Components of a Sprinkler Irrigation system include: (but not limited to)</p> <ul style="list-style-type: none"> • Prime Mover/Pump Suction Pipe: required for lifting water from the source and pushing it through the distribution system under sufficient pressure. • Main Line: carries water from the source (pumping unit) to the various parts in the field. • Sub-Main: carries water from the main to the lateral lines.
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<ul style="list-style-type: none"> • Pressure Regulator: reduce incoming water pressure to the ideal pressure for the system. • Pipe: Carries water through the system. • Micro-Tubing: delivers water from the emitters to the plans. • Emitters: deliver water at a slow, consistent rate. • Flush Valve/Cap: attached to the end of each irrigation line so that dirt and debris can be flushed out. 	<ul style="list-style-type: none"> • Lateral Lines: carries water from the main line or sub lines to the sprinkler head through the rise pipe. These are portable and equipped with quick coupling devices. • Sprinkler Head: used for spraying water on to the field. These may be rotating head, fixed head or perforated type. • Sprinkler Lead: classified based on pressure: low operating pressure sprinkler intermediate pressure sprinkler or high-pressure sprinkler.
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2.5. Comparative analysis of operational procedures adopted by selected states

Table 2.6: Comparison of three states for on procedures

Parameter	Gujarat	Andhra Pradesh	Haryana
Implementing agency	GGRC	APMIP	MICADA
Funding source	State Govt./GOI	State Govt./GOI	State Govt./GOI
Subsidy model	Per unit area/per farmers	Per family	Area based
Extent of subsidy	50% of the Micro Irrigation System (MIS) cost or Rs 24000/- per acre, whichever is less.	50-100% (Rs. /ha) and per family cap max. 5-10 acres under different categories	85% on MIS, 70-85% on water ponds and 75% on solar pumps, to any farmer
Flow of funds	Funds deposited with GGRC on annual basis for disbursal	Funds allocated according to district quota and company wise target set centrally	First come first serve through portal on annual basis from the budget of centre and state
First point of contact	Dealers/manufacturer	Line department	MICADA
Completion time/delay in installation and payments	Detailed work-flow charts stipulate maximum time for each step-in application processing	Detailed work-flow charts stipulate maximum time for each step-in application processing	Detailed work-flow charts stipulate maximum time for each step-in application processing
Autonomy	Semi- autonomous corporation (GGRC) with strong financial support	APMIP works under Horticulture department	MICADA is an independent authority under Irrigation and water resources department
Organizational structure	Centralized; single window operations	Decentralized; district offices carry out key functions	Multi-centric and decentralized
Subsidy regulated or unregulated	Unregulated; no quotas for drips / sprinklers or for MI companies	Yearly quotas fixed; MI companies allotted geographical domains	Subsidy irrespective of farmers category on first come, first serve on portal basis
Administration and processing	Streamlined; uniform procedures	Variation between districts; ambiguous chain of command	Dark zone gets additional 15% contribution from ABY
Transparency	Online tracking of application status	Toll-free number for enquiries about application status	Web App based system

Marketing strategies	Farmer networks; perceived quality of service	Dealer networks; perceived quality of service	Through approved vendors, targets fixed as per crops
Provision of post installation services	One-year agronomic services; 5-year system maintenance services	5% payment retained as guarantee for providing after-sales services to farmers	On agreed terms and conditions
Quality of service	Emphasized but variable; despite the threat of deregistration; due to poor farmer awareness	Emphasized but variable; despite the threat of deregistration due to poor farmer awareness	Monitored by MICADA staff
Major market players	Jain Irrigation	Jain Irrigation	Jain Irrigation
Electricity subsidy/ policy	Yes	No	No
Major crops covered	Groundnut, Cotton, Sugarcane & castor while the major horticulture crops covered under the scheme are Potato, Banana, Mango, Papaya and Vegetables	Oil Palm, Sugarcane, Banana, Papaya, Citrus & Coconut	All crops
Norms of installation (120/30/60 cm)	Need based	Need based	120*60 cm for crops
Ground water table position	52.3 metres	6.51 metres	
Water charges			
Electricity supply hrs to the farmers	9 hrs	10 hrs	9 hrs
Use of recycled water	For non-drinking purpose	Used on orchards, vineyards and certain vegetable crops	5% farms
Review			

2.6. Israel: Country overview and reasons for success in MI

Israel is one of the most densely populated countries in the world with a population of 91.76 lakhs equivalent to 0.11% of the world (2023). However, only 17.42 % of the land (2021) is arable and half of that is irrigated. About 1129 million cubic meters of water is use annually for irrigation, that include 30% of treated water mainly for drip irrigation of orchards and other crops. Drip irrigation has 70-80 % WUE compared to 40% by flood irrigation. Recycled use of water, wastewater, adding nutrients mixed in with the water and desalination are the recent new innovation used to solve problem of water scarcity in Israel. Israel is a small country with a relatively diverse topography, consisting of a lengthy coastal plain, highlands in the north and central regions, and the Negev desert in the south. Running the length of the country from north to south along its eastern border is the northern terminus of the Great Rift Valley. Israel has a wide variety of climatic conditions, caused mainly by the country's diverse topography. There are two distinct seasons: a cool, rainy winter (October–April) and a dry, hot summer (May–September). More than half of the country is arid or semi-arid, and the rest of the country is

dominated by steep hillsides and forests. The country also has scattered rainfall, with the Northern region receiving a generous 700 mm per year, the Central region only 400-600 mm annually and the South a meagre 25 mm annually. The main problem facing agriculture is the scarcity of water. Water is diverted through pipelines from the Jordan and Yarqon rivers and from Lake Tiberias to arid areas in the south. Because almost all the country's current water resources have been fully exploited, further agricultural development involves increasing yields from land already irrigated, obtaining more water by cloud seeding, reducing the amount of evaporation, desalinizing seawater, and expanding desert farming in the Negev by drawing on brackish water found underground. Israel has perfected drip-irrigation methods that conserve water and optimize fertilizer use.

Solving issues through technology in Israel

1. Eighty percent of farms land in the country are owned and run by kibbutzim (collective villages) and moshavim (cooperative villages).
2. Kibbutzim often develop, design, manufacture, and market their own agri-technology inputs. Drip irrigation was developed in such a kibbutz, which subsequently gave birth to Netafim.
3. These farmers work closely with the country's ten agricultural research institutes including the Agricultural Research Organisation (ARO), part of the Ministry of Agriculture.
4. More than twenty-five professional and marketing associations also fund R&D, as do various government bodies and hundreds of private firms in the biotechnology and computer software sectors.

Rationale for success in Israel:

1. There is a real focus on sustainable agriculture because of the climatic conditions and scarcity of natural resources. These unique conditions have also necessitated a close collaboration between farmers, scientists, the government, and localised agricultural stakeholders.
2. The Ministry of Agriculture is dedicated to the efficient use of water and treated wastewater and promoting water recycling.
3. The Ministry of Agriculture allocates grant to farmers who practice sustainable agriculture practices such as drip irrigation.
4. Free-market forces also play a crucial role in the country, taking on turnkey projects that incorporate more efficient water use, irrigation systems, crop and seed choice.
5. Strong political will with a focus on the concept of sustainable agriculture and special emphasis on R&D has resulted in virtually all irrigation being done through drip in a matter of four decades.

2.7. Key stake holders in micro-irrigation in India

[1] Political leadership [2] Funding source [3] Implementing/nodal agency [4] Industry – manufacturers and dealers; and [5] Beneficiary farmers are the five key stakeholders in the implementation of state-level micro-irrigation promotion programs (Fig. 2.2). Of these, the role of the implementing/nodal agency is critical. MICADA is the main nodal agency for micro-irrigation in Haryana. At present micro-irrigation promotion programs in the state are

implemented by MICADA for vegetables, horticulture, and agricultural crops. The horticulture department earlier used to cater to the demand for drip irrigation among horticulture farmers while the agriculture department for sprinkler irrigation systems used in the cultivation of row crops. Similarly, irrigation & water resource department take care for the irrigation development projects (ponds, reservoirs etc.). Statistics provided by MICADA indicate that there are opportunities to expand and upscale the adoption of micro irrigation in dark zone block of the state. In a comprehensive assessment of water table analyses, Kurukshetra, Kaithal, Karnal, Mahendergarh, Charkhi Dadri districts were identified as highly vulnerable districts. Boosting agricultural productivity in these districts can create babble effects on other sectors of the economy.

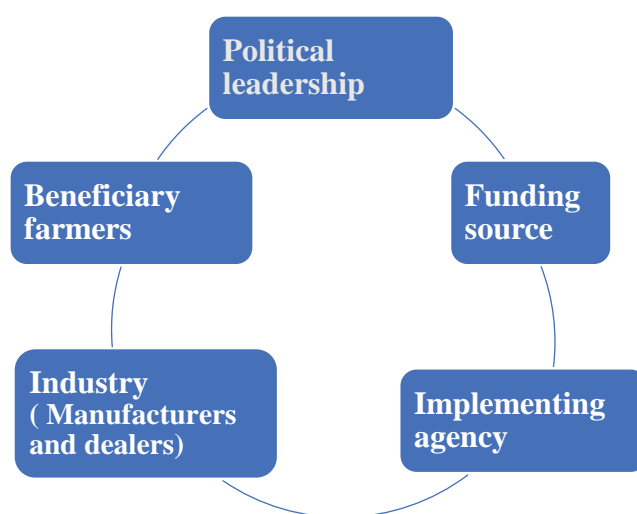


Fig. 2.2. Key stakeholders in micro-irrigation promotion programs

2.8. Current status of MI in the country

The Department of Agriculture & Farmers’ Welfare implemented the Centrally Sponsored Scheme (CSS) of Per Drop More Crop (PDMC) in the Country from the year 2015-16 to 2021-22 (Table 2.7) as a component of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). From the year 2022-23, the scheme is being implemented under the Rashtriya Krishi Vikas Yojana (RKVY) by MICADA. PDMC scheme focuses on enhancing water use efficiency at farm level through Micro Irrigation, namely, Drip and mini sprinkler Irrigation systems.

An area of 30.55 lakh hectare has been covered under Micro Irrigation in the Country through PDMC scheme during the last three years. An area of 83.06 lakh hectare has been covered under

Table 2.7.: State-wise area covered under Micro Irrigation through PDMC from 2015-16 to 2023-24 (till date) and percentage.

S. No.	State/UT	Area covered under MI (ha) [2015-16 to 2023-24 (till date 12-12-2023)]	% to total coverage in the Country [2015-16 to 2023-24 (till date 12-12-2023)]
1	Andhra Pradesh	910546	10.96
2	Bihar	28258	0.34
3	Chhattisgarh	148146	1.78
4	Goa	875	0.01
5	Gujarat	1071399	12.90
6	Haryana	90988	11.04
7	Himachal Pradesh	12235	0.15
8	Jharkhand	34675	0.42
9	Jammu & Kashmir	1104	0.01
10	Karnataka	1801629	21.69
11	Kerala	5608	0.07
12	Madhya Pradesh	356091	4.29
13	Maharashtra	938089	11.29
14	Odisha	95475	1.15
15	Punjab	14502	0.17
16	Rajasthan	708193	8.53
17	Tamil Nadu	1083784	13.05
18	Telangana	326339	3.93
19	Uttarakhand	32252	0.39
20	Uttar Pradesh	354715	4.27
21	West Bengal	95964	1.16
22	Arunachal Pradesh	12442	0.15
23	Assam	44356	0.53
24	Manipur	15894	0.19
25	Mizoram	8559	0.10
26	Nagaland	19180	0.23
27	Sikkim	12972	0.16
28	Tripura	4145	0.05
29	Ladakh	3	0.00004
	Total	8228418	

Micro Irrigation in the Country under PDMC from 2015-16 to 2023-24 (till date 12-12-2023). Top five states are Karnataka, Tamil Nadu, Gujarat, Haryana, Maharashtra and Andhra Pradesh. State-wise details and percentage of coverage is as under (Table 2.6). The Micro Irrigation helps in water saving as well as reduced fertilizer usage through fertigation, labour expenses, other input costs and overall income enhancement of farmers. Recent evaluation studies of the scheme have reiterated that Micro

Irrigation is relevant in achieving national priorities such as improving on-farm water use efficiency, enhancing crop productivity etc. A micro-irrigation fund (MIF) with corpus of Rs. 5000 crore was created with the National Bank for Agriculture and Rural Development (NABARD) during 2018-19 to help states mobilise resources. The increase in irrigation cover since 2017-18 was driven by six programmes and projects, according to data seen by HT. These are the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) and the Accelerated Irrigation Benefit Programme (AIBP), under which Rs. 11,505 crore was released between 2017-18 and 2021-23; Har Khet Ko Paani-Surface Minor Irrigation (Rs. 4,000 crore); PMKSY-groundwater projects (Rs. 787 crore); special package for Maharashtra (Rs. 1,988 crore); Rajasthan and Srihind feeder (Rs. 300 crore) and Shahpur-Kandi project (Rs. 298 crore).

An amount of Rs. 18714.69 crore has been released as Central Assistance to the States under PDMC Scheme from 2015-16 to till date (12-12-2023). Top five beneficiaries are Karnataka, A.P., Maharashtra, T.N. and Gujarat. State-wise details are as under (Table 2.8):

Table 2.8.: State-wise details of central assistance released (Rs. in Crore) under PDMC scheme from 2015-16 to 2023-24 (till date 12-12-2023)

S. No.	State/UT	Central Assistance released
1	Andhra Pradesh	2612.73
2	Bihar	121.71
3	Chhattisgarh	285.14
4	Goa	3.04
5	Gujarat	1864.60
6	Haryana	353.79
7	Himachal Pradesh	116.85
8	Jharkhand	200.64
9	Jammu & Kashmir	60.47
10	Karnataka	2696.79
11	Kerala	42.53
12	Madhya Pradesh	882.86
13	Maharashtra	2355.71
14	Odisha	265.16
15	Punjab	56.93
16	Rajasthan	1175.45
17	Tamil Nadu	2308.83
18	Telangana	712.54
19	Uttarakhand	283.55
20	Uttar Pradesh	868.54
21	West Bengal	190.84
22	Arunachal Pradesh	125.82
23	Assam	155.57

24	Manipur	206.36
25	Meghalaya	31.73
26	Mizoram	157.47
27	Nagaland	261.06
28	Sikkim	255.77
29	Tripura	58.32
30	Andaman & Nicobar Islands	0.81
31	Puducherry	2.02
32	Ladakh	1.00
	Total	18714.63

2.9. Growth of micro irrigation in Haryana

Physical & financial progress (Horticulture & Agriculture Crops) under MI scheme (Table 2.9). Haryana has disbursed 650.58 crores from its own share and 90 crores for the centre during 2023-24 through MICADA (Table 2.12). Growth under different sectors is presented in Fig. 2.3, 2.4 and Table 2.9 - 2.11).

Table 2.9.: Physical progress of MI from 2006-07 to 2022-23 (Area in ha.) in Haryana

	Year	Drip	Sprinkler	Total
1	2006-07	812	1864	2676
2	2007-08	1041	6735	7776
3	2008-09	2139	20170	22309
4	2009-10	2468	790	3258
5	2010-11	3900	5254	9154
6	2011-12	2751	5961	8712
7	2012-13	2645	3914	6559
8	2013-14	2504	3860	6364
9	2014-15	1550	1850	3400
10	2015-16	1756	1360	3116
11	2016-17	1158	4624	5782
12	2017-18	2105	8315	10420
13	2018-19	2903	10549	13452
14	2019-20	3032	18795	21827
15	2020-21	3234	15373	18607
16	2021-22	1937	20063	22000
17	2022-23	3333	33149	36482
	Total			

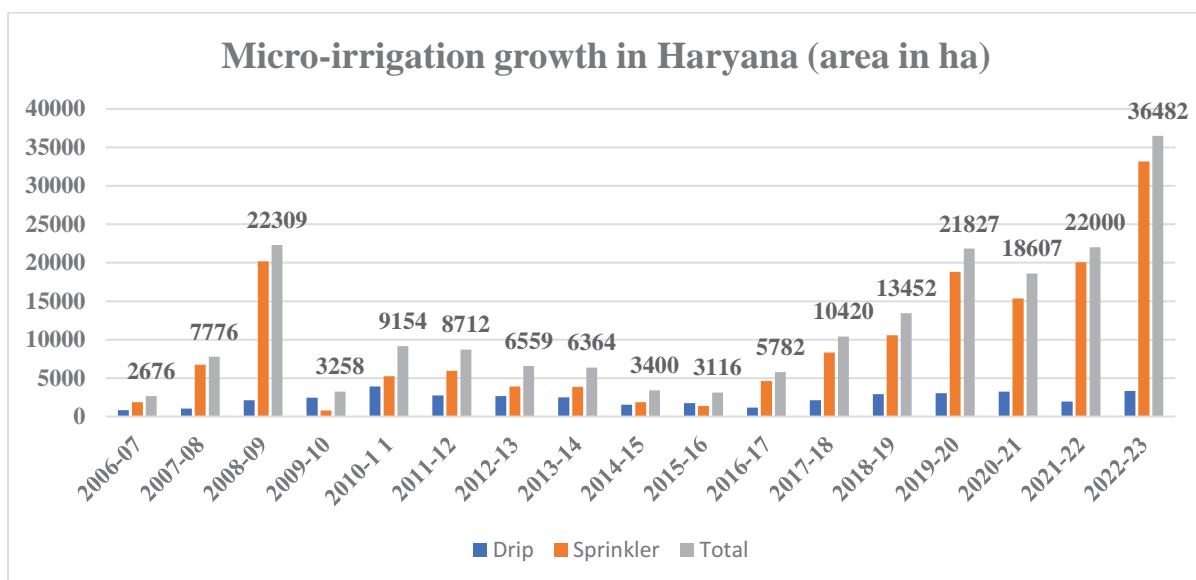


Fig. 2.3: Micro-irrigation growth in Haryana (area in ha)

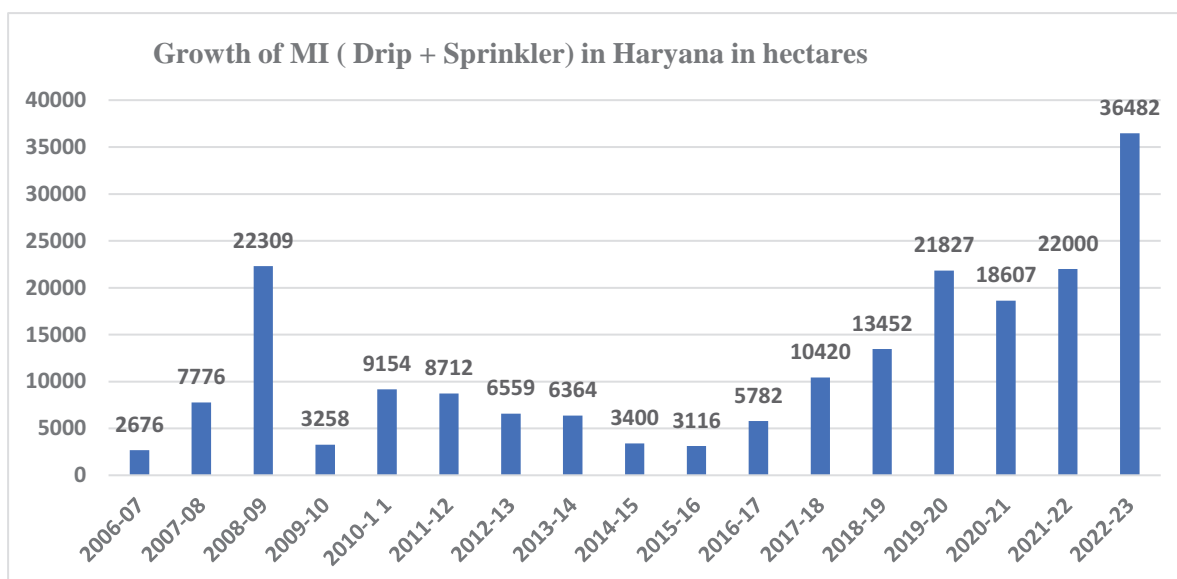


Fig. 2.4: Growth of MI (Drip + Sprinkler) in Haryana in hectares

Table 2.10.: Financial Progress of MI from 2006-07 to 2022-23 (Rs. in lakhs) in Haryana

	Year	Available budget	Expenditure	Percentage utilization
1	2006-07	583.69	235.74	40
2	2007-08	1124.36	645.20	57
3	2008-09	2113.62	1891.39	89
4	2009-10	942.42	851.76	90
5	2010-11	2624.10	2594.31	99
6	2011-12	4065.40	4034.09	99
7	2012-13	6648.22	6260.83	94
8	2013-14	6784.58	6189.32	91
9	2014-15	3051.72	3029.07	99
10	2015-16	4416.75	2000.45	45
11	2016-17	8221.23	2083.31	25
12	2017-18	5608.59	2387.86	42

13	2018-19	7878.51	4252.30	54
14	2019-20	10500	10275.54	98
15	2020-21	6750	5975.00	89
16	2021-22	58043	19245.99	33
17	2022-23	85369	57810.15	68

Table 2.11: No. of Beneficiaries Physical and financial progress report under MI (2022-23) district wise in Haryana

S. N.	Name of district	Assistance disbursed till 31.03.2023		
		Beneficiaries (No.)	MI Area (acres)	Total assistance (Rs. In lakh)
1	Ambala	95	318.54	56.37
2	Bhiwani	10546	35913.26	1 1210.17
3	Charkhi Dadri	4516	13764.84	4146.43
4	Faridabad	9	15.48	7.17
5	Fatehabad	310	1062.19	223.59
6	Gurugram	819	2063.19	476.97
7	Hisar	1966	7862.14	2045.04
8	Jhajjar	782	2270.03	453.47
9	Jind	40	132.02	49.26
10	Kaithal	169	244.82	85.07
11	Karnal	34	125.44	52.67
12	Kurukshetra	448	615.98	230.96
13	Mahendergarh	4679	11458.56	3179.21
14	Nuh	1161	3123.55	956.28
15	Palwal	20	69.02	23.15
16	Panchkula	43	107.17	20.90
17	Panipat	41	87.49	22.14
18	Rewari	3214	7401.92	1596.28
19	Rohtak	87	244.62	61.22
20	Sirsa	925	4178.77	822.61
21	Sonipat	21	45.86	18.50
22	Yamuna Nagar	21	102.58	33.58
	G. Total	29946	91207.54	25771.04



**Table 2.12. MICRO IRRIGATION & COMMAND AREA DEVELOPMENT AUTHORITY HARYANA
PANCHKULA- Outlay and Expenditure 2023-24 (Lakh INR)**

	Name of Head	Budget Estimate 2023-24			Revised Estimate 2023-24			Expenditure incurred so far		
		Centre Share	State Share	Total	Centre Share	State Share	Total	Centre Share	State Share	Total
1.	Area Development Programme for Canal Area (50:50) (P-02-24-2705-51-190-95-51) 09) Grant-in-Aid-General	0.00	5000	5000	0.00	5000.00	5000.00	0.00	4862.00	4862.00
	43) Grant for creation of capital assets (including supplementary Budget of Rs. 200.00 cr.)	0.00	40000	40000	0.00	20000.00	20000.00	0.00	20000.00	20000.00
2.	Mobilizing the resources for expanding coverage of Micro Irrigation under NABARD-MIF, P-1-19-2705-51-NA-188-99-51									
	43-Grant for creation of Capital Assets	0.00	25000	25000	0.00	20000.00	20000.00	0.00	17335.00	17335.00
	Total		70000	70000	0.00	45000.00	45000.00	0.00	42197.00	42197.00
3.	Implementation of Rastriya Krishi Vikas Yojana-Per Drop More Crop (General Category) P-02-19-2705-51-190-94-51.	20384	30576	50960	4884.00	13823.00	18707.00	9000.00	22861.00	31861.00
4.	Implementation of Rastriya Krishi Vikas Yojana Per Drop More Crop (SC Category) P-02-19-2705-51-789-97-51.	720	1080	1799	1136.00	658.00	1794.00	0.00	0	0
	Total	21104	31656	52760	6020.00	14481.00	20501.00	9000.00	22861.00	31861.00
5.	Area Development Programme for Canal Area, P-2-19-2705-51-190-95-51									
	09) Grant-in-Aid-General	0.50	0.50	1.00	0.50	0.50	1.00	0.00	0.00	0.00
	43) Grant for creation of capital assets	0.50	0.50	1.00	0.50	0.50	1.00	0.00	0.00	0.00
	Total	1.00	1.00	2.00	1.00	1.00	2.00			
	Grand Total	21105	101657	122762	6021.00	59482.00	65503.00	9000.00	65058.00	74058.00

2.10. Micro-irrigation systems market trend

In recent years, the cultivation of flowers and vegetables in greenhouses has emerged as a major alternative to overcome yield issues. The greenhouses in the country are mostly equipped with micro-irrigation systems. Under the greenhouse segment, drip irrigation is the most dominant micro-irrigation system. The revenue from greenhouses also increased in the past few years. For instance, the revenue of greenhouses in 2020 was USD 20.6 million, and it increased to USD 28.5 million in 2021. The increase in the revenue from greenhouses also

contributes to the growth of the MI market. Central and state governments in the country are granting subsidies for the construction of greenhouses and for installing micro-irrigation systems. For instance, in the 2021 budget, the Indian government set the target of covering 10.0 m ha in five years under micro-irrigation. Similarly, in the year 2019-20, about 1.1 million farmers benefited from the adoption of drip and sprinkler irrigation. Thus, increasing intervention of several state governments by providing subsidies, coupled with rising product innovation of major players, is anticipated to drive the market further. Maharashtra state dominates the Indian market for micro irrigation. The Indian micro irrigation market is majorly consolidated where Jain Irrigation Systems Ltd and Netafim Limited are most established. They have high competition in capturing the market shares in most of the top agricultural states with high micro irrigation penetration. These are major player in micro irrigation market in India.

- a) Jain Irrigation Systems Limited
- b) Netafim
- c) Revolus
- d) Finolex Plasson Industries Private Limited
- e) Premier
- f) Captan
- g) Harvel
- h) Mahindra EPC Industries LTD
- i) Nimbus

The state governments are urging the central government to allocate more funds under the Pradhan Mantri Krishi Sinchai Yojana (PMKSY) to bring at least 50% of agricultural land under micro-irrigation over the next five years. Along with this, the increased partnership of major players with the government is encouraging the micro-irrigation market in the state. For instance, Jain Irrigation Systems Ltd is an Indian agri-business firm offering drip and sprinkler systems, pipes and fittings, plumbing systems, tissue culture, solar products, and integrated drinking water solutions. With government support, the company has set up drip irrigation pilots for sugarcane in different parts of the country. Thus, the increased government support and innovative ideas from the key players are aiding the growth of the MI market. As per estimate that Indian Micro-irrigation System Market has been assessed of 20.6 million USD (2020) and grew up to 28.5 million USD (2021) just with in period of one year.

2.13. List of registered firms with MICADA

Table 2.13. Approved list of vendors by MICADA till 2024.

1.	A.T.S Trading Company, Opp. Central Bank, Siwani Road, Tosham, Bhiwani, Haryana-127040
2.	Aaram Plastics Pvt. Ltd., 101, Vinayak Complex, Station Road, Jaipur-302001 (Raj.)
3.	Agarwal Electrical and Infrastructure Pvt. Ltd., Jui Road, Village-Dulheri, Bhiwani
4.	Ajay Polymers, 14 th KM Stone, Delhi Road, Hisar, Haryana
5.	ALLIANCE INDIA IRRIGATION, Nearby Bus Stand, Nangal Mundi, The. Rewari, Distt. Rewari -123411
6.	Ankit Irrigation PVT. LTD., 105-A Adarsh Plaza, Khasa Kothi, Bani Park, Jaipur - 302001
7.	Apollo Pipes Ltd., Hargobind Enclave Vikas Marg, Delhi-110092
8.	Ashwani Kumar Ashok Kumar Pvt. Ltd., 555 Udyog Nagar, Behind Sheesh Mahal, Delhi Road, Hisar-125005, Haryana
9.	ASIAN TUBES, Opp. Huda Sector-3, Hisar Road, Fatehabad-125050 (Hry.)
10.	BAGHBAANVINIMAYPVT LTD. 727 North Avenue ARG Group Opp. Anaj Mandi, Sikar Road Jaipur.
11.	BALAJI AGRO SYSTEMS PVT.LTD, 177-178, Huda Industrial Area, Sec-26, Bhiwani -127021 (Hry.)
12.	BALAJIIRRITECH PVT. LTD., 13 Old Housing Board Colony, Opp. District Courts, Bhiwani-127021 (Hry.)
13.	Balson Polyplast Pvt. Ltd., Survey no.-13/2, P-1, Plot No.-4, National Highway, 27 Opp. Sadak Pipliya Gate, Village- Sadak Pipliya, TA. Gondal, District- Rajkot-360311
14.	BHARAT DRIP IRRIGATION AND AGRO, G-1-185, Road No. 10, RIICO Ind. Area Bindayka, Sirsi Road, Jaipur
15.	Bharat Polymers, Plot No.-256, Sector-3, HSIIDC, Karnal-132001
16.	BHUMI POLYMERS PVT LTD, Survey No. 236, Plot No. 34, Inside Bhumi Gate, Krishna Ind. Area, N/H 27, Verval (Shapar), Distt. Rajkot-360024 (Guj.)
17.	BICHHWAL PIPE AGENCY, Singhana Road, Narnaul (Hry.)
18.	Captain Polyplast Ltd, UL-25, Royal Complex, Bhutkhana Chowk, Dhebar Road, Rajkot-360002, Gujarat.
19.	Deepak Mishra
20.	DESSONS AUTOTECH PRIVATE LIMITED, 10KM Stone on Barwala Ambala Road, Panchkula-134118 (Hry.)
21.	DINESH IRRIGATION PRIVATE LIMITED,86-B & 86-B-II, Jhotwara Ind. Area, Jaipur-302012 (Raj.)
22.	Disha Industrial Corporation, H. No.-203, Sector-4, Rewari-123401, Haryana / Godown- Near Rao Water Supplier, Uttam Nagar, Rewari.
23.	Finolex Plasson Ind. PVT. LTD. 4 th Floor, P-14 Rajiv Gandhi Infotech Park, Phase-I, M.I.D.C., Hinjewadi, Pune -411057
24.	Harvel Agua India Pvt. Ltd., 301-304, Meghdoot, 94 Nehru Place, New Delhi-10019
25.	HASTI IRRIGATION, F-76, RIICO Industrial Area, Behror, Distt. Alwar (Raj)
26.	HASTI PIPES PRIVATE LIMITED, Plot No. F-77, RIICO Ind. Area Phase –I, Behror, Alwar (Raj.) 301701
27.	HIMALYAN PLASTICS LIMITED, 9&10, Ind. Estate, Chambaghat, Solan-

	173213 (HP)
28.	IRRILINK DRIP IRRIGATION INDUSTRIES, Office :3, Shubh Complex, Near Vishwkarma Temple, Highway, Deesa-385535 (Gujarat) India
29.	Jagdish Machinery Store, Jhajjar Road, Near Dhanu Mandi Gate, Opp. Canara Bank, Rohtak-124001 Hry.
30.	Jai Shri Balaji Industries, Behind Shree Ram Petrol Care, Nearby Railway Crossing, Siwani, Bhiwani, Haryana-127046
31.	JAIN AGRO Jhajjar Road, Rohtak
32.	JAIN IRRIGATION SYSTEMS LTD, Plastic Park, P. Box No. 72, NH No. 6, Jaljaon-425001 (MH)
33.	Jamidar Pipe Industries, Plot-G-1-127, RIICO Industrial Area, Behror, District-Alwar (Raj.)
34.	Jindal Sanitaryware Pvt Ltd
35.	JMS Trading company, Near Dhanu Mandi, Jhajjar Road, Rohtak 124001
36.	Kisan irrigations and infrastructure ltd, SCO-2, 2 ND Floor Opp. UCO Bank, Ambala Chandigarh Highway Zirakpur Distt. Mohali PB-140603
37.	KISAN SALES ENTERPRISES, Narnaul road, Ateli Mandi-123021 (Hry.)
38.	Kissan Irrigation, VPO- Jhojhu Kalan, Bhiwani
39.	KK PIPES AND PRODUCTS PVT LTD, 237, Shastri Market, Indore-452007
40.	KRITI INDUSTRIES, LIMITED, MEHTA Chamber,34, SIYAJANJ, INDORE 452007
41.	L. S. Contractor, Flat No.-3, New Housing Board Colony, Barnala Road, Sirsa.
42.	L. M. INDUSTRIES, Plot No. 1, HSIIDC, Industrial Estate, Narwana-126116 (Hry.)
43.	M R BIOFUELS, D-21, Rath Nagar, Behror Road, Alwar (Raj.) 301001
44.	MS. Mahavir Pipes, Nahar Road, Kosli (Near Revti Sadan), Bus Stand, Jhal, Haryana.
45.	M/S Ganesh Irrigation, Loharu Road, Ch. Dadri, Bhiwani, Haryana
46.	M/S RIDHISIDHI ENGINEERING WORKS, 1.5 KM Stone, Chikanwas-Jagan Road, Block Agroha, Distt. Hisar-125001 (Hry.)
47.	MAHALAXMI AGRO AGENCY, New Anaj Mandi, Behal, 127028, Distt. Bhiwani (Hry.)
48.	MAHENDRA IRRIGATION AND STEEL INDUSTRIES, Majra Khurd, Mahendergarh -123029
49.	Malik Enterprises, H No.-2409, Sector-13, Bhiwani, Haryana.
50.	MARUTI IRRIGATION COMPANY, VPO Dhani Hunat Tehsil-Siwani
51.	Metro Irrigation Pvt. Ltd., Plot No.-11, Industrial Area, Sector-21, Bhiwani-127021.
52.	Mohit India, F-21, Industrial Area, Bhiwadi-301019, Alwar (Raj.).
53.	MOONGIPA ENTERPRISES, Siwani Road, Tosham Distt. Bhiwani (Hry.)
54.	MOONGIPA IRRIGATION CO, Siwani Road, Tosham, Distt. Bhiwani (Hry.)
55.	MUNGIPAIRRITECH PRIVATE LIMITED, Juhi Road, Dulheri, Tosham Bhiwani (Hry.) 127040
56.	National Irrigation Equipment Co., 2 KM Stone, Delhi Road, Rewari-123401, Haryana, India
57.	NAV KAR TRADING COMPANY, 1496/25, Dhannu Mandi, Jhajjar Road, Rohtak -124001
58.	Netafim Irrigation India Pvt. Ltd., C-380 & 381, 2 nd Floor, Palam Extension Area, Ram Phal Chowk, Sector-7, Dwarka, New Delhi-110045
59.	NICE IRRIGATION EQUIPMENT CO., 27,38 Industrial Area Delhi Road, Rewari-123401 (Hry.)

60.	Nimbus Pipes Ltd, G-9C, 2 nd Floor, Kabir Marg, Bany Park, Jaipur-302016 (Raj.)
61.	NIRMAL POLYFAB PVT. LTD., 2KM Milestone Uttam Nagar Rewari-123401
62.	ORI-PLAST LTD, f-188 (K&L, J-1) & G-180 (O&P), RIICO Industrial Area, Phase-II, Behror -301701
63.	PATHAK SALES CORPORATION, Near RAO Water Supplier, Uttam Nagar, Delhi Road, Rewari-123401 Hry.
64.	Pawan Polytex Private Ltd., F-20, RIICO Industrial Area, Nokha- 334803, Bikaner (Raj.)
65.	PIONEER IRRITEK, Mal Godam Road, Near Kanod Gate, Rewari-123401(Hry.)
66.	POLYSIL IRRIGATION SYSTEMS PVT. LTD., Survey No. 340/1, At –Post-Raniya, Sakarda-Bhadra Road, TA-Savli, Distt. Vadodra-391780 (Gujarat)
67.	Premier Irrigation Adritec Pvt. Ltd., 17/1C, Alipore Road, Kolkata-700027.
68.	PRINCE PIPES AND FITTING LTD, The Ruby, 8 th Floor-29, Senapati Bapat Marg (Tulsi Pipe Road) Dadar (W), Mumbai-400028 Maharashtra
69.	Punjab Agro Pvt. Ltd.
70.	RAINTOP IRRITECH SOLUTIONS, Ho. No. 816, Sector-3, Part-1, Rewari-123401 (Hry.)
71.	Rajasthan Engineers and Contractors Enterprises, F-45, Industrial Area, Sikar (Raj.)
72.	RAJKEE IRRIGATION, Street No. 11, Champapuri, Rohtak Road, Charkhi Dadri-127306 (Hry.)
73.	RATHIPOLYPLAST PVT. LTD. 731, North Avenue, ARG Building, Road, No. 9 Sikar Road Jaipur -13
74.	RENOWN IRRIGATION SYSTEMS LIMITED Survey no. 54/2/P ₂ , Plot No. -2, NH-8, B, Junagarh- Jatpur Highway, Opp. Gyan Bharti School, Village –Sukhpur, Junagarh-362310. (Guj)
75.	Rivulis Irrigation India Pvt. Ltd., 203 May Fair Towers, K B Joshi Path, Wakdewadi, Shivaji Nagar, Pune Maharashtra-411005
76.	RUKMINI POLYTUBES PVT. LTD. X-18, 2 nd Floor, Room No. 12, Lohamandi, Naraina, N. Delhi -110028
77.	RUNGTA INDUSTRIES, Rohtak Road, Near Hanuman Mandir, Charkhi Dadri - 127306 (Hry.)
78.	RUNGTA IRRIGATION LIMITED, 101, Pragati Tower 26, Rajendra Place, New Delhi-110008
79.	SARNA MARBLES PVT LTD, A-220/221, RIICO Industrial; Area (Extn.) Phase II Bagru-303007, Jaipur (Raj)
80.	SAVRAJ INDIA IRRIGATION, Village Baluda Tehsil Sohna Distt. Gurugram (Hry.) 122103
81.	Serla Farmer Producer Company Ltd., 10, Ward-3, Vikash Nagar, Behal, Bhiwani, Haryana
82.	Shiv Shakti Pipe Industries, G-1/110 & 123, RIICO Industrial Area, Phase-1, Behror (Alwar), Rajasthan- 301701.
83.	Shiva Irrigation System, DSB-319, HUDA City Centre, LIC Road, Bhiwani, Haryana-
84.	SHIVAM IRRIGATION WORKS PVT. LTD. Plot No. 27, Sector-21, HSIIDC Ind. Area, Bhiwani -127021 Hry.
85.	Shree Balaji Enterprises, Bhiwani Road, Near Ram Singh Colony, Hansi-125033, Haryana
86.	Shree Bhandari Plastic Pvt. Ltd.
87.	SHREE SALASAR INDUSTRIES,8-A1, RIICO Ind. Area, Sarna Dungar, Jaipur 302012

88.	SHREE SHYAM IRRIGATION, H.O. Bhiwani Road, Bus Stand Jhojhu Kalan Mfg. Unit: Jawa Road, Jhojhu Kalan Teh. & Distt. Charkhi Dadri-127310 (Hry.)
89.	SHREE SHYAM PIPE UDYOG, Nahar Road, Railway Station, Kosli, Rewari - 123302
90.	Shri Ram Pipe Factory, G-1/130, RIICO Industry Area, Phase-1, Behror, District-Alwar-301701
91.	SIGNET INDUSTRIES LIMITED, Survey No. 233, D. No. 2-34/35, Near Masqati Dairy Farm, Nagarjuna Sagar Road, Turkeyamjal Village, Ranga Reddy Distt (T.S)
92.	SIYARAM IRRIGATION PRIVATE LIMITED, Rajgarh Road, Panihar Chowk, Choudhariwas, Hisar-125001 (Hry.)
93.	SIYARAM POLYMER PVT. LTD., Balaji Farmhouse, Plot No. 33, Near Green Beach Hotel, Gangwa, Hisar (Hry.)
94.	Spark Irrigation Pvt Ltd., Gate No.-332, Tarsod, District- Jalgaon - 425003
95.	SRMPLASTOCHEMPRIVATE LIMITED,
96.	Sturdy Industries Ltd., 44 & 45, Industrial Area, Sector-1, Parwanoo-173220, District-Solan, HP.
97.	Supreme Industries
98.	Swasti Polytech Pvt. Ltd., 2 KM Milestone, Delhi Road, Gurudwara Wali Gali, Near Public Health, Water Works, Uttam Nagar, Rewari-123401.
99.	Swastic Sprinkler System, VPO- Sadat Nagar, Nahar Road, Kosli, District-Rewari, Haryana- 123302.
100	SWATI ENTERPRISES, Delhi Road, Uttam Nagar, Rewari (Hry.)
101	TIRUPATISTRUCTURALS LTD, Plot No. 81, F.I.E. Patpar Ganj, Delhi -110092
102	UNNATI AGRICULTURAL PRODUCTS PRIVATE LIMITED, House No. 22, Ward No. 4, Near Masjid, Dehana, Mewat, Mewat, (Hry.) 122107
103	Vikas Irrigation, Booth no. 88, EXT. Grain Market, Dhand, Kaithal (Hry.)-136020
104	VINDHYA INDUSTRIES, 6 TH KM Stone, Delhi Road, Hisar
105	Vishakha Plastic Pipes Pvt Ltd., Vishakha House, Ashirwad Paras, Corporate House No.-2, Corporate Road, Parhlad Nagar, Ahmedabad-380015, Gujarat.

2.11: Provision of post installation services

Currently there is no compiled list of the centres/shops engaged in providing post installation services in the state. The major market players should open their post installation services at block/cluster level.

LAYOUT DESIGN OF DRIP & SPRINKLER IRRIGATION SYSTEMS

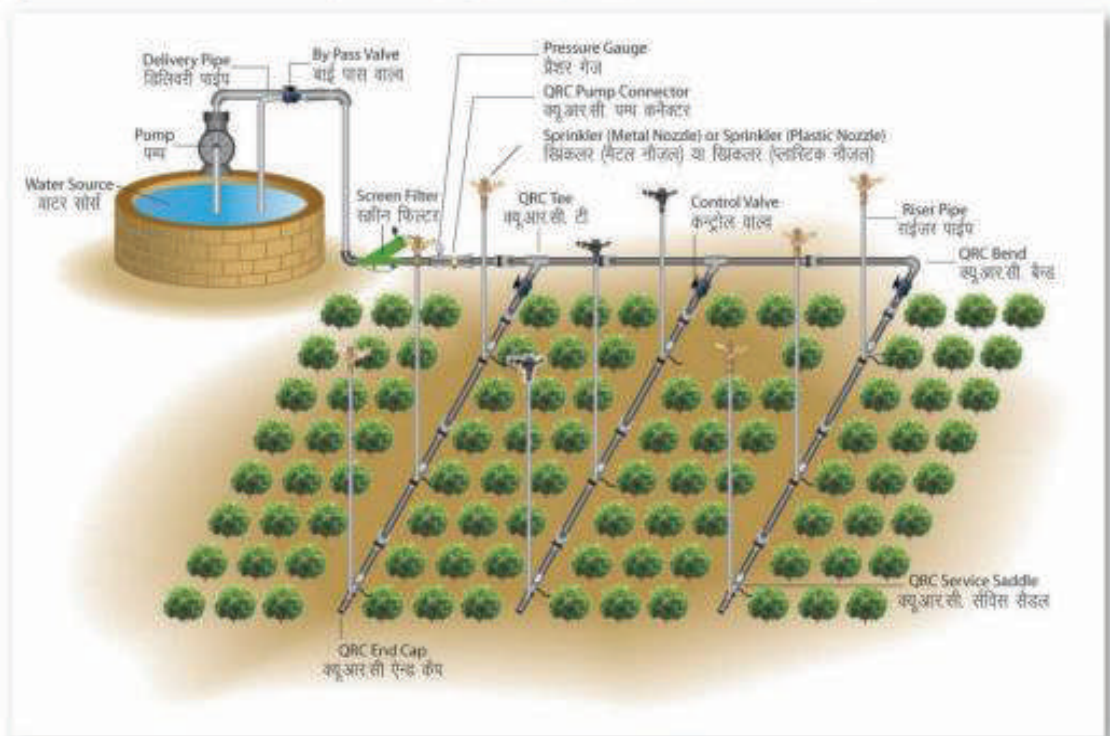
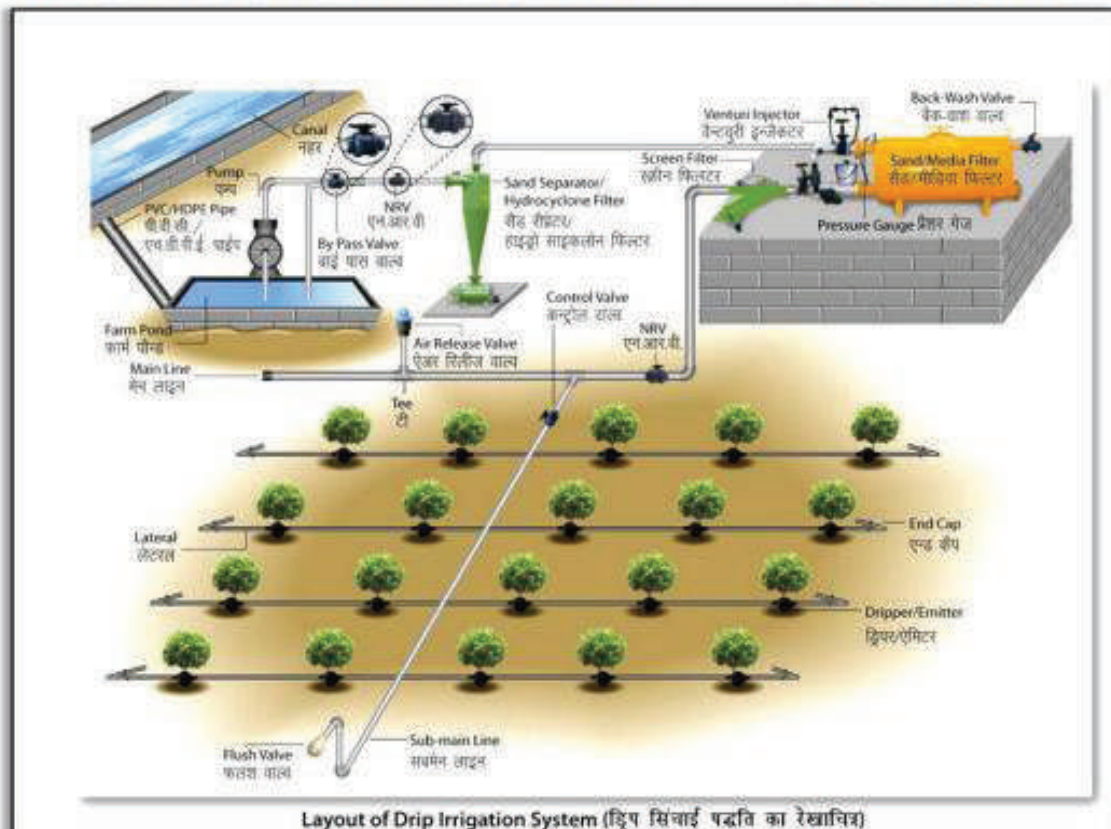


Fig.2.5: Layout design of drip and sprinkler irrigation system

SECTION- 3

Major recommendations/Suggestion for quick adoption of MI in the state.

3.1: Major recommendations / Suggestion for quick adoption of MI

1. The present drip irrigation subsidy is only for 120 cm spacing which is used only in cotton (and to some extent in sugarcane); the water saving is only in one season and that too in the rainy season where rainfall has large contribution. Drip spacing at 60 cm should be allowed as that will ensure water saving in both seasons and most crops.
2. Portal should always remain open as most of the time (end of financial year) it is closed and that is the time when farmers have money after the sale of winter season crops and delay in opening the portal lowers the interest of farmers when they have already spent that money.
3. As the cheating in MI is being mostly done by local companies by showing more area than actual MI and that too by using poor quality products. License of all these companies with no inhouse production and below standard products should be cancelled and not renewed in the future. Only reputed brands of MI Vendors should be allowed to operate in the state.
4. Local companies engaged in MI generally do not have agronomists and engineers in their team. Therefore, each company must have competent agronomist and engineer in its team to cater crop specific requirements of MI farmers.
5. There should be specific time limit for disbursement of subsidy to farmers so that farmers are encouraged to adopt new technologies.
6. There should be no GST on agricultural implements including MI system as it is all supported by the government; even if it is must, it should not be >5%.
7. Currently two portals are working in MICADA for MI registration and many stakeholders are not able to update their information. Both the portals should be merged to avoid any confusion.
8. Demonstration/Farmer trainings on MI system should be conducted in each KVKs/Regional Research Station/Central or state farm in the state to create awareness among stakeholders regarding benefits of water saving and fertilizers through MI.
9. Center for Advanced Study on MI should be established in the State to strengthen the academic, research and extension activities on MI.
10. Agricultural Institutes should ensure that MI is given priority while allotting research problems to research scholars and also felicitate with suitable awards for outstanding work on MI.

11. Timely release of subsidies of water tank and MI system is the major issue in the successful implementation of MI scheme. Therefore, higher officials should review the entire process quarterly.
12. Subsidy on water tanks is based on 2016 materials cost; but there is steep rise in the cost during the last 8 years and farmers are not getting actual subsidy amount. As per the latest MICADA ruling; the pond size and cost are further reduced to the discouragement of MI farmers.
13. The conflict of power load has arisen due to installation of additional motor to lift water from the tank. Farmers may be allowed to install additional motor without any additional burden/formality. The matter should be resolved with the higher authority of the electricity department.
14. Since sugarcane is a water-demanding crop, establishing micro irrigation in sugarcane should be the priority of the government. Moreover, sugarcane crop is widely acceptable in the state in terms of yield and mechanization at wide row spacing.
15. Community tanks (Outlet based projects) for MI are not successful for lack of farmers cooperation and system faults rectification and priority should be given for individual farmers tanks.
16. Portal for underground pipeline (UGPL) should remain open for throughout the year.
17. Periodic survey after every 5 years on MI discontinued farmers should be conducted to identify the reasons.
18. Keeping in view the power crisis, solar panels should be installed at all the MI units and applications for solar pumps should be accepted throughout the year.
19. Presently solar plates are installed adjacent to water tank in the open but threat of damage from wild animals or some mischievous person cannot be ruled out. So, the installed solar plates must be fenced in separate block of wire mesh for its safeguard.
20. Portable solar system (mounted on a trolley) should be allowed where fields of a farmer are scattered at different locations and where safety of the system is not secured.
21. At present solar power is used in bi-directional metering system which functions only when they are connected with the energised grid, hence enhances the overall cost of project specially which are lying in remote area *i.e.* far away from available grid connection. Therefore, in future exclusively functioning solar power inverter needs to be installed mainly where the cost of connecting with grid comes out more than the cost of inverter.
22. Currently we are constructing trapezoidal water tanks for collection of water coming from the canal outlet and that too with single layer brick lining layered over 15 mm

- (1:3) CM. Plaster with polythene beneath it. It has been gathered from field Engineers during site visit that they are not able to execute item of 15 mm thick (1:3) CM. Plaster over polythene especially on slopes as it slides down. Therefore, it may be executed with plaster over prepared sub grade instead over polythene. Even two layers of plasters as in lining of canal will be good for water retaining structure alike tank. Farmers may be allowed to choose the size and shape of the materials used for tank construction as per their convenience, requirements and capacity.
23. Atal Bhujal Yojana (ABY) contributes for farmers villages where water table is >30 m, but if farmers of that village have less interest; these benefits can be provided to interested farmers in the adjoining villages as that will be more helpful in water saving. Moreover, in some villages water level is >30, but not included in ABY benefits. The water level also varies in the same village, so the criterion should be modified.
 24. Some farmers are interested in Rain gun for irrigating tall crops/horticulture crops and it should be included in the subsidy.
 25. Subsidy for MI on Panchayat/Trust/Society land may be allowed.
 26. In desert/dark zone limit of land from 12.5 acre should be increased, similarly for small farmers the portal is not accepting land < 1 acre, this should also be allowed for MI adoption.
 27. Floating structure for Solar System should be adopted to save space and check evaporation loss of water as the integration will increase farmers income – the very purpose of the government.
 28. Some farmers are also interested in fish production in water tanks and the information of total tanks should be shared with fisheries department and accordingly approval may be sought. Fisheries department must enable proper guidance to the needy farmers. Additional filtration unit may be included in ponds where fish cultivation is to be adopted.
 29. For raising the height of nozzle like sugarcane or orchard, the calculation of energy requirements for pumping water through sprinklers or MI Systems should be taken care as farmers have limited energy sources.
 30. There are no repair centres or trained person to fix the fault in MI system. Young farmers in all blocks should be trained to meet the need of repair as a technical person coming from far off cost more to the MI farmer.
 31. Provision of nearby post installation services to MI adopter in a cluster of 5-6 villages must be ensured.

32. There is no provision of subsidy on MI system for farmers who are raising crops on leased land. If a person provide affidavit for 5-years lease of land and wish to adopt MI system, should be considered for subsidy.

3.2: General recommendations / Suggestion for quick adoption of MI

1. Quality of materials must be ensured and third-party review should be conducted every year by joint team of Irrigation & Agriculture Department.
2. If all the errors of these projects are rectified and run properly, then people will be interested in setting up such projects and by removing water shortages, crops yields can be increased even with less amount of water.
3. Some farmers in Sirsa, who wish to use shallow tubewell to lower the water table due to flood water are not allowed by the Power department; whereas the total approved power load is insufficient to run both submersible and shallow tubewells at the same time.
4. Paired row planting of the crops should be encouraged to reduce the installation cost on lateral pipes and other inputs using 120 cm driplines.
5. The power subsidy for farmers may be given to only MI adopting farmers.
6. Electric meters be installed on all tubewells connections to monitor energy use for pumping water for future planning, but no charges be made as of now.
7. An arrangement like filter media or hydro cyclone sand separator should be provided to prevent storm water/mud from draining directly into the water storage tank.
8. Where water table is shallow, above ground height of tank may be allowed as in case of Rajasthan, so that farmers can take benefits of tank in those areas for MI system. Tanks can be filled using available system with the farmers.
9. Transformer/Potential Transformer (CT/PT) of sufficient capacity after checking their compatibility with motor pumps be installed for smooth running of the system.
10. Fencing of MI area should be made compulsory to avoid loss of structure and damage by animals to the driplines.
11. Visit of farmers within the district should be arranged to best MI farmers for improving their confidence and conviction as some farmers still have doubts about raising paddy with drip system.
12. If the distance of water tank is more from the main source; covered water pipes support should be provided to save leaching of water from kutccha nalas.

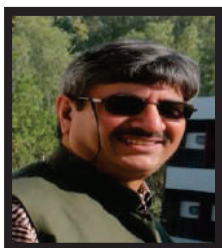
13. Provision of repair of old tanks should be included for greater adoption and proper utilization of MI infrastructure, similar to repair of water courses repair after a certain period of construction.
14. In sandy soils head unit of more than one hydro cyclone sand separator (Filtering sand) should be allowed after verification of MICADA staff for its need to reduce failure of MI adoption.
15. Subsidy on automation system should be provided to lower the cost of labour and improved efficiency for large fields.
16. Pressure Compensation (PC) unit should be included for MI system for uniform distribution of fertilisers and water under undulating fields.
17. Winder for drip lines should be included in the subsidy as proper handling will increase the life of driplines.
18. MI adopting farmers should be felicitated at district/state level programme to encourage fellow/other farmers in adopting MI system.
19. Special subsidy on water soluble fertilizers be provided to drip farmers to lower the consumption of fertilizers for which central govt is paying several lakh crore subsidies.
20. Farmers interested in crop diversification e.g. avocado, papaya, fig, banana alone or intercropped with sugarcane and other new crops should be helped for market support/subsidies.
21. The Kyminasi Crop Booster like Technologies should be promoted to save water and environment.

Meetings with progressive farmers and other stakeholders

Meetings with progressive farmers and other stakeholders		
Hisar	07-03-2023	MI group members meeting
Bhiwani	15-05-2023	With farmers, scientists and MI vendors
Karnal	19-05-2023	With farmers, scientists and MI vendors
M. Garh	02-06-2023	With farmers, scientists and MI vendors
Hisar	21-07-2023	MI Group members to discuss the issues of MI in Haryana
Hisar	05-12-2023	Preparation of report - discussion
Hisar	15-01-2024	Finalization of report and submission

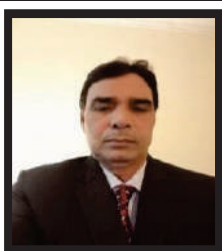


About the Chairman and Members of the Working Group



Dr. Samunder Singh retired on 31st January 2020 as Prof. & Head of Agronomy Department, CCSHAU Hisar after 36 years of service. He did his PhD from the University of Strathclyde, Glasgow Scotland and Post-Doc from the University of Florida, USA. Currently he is holding the prestigious position of President (Ist Indian), the International Weed Science Society (IWSS) and Director (Agronomy) Micro Irrigation and Command Area Development Authority, Panchkula, Haryana Government.

Dr. Singh generated >80 recommendations on effective weed management; organized 5 National and 10 International Conferences and first time Students Weed Contest in India in 2020; received research grants worth Rs. 67 million from India and abroad. Dr. Singh was first to detect herbicide resistance in five wheat weeds in India and generated technology for their effective management and developed a rapid herbicide resistance test for *Phalaris minor* (Kanki) and *Avena ludoviciana* (wild oat) in wheat first time in the world. He presented scientific research papers in 101 conferences in Australia, Canada, China, Czech Republic, Denmark, India, Indonesia, Israel, Japan, Malaysia, Spain, Singapore, South Korea, Thailand, UK, USA, Vietnam.



Dr. Ashok Kumar retired from CCSHAU, Hisar after serving as Professor, Principal and Director. He is Fellow of National Academy of Agricultural Sciences and many other professional Societies. He was PDF at the United Kingdom, Australia and Japan. Dr. Ashok Kumar authored more than 280 publications including a book in Hindi. Presently, Dr. Kumar is a member of Research Advisory Committee of ICAR-Indian Institute of Agricultural Biotechnology, Ranchi and ICAR-National Agricultural Science Fund. Dr. Ashok Kumar is presently working as Dean, Faculty of Agricultural Sciences,

SGT University, Gurugram.



Dr. Manohar Sahai Sidhpuria served on various administrative positions in CCSHAU and presently, he is working as Estate Officer cum Chief Engineer in the university. His area of specialisations is Irrigation Systems including Micro Irrigation, Dryland Agriculture, Irrigation and drainage, Soil & Water conservation Engineering and Groundwater Engineering. He has published more than 100 research papers/articles/chapters in various scientific publications/journals. He also possesses vast technical experience as Member of various Committees. He is also working as Expert on the panel of Public

Service Commission of various States.



Dr. Mehar Chand is working as Professor (Agronomy) at College of Agriculture, Kaul. He also served as the Member Secretary, Haryana Kisan & Agricultural Costs and Prices Commission, Panchkula from January 2021 to May 2022. His area of expertise is natural resource management, mechanization, weed management, agronomical requirement of field crops. He has published more than 200 research papers/articles in the journal of repute. He also possesses vast Administrative/technical experience as Member, BOM, LLUVAS, Hisar, Member State Environment Impact Assessment Authority, Haryana, Member,

Haryana Pond and Wastewater Management Authority



Sh. Suresh Kumar is a progressive farmer of Haripur village in Bhiwani and practicing Micro Irrigation (drips) for the last 20 years, raising vegetables and fruits crops (citrus). He is uniquely harvesting rainwater from roadside to his water tank used for MI system, saving water, land erosion and road damage. He is associated with several farmer organizations and guiding them about water saving and increasing their crops yield through scientific agriculture. He is engaged in agriculture since 1980 and diversified cropping system, raising different crops and rearing cows following AI technology to improve breeds. He

also cultivated castor and found it remunerative to the farmers of dry land areas. He is actively engaged in spreading government policies to farmers and conveying their problems to the government.

Glimpse of Working Group Interaction Meetings with stakeholders





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