

National Mission on Micro Irrigation (NMMI)



Impact Evaluation Study June, 2014



Submitted to:
Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation

by:

Global AgriSystem
Your Partner in Agri-business

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PREFACE

The growing need for food security and increased population has resulted in higher demand for irrigation water which could only be met by judicious use of available water resources. The Government therefore launched a Centrally Sponsored Scheme on Micro Irrigation in January, 2006, with the an objective to increase the area under improved methods of irrigation for better water use efficiency to provide stimulus to agricultural growth. The scheme was further upscaled into Mission Mode in 2010 as the National Mission on Micro Irrigation (NMMI).

The Mission has now completed almost 8 years and has made significant progress in achieving its objectives. The Department of Agricultural and Cooperation in association with National Committee on Plasticulture Applications in Horticulture (NCPAH) therefore selected M/s Global AgriSystem Pvt. Ltd to undertake the Impact Evaluation Study in 13 selected States. The study was carried out in 64 districts of the country and more than 7400 beneficiaries and non-beneficiaries were interviewed.

The study reveals that the scheme has benefitted the farmers in term of enhanced productivity and reduced cost on electricity and fertilizers. The average productivity of fruits and vegetables has increased about 42.30 percent and 52.80 percent respectively. Besides, the Scheme has also succeeded in reducing the irrigation cost which was found to have been reduced by 20-50 percent with average of 32.30 percent. Use of micro irrigation system has also helped the farmers in cutting down the electrical consumption which was found to have been reduced by about 31 percent. Successful implementation of the Scheme has also led to average reduction in fertilizer usage with average reduction of about 28 percent in total fertilizer consumption in the surveyed states.

The study received continuous support and encouragement from Mr. Sanjeev Chopra, Joint Secretary & Mission Director (MIDH) MoA, Government of India and I extend my heartfelt thanks to Mr. Chopra for his continuous support and guidance in preparing this report. We gratefully extend our appreciation to Mr. Krish S. Iyengar, Executive Director and Mr. Naresh Modi, Mr. Alok Mishra, Mr. Rohit Lall of the National Committee of Plasticulture Application in Horticulture (NCPAH) for sparing their valuable time to guide us during the entire project duration. We also appreciate the help provided by Mrs. Sadhna Khanna under Secretary, MoA, Gol and Dr. Jose C. Samuel, Chief Consultant (NHM).

It would have been impossible to complete this study without the support of 7400 farmers and other stakeholders such as system suppliers, financial institutions, NGOs, PRIs etc. spread over 13 states. We extend our gratitude to these farmers who deserve special appreciation for extending their willing cooperation in giving their valuable time, responding to the questionnaire and share their views and concerns during the field study. We also take opportunity to thank State Agriculture as well as Horticulture Department & other stakeholders of the 13 States where the study was undertaken. Members of the team have put in lots of hard work and duly deserve appreciation for carrying out the survey. Prof B.K. Sikka, Agro Economist and Prof J.N. Raina, eminent Soil Scientist, deserve our special appreciation for their guidance.

If the study helps the policy makers to make this scheme more effective and useful, we would feel that the effort has been worth it.

Gokul Patnaik

Gokul Patnaik
(Chairman)

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Abbreviations/ Acronyms

A&C	Agriculture & Cooperation
AP	Andhra Pradesh
APMIP	Andhra Pradesh Micro Irrigation Project
BIS	Bureau of Indian Standards
CHRKBK	Chhattisgarh Rajya Beej and Krishi Vikas Ltd
CIPET	Central Institute of Plastic Engineering and Technology
CSS	Centrally Sponsored Scheme
CWC	Central Water Commission
DMIC	District Micro Irrigation Committee
DoA	Directorate of Agriculture
DoH	Directorate of Horticulture
DRDA	District Rural Development Agency
EC	Electrical Conductivity
FGD	Focused Group Discussion
GAPL	Global AgriSystem Pvt. Ltd.
GGRC	Gujarat Green Revolution Company
GoI	Government of India
HDC	Horticulture Development Society
HDPE	High Density Polyethylene
HP	Horse Power
IA	Implementing Agency
ICT	Information & Communication Technology
IEC	Information Education & Communication
KGK	Krishi Gyan Kendra
KVK	Krishi Vigyan Kendra
MI	Micro Irrigation
MI System	Micro Irrigation System
Mha	Million hectare
Mhm	Million hectare metre
MIDH, MoA	Mission for Integrated Development, Ministry of Agriculture
MoWR	Ministry of Water Resources
NCPAH	National Committee on Plasticulture Applications in Horticulture
NHM	National Horticulture Mission
NMMI	National Mission on Micro Irrigation
PFDC	Precision Farming Development Centre
RKVY	Rashtriya Krishi Vikas Yojana
SAU	State Agricultural University
SC	Scheduled Cast
SMIC	State Micro Irrigation Committee
SPV	Special Purpose Vehicle
ST	Scheduled Tribes
ToR	Terms of Reference
UP	Uttar Pradesh

Executive Summary

Micro irrigation technologies (MI) are being promoted in India by the central and state governments, by providing different kinds of financial, institutional and technical support. These technologies are promoted primarily as: (1) a means to save water in irrigated agriculture, (2) as a strategy to increase income and reduce poverty, and (3) to enhance the food and nutritional security of rural households. Despite the reported significant economic advantages and the concerted support of the government and NGOs, the current area under micro irrigation in India remains an insignificant proportion of its potential. Rising demand for irrigation water in the face of its inefficient use and concerns of growing water scarcity which has brought into renewed focus for conserving water and combating water scarcity including efforts in improving water use efficiency with the available water resources.

The real thrust on promoting MI adoption largely started with the recommendations of the Report of the Task Force on Micro Irrigation in 2004. The report sought to increase the emphasis on MI technology and recommended the Centrally Sponsored Scheme (CSS) in 2005-06. The Scheme was further upscaled into Mission Mode in 2010 to accelerate the rate of adoption of micro irrigation technologies under central sector programs.

Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation assigned the study on **“Impact Evaluation of National Mission on Micro Irrigation (NMMI)”** to access the performance of the programme implementation and access the impact of this Scheme on increase in farmers' income through adoption of the MI system.

The study was conducted in 13 states comprising of 64 districts in the sampled states namely Andhra Pradesh (AP), Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Sikkim, Uttar Pradesh (UP) and Uttarakhand. The field survey to get first-hand information was conducted for a total sample of 7400, comprising beneficiary and non-beneficiary farmers in these selected states by adopting **stratified-purposive-sampling design**. Apart from this information was also collected from MI system suppliers and government officials under State Horticulture Mission and related departments.

Owing to promotional schemes introduced by the state and central governments, the area under micro irrigation has increased from 11,817 ha in 2005-06 to over 3.61

million ha in 2012-13¹ under NMMI in the country. Despite having many advantages over conventional method of irrigation, the area under micro-irrigation presently occupies only about 5.71 percent of the total potential area. As per the available data, only 2.85 percent of total irrigated area is under drip irrigation and 2.86 percent is under sprinkler irrigation.

Findings of the Study

A. Current Status

- i. The Scheme since its inception in 2005-06 has made rapid stride across the country. It has succeeded in bringing about 3.56 million ha area under micro irrigation in the sampled 13 states². The physical targets for the period 2005-06 to 2012-13 were fixed to the extent of 3.83 million ha out of which 3.56 million ha has been brought under MI. The Targets and achievements for financial outlay were Rs.5012.8 and Rs.5006.5 crores respectively. The overall physical and financial achievements thus come out to be 92.99 & 99.87 percent. The extent of achievements however, varied among different states. States like Bihar, Karnataka, Odisha, Rajasthan and Sikkim achieved more than 90 percent of the set physical and financial targets. Uttarakhand could achieve only 21 percent of physical and 31 percent of the financial targets. Other States such as AP, Chhattisgarh, Gujarat, Haryana, Maharashtra and Tamil Nadu succeeded to achieve more than 70% of their physical targets.
- ii. AP, Gujarat & Maharashtra are leading states in the every aspect of performance the different activities involved in the process streamlined in the guideline of NMMI. While Bihar, UP, Sikkim & Uttarakhand states are lacking in terms of the functions mentioned in the guidelines.

B. Pattern of Assistance (subsidy)

- i. Most of the states are giving subsidy of more than 70 percent for installation of MI system. However, comparison of various states and analysis clearly demonstrates that increased subsidy had no significant impact on the increase of area coverage under MI system. Farmers in

¹ NCPAH

² Ministry of Agriculture

Maharashtra, Gujarat and Haryana were 22.3, 14.0 and 10.0 percent respectively in case of sampled beneficiaries while pertinent subsidy component in these states was 60, 50 and 90 percent respectively. Similarly, area coverage in Rajasthan, Tamil Nadu and Bihar was noted to be 7.3, 4.5 and 3.1 percent respectively and the corresponding figures for subsidy were 90, 75 and 90 percent. The aforesaid observation clearly suggests that **increase in subsidy component beyond a limit has little or no impact on area coverage under MI system**. The relationship between area expansion under MI and quantum of subsidy has been computed considering beneficiaries' data on area expansion in different states before and after adoption of MI system. Hence, the relationship of subsidies with area expansion as such does not refer to any specific year.

- ii. The efficiency of scheme implementing agency is very high as most of the farmers have reported that their applications are processed and sanctioned in less than 40 days as against 60 days specified in the guidelines. Similarly, in most of the sample states, beneficiaries are reported to be satisfied with respect to the procedure for filing the application till disbursement of the subsidy amount.
- iii. **Presently subsidy is limited to maximum area of 5 hectare per beneficiary which is an impediment to the growth of area under micro-irrigation.** The data on size and distribution of operational land holdings in the country also suggest that medium and large farmers accounted about 15 percent of total land holdings but occupying more than 55.42 percent of the total area. Therefore, increase in the limit of maximum area per beneficiary would lead to combat water scarcity as well as the sustainable agriculture.
- iv. All the states have reported convergence of Mission interventions with different schemes of the Government of India and State level programmes. Most of the districts have converged NFSM and other programmes such as RKVY, ICDP, Farm Mechanization, NHM etc.

C. Sources of Awareness and Reasons of Non-adoption

- i. The major sources of awareness about the NMMI scheme were; MI system suppliers followed by fellow farmers and extension workers.

- ii. The non-beneficiaries farmers had mix responses for not adopting the scheme because of lack of awareness regarding subsidies, lack of technical knowledge, high capital cost, and system being not economic for their crops and therefore not required.
- iii. As per primary survey of the sampled beneficiaries, about 59 percent of the respondents were small & marginal farmers and 13 percent were women farmers who have taken the advantage of the Scheme.

D. System Cost and Sources of Fund

- i. On an average, the cost of system per hectare incurred by the beneficiaries ranged between Rs. 54457.36 to Rs. 72,086.31 in drip system and Rs. 20,481 to Rs. 28,171 in sprinkler irrigation system depending on the cropping pattern, crop spacing etc.
- ii. Almost in all states, farmer beneficiaries use their own funds for contributing margin money (98.66%). Other sources, albeit a small proportion, constitutes banking, KCC & money lenders.
- iii. Most of the farmers borrowed money at less than 10 percent of rate of interest from banks and KCCs.

E. Technical Observations about MI System

- i. It was observed that about 64 percent of the beneficiaries installed drip system, 34 percent sprinkler system and 2 percent have installed both the systems in their fields. The highest proportion of drip was observed in Karnataka because of higher proportion of area under horticulture crops whereas adoption of sprinkler was higher in Bihar because of higher proportion of area under field crops.
- ii. The majority of the beneficiaries (about 68.87%) farmers of all the 13 states have got their soil and water tested. In Gujarat, UP, Maharashtra & Rajasthan, soil testing adopted by 69.27%, 52.75%, 73.37% and 79.13 % of respondents respectively.
- iii. More than 70 percent of the respondent farmers of AP, Gujarat, Sikkim and Odisha were using in-line drip irrigation system, whereas, more than 45

percent beneficiaries of Haryana and Uttarakhand reported to practice on-line drip irrigation system.

- iv. The farmers were using screen filters, centrifugal separators/ hydrocyclone filter, disc filter, sand media filters depending on the need. The data reveals that screen filters are being commonly used by the beneficiaries in most of the sampled states except Haryana where more than 65 percent beneficiaries are using hydrocyclone and screen filters in combination due to the water quality as they are using canal water. Moreover, additional subsidy is being provided on hydrocyclone type of filters to ensure the complete removal of organic and inorganic contaminants.
- v. The farmers in almost all the states reported that components of MI System met the BIS norms. The average figure for all the sampled states where system components were as per the BIS norms came out to be around 98 percent.
- vi. It was informed that the systems were well designed except in case of Sikkim and Odisha where the systems were functional, but not able to meet the farmers' expectation in totality.

F. After Sales Services

- i. On an average, 91% of the beneficiaries across the sampled states reported that after sales services are being provided to them & also they receive the services at the required time. Most of the sampled beneficiaries revealed that they are getting warranty of the MI system.
- ii. In almost all the states, the sampled beneficiaries revealed that no technical support/ guidance on agronomic practices are extended to the users as they generally tell to take the help of extension agencies.

G. Impact Analysis

- i. The irrigated area has increased in all the surveyed states after the introduction of NMMI Scheme. The Irrigated area within the 5892 sampled beneficiaries of the 13 states before adoption of MI system was found to be 13320.86 ha which became 14441.47 ha after adoption of MI system. It is therefore concluded that total percentage increase in irrigated area with

the sampled beneficiaries in 13 states after adoption of MI system was noted to be 8.41% from same source of water. Maharashtra has topped the list with 22.28% growth in irrigated area followed by Chhattisgarh.

- ii. **Farmers of all the states have shown an increase in area under horticulture crops after the adoption of the MI system. The cropped area after implementation of CSS for promotion of MI during 2005-06 and subsequently NMMI has shown an increase which may be due to utilization of degraded/ marginal land into cultivable land & increase in cropping intensity.**
- iii. **Scheme has performed well in terms of reduction in input cost** and significant cost saving has been observed for irrigation in all the surveyed states. Irrigation cost is reduced by 20%-50% with average of 32.3%. **Reduction in electricity consumption after installation of MI system.** Average electricity consumption has been reduced by about 31% after using the micro irrigation system. **Saving of fertilizers** with averages reduction of about 28% in total fertilizer consumption in the surveyed states. Fertilizer saving vary from 7%- 42%.
- iv. Micro irrigation has generated benefits to the farmers in terms of enhancement of the productivity. **The average productivity of fruits and vegetables has increased about 42.3% and 52.8%, respectively mainly because of crop spacing, judicious use of water and other inputs etc.**
- v. The overall benefits accrued from the micro irrigation system are reflected in the income enhancement of the farmers. **All the surveyed states reported increase in farmer's income in the range of 20% to 68% with an average increase of 48.5%.**
- vi. Benefit Cost (BC) ratio of installing micro irrigation system is greater than "1" across the states and across the crops, which signifies the importance of MI system in net income enhancement of the farmers. The BC ratio was observed to be highest in Odisha among fruits & vegetables whereas, in flowers, Rajasthan & Haryana beneficiary farmers achieved higher BC ratio.
- vii. The positive outcomes have made the food security effective due to the increase in the production and productivity of different crops and increased area under irrigation from same source of water. Area under horticulture crops as well as nutritional security has also enhanced.

H. Employment Generation

- i. Beneficiaries of all the states under study have shown decrease in utilization of the labor in pre-harvest practices that is labor saving on irrigation, weeding, fertilization and other operations. It shows that the use of human labor after the use of micro irrigation has decreased significantly and ranges between 7.41 to 18.75 percent. But, in post-harvest operations, right from harvesting to handling and disposal of the produce, there is an increase in labor utilization and it ranges between 21.19 to 50.23 percent due to the increase in the production which requires more of the labor for harvesting, assembling and grading, handling, transportation and disposal of the produce.

I. Training and Capacity Building

- i. Among the surveyed states, more than 90 percent of the sampled beneficiary farmers in the state of Haryana, Karnataka, Sikkim & Tamil Nadu had training on different aspects of MI System whereas **farmers of Bihar & Odisha, only 20 & 52 percent of the beneficiaries have received the training.**
- ii. Results of survey revealed that the system suppliers / manufacturers are the major sources for imparting training as more than 90 percent of the farmers received training from them. **Very less proportion of the respondents reported to have training from other sources such as SAUs, KVks etc.** The participant beneficiaries revealed that the duration of training period generally was of 1-2 days. Almost all the respondents of Tamil Nadu, UP, Chhattisgarh, Haryana were given training materials during the training while few beneficiaries of the Bihar and Uttarakhand, Karnataka were provided such training materials.
- iii. Key areas for training were operation and maintenance of the system, adoption of package practices under MI, and opportunities for introducing new crops. Demonstration was other means of motivation and capacity building. It was also found to be a good means of promotion.

J. Promotional Activities

- i. The farmers of the majority of the states acknowledged that the implementing agencies are promoting NMMI schemes in local language

however, were not aware of the dedicated website for MI scheme in their state. It is due to the fact that most farmers do not have access or willingness to use internet for information gathering.

- ii. It was noted that maximum beneficiaries of Haryana (98%) followed by Sikkim (80%), Rajasthan (64%) and Uttarakhand (63%) have visited the demonstration trials laid out in the nearby areas.

Thus, it may be concluded that positive outcomes in terms of crop productivity enhancement due to implementation of MI Scheme have contributed significantly to food and nutritional security requirements. The NMMI has helped to widen the food basket of the country with significant contributions coming from the bringing more area under irrigation and with judicious use of water. New farm practices and innovations with support of government have encouraged the farmers to shift toward new crops giving higher income.

It is noteworthy that the incremental net returns were observed to be generally higher for cash crops such as fruits, vegetables, groundnut, cotton, etc. than for food crops viz., bajra and wheat.

Recommendations and Policy Implications

Given the vast potential benefits of micro-irrigation and fast decline of availability of water for irrigation in the country, a number of technical and policy interventions are required to be introduced so as to increase the adoption of micro-irrigation in India. The needed recommendations and interventions are presented below:

A. Scheme Related

- 1) The rate of subsidy provided under NMMI through central government is fixed uniformly for different categories of farmer with a limit of 5 hectare. This needs to be restructured as about 15% of the large and medium farmers' accounts for more than 55.42% of the land in India. Therefore, this limit of five hectares needs to be enhanced for extending the subsidy.
- 2) States often compete with each other to increase the subsidy component. However, it has been noted that higher subsidy does not necessarily lead to more area coverage under MI system as the highest increase in area under MI has been achieved by states which offer subsidy in the range of 50-75 percent e.g. Maharashtra, Chhattisgarh, Gujarat and Odisha. In case of AP which increased subsidy from 70 to 90 percent in 2011-12, the additional area to come under MI in

fact decreased as compared to the previous years. It is therefore, recommended that the states should be advised to seriously consider that the quantum of subsidy should preferably be not more than 50-70 percent including state and central share.

- 3) No uniform pattern is being followed by states for implementation of this scheme. It has been observed that in some states more than one department are involved in parallel, e.g. Karnataka where it is being implemented by both agriculture and horticulture departments. In such cases there is often lack of coordination which adversely affects the outcome of the scheme. It has also been observed that where a single department is designated as the implementing agency (e.g. horticulture or agriculture) it does not pay adequate attention to the crops coming under the purview of other departments. Perhaps one of the best implementation strategies is to designate an independent Special Purpose Vehicle (SPV) on the pattern of Gujarat (GGRC) and AP (APMIP). States may be encouraged to replicate such a strategy.
- 4) The penetration of MI is only 5% of the irrigated area, even in the states under study where there is a lot of emphasis on NMMI, penetration is only 11.18 percent of the potential (identified by various studies; ref India Stat). It is proposed that NMMI may fix a target of achieving 25% of the potential during XII plan by addressing various constraints such as:
 - a. One of the major reasons for the slow growth of micro-irrigation in India is the high initial investment. In spite of availability of subsidy from state agencies, majority of the farmers are reluctant to invest in micro-irrigation system even in horticulture crops, which is highly suitable for drip irrigation. Therefore, micro-irrigation system should be planned and designed based firmly on location specific parameters to reduce the cost of installation as well as promoting low cost technology so that poor farmers can also participate.
 - b. Capacity building activities for operation and maintenance of system, crop diversification, using most economical and appropriate Package of Practices etc. need to be made an integral part of the programme and be made mandatory for each and every beneficiary. The tool to deliver could be MI system supplier in co-ordination with SAU and extension department of the state.

- 5) Micro irrigation System is mostly promoted through subsidy schemes and not as an on-farm water and land management strategy. In certain states, under subsidy scheme, the requisite consideration have not been given in respect of field size, shape, topography, type and location of water source, seasonal fluctuations, type of soil and crop to be grown. As a result, in certain cases, the subsidy may not match the specific situation of an individual farmer, consequently the system may not match the site specific situations of an individual farmers consequently the system may not operate to the complete satisfaction of the farmer.

B. Technology Related

- 1) There is a need to establish a Central Testing Facility (CTF) to deal comprehensively with the design, development and testing of all equipments, devices, machines used in micro irrigation systems using state-of art technology. It is suggested that the Government may consider contacting regular and random technical audit of the system to cover about 2-3 percent beneficiaries within first and second year of the installation. This will keep check on to quality and suppliers will be more vigilant to supply good quality of system.
- 2) It is suggested that the implementing agencies should be more vigilant regarding warranty and after sales service of the system provided by the suppliers. **It is proposed that 10 percent of the subsidy may be released after one year subject to satisfactory performance of the system as certified by the beneficiary. Maintenance manual in vernacular language should be made available to the beneficiaries at the time of installation of the system.**
- 3) It is observed that the cost of micro-irrigation accessories such as emitters, filters, laterals, etc. vary between shops and places. Sometimes farmers do face problem in getting spare parts in time. It is necessary to provide quality materials in time for farmers for the speedy adoption of micro-irrigation.
- 4) **Inadequate information about the operation, maintenance as well as the usefulness of micro irrigation is one of the main reasons for its uneven spread across regions in India. Farmers still do not have full knowledge regarding the usefulness of the micro irrigation.** Even the adopters do not know fully how much of subsidy is available per hectare for different crops.
- 5) Clogging of drippers mainly due to poor quality of water helps in bacterial growth which can be controlled by using chlorination which acts as a powerful oxidizing agent and vigorously attack micro-organisms such as algae, fungi and bacteria.

Also acid is injected into drip irrigation system to lower the pH of the irrigation water and this helps in preventing the precipitation of salts such as calcium carbonate, magnesium carbonate or ferric oxide. It has been observed during the course of survey that the availability of sulphuric acid in the nearby towns is a major constraint and farmers are forced to purchase new spares by discarding clogged drippers. It is, therefore, recommended that system suppliers should make acid available to the growers as part of their after sales service obligation. Therefore, studies need to be carried out to device efficient eco friendly de-clogging measures so that farmers do not suffer from such problems.

C. Awareness and Capacity Building

- 1) The extension network currently operated mainly by government agencies does not seem to be making significant impact on the adoption of this technology. Therefore, there is a need to revamp the entire extension network by involving the MI system manufacturers in order to increase & improvise the existing quality of extension services.
- 2) MI system manufacturers should be involved intensively in promoting micro-irrigation by introducing frequent demonstration at farmers' field and strategic locations in the district/ state. The MI system manufacturers should be involved in providing advice on agronomic packages to the farmers so as to encourage the adoption of micro irrigation at a large scale.
- 3) Since MI system suppliers are one of the major sources of creating awareness among potential beneficiaries, their involvement in laying down demonstration may be increased. Similarly, imparting training on technical and operational aspects of the system be included as mandatory part of the training of the farmers by the system suppliers. The training may also include aspects of package of practices which may be standardized by the SAUs & other related organization and supplied to system suppliers for further dissemination to the farmers.
- 4) **Awareness on MI system is low in states like Bihar, UP and Odisha.** Special drive is needed for exposure visits/ trainings to make them aware about the benefits and operation of the system. The number of demonstration farms should also be increased.
- 5) It is understood from the field study that the officials who are involved in promoting micro-irrigation technology under the Gol Scheme have inadequate knowledge about the technical and other details of MI. Therefore, the state

government extension staffs need to undergo ‘Refresher Courses and exposure visits’ to have basics of micro-irrigation thereby enabling their role in the implementation of the scheme.

D. Follow up Actions

- 1) Though micro-irrigation has been in use in different States since mid-eighties, State-wise potential area is not estimated as of today. Therefore, **it is essential to prepare State-wise and crop-wise potential area for MI**. A detailed estimate on State-wise potential would be useful to fix the target to be achieved and further to develop the road map for MI adoption in the country.
- 2) It is evident from field study that capital cost required to install micro irrigation system is relatively high. Because of this reason, considerable percentage of farmers have expressed that they are unable to adopt this technology for low value crops. There has been a significant development in the MI technology and efforts should be on developing and popularizing low cost technologies. This would help reducing the cost of the system and increasing the adoption of micro-irrigation at a large scale.
- 3) At least one percent of the outlay on micro-irrigation needs to be earmarked for research on micro-irrigation technology and development of package of practices as well as crop diversification potential.
- 4) The information regarding all the activities under NMMI scheme at national and state level should be under public domain. Although presently, very few farmers are using internet based information, yet this is becoming popular and it is expected that in next few years, websites and internet will become a major source of information particularly among younger population. Therefore, the website of NCPAH be made more popular and content may also be increased to include PoP and crop diversification.

1 Introduction

1.1 Project Background

Water is one of the most critical inputs for agriculture; however, the share of water availability to the agriculture sector is declining at an alarming rate due to its ever increasing demand for the energy, industry and domestic purposes. Much of the available irrigation water in India is applied through the conventional surface irrigation methods, which involve huge conveyance and distribution losses resulting in low overall irrigation efficiencies (35-40%). The poor irrigation efficiency of these systems not only reduce the anticipated outcomes from investments in the water resources, but also create environmental problems, like, lowering of water table due to over-exploitation of sub-surface water resources, water-logging and soil salinity, thereby adversely affecting the crop yields.

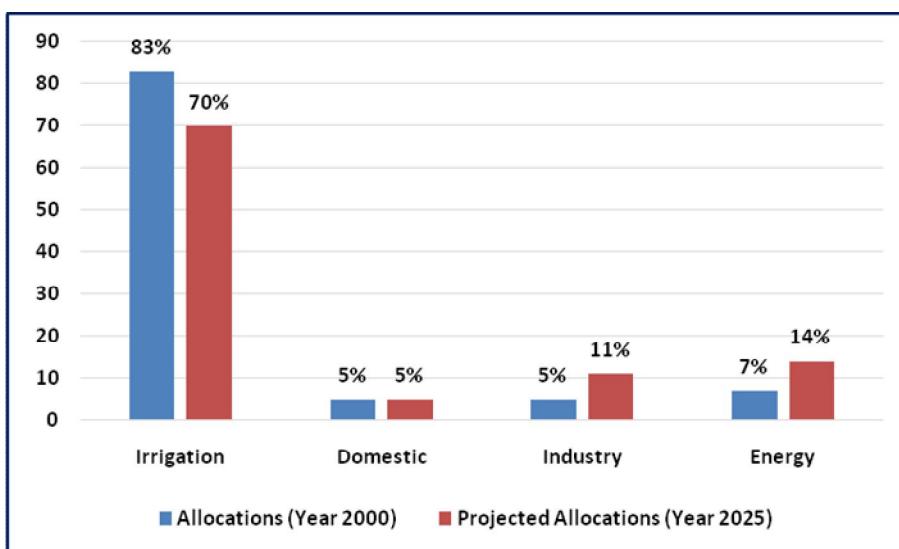


Figure 1: Percentage Annual Allocation (share in availability) of Water

Source: Central Water Commission, MoWR, GoI

On the other hand, the situation of cropping under irrigated and rain fed conditions is quite decimal. There is a decimal chance of further enhancement to the area under irrigation which calls for improving the water use efficiency of the available water resources which can be accomplished through the proven water saving technologies such as micro irrigation systems. The term micro irrigation describes irrigation systems that deliver water through small devices directly in the plant root zone at prescribed rate at regular interval of time.

In countries like Israel, the water-use efficiency in agriculture sector has been improved in physical (technical) terms of water use per tonne of output (or hectare irrigated) due to improvements in agricultural water use efficiency. As a consequence, the share of agriculture in total water use fell from over 70 percent in 1980 to 57 percent by 2005 and further, it is projected to decline to 52 percent by 2025.³ Even in Indian scenario, Micro-irrigation (MI) methods have been found to have significant water saving and crop productivity benefits. Studies have claimed water saving of 40 – 80 percent and productivity gains up to 100 percent (Raina et al 1999: 2013 Sivanappan 1994; Palanisami et al. 2011).

Keeping these advantages in view, the Government of India (GoI) constituted a Task Force in 2004 to assess the potential of MI technologies in the country. The Report of the Task Force sought to increase the emphasis on MI technology and recommended a broader framework, viewing adoption of MI technologies as a part of the overall water management strategy. It also recommended allocation of more financial resources of subsidies for MI adoption, with state governments contributing 10 percent of the cost, while the central funds would account for 40 percent and advised greater flexibility for states to determine their appropriate implementation structure and institutional mechanisms for subsidy disbursement.

The main objectives of the National Mission on Micro Irrigation are as follows:

- To increase the area under micro irrigation through improved technologies.
- To enhance the water use efficiency in the country.
- To increase the productivity of crops and farmers' income.
- To establish convergence & synergy among on-going Government programmes.
- To promote, develop and disseminate micro irrigation technology for agriculture/ horticulture development with modern scientific knowledge.
- To create employment opportunities for skilled and unskilled person especially unemployed youth.

1.2 Salient Features of the Scheme

NMMI is a Centrally Sponsored Scheme in which 40% of the cost of the MI system is borne by the Central Government, 10% by the State Government and the remaining amount is borne by the beneficiary either through his / her own resources or loan

³ OEDC-FAO Agricultural Outlook 2012-2021

from financial institutions. In respect of small and marginal farmers, the share of Central Government increases by 10% to make 50% of the cost of the system. The main features of the scheme are:

- All categories of farmers are eligible to avail assistance under this scheme.
- Assistance to farmers is limited to a maximum area of five (5) ha per beneficiary.
- Assistance for laying down demonstration on farmers field are given 75% subsidy for a maximum area of 0.5 ha per demonstrate and is met entirely by the Central Government.
- Assistance is available for both drip and sprinkler irrigation for wide spaced as well as close spaced crops. However, assistance for sprinkler irrigation system is available only for those crops where drip irrigation is uneconomical.
- Assistance is available for irrigation systems for protected cultivation including greenhouses, polyhouses and shade net houses.
- The subsidy amount is calculated taking into consideration cost of fertigation with fertilizer tank / venturi systems, sand filters / media filters, hydro-cyclone filters / sand separators and other different type of filters and valves required for MI system.
- Panchayati Raj Institutions (PRIs) are involved in promoting the scheme identification of priority areas, identification of beneficiaries and organizing interactive meetings with the representatives of micro irrigation industry.
- At the National Level, the Executive Committee of NMMI reviews the progress of NMMI and approve the Annual Action Plans of States. At the State level, the State Micro Irrigation Committee (SMIC) oversees the implementation of the Mission programme in districts. The District Micro Irrigation Committee (DMIC) coordinates the implementation of NMMI programme at the District level. NCPAH coordinate and monitor the programme of NMMI in different States.
- The scheme is implemented by an implementing Agency (IA) at the State level duly appointed by the State Government. Funds are released directly to the IA on the basis of approved plans for each year.
- The IA prepares the Annual Action Plan for the State on the basis of the district plans and get it forwarded by SMIC for approval of the Executive Committee (EC) of NMMI.
- The State Level Micro Irrigation Committee (SMIC) undertakes registration of System Manufacturers, who are authorized to supply systems to the farmers under the NMMI subsidy scheme. One of the important criteria for registration is that these manufacturers should be able to supply the systems as Bureau of

Indian Standards (BIS) marking and provide proper after sales service to the satisfaction of the farmers.

1.3 The Assignment

NMMI has now been in operation effectively for more than six years and the government feels that this is the right time to asses and quantify the impact of Scheme. The Govt. of India, Ministry of Agriculture, Department of Agriculture and Cooperation, Krishi Bhawan, New Delhi has engaged Global AgriSystem through open bid to carry out an Impact Evaluation Study of National Mission on Micro Irrigation (NMMI) Scheme.

1.4 Objectives of the Study

The “National Mission on Micro Irrigation (NMMI)” was to be evaluated in terms of water saving, increase in area, production and productivity of major crops so as to serve various objectives of National Food Security, crop diversification with the changing food consumption habits, saving of various inputs such as fertilizer, power etc. that are of paramount importance to the country. The prime purpose/ objectives of the study are as follows:

- i. Transparency in identification of beneficiaries; prioritizing for release of funds in order of the application; approval of system suppliers; timely release of financial assistance; dovetailing of various MI schemes; effectiveness of various MI technologies, methodology adopted for record keeping, auditing, and effectiveness of the state implementing agencies.
- ii. Overall performance of the programme implementation and whether the programme is being implemented as the operational guidelines of NMMI in various states.
- iii. Employment generated due to the implementation of NMMI and efforts laid for the development of human resources w.r.t. Micro Irrigation between FY 2005-06 to 2011-12.

2 Approach and Methodology

The evaluation study of the “National Mission on Micro Irrigation” (NMMI) scheme requires a wholesome approach, to find out proper impact of the scheme at the ground level. Keeping in view the scope of work, given ToR's and with the understanding of the objectives, the approach and methodologies adopted by the Consultants are summarized in the following paragraphs.

2.1 Approach

The approach adopted for the present impact evaluation study is based on use of both the secondary as well as primary data collected from 13 states conducting interviews of various stakeholders (Figure 2).



Figure 2: States Covered for Study (Star Marked)

The study comprised primarily adopting the following steps:

- Beneficiaries who availed the assistance to install MI system and non-beneficiaries from the same area/ village who did not install MI.
- Mobilisation of the study team.
- Continuous contact and consultations with the various concern agencies and the Client. Sharing of information throughout the study period with the Client and flexibility to respond to desired changes and directions.
- Collection and review of reports, documents, government policies, plans and programs.
- Development of questionnaires and checklists for primary data collection.
- Interaction and interview with policy makers, planners, bureaucrats, development workers, traders and etc.
- Field survey in the selected areas.
- Analysis of secondary and primary data using appropriate tools.
- Survey of beneficiaries & non-beneficiaries to arrive at a comparative analysis of the advantages derived by the adopters

2.2 Methodology

Based on above approach, following methodology is adopted to carry out the evaluation study.

Table 1: Methodology Adopted for Impact Assessment

Sl. No.	Description of the Method	Description of the Units Covered
1.	Survey Method	
	a. Sample Survey	Selected beneficiary and non-beneficiary households
2.	Rapid Appraisal Method	
	a. Focus group discussions	Beneficiary and non-beneficiary households
	b. Semi Structured interviews with key informants	<ul style="list-style-type: none"> • Various implementing agencies at district and block levels • Manufacturers/ service providers • Non-Governmental Organizations(NGOs), Financial Institutions • Village elders, community leaders and Knowledgeable persons

Source: GAPL

2.2.1 Sources of Data Collection

The primary data has been collected through participatory discussions and structural interviews/ semi- structured questionnaires for covering various evaluation parameters from various stakeholders:

- Farmers
- Officials of horticulture/agriculture departments
- Officials of Irrigation department
- Scientists from Krishi Vigyan Kendras and agricultural universities
- Banks & other financial institutions
- Social mobilizers, Pradhan
- Opinion leaders/progressive farmers
- Industry

Secondary data regarding physical and financial targets & achievements was obtained from Ministry of Agriculture & NCPAH. Other sources of published data such as NHB statistics, Published research in the reputed journals, GoI publications as well as Statistics from State and District level have been utilized for secondary data.

Task 1: Review of Secondary Information

A desk review of secondary data regarding overall area under irrigation, research work on potential of MI, cropping pattern and land use, progress, position regarding distribution. Similarly, physical and financial performance relating to various components of the Scheme has been collected from MoA, NCPAH and State Government agencies. The information collected has thereafter been analyzed for reaching to conclusions.

Task 2: Field Research and Primary Data

In depth field study has been carried out to find out stakeholders' perception and impact assessment of the scheme. Field study included three segments:

- i. A detailed survey of **farmers(both beneficiaries and non-beneficiaries)** through a structured questionnaire and PRA techniques
- ii. **Implementing agencies and officials** to assess the efficiency and efficacy of implementation of the scheme.
- iii. **Institutions** – an interaction with officials of the agriculture universities to understand current technologies in micro-irrigation, their adaptability to India agriculture and sustainability in the long run.

Task 3: Developing the Sampling Plan for primary survey and the Associated Fieldwork Schedules

2.2.2 Sampling

The evaluation study was conducted in the given 13 states. The detailed sampling plan followed for the evaluation study was as under:

Table 2:Sampling Plan

Sl. No.	Stage of Sampling	Sampling Unit	Criteria for Selection of Sample Units	Sample Method Adopted	Description of the Sample Units	Number of Sample Units
1.	I Stage	Agro climatic regions	As per state classification	Micro units	Best and average performing	See Table 4
2.	II Stage	District	Level of Micro Irrigation coverage as proxy for development	Stratified Purposive Sampling	<ul style="list-style-type: none"> Additional area brought under irrigation Best and average performing districts in ratio of 75:25 	4-6 districts in plain areas and 2-3 in hilly states. In all 64 districts have been selected.
2	III Stage	Blocks	Level of Development	Stratified Purposive Sampling	<ul style="list-style-type: none"> Additional area brought under irrigation in the block Best and average performing blocks in ratio of 75:25 	5-8 blocks in plains and 5-7 in hilly states covering from each sample district. A total of 398 blocks were finally selected.
3	IV Stage	Villages	Coverage of Programmes	Stratified Purposive cum cluster Sampling	Best and average geographical connectivity	
4	V Stage	Households	Beneficiaries on random basis & non beneficiaries from similar conditions	Stratified Purposive Random Sampling	Proportionate sample according to size of holding and area under micro irrigation	7400 farmers including 5892 beneficiary household from 13 states.

Source: GAPL

2.2.3 The Sample Design

Multi-stage - stratified - purposive –random sampling design has been adopted in the study. The samples have been collected from all the identified states. The consultant has applied Stratified Random Sampling Method. The sample is representative and has been covering all categories of farmers. The sampling has been taken into account the extent of implementation of NMMI Scheme in the State.

Selection of districts and blocks

Selection has been done in a manner so as a representative data emerged from that particular sampled state. The sample has covered selected districts in 13 states as per the ToR. The details of sample size both of beneficiaries and a non-beneficiary across the states has been summarized in Table 4.

Districts have been selected from each selected region of the state. Four to seven districts (two to four from hilly states), from each state have been selected. The selected districts were ranked as per their performances where one district each from the high, good, average & poor performance were included for drawing samples as summarized in the following table.

Table 3: State wise List of Sampled Districts Covered in the Study

S. No.	States	Districts						
		1 st	2 nd	3 rd	4 th	5 th	6 th	7 th
1	AP	Anantpur	Medak	Nalgonda	Adilabad	Nellore	Krishna	Vishakhapatnam
2	Bihar	West Champaran	Rohtas	Gaya	Madhepura			
3	Chhattisgarh	Durg	Sarguja	Kanker	Jashpur			
4	Gujarat	Banaskantha	Bhavnagar	Jamnagar	Bharuch	Mehsana	Anand	
5	Haryana	Bhiwani	Sirsia	Fatehabad	Karnal			
6	Karnataka	Belgaum	Hasan	Bidar	Chitradurga	Mysore	Bellary	
7	Maharashtra	Jalgaon	Ahmednagar	Jalna	Kolhapur	Wardha	Ratnagiri	
8	Odisha	Ganjam	Mayurbhanj	Boundh	Nayagarh	Bhadrak		
9	Rajasthan	Jalore	S. Madhopur	Jodhpur	Jhalawar	Hanumangarh	Udaipur	
10	Tamil Nadu	Erode	Tirunelveli	The Nilgiris	Thiruvarur	Villupuram		
11	UP	Jhansi	Balia	Saharanpur	Siddharth Nagar	Kannauj	Aligarh	
12	Sikkim	Gangtok	Mangan					
13	Uttarakhand	U S Nagar	Haridwar	Nainital				

Source: GAPI

Further, blocks were selected on the basis of coverage in area under irrigation which is taken as a proxy of development of micro irrigation infrastructure. From each sample district 5-8 blocks - best, and average performed blocks (75:25 ratio) were selected randomly among those where MI systems have been installed.

2.2.4 Selection of Beneficiaries and Non-beneficiaries

Villages have been purposively selected on the basis of coverage of the programme. The selection of the sampled beneficiary farmer/households has been made randomly for each selected village. A complete list of beneficiaries are drawn and divided into various size classes. In the each selected village the households were finalized on the

basis of their farm holding, socio-economic status and coverage of programmes. Besides this, non-beneficiaries were also selected to identify reasons for their non-participation in the programmes and also to compare the benefits drawn by beneficiaries compared to this category. This in fact facilitated the impact evaluation study, based on ‘with and without’ approach. The farmers selected for the primary survey include various categories of farmers. Besides, it also includes PRIs and district & state level concerned functionaries. It is pertinent to mention here that the sampling design has taken care that the beneficiaries selected are representative of overall population of the beneficiaries at State and District levels. The total sample comprises of beneficiaries and non-beneficiaries in the ratio of 80:20.

Table 4: State wise Sample Distribution for the Study

Sl. No.	Name of State/ UT	Sample Districts	Sample Blocks/ district	Farmers per block	Total respondents	Beneficiaries	Non beneficiaries
1	AP	7	6	20	840	672	168
2	Bihar	4	8	20	644	516	128
3	Chhattisgarh	4	6	20	480	384	96
4	Gujarat	6	6	20	720	576	144
5	Haryana	4	5	20	401	320	81
6	Karnataka	6	6	20	720	576	144
7	Maharashtra	6	7	20	881	672	169
8	Odisha	5	6	20	600	480	120
9	Rajasthan	6	6	20	712	574	138
10	Tamil Nadu	5	6	20	575	455	120
11	UP	6	7	20	695	527	168
12	Sikkim	2	5	6	60	50	10
13	Uttarakhand	3	6	6	112	90	22
Total		64			7400	5892	1508

Task 4: Validation of Sampling Plan and Questionnaires

Field research has been carried out on the predefined and approved questionnaires in active consultations with DAC. The final sampling plan and questionnaires and field survey plans have been validated by DAC

Task 5: Pilot Testing & Survey Preparation

In order to validate that the questionnaire were able to gather information as per design and to train the supervisors of the survey team a pilot survey was undertaken in Uttarakhand and Maharashtra. The main purpose of pilot testing the survey was to check the validity of the questionnaire by finding questions or words that might be misinterpreted, misread or misunderstood as well as to check the functionality of the

questionnaire in the field. Training of the interviewers and supervisors which is one of the most important stages prior to conduct of field work was done to familiarize the interviewers with the survey instruments.

Task 6: Constituting Field Work Teams and Briefing Meeting with Field Supervisors and Field Investigators

On acceptance of the final questionnaires and the sample plan, the field teams were gathered in Delhi and a briefing meeting and training session had been held for the field research teams.

Task 7: Primary Data Collection Exercise

During the fieldwork face to face interviews were held with various types of respondents including State Agriculture/ Horticulture departments and other stake holder as mentioned above were interviewed with structured information schedules and information was collected accordingly.

Task 8: Stakeholder Discussion:

Participatory discussion was arranged with various stakeholders at various levels as follows:

I Stage: At inception stage to discuss and finalize work plan, questionnaire and methodology

II Stage: After completion of field survey to discuss preliminary finding

III Stage: After submission of DPR to discuss the recommendation and finalize the report.

Task 9: Data Entry, Analysis of Secondary and Primary Data and Report Writing

Both primary and secondary data is being collected, compiled and tabulated and analyzed to arrive at appropriate conclusions.

2.3 Limitations of the Study

The study was conducted for 13 states and the consultant completed this study under certain limitations which were as follows:

- a. Like any study based on sampling method, the findings of the response of respondents have been extrapolated to the entire scheme for the purpose of

studying the achievements & objectives of the scheme, impact of the scheme and methodology of the implementation of the scheme etc.

- b. It took almost more than one month to get the comments on the Inception Report as well as questionnaires which led to delays in the mobilization of the field work.
- c. The consultant and the survey team got stuck during the study period due to the complications & coordination between state & central government authorities.
- d. Due to natural disaster taking place in Uttarakhand, the districts to be covered were changed as it was difficult to reach the selected districts.
- e. The field work coincides with rainy season and this year there were heavy rains in few states which also hampered the field study. Moreover, the information regarding beneficiaries of the selected states was not provided in time, therefore the survey team had to visit those areas more than one time. For example, in case of Haryana, the survey team visited state authorities with list of districts identified for survey by consultant in consideration with MoA and NCPAH, but the state authorities did not agree and wanted some time to suggest changes and therefore, survey team had to wait which led to delay.
- f. In the states like UP and Tamil Nadu, the state government officials did not cooperate to provide information of beneficiaries in the beginning and consultants had to mobilize GoI authorities to send communication for co-operation which caused delay in starting field work.
- g. In the state of UP, the designed sample size has not been achieved for covering 168 farmers (beneficiaries) as number of beneficiary farmers in selected districts was less, therefore, the sample size has been constraint accordingly.

In spite of these limitations, efforts were made by the consultant to complete the study in time.

3 Assessment of Current Status

3.1 Performance of MI Scheme

Micro Irrigation industry in India is driven by the assistance from the central and the state governments. The NMMI has given major impetus to the growth of the industry. In fact, the growth of the MI industry can be viewed as per growth of fund allocation to MI scheme. The trend of area coverage and total subsidy advanced in the states under study has been shown in the figure 3.

Annual subsidy advanced has shown increasing trends continuously except for the year 2008-09 whereas the growth of area coverage has witnessed some fluctuations in the year 2007-08 and 2012-13. Despite this fluctuation, the growth in the area coverage is not proportional to the growth in fund spent. The both trend lines witness convergence in growth up to 2009-10 but there after witnessed the divergence in growth.

The fund spent has witnessed sudden jump after the conversion of the NMMI scheme from CSS in the year 2010-11. The fund spent has increase by about 62 percent from 2009-10 to 2010-11 and the increase in area coverage is 15.38 percent in corresponding period. This fact was further analyzed and the main reason for high subsidy amount is the reason of revision in the cost norm per hectare and more area coverage under drip system.

The cumulative area coverage since the launch of scheme to 2012-13 in the states under study is about 3.56 Million ha and the total subsidy advanced till 2012-13 stood at Rs. 5,006 crores in the same states.

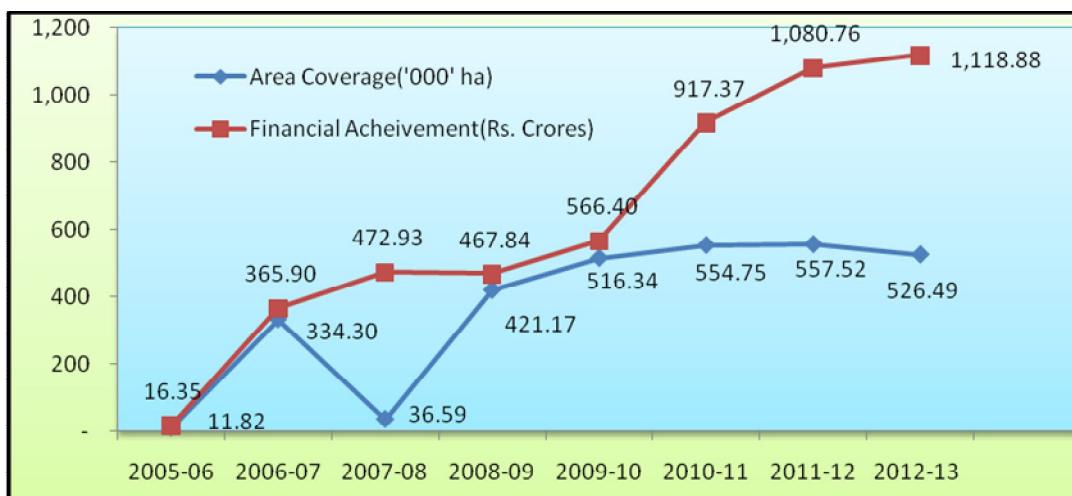


Figure 3: Physical and Financial Performance of NMMI Scheme
Source: Ministry of Agriculture

Table 5: Year wise Area under Different MI Systems of Sampled Beneficiaries

Year	Area under Drip Irrigation (ha)	Area Under Sprinkler Irrigation (ha)
2000	2.23	1.62
2001	4.45	0.00
2005	1.01	0.00
2006	152.79	5.46
2007	176.56	82.82
2008	602.09	219.29
2009	644.67	229.61
2010	765.67	468.18
2011	1287.97	783.28
2012	4214.96	2025.78
2013	307.84	313.55

Source: GAPL survey

The above table depicts that the year wise area under drip is expanding more in comparison to the area under sprinklers that leads to higher system cost. This may be the reason for splitting lines of physical and financial achievements after 2009 in the figure 2. It may also be inferred from the table 5 that subsidy has been increased in most of the states that caused increase in financial achievement than physical achievement which led to splitting trend line of physical and financial achievements.

Table 6: Comparison of Subsidy between Pre and Post NMMI Scheme

S.No	State	Total Subsidy of the farmers (%)		
		Pre NMMI Scheme	Post NMMI Scheme	
			Small & Marginal Farmers	General Farmers
1	AP	70	90	75
2	Bihar	90	90	80
3	Chhattisgarh	70	75	50
4	Gujarat	50	50	50
5	Haryana	90	90	90
6	Karnataka	75	80	50
7	Maharashtra	50	60	50
8	Odisha	70	90	80
9	Rajasthan	70	70	70
10	Sikkim		60	60
11	Tamil Nadu	65	100	75
12	UP	50	90	75
13	Uttarakhand	50	60	60

3.2 State wise Performance

AP and Gujarat were the pioneer states which harnessed the benefits of the scheme with area coverage of about 678 thousands and 504 thousands ha. In 2006-07, more states were brought under the scheme and by the end of 2007-08; all the states under study except Sikkim and Uttarakhand were covered during 2011-12.

The states of AP followed by Maharashtra are top in the list of area coverage as well as total subsidy advanced under MI. The total cumulative central subsidy advanced and total area covered since the launch of the scheme is shown in the graph.

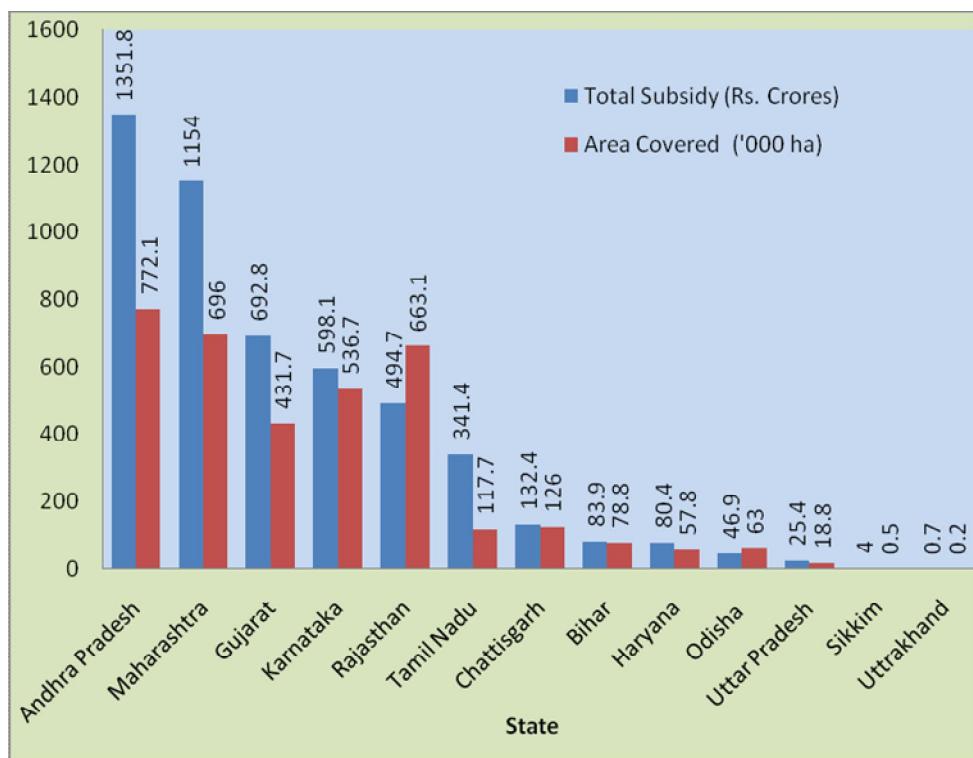


Figure 4: State wise Central Subsidy (Rs. Crores) and Area Coverage ('000' ha) under NMMI

Source: Ministry of Agriculture

3.3 Targets and Achievements

The states under study have achieved 99.87% financial targets but the achievement of physical targets stood at 92.99%. The states of Gujarat and Maharashtra have achieved 100% financial targets but have not met the physical targets. In Gujarat, the financial utilization is 100.26% due to inclusion of interest amount. The state of Bihar, Karnataka, Odisha, Rajasthan and Sikkim which have achieved more than 100% physical targets without utilizing the total allotted fund.

It is pertinent to mention that achievements are exceeding the value of 100 percent. Since the preceding year unspent balance has been brought forward to next year. The scheme was launched in 2011-12 in Sikkim and Uttarakhand and the Sikkim has performed much better in physical target achievement as compared to Uttarakhand. In fact, Sikkim is the top performer in physical target achievements whereas the Uttarakhand is least one among the states under study as the scheme is launched few years back only. The state wise cumulative (2005-06 to 2012-13) physical and financial targets vs. achievement are given in the table below.

Table 7: State wise Cumulative Physical & Financial Targets and Achievements

State	Physical ('000'ha)			Financial (Rs. in lakh)		
	Target	Achievement	% Achievement	Target	Achievement	% Achievement
AP	871.16	772.05	88.62	137148.00	135175.58	98.56
Bihar	66.76	78.80	118.04	8132.10	7260.62	89.28
Chhattisgarh	135.15	126.02	93.24	13713.70	13239.69	96.54
Gujarat	461.02	431.72	93.64	72471.00	72659.00	100.26
Haryana	66.38	57.83	87.12	8820.86	8042.93	91.18
Karnataka	510.96	536.68	105.03	60889.32	59812.26	98.23
Maharashtra	941.79	696.05	73.91	115428.00	115428.00	100.00
Odisha	54.06	63.02	116.58	5062.00	4687.63	92.60
Rajasthan	576.40	663.07	115.04	50392.96	49468.94	98.17
Tamil Nadu	118.97	117.67	98.90	29616.60	29374.90	99.18
UP	27.12	18.83	69.41	2799.04	2540.98	90.78
Uttarakhand	1.01	0.22	21.39	225.00	70.00	31.11
Sikkim	0.39	0.51	130.02	600.00	400.00	66.67
Total	3,831.17	3,562.46	92.99	501280.09	500644.90	99.87

Source: Ministry of Agriculture

The major inferences drawn from table below are as follows:

- The scheme made rapid stride after the launch and achieved more than 80% of the targets both physical and financial in 2006-07 and the physical and financial targets have been achieved more than 100% in the subsequent year i.e. 2007-08 to 2009-10.
- The financial target achievement has been more than 100% on 2007-08 onwards except for the year 2011-12 whereas the physical target achievement has been declined after 2009-10.
- The Scheme has performed best in terms of both physical and financial targets achievement with around 130% achievement.

The year wise cumulative (2005-06 to 2012-13) physical and financial targets v/s achievement is given in table below.

Table 8: Year wise Cumulative Physical and Financial Targets and Achievements

S.No.	Year	Physical			Financial		
		Target (Ha)	Achievement (Ha)	% Achievement	Target (Rs.)	Achievement (Rs.)	% Achievement
1	2005-06	180223.00	11817.00	6.56	23284.15	1635.17	7.02
2	2006-07	397365.00	334300.60	84.13	44575.99	36590.33	82.09
3	2007-08	324048.70	421173.90	129.97	39896.32	47293.48	118.54
4	2008-09	423095.00	516338.00	122.04	41724.62	46784.26	112.13
5	2009-10	425764.00	554752.77	130.30	43531.57	56640.40	130.11
6	2010-11	667700.00	640069.00	95.86	90084.11	91736.80	101.83
7	2011-12	698197.00	557521.43	79.85	108290.00	108076.15	99.80
8	2012-13	714788.00	526485.00	73.66	109893.00	111888.00	101.82
Total		3831180.70	3562457.70	92.99	501279.76	500644.59	99.87

Source: Ministry of Agriculture

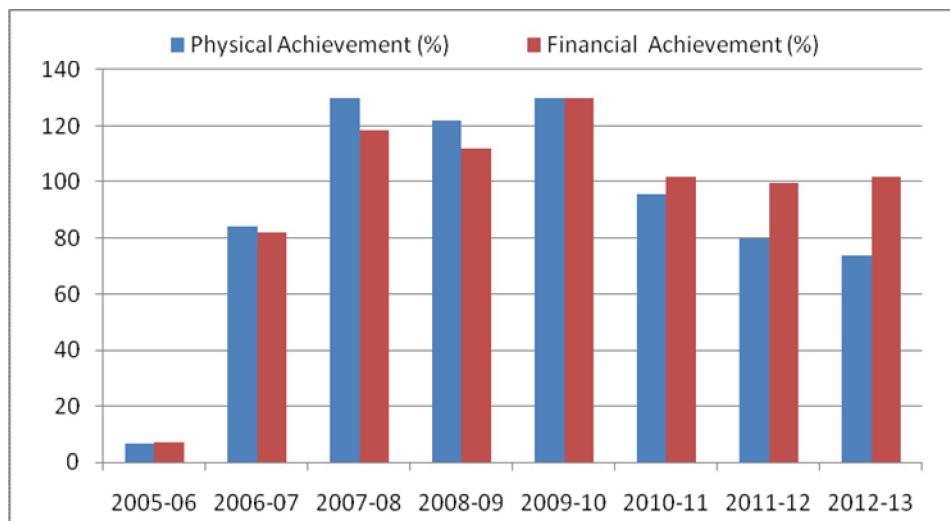


Figure 5: Year wise Targets and Achievements

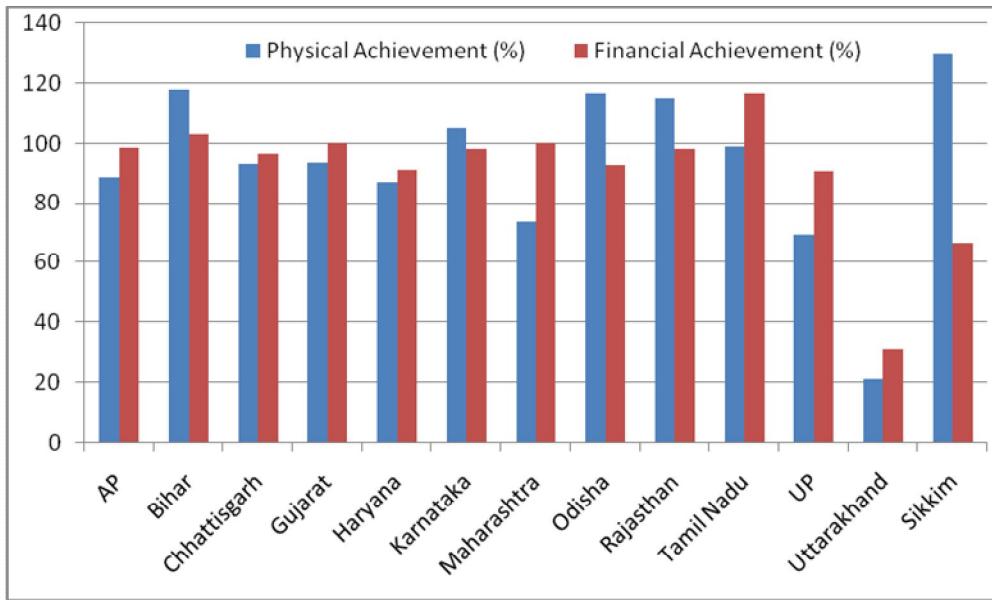


Figure 6: State wise Cumulative Targets and Achievements (2005-06 to 2012-13)

The performance of the scheme in different states and in different tenure can be sum up as under:

- The scheme created a good imprint in 2006-07 and achieved 82.13% and 82.09% of physical and financial targets respectively in the states under study. In this year state of Gujarat, Karnataka, Maharashtra and Rajasthan achieved more than 100% of physical targets.
- The performance of scheme contributed to be extremely well in the year 2007-08 to 2009-10 and registered more than 100% achievement of both physical as well as financial target.

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Table 9: Year & State wise Physical Targets and Achievements ('000' ha)

State	2005-06		2006-07		2007-08		2008-09		2009-10		2010-11		2011-12		2012-13 (March' 13)	
	T	A	T	A	T	A	T	A	T	A	T	A	T	A	T	A
AP	45.52	6.78	193.46	84.62	46.39	114.85	85.21	123.58	114.45	138.34	165.50	122.76	88.95	105.06	131.69	76.07
Bihar	-	-	14.22	-	-	0.23	-	0.31	-	0.11	-	13.49	1.96	23.29	50.57	41.37
Chhattisgarh	-	-	28.75	4.60	10.06	20.83	13.63	30.57	17.64	15.77	28.78	21.83	17.17	18.39	19.12	14.02
Gujarat	16.72	5.04	18.25	24.34	45.16	43.04	33.56	53.43	33.33	66.25	80.34	78.29	130.29	65.10	103.38	96.23
Haryana	-	-	5.37	2.82	7.22	7.78	32.40	22.30	1.58	3.26	4.43	9.34	6.12	5.79	9.28	6.54
Karnataka	25.23	-	23.74	38.85	53.52	62.94	84.17	92.62	81.31	108.21	72.70	87.45	63.17	58.01	107.13	88.61
Maharashtra	41.86	-	65.12	108.26	103.67	82.22	128.76	100.41	84.67	94.51	118.03	118.03	271.94	116.00	127.75	76.62
Odisha	-	-	3.31	1.22	1.03	3.07	3.75	2.50	7.58	12.78	9.34	12.01	11.52	11.84	17.52	19.61
Rajasthan	13.03	-	39.75	67.72	44.71	73.74	40.23	77.73	85.21	95.56	148.00	147.61	107.07	122.18	98.40	78.54
Tamil Nadu	28.95	-	5.40	-	12.30	7.82	-	11.60	-	18.01	35.00	26.15	-	27.55	37.32	26.54
Uttar Pradesh	8.91	-	-	1.86	-	4.66	1.38	1.29	-	1.97	5.59	3.11	-	3.79	11.25	2.14
Uttarakhand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.01	0.22
Sikkim	-	-	-	-	-	-	-	-	-	-	-	-	-	0.51	0.39	-
Sub Total	180.22	11.82	397.37	334.30	324.05	421.17	423.10	516.34	425.76	554.75	667.70	640.07	698.20	557.52	714.79	526.49

Source: Ministry of Agriculture

Impact Evaluation Study on “National Mission on Micro Irrigation (NMMI)”

Table 10: Year and State wise Financial Targets and Achievements (Rs. Crores)

State	2005-06		2006-07		2007-08		2008-09		2009-10		2010-11		2011-12		2012-13 (March' 13)	
	T	A	T	A	T	A	T	A	T	A	T	A	T	A	T	A
AP	61.29	9.34	195.20	112.77	57.48	145.59	97.27	108.36	143.11	178.29	240.00	240.00	287.20	287.20	289.93	270.21
Bihar	-	-	24.82	-	-	0.26	-	0.22	-	0.11	-	8.26	4.50	21.67	52.00	53.40
Chhattisgarh	-	-	30.33	2.56	7.83	17.51	9.54	20.60	12.52	11.93	10.19	18.01	35.00	35.00	31.72	26.78
Gujarat	21.82	7.01	33.56	39.31	73.50	49.27	48.99	73.96	44.47	54.26	120.00	120.00	166.64	166.95	182.00	182.01
Haryana	-	-	4.44	2.32	6.04	5.08	12.07	12.78	2.12	3.85	13.61	14.02	19.93	16.67	30.00	25.71
Karnataka	35.84	-	24.57	44.52	68.65	75.98	73.19	58.45	63.81	86.85	92.54	89.45	109.65	91.65	140.65	151.22
Maharashtra	48.08	-	87.97	134.66	138.97	127.92	147.48	134.44	107.07	132.26	222.37	222.65	249.80	249.80	150.18	152.21
Odisha	-	-	4.54	1.43	1.08	1.01	3.38	2.93	5.28	8.71	8.10	6.97	8.23	8.93	20.00	16.90
Rajasthan	10.48	-	28.33	26.87	23.41	29.08	23.82	30.09	56.93	60.73	120.00	116.20	130.95	128.24	110.00	103.47
Tamil Nadu	42.91	-	12.01	-	22.00	15.60	-	23.67	-	25.58	65.91	77.97	66.25	66.25	83.00	132.35
UP	12.42	-	-	1.46	-	5.62	1.50	2.35	-	3.81	8.12	3.83	-	4.41	5.95	3.93
Uttarakhand	-	-	-	-	-	-	-	-	-	-	-	-	0.75	-	1.50	0.70
Sikkim	-	-	-	-	-	-	-	-	-	-	-	-	4.00	4.00	2.00	-
Sub Total	232.84	16.35	445.76	365.90	398.96	472.93	417.25	467.84	435.32	566.40	900.84	917.37	1,082.90	1,080.76	1,098.93	1,118.88

T: Target, A: Achievement

Source: Ministry of Agriculture

3.4 Performance of Scheme for Area Coverage as Compared to Potential

Potential of different MI Systems in terms of drip and sprinkler has been assessed by various researchers by using the secondary data. For assessing the potential of MI in different states the variables considered were state-wise and source-wise irrigation area, cropped area and crops wise suitability for different MI systems. Potential area is calculated on the basis of area already brought under MI system from the existing irrigated area. While calculating potential area in sampled states, we have also considered area under paddy, which may diversify into horticultural and other cash crops in future. For the purpose of arriving at some conclusion regarding performance of MI under the states, data on potential area and actual area brought under drip and sprinkler irrigation in the states (NCPAH) has been analyzed.

Table 11: Potential and Cumulative area under Drip & Sprinkler Irrigation

States/UTs	Total (Area in "000 ha)				Drip (Area in "000 ha)				Sprinkler (Area in "000 ha)			
	Potential /Irrigated area	Cumulative area under MI till 2012-13 **	Balance Potential area for MI *	Potential area (%)	Potential area*	Cumulative area under drip till 2012-13**	Balance Potential Area*	Potential area (%)	Potential area for Sprinkler *	Cumulative area under sprinkler till 2012-13 **	Balance Potential Area*	Potential area (%)
AP	6785	771.00	6014.00	88.64	5068.40	576.05	4492.35	66.21	1716.61	194.95	1521.66	22.43
Bihar	5158	78.67	5079.33	98.47	118.63	1.81	116.82	2.26	5039.37	76.86	4962.51	96.21
Chhattisgarh	1648	156.55	1491.45	90.50	125.25	11.72	113.53	6.89	1522.75	144.83	1377.92	83.61
Gujarat	4137	436.69	3700.31	89.44	2300.17	242.60	2057.57	49.74	1836.83	194.09	1642.74	39.71
Haryana	5680	57.53	5622.47	98.99	1493.84	15.39	1478.45	26.03	4186.16	42.14	4144.02	72.96
Karnataka	4137	414.85	3722.15	89.97	1563.79	156.97	1406.82	34.01	2573.21	257.88	2315.33	55.97
Maharashtra	3806	647.97	3158.03	82.98	2298.82	456.09	1842.73	48.42	1507.18	191.88	1315.30	34.56
Odisha	1437	51.99	1385.01	96.38	287.40	10.42	276.98	19.27	1149.60	41.57	1108.03	77.11
Rajasthan	8903	644.23	8258.77	92.76	890.30	64.21	826.09	9.28	8012.70	580.02	7432.68	83.49
Tamil Nadu	3519	117.60	3401.40	96.66	3431.03	115.30	3315.73	94.22	87.97	2.30	85.67	2.43
UP	19354	18.69	19335.31	99.90	10354.39	10.04	10344.35	53.45	8999.61	8.65	8990.96	46.46

Source: * Directorate of Economics & Statistics, MoA, Gol,

** NCPAH (excluding Uttarakhand & Sikkim)

Note :- Analysis by GAPL

It has been assessed that there is potential of bringing area under MI system is around 61.17 million ha in the states under study (excluding Sikkim & Uttarakhand). Out of this, about 34.90 million ha is having potential for sprinkler irrigation for crops like cereals, pulses and oilseeds in addition to fodder crops. The potential area for drip has been estimated in the study to be around 26.27 million ha suitable for cotton, sugarcane, fruits and vegetables, spices and condiments and some pulses crops like red gram etc.

The percentage of actual area against the potential estimated under drip irrigation in different states varied between 66.21% in Andhra Pradesh, followed by Uttar Pradesh (53.45%), Gujarat (49.74%) and Maharashtra with 48.42%. In case of sprinkler irrigation, the percentage of actual area against the potential estimated was 2.43 % (Tamil Nadu) and

the highest of 96.21% (Bihar). Compared to the potential of 61.17 million ha in the all eleven states, the present area under MI accounts for 3.39 million ha (1.66 million ha under drip and 1.73 million ha under sprinkler) which is about 5.55 % (Table 11). The present figures thus reflect the extent of MI systems covered under different government programme as well as own investment by the farmers. However, the actual area under MI may vary according to the extent of use by the farmers.

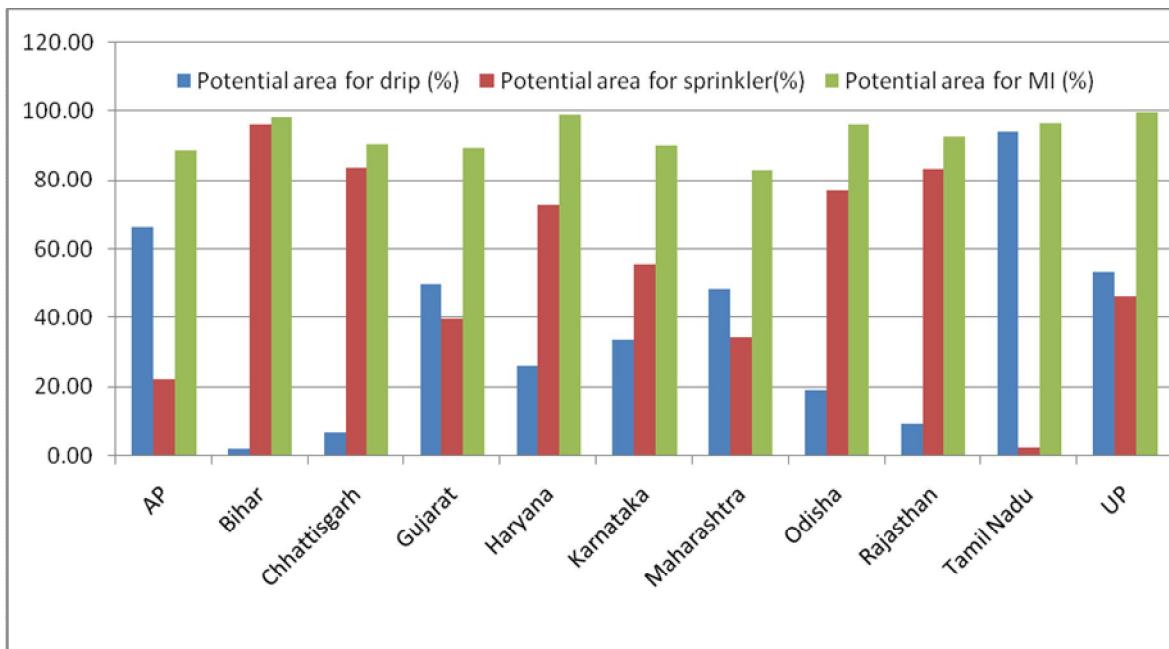


Figure 7: Proportion of Area under Drip and Sprinkler Irrigation

Source: GAP Analysis

3.5 Pattern of Assistance

3.5.1 Indicative Cost of Installing Micro Irrigation System

As per the guidelines of NMMI, the States have been categorized in the following categories:

- **Category A:** States where more than 20,000 hectares have been brought under drip irrigation come under ‘A’ Category. This would include the States of AP, Gujarat, Karnataka, Maharashtra, Madhya Pradesh, Punjab, Rajasthan and Tamil Nadu.
- **Category B:** All the states except those covered under the category ‘A’ and those falling in the Himalayan belt would come under this category.
- **Category C:** All the North Eastern States, Sikkim, Himachal Pradesh, Jammu & Kashmir, Uttarakhand and Darjeeling district of West Bengal.

Keeping in view the level of awareness, proximity to the manufacturing units, distance involved in transportation, potential for drip irrigation, the cost of drip system in Category ‘B’ States is estimated to be 15% higher than Category ‘A’ States while for Category ‘C’ States it is estimated to be 25% higher than Category ‘A’ States.

Cooperative Societies/Self Help Groups/Incorporated Companies are also entitled to avail assistance on behalf of its members. In such cases, the individual beneficiary receives assistance through the Cooperative Society /SHG/Incorporate company and not directly.

3.5.2 State-wise Pattern of Assistance

It was observed that the states are giving subsidy on MI ranging from 50 percent to 100 percent depending on the size of the holding and category of the farmers in different states. However, the central share is same across the states. It may be seen from the Table 12that in Tamil Nadu, the quantum of subsidy is 100 percent for small & marginal farmers whereas in AP for SC/ST farmers the quantum is cent percent.

Table 12 : State wise Quantum of Subsidy to Different Categories of Farmers

S.No	State	Percentage of subsidy to small & marginal farmers	Percentage of subsidy to other farmers	Remarks
1	AP	90	75	APMIP arranges the following Micro Irrigation systems to farmers with government subsidy (SC/ST: 100% subsidy) (others: 90% / 75% / 60%) for Drip (Inline & Online), Semi-Permanent Sprinklers and Rain Guns.
2	Bihar	90	80	About 98% area is under sprinkler irrigation
3	Chhattisgarh	75	50	About 93% area is under sprinkler irrigation
4	Gujarat	50	50	Uniform pattern of subsidy, Gujarat Green Revolution Company Limited (GGRC)
5	Haryana	90	90	Additional subsidy is provided for hydro-cyclone filters
6	Karnataka	80	50	For the first 2 ha out of 5 ha per beneficiary ceiling on the area to be undertaken under the scheme.
7	Maharashtra	60	50	25 per cent of the beneficiaries are small and marginal farmers.
8	Odisha	90	80	Subsidy rate under NMMI w.e.f. 2013-14
9	Rajasthan	70	70	90% for drip, 70% for sprinkler(mini) ,60% & 50% for portable sprinkler for SC/ST and General Category respectively
10	Sikkim	60	60	NMMI scheme was launched in 2011-12
11	Tamil Nadu	100	75	“Tamil Nadu Horticulture Development Agency” (TANHODA). Subsidy effective from 25.11. 2011
12	UP	90	75	Subsidy rate under NMMI w.e.f. 2012-13
13	Uttarakhand	60	60	NMMI scheme was launched in 2011-12

Note: The Central Government share in total subsidy is 50% for small , marginal , OBC, SC/ST & women categories and 40% for general categories

Sources: State Level Nodal Agencies

3.5.3 Quantum of Subsidy and Adoption of MI System by Farmers

Increase in area under MI has not been found to be significantly higher in case of the states giving higher subsidy quantum and vice versa. The Data on area coverage under MI System & extent of subsidy provided clearly demonstrates that increasing the extent of subsidy had no significant impact on area coverage under MI system. The case in point pertains to increase in area under MI in Maharashtra and Gujarat where the subsidy for small & marginal is 60 percent and 50 percent respectively whereas the area increase was 22.3 and 14.0 percent respectively. Similarly, area coverage in Haryana, Tamil Nadu and Bihar was noted to be 7.3, 4.5 and 3.1 percent respectively the corresponding figures for subsidy were 90, 75 and 90 percent. The increase in area under MI was only 1.3 and 7.3 percent, respectively, for UP & Rajasthan where subsidy level was 90 and 70 percent as per the data available from implementing agencies. The aforesaid observation clearly suggests that increasing the subsidy component had no impact on area coverage under MI system. The relationship between area expansion under MI and quantum of subsidy has been computed considering beneficiaries' data on area expansion in different states before and after adoption of MI system.

A critical perusal of data on area coverage collected by our team and also the one quoted by India Statistics portal vis-a-vis the magnitude of subsidies suggests that the states should be advised to seriously consider that the quantum of subsidy to be restricted between 50-70 percent including state and central share and depicted in the table 13.

Table 13: State wise Quantum of Subsidy and Area Coverage

State	Total Cultivated Area (000 ha)	Net Irrigated area (000 ha)*	Area under NMMI (000 ha) **	Percent Irrigated Area under MI	Area under MI Percent Increase (Beneficiaries)***	Quantum of Subsidy (%) for General Category	Quantum of Subsidy (%) for Small & Marginal farmers
AP	13415.00	5034.00	770.90	15.31	12.40	75.00	90.00
Bihar	6179.00	3030.00	78.70	2.60	3.10	80.00	90.00
Chhattisgarh	4949.00	1356.00	156.50	11.54	15.00	50.00	75.00
Gujarat	10681.00	4233.00	436.60	10.31	14.00	50.00	50.00
Haryana	3640.00	2887.00	57.50	1.99	10.00	90.00	90.00
Karnataka	11722.00	3490.00	414.90	11.89	2.60	50.00	80.00
Maharashtra	18772.00	3256.00	647.90	19.90	22.30	50.00	60.00
Odisha	5559.00	1284.00	51.90	4.04	11.00	80.00	90.00
Rajasthan	19584.00	6661.00	644.20	9.67	7.30	70.00	70.00
Sikkim	82.00	14.00	NA	NA	0.70	60.00	60.00
Tamil Nadu	5969.00	2912.00	117.60	4.04	4.50	75.00	100.00
UP	17808.00	13386.00	18.60	0.14	1.30	75.00	90.00
Uttarakhand	766.00	336.00	NA	NA	1.60	60.00	60.00

Source: GAPL Analysis

*As per records of Directorate of Economics and Statistics; ** As per records of NCPAH

*** As per our survey in the sampled states;

3.5.4 State Implementing Agencies

The NMMI scheme is being implemented by specially designated agencies by the respective state governments and is provided one percent of the annual outlay/ actual release of funds for administering and monitoring the scheme at district level. It has been observed that Directorate of Horticulture is the implementing agency for NMMI in nine states. The scheme is implemented by Directorate of Agriculture in Maharashtra and Chhattisgarh; Rajya Beej & Krishi Vikas Ltd (CHRBKV) in Chhattisgarh. In case of AP and Gujarat, the scheme is being implemented by AP Micro Irrigation Project (APMIP) and Gujarat Green Revolution Company (GGRC) respectively.

Table 14: State-Implementing Agencies for NMMI

State	Implementing Agency	Focus	Nature of Association
AP	APMIP	Micro Irrigation	SPV- relatively autonomous unit within Horticulture Department
Bihar	DoH	Agriculture & Horticulture	Government Department
Chhattisgarh	CHRBKB	Agriculture & Horticulture	Government Department
Gujarat	GGRC	Micro Irrigation	Registered Under Company's Act Public Ltd.
Haryana	DoH	Agriculture & Horticulture	Government Department
Karnataka	DoA &DoH	Agriculture & Horticulture	Government Departments
Maharashtra	DoA	Agriculture & Horticulture	Government Department
Odisha	Horticulture Development Society (OHDC)	Nodal Agency for NHM	Registered under Society Registration Act
Rajasthan	Rajasthan Horticulture Development Society (RHDS)	Agriculture & Horticulture	Horticulture Development Society (RHDC)
Tamil Nadu	DoH	Agriculture & Horticulture	Government Department
UP	DoH	Agriculture & Horticulture	Government Department
Sikkim	DoH	Agriculture & Horticulture	Government Department
Uttarakhand	DoH	Agriculture & Horticulture	Government Department

Source: State Departments

Micro irrigation has been an integral component in some of the schemes of Horticulture Division such as schemes for area expansion. The quantum of subsidy varies in these schemes as compared to NMMI scheme. This goes against the principle of convergence of schemes. It is recommended that assistance for micro irrigation component on pattern of NMMI may be made available under ongoing area expansion schemes.

It has been observed that the scheme implemented by the state departments such as horticulture, agriculture and others are not fully yielding the desired results because of the following:

- 1) The state departments are also occupied with their own targets and other related activities and are not able to devote desirable time for the implementation of NMMI activities.
- 2) This also creates bias toward their own field such as horticulture department may not give due consideration to field crops etc.
- 3) The extension workers of state departments are involved in providing extension services, training, and field demonstrations etc. of their parent department which affects their working.

It is being proposed that separate institute may be created in the line of AP and Gujarat model so that effectiveness, transparency, monitoring and targets are fully achieved. The subsidy process flow charts for AP & Gujarat are given in Annexure I. The consultant has no bias against state departments or government institutions but for meeting the objectives of NMMI such recommendations have been proposed.

3.5.5 Extent of Convergence with Other Schemes

One of the objectives NMMI scheme is to establish convergence and synergy among different on-going programmes in the country. During the course of the study, it was observed that in case of NMMI scheme, there has been convergence among various on-going programmes such as National Food Security Mission (NFSM), NHM, RADP, RKVY, Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize (ISOPOM), Technology Mission on Cotton (TMC) and number of state level schemes being implemented by respective states.

Rainfed Area Development Programme (RADP) - A Sub-Scheme under Rashtriya Krishi Vikas Yojana (RKVY). The basic premise of the proposed programme is to encourage exploitation of the potential of different farming systems based upon the natural resource assets/endowments (ponds, land development, nursery etc.) created either by the farmers or through schemes like MGNREGA, RKVY, NHM and Watershed Projects. This may act as a catalyst to accomplish the ultimate objective of enhancing productivity, minimizing the risk of crop losses due to uncertainties of weather conditions, harnessing efficiency of resources, assuring food and livelihood / income security at farm level and strengthen the farmers' capacity to adapt to climatic changes. Therefore, converging the upgraded utilities developed through watershed development programmes/ MGNREGA in terms of water harvesting and micro water storages through effective application and distribution systems like improved conveyance, field channels, pressurized irrigation, water lifting devices etc.

to enhance the potential of farming systems. The subsidy under this scheme is also extended for installation of pressurized / micro irrigation as per norms of NMMI only if not possible through convergence. All the States have reported convergence of Mission interventions with different schemes of the Government of India and State level programmes. Most of the districts have converged NFSM interventions with programmes such as RKVY, ICDP, Farm Mechanization, NHM, Micro-Irrigation, and other State programmes.

3.5.6 Food Security and the Micro Irrigation Scheme

To achieve required food production with increasing population, India has to enhance the current irrigation potential of 91 M ha to 160 M ha. but, the total water resources estimated are 230 M hm⁴ to cater the need to the non-agricultural uses also. The country is likely to be water stressed in the coming years. Therefore hand in hand with technologies for water harvesting and storage, technologies for precision water application methods need to be adopted.

The food security primarily has the three objectives of ensuring production of adequate food supplies, maximizing stability in the flow of supplies and securing access to available supplies on the part of those who need them. Access to food has two defined components to it. One, interventions aimed at boosting agricultural productivity and the second adopting strategies to promote employment, social protection measures cash transfers to the poor to improve their access to the available food. India has already in place social protection as a component of food security.

As mentioned earlier, several projects for utilization of surface water as well as ground water resources have been undertaken. However, in some cases, the unplanned development has led to over exploitation of the resource affecting the physical sustainability. The adverse impact of such unplanned development is evident from the alarming decline in water table in some areas. The developmental activities for utilization of water resources as also the development in other sectors particularly industrial sector coupled with urbanization have resulted in water pollution – both surface water as well as ground water. Further, the utilization of the created facilities is far from optimal as the water sector in India suffers from: (a) relatively low water use efficiency; and (b) increasing gap between the created irrigation potential and the utilized irrigation potential.

In this regard, it may also be important to note that the future development of water resources are bound to be more challenging as the easy options particularly from the

⁴Micro Irrigation Management in Cotton, CICR Technical Bulletin No: 31

topographical and geological considerations have since been tapped. Further, the future water resources development projects would need rigorous environmental and social evaluations.

In view of above mentioned challenges and particularly to address the two serious issues namely “food security” and “impact of climate change”, initiatives have been taken by the Ministry of Water Resources to identify the most appropriate approach for water resources management and also to assign priorities.

Despite variations in availability of water, both within and over the years, the long term average available water resources of the country may be considered to remain unchanged. Therefore the increasing demand for water for various purposes are bound to result in competition among the “uses” as well as among the “user groups” and with time such competitions are becoming fiercer and fiercer. The conflicts among the “users groups” are visible in the form of increasing inter-State issues. The prioritization of water uses for different purposes at different point of in the planning process as also during the operation is becoming more and more challenging in view of conflicting social and economic considerations. Such changing scenario calls for identification of most appropriate strategies for effectively addressing the future challenges.

At the current cereal intake of 143 kgs / per capital/annum, cereal requirement for household consumption will be around 192 million tons in 2020. The requirement will be more if the increase in household demand due to income growth is also considered. At 5 per cent per annum growth in total expenditure and population of 1.343 billion, household cereal demand works out to 221 million tons in 2020 and for food grains 241 million tons. With a grossing factor of 1.14, the total (household plus non-household) demand for cereals may be around 253 million tons. The above cereal demand projections are made with the assumption of stability of tastes and preferences in food consumption. If the trend of food grain production as witnessed during the last two decades is sustained, the production of additional 57 million tons of cereals and 76 million tons of total food grains in the coming two decades may not be out of reach for India. The demand projections may turn out to be on a higher side if the secular trend of change in consumer preferences away from cereal consumption persists. Demand for superior food items such as dairy and animal husbandry products, sugar, fruits and vegetables are expected to grow much faster during the coming decades. The estimated demand in 2020 for milk and milk products will be around 166 million tons, edible oils 11 million tons, meat, fish and eggs 11 million tons, sugar and gur 25 million tons and fruits and vegetables 113 million tons.

It may be noted that food grains, pulses, oilseeds, sugar, fruits and vegetables, poultry, dairy, meat, fish, etc. constitute the bulk of the output in the agriculture sector. The performance of agriculture is important for availability and access to food as more than 55

per cent people in the country are dependent on this sector. There are both short run and long run problems in agriculture. Farmers' suicides continue unabated, even increasing in some states, as growth rate in yield is on the decline. Farming is fast becoming a non-viable activity. Further scope for increase in net sown area is limited. Land degradation in the form of depletion of soil fertility, erosion, and water logging has increased. There has been decline in the surface irrigation expansion rate and a fall in the level of the ground water table. Exposure of domestic agriculture to international competition has resulted in a high order of volatility in prices. Disparities in productivity across regions and crops, and between rain fed and irrigated areas has increased. Long term factors like steeper decline in per capita land availability and shrinking of farm size are also responsible for the agrarian crisis. Land issues such as SEZs, land going to non-agriculture, alienation of tribal land etc. are becoming important.

The Steering Committee report on agriculture for the Eleventh Plan (Goi, 2007) has identified the possible reasons for deceleration in agriculture since the mid- 1990s. According to the report, the major sources of agricultural growth are: public and private investment in agriculture and rural infrastructure including irrigation, technological change, diversification of agriculture, and fertilizers. A major challenge to food security comes from dietary diversification of the poor. If cereal pricing is left to the market forces, government playing the facilitating role, land may be released from rice and wheat cultivation to meet the growing demand for non-cereal crops such as oilseeds, fruits and vegetables in accordance with diet diversification.

The micro irrigation system is a proven technology that helps in improving the productivity of crops by judicious use of water. MI system has resulted in improving the productivity of wheat, maize, and pulses by 24.05 %, 13.48%, and 28.69% respectively. Area under horticulture crops as well as nutritional security has also enhanced.

The positive outcomes on the food security due to the increase in the production & productivity of different crops and increased area under irrigation from same source of water. However, keeping in view the growth population of the country, we need to boost the production that can be possible with the help of innovation & transparency in the irrigation system in NMMI scheme.

3.6 Mission Structure Review

3.6.1 National Level

National Level: The Horticulture Division in the Department of Agriculture & Cooperation, Ministry of Agriculture coordinates the overall activities and review the progress of implementation of the Mission in the country. The Executive Committee (EC) of is chaired

by Secretary (A&C), Department of Agriculture & Cooperation to oversee the activities of the Mission and to approve the State Annual Action Plans besides projects on technology transfer etc. National Committee on Plasticulture Applications in Horticulture (NCPAH) is entrusted in the monitoring and reviewing the progress of the scheme.

Executive Committee (EC) reallocates resources across States and approves programmes on the basis of approved subsidy norms. EC is empowered to approve special interventions for tackling emergent requirements. EC can also constitute Sub-Committee (SC) / Empowered Committee (EMC) and delegate power to SC / EMC for emergent requirements like revision of cost norms, inclusion of equipment, etc. if required based on the recommendations of EC of NMMI.

3.6.2 State Level Micro Irrigation Committee (SMIC)

At the State level, State Micro Irrigation Committee (SMIC) under the Chairmanship of Agriculture Production Commissioner / Principal Secretary (Horticulture / Agriculture) oversees the implementation of the scheme in their respective States. The Panchayati Raj Institutions in the State are also member of the SMIC represented in the SMIC and involved in the implementation of the Scheme. The Chairman, at his discretion, can co-opt officials / experts as invitees. The SMIC meeting is held once in every quarter. The state level micro irrigation committees have been assigned to perform the following functions as per the guidelines:

1. Organise base line survey and feasibility studies in different parts of the state covering various crops and technologies.
2. Ensure smooth implementation of Micro irrigation programme in different districts of the state.
3. Ensure allocation of state share required for implementing the scheme and make it available to the implementing Agency.
4. Finalise and forward the consolidated actions plans of the Districts to DAC.
5. Register the System Manufacturers and circulate the list of System Manufacturer's registered with SMIC along with the quoted price to the District Micro Irrigation Committee (DMIC) and Implementing agencies. They will also indicate the quantum of money to be paid by the beneficiaries/banks to the manufacturers before installing the system.
6. Mobilize credit requirement of the farmers through the Financial Institutions for installing Micro Irrigation System.
7. Organise various training and extension programmes for farmers, officials, NGO's, entrepreneurs etc. involving PFDCs.

8. Host a website indicating the details and status of the progress of NMMI scheme in different districts of the state.

During the course of discussions, qualitative assessment was made on the basis of these parameters such as organise base line survey and feasibility studies in different parts of the state covering various crops and technologies are regularly prepared and accordingly assessment has been made. Similarly, the same criterion was adopted in other parameters to arrive at final assessment and these were summarized in the table 15. It may be seen from the table that the states of AP, Gujarat, Maharashtra are performing better than other states as far as their functions and responsibilities are concerned whereas Bihar and UP are the lagged states in this regard. It may be premature to comment on the performance of Sikkim and Uttarakhand states because the scheme is recently implemented.

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Table 15: Performance of the Functioning of SMICs in Sampled States

Functions/ States	Base line survey and feasibility studies	Implementation	Allocation of the State Share	Action Plan	Registration of the System Suppliers	Mobilize Credit for Farmers	Capacity Building Programme	Website Hosting	Assessment
AP	Medium	High	High	High	High	Low-medium	Medium	Medium	Medium-high
Bihar	Low	Low	Low	Low-medium	Low-medium	Low	Low	Low	Low
Chhattisgarh	Low-medium	Medium	Medium	Medium	High	Low-medium	Low-medium	Low-medium	Medium
Gujarat	Medium	High	High	High	High	Low-medium	Medium	Medium	Medium-high
Haryana	Low-medium	Medium	Low-medium	High	Low-medium	Low-medium	Low-medium	Medium	Low-medium
Karnataka	Low-medium	Medium	High	High	High	Low-medium	Medium	High	Medium-high
Maharashtra	Medium	Medium	High	High	High	Low-medium	Medium	Medium	Medium-high
Odisha	Low-medium	Medium	Low-medium	High	High	Low-medium	Low-medium	Low-medium	Medium
Rajasthan	Low-medium	Medium	High	High	High	Low-medium	Medium	Medium	Medium-high
Tamil Nadu	Medium	Medium	Medium	High	High	Low-medium	Medium	High	Medium-high
UP	Low	Low	Low	Low	Low-medium	Low	Low	Low	Low
Sikkim	Low	Low	Low	Low-medium	Low-medium	Low	Low	Low	Low
Uttarakhand	Low	Low	Low	High	Medium	Low	Low	Low	Low

Source: GAPL analysis

Note: High: Response is more than 80 %, Medium: Response is between 50 to 70 %, Low: Response is below 50 %.

The above table shows the assessment of performance & functioning configuration. The scales are used to represent the intensity of the functions ongoing into the sampled state. The registration of the system suppliers are scaled as per the number of manufacturers in proportion to the size of the state. It has been observed that AP, Gujarat & Maharashtra are leading states in the every aspect of the different activities involved in the process streamlined those are mentioned in the NMMI guidelines.

It has further been observed that Bihar, UP, Sikkim & Uttarakhand states are lacking in terms of the functions mentioned in the guidelines. There are still many dots to be connected in these states to get the desired and satisfactory results.

3.6.3 District Level Micro Irrigation Committee (DMIC)

At the District level, District Micro Irrigation Committee (DMIC), headed by the Chief Executive Officer (CEO) of Zila Parishad / District Rural Development Agency (DRDA) / Collector of the District, with members / representatives from concerned departments viz. Agriculture, Horticulture, Rural Development, Irrigation and Water Resources, Growers' Association, Krishi Vigyan Kendras (KVKs) and local lead Banks are responsible for implementing the NMMI programme in the district. The DMIC meeting is held once in every month.

The DMIC performs the following functions as per the guidelines:

1. Forward the District Action Plan to SMIC for compilation of State Action Plan and forward it to the Ministry of Agriculture.
2. Mobilize credit requirement of the farmers through the Financial Institutions for installing Micro Irrigation System.
3. Monitor and review the physical & financial progress of implementation of Mission programme.
4. Review the submission of utilization certificate by the implementing agency.
5. Provide Feedback to SMIC on monthly basis by 6th/7th of each month.

It was observed that DMIC in almost all the states are preparing their district plans regularly and in time except for Bihar, UP, Sikkim and Uttarakhand and accordingly assessment has been made. Similarly, the same criterion was adopted in other parameters to arrive at final assessment. The table below shows the extent of functioning at the district level. It is also portraying almost the same picture that is being shown under the state level.

Table 16: Performance of the Functioning of DMICs in Sampled States

Functions/ States	District Plan	Mobilizing Credit	Review & Monitoring	Submission of Utilization Certificates	Monthly Feedback & Reporting	Own Assessment
AP	High	Low-medium	High	Medium	High	Medium-high
Bihar	Medium	Low	Low-medium	Low	Low-medium	Low
Chhattisgarh	High	Low-medium	Medium	Low-medium	Medium	Low-medium
Gujarat	High	Medium	High	Medium	High	Medium-high
Haryana	High	Low	Medium	Medium	Medium	Medium
Karnataka	High	Medium	High	Medium	High	Medium-high
Maharashtra	High	Medium	High	Medium	High	Medium-high
Odisha	High	Low-medium	Low-medium	Low-medium	Medium	Medium
Rajasthan	High	Low-medium	High	Medium	High	Medium-high
Tamil Nadu	High	Low-medium	Medium	Medium	Medium	Medium
UP	Medium	Low	Low-medium	Low	Low-medium	Low
Sikkim	Medium	Low	Low-medium	Low	Low-medium	Low
Uttarakhand	Medium	Low	Low-medium	Low	Low-medium	Low

Source: GAPL analysis

Note: High: Response is more than 80 %, Medium: Response is between 50 to 70 %, Low: Response is below 50 %.

3.6.4 Improving Efficacy of the Institutional Mechanism

The following measures may be taken to improve the efficacy of the institutions involved in the implementation of the scheme:

1. The utilization certificates to be submitted in time for the prompt release of the funds.
2. SPV on the pattern AP state and separate institute like GGRC in Gujarat may be adopted for improving the efficiency and transparency.
3. The meeting of various committees formed under the programme should be held regularly. The meetings of the SMIC should be convened on quarterly basis and the same may also not tag with other meetings in order to give proper focus on the implementation of the programme.
4. Human Resource Development is one of the key factors for successful implementation of other sub components of any programme. The capacity building at all levels -farmers, field level workers, technical officers and scientists and developing orientation skills of all the stake holders in the context of changing needs of agriculture to be intensified. More training programmes for all the stakeholders should be organized.

3.7 Role of Panchayati Raj Institutions (PRIs) in NMMI Scheme

Panchayats have been entrusted mainly in identification of the beneficiaries in their respective jurisdiction. The interested farmer put his application to the Panchayat and after verification, the case is recommended. Panchayati Raj Institutions are involved in the following activities:

- i. Selection of crops and identification of priority areas for implementation.
- ii. Authorization of beneficiaries, compilation of application forms / proforma invoices and creation of local initiatives in promotion of micro irrigation technology.
- iii. Organization of interactive meetings with the representatives of MI industry.
- iv. Training, extension and awareness creation (added as per GoI notification dated. 20.8 2013).

However, during the course of discussions, it was observed that PRIs role is not only limited to compilation of necessary documents required for submission of application forms, but also involved in Information-Communication-Education (IEC) activities as shown in the.

The major activities and roles of PRIs practiced in different sampled states are as follows:

- A. Issues no objection certificate on first come first serve basis, Gram Panchayat informs to Gram Sabha regarding the selection of NMMI beneficiaries as well as verification of the land ownership
- B. Verification & certification of the farmers' ownership & domicile, involved in IEC activities, Issues no objection certificate on first come first serve basis
- C. Verification & certification of farmers' domicile, Issues no objection certificate on first come first serve basis
- D. Verification & certification of the farmers' ownership & domicile, involved in IEC activities, recommendation of farmers', Issues no objection certificate on first come first serve basis
- E. It is suggested that Panchayati Raj Institutions are required to be more effective in their roles & responsibilities as per the guidelines for which sensitization exercises through training and capacity building programmes may be initiated.

4 Primary Survey: Respondents' Profile and Findings

Primary survey of 7400 farmers was conducted in 13 states as per the sampling plan detailed in chapter 2. The coverage is quite systematic & comprehensive hence, no distortion in the findings is expected due to disproportionate representation of any specific category.

The purpose of analyzing the profiles of different respondents and deriving the findings was to evaluate the overall impact created by the scheme and to find the gap between planned objectives and outcome after the execution of the scheme along with identifying the best possible solution to fill the gap if any.

4.1 Demographic Profile (Sampled Beneficiaries & Non-beneficiaries)

The socio economic conditions of the target group indicate their basic characteristics which may be instrumental in the adoption of new technologies and interventions. The demographic profile of the farmers covered in the survey in terms of their education profile, gender, category etc. is presented in the following section.

4.1.1 Size of Land Holding

The benefit of the NMMI scheme is extended to the farmers on the basis of size of holding. As per the norms, at least 33 percent of the allocation is to be utilized for the small, marginal and women farmers. Similarly, the quantum of the subsidy is more for small and marginal farmers. The beneficiaries in case of small and marginal farmers are eligible for subsidy up to 60 percent of the cost of drip/ sprinkler irrigation system and the remaining 40 percent have to borne by the farmers. However, in the case of general categories of the farmers, subsidy assistance is 50 percent of the cost of the system which is shared in the ratio of 40:10:50 by the central, state government and the beneficiaries. The states are free to provide additional subsidy to the beneficiaries from their own resources.

Keeping the above factor in view, the sampled farmers were categorized as per the prescribed guidelines (Table 18) into three categories based on their land holdings such as marginal & small farmer under 2 hectares, medium between 2-10 hectares and large above 10 hectares. The results on distribution of the farmers according to their land holding category have been presented in the table 17 for both beneficiaries and non-beneficiaries.

Table 17: Land Holding Status of Beneficiary and Non Beneficiary Farmers

State	Beneficiaries				Non Beneficiaries			
	Total Beneficiaries	Category of Farmers (%)			Total Non-Beneficiary	Category of Farmers (%)		
		Marginal & Small	Medium	Large		Marginal & Small	Medium	Large
AP	672	92.41	7.59	0.00	168	96.43	3.57	0.00
Bihar	516	11.05	79.45	9.50	128	53.91	44.53	1.56
Chhattisgarh	384	83.59	15.89	0.52	96	93.75	6.25	0.00
Gujarat	576	41.32	56.6	2.08	144	58.33	38.19	3.48
Haryana	320	33.44	60.62	5.94	81	45.68	51.85	2.47
Karnataka	576	76.91	22.92	0.17	144	83.33	16.67	0.00
Maharashtra	672	83.04	16.66	0.30	169	83.43	16.57	0.00
Odisha	480	52.50	47.08	0.42	120	55.00	44.17	0.83
Rajasthan	574	37.11	60.28	2.61	138	68.84	28.99	2.17
Sikkim	50	100.00	0.00	0.00	10	90.00	10.00	0.00
Tamil Nadu	455	82.86	17.14	0.00	120	83.33	16.67	0.00
UP	527	33.97	65.46	0.57	168	66.67	32.73	0.60
Uttarakhand	90	50.00	46.67	3.33	22	77.27	22.73	0.00
Total	5892	58.74	39.43	1.83	1508	73.08	26.00	0.92

Source: GAPL survey

Marginal, small and medium category of farmers accounted for 58.74 and 39.44 percent of the beneficiaries where as 1.83 percent farmers are reported to be under large category among beneficiaries while among non-beneficiaries, 73 percent farmers fall under the category of marginal-small farmers and 26 percent are under medium land holding category. The distribution of large farmers among non-beneficiaries are not observed in Andhra Pradesh, Chhattisgarh, Karnataka, Maharashtra, Sikkim, Tamil Nadu and Uttarakhand.

The above table reveals that the proportion of a small and marginal farmers are observed to be highest in Sikkim, followed by Andhra Pradesh, Chhattisgarh, Maharashtra and Tamil Nadu among the sampled farmers. The proportion of medium and large farmers accounted for 39.43 percent of the total beneficiaries.

The data on size and distribution of operational land holdings in the country (Table 18) also suggest that medium and large farmers accounted about 15 percent of total land holdings thus occupying approximately 55.42 percent of the total area. The average size of land holding with the medium and large category of farmers was also noted to be 6.08 and 18.10 hectare respectively.

Table 18: Size and Distribution of Operational Holdings

S.No	Category of Holding	Size Group (Ha)	Holding (%)	Total Area Coverage (%)	Average Size (Ha)
1	Marginal	< 1.0	67.1	22.5	0.39
2	Small	1.0 - 2.0	17.91	22.08	1.42
Sub Total			85.01	44.58	
3	Semi Medium	2.0 - 4.0	10.04	23.63	2.71
4	Medium	4.0 - 10.0	4.25	21.2	5.76
5	Large	> 10.00	0.7	10.59	17.38
Sub Total			14.99	55.42	
Total			100	100	1.15

Source: Agriculture Census -2010

In light of these facts, the present limit of area up to 5 hectare under NMMI scheme needs to be re-looked and calls for relaxation of farm size limitations in providing subsidies. This will not only increase the area under MI and improve the water use efficiency, but will also contribute significantly towards food security on sustainable basis.

4.1.2 Categories of Farmers

The NMMI scheme is extended to all the categories of the farmers and the mission has earmarked the total allocation to SC/ST farmers as per their proportion to the population in the district. The following table summarizes the categories on their category both for beneficiaries and non-beneficiaries:

Table 19: Category wise Proportion of Beneficiary and Non Beneficiary Farmers

State	Beneficiaries				Non Beneficiaries					
	Total Beneficiaries	Farmers Categories (%)			Total Non-Beneficiaries	Farmers Categories (%)				
		Gen	OBC	ST		Gen	OBC	ST		
AP	672	27.68	50.74	11.16	10.42	168	37.50	43.45	11.31	7.74
Bihar	516	36.43	58.53	2.13	2.91	128	27.34	66.41	3.91	2.34
Chhattisgarh	384	34.38	28.91	33.07	3.65	96	15.63	38.54	36.46	9.38
Gujarat	576	72.22	20.83	5.56	1.39	144	75.69	20.83	2.08	1.39
Haryana	320	82.19	16.56	0.00	1.25	81	69.14	27.16	0.00	3.70
Karnataka	576	64.24	20.49	7.12	8.16	144	61.11	24.31	9.03	5.56
Maharashtra	672	75.74	22.47	1.04	0.74	169	76.33	20.12	1.78	1.78
Odisha	480	54.58	33.54	9.17	2.71	120	55.00	26.67	15.00	3.33
Rajasthan	574	37.11	52.79	7.14	2.96	138	30.43	65.22	2.90	1.45
Sikkim	50	24.00	22.00	54.00	0.00	10	70.00	20.00	10.00	0.00
Tamil Nadu	455	40.44	51.87	0.66	7.03	120	57.50	35.83	0.00	6.67
UP	527	41.56	54.08	0.19	4.17	168	26.79	61.31	1.19	10.71
Uttarakhand	90	54.44	15.56	1.11	28.89	22	45.45	22.73	0.00	31.82
Total	5892	50.97	37.44	6.96	4.63	1508	48.67	39.19	6.83	5.31

It may also be seen from the above table, which shows coverage of different categories of farmers selected for primary survey on random basis the implementing agencies in various states under study were able to provide the benefits of NMMI scheme to all the categories of the farmers based on its norms.

4.1.3 Gender

The role of the women in agriculture is more than 60 percent for conducting different farm activities like tending of animals , farm operations (except ploughing) and other farms house activities. In the guidelines of the NMMI schemes, a special mention has been made for the benefits to be extended under the scheme to the women farmers. Therefore, the coverage of number of male and female beneficiaries in the survey is presented in the following table.

Table 20: Gender Status of Beneficiaries and Non Beneficiaries

State	Beneficiaries			Non Beneficiaries		
	Total Beneficiaries	Gender (%)		Total Non- Beneficiary	Gender (%)	
		Male	Female		Male	Female
AP	672	83.48	16.52	168	97.02	2.98
Bihar	516	93.99	6.01	128	96.88	3.13
Chhattisgarh	384	89.32	10.68	96	92.71	7.29
Gujarat	576	94.27	5.73	144	97.92	2.08
Haryana	320	37.81	62.19	81	100.00	0.00
Karnataka	576	86.28	13.72	144	99.31	0.69
Maharashtra	672	93.45	6.55	169	98.22	1.78
Odisha	480	88.96	11.04	120	98.33	1.67
Rajasthan	574	90.59	9.41	138	97.10	2.90
Sikkim	50	88.00	12.00	10	90.00	10.00
Tamil Nadu	455	88.35	11.65	120	98.33	1.67
UP	527	88.43	11.57	168	98.21	1.79
Uttarakhand	90	86.67	13.33	22	100.00	0.00
Total	5892	86.81	13.19	1508	97.68	2.36

Source: GAPL Survey

It may be seen from the above that proportion of male among the entire sampled respondent is higher than 85 percent in case of beneficiaries and non-beneficiaries both. This may be due to the fact that in most cases, the land is generally in the name of head of the family and being a patriarchic society land ownership rests with the male gender.

4.1.4 Educational Status

Education plays an important role in the development and the same is true for the NMMI schemes. Therefore, the education status of sampled farmers both beneficiaries and non-beneficiaries was enquired. This information is summarized in table below.

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Table 21: Education Status of Beneficiaries and Non-beneficiaries

State	Beneficiary					Total No. of Non-Beneficiary	Non Beneficiary					
	Total Beneficiary	Education status (%)					Not Educated	Education status (%)				
		Not Educated	Primary	High School	Sr. Secondary			Primary	High school	Sr. Secondary	Graduate and above	
AP	672	2.23	22.32	44.35	25.15	5.95	168	0.60	19.64	52.98	23.21	3.57
Bihar	516	6.59	20.35	31.20	16.67	25.19	128	10.16	28.91	28.13	13.28	19.53
Chhattisgarh	384	11.20	35.68	25.26	15.89	11.98	96	5.21	41.67	31.25	17.71	4.17
Gujarat	576	11.28	29.17	30.73	16.32	12.50	144	13.89	29.86	31.94	10.42	13.89
Haryana	320	20.94	14.38	24.69	14.38	25.63	81	3.70	27.16	32.10	18.52	18.52
Karnataka	576	3.13	30.90	42.88	13.54	9.55	144	6.25	36.81	32.64	16.67	7.64
Maharashtra	672	2.98	23.21	40.03	16.22	17.56	169	4.14	22.49	42.01	17.75	13.61
Odisha	480	6.88	27.08	32.29	17.50	16.25	120	9.17	32.50	31.67	12.50	14.17
Rajasthan	574	7.84	42.68	39.37	5.57	4.53	138	12.32	42.75	42.75	2.17	0.00
Sikkim	50	2.00	16.00	30.00	20.00	32.00	10	10.00	10.00	30.00	20.00	30.00
Tamil Nadu	455	3.52	23.74	45.05	11.65	16.04	120	5.83	39.17	45.00	9.17	0.83
UP	527	6.07	34.54	40.23	11.95	7.21	168	4.76	25.60	41.07	20.24	8.33
Uttarakhand	90	11.11	18.89	20.00	35.56	14.44	22	36.36	13.64	27.27	18.18	4.55
Avg. Total	5892	6.77	27.66	36.64	15.56	13.36	1508	7.29	30.37	38.06	14.99	9.28

Source: GAPL Survey

In most of the sampled areas, the most of the farmers are educated except in Haryana where about 21 percent of the beneficiaries reported to be not educated. The higher proportion of graduate among beneficiaries in most of the states as compared to non-beneficiaries clearly indicates that educated and informed farmers are more likely to adopt MI Systems.

4.1.5 Status of Communication Facilities

Communication Media is an important tool of flow of information particularly in agriculture as pre and post-harvest operation are time bound as well as subject to use of resources. Quick and authentic information are required for weather forecast, agriculture operations and practices, information about the markets for disposal etc. Numbers of portals such as AGMARKNET have been launched to benefit the farming community.

Table 22: Mobile Phone Ownership

State	Beneficiary having Mobile (%)	Non Beneficiary having Mobile (%)
AP	19.79	11.90
Bihar	80.43	60.16
Chhattisgarh	38.54	6.25
Gujarat	87.67	65.97
Haryana	67.19	59.26
Karnataka	29.34	9.03
Maharashtra	24.26	4.14
Odisha	33.33	19.17
Rajasthan	55.05	55.07
Sikkim	74.00	90.00
Tamil Nadu	24.62	2.50
UP	11.95	16.07
Uttarakhand	35.56	13.64
TOTAL	41.89	26.99

The consultants have captured the status of mobile ownership among beneficiaries as well as non-beneficiaries for the comparison purpose. The following facts have been observed from the table above:

- 40 percent of the farmers are having access to mobile phones. The table further reveals that the maximum number of beneficiaries possessing mobile phones were in Gujarat (88%) followed by Bihar (80%), Sikkim (74%) and Haryana (67%).
- This is an encouraging trend as farmers are making use of the Information and Communication Technology.
- Less than 27 percent of the non-beneficiaries have access to the mobile phones whereas the average of mobile holders among beneficiaries was noted to be around 42 percent.

- It may further be added here that total number of mobile users as per “India Mobile Landscape” (IML), 2013 study were 55.48 crores and out of this about 29.8 crores (53.7%) are 22 percent are in rural areas.
- Further, if we analyze the overall scenario of mobile penetration it comes to about 25 percent. The penetration of this technology was noted to be much higher in case of beneficiaries using mobiles.
- The field observations gathered from the farmers of sampled states correlates that with increase in income due to MI technologies, the beneficiary farmers have started use of this technology.

It shows that the different positive attributes of MI technology enabling adopters to access the technology, updating themselves with the mobile technology that lead the beneficiaries towards attaining better social status due to increase of their income and purchasing power. As for the availability of email IDs with the sampled farmers is concerned, negligible number of farmers had this mode of communication.

4.2 Results and Discussions

4.2.1 Quality of soil and irrigation water

Irrigation with saline water through the conventional methods like flooding, results in accumulation of salts in soil profile resulting in, reduced availability of water to plants, poor to delayed germination and slow vegetative growth rate. However, with the use of micro-irrigation systems (drip/sprinkler) the saline water is applied frequently in lesser amounts, due to which the evaporation losses of irrigation water are very less which prevents the accumulation of salts and keep their concentrations well below the harmful limit in crop root zone. Thus, at places where the fresh water resources are limited alternative, non-conventional water resources like saline water aquifer, may be exploited to feed the expansion drive for irrigation. In this context, the scientific use of saline water in conjunction with adaptable water use technologies has been advocated as a perfect proxy for irrigation.

The electrical conductivity of saline soils is > 4 dS/m and pH is > 8.0 . In the areas having problems of soil salinity, the soil and water testing are specifically important to adopt the appropriate measures to draw full advantage of the micro irrigation system. The data on extent of saline soils in the sampled states coupled with the farmers responses on getting their soils and water tested are cited in table 23.

It has been documented that clogging factor in MI system is minor, moderate and severe in water samples having EC values < 0.80 , $0.8-3.1$ and > 3.1 dS/m, respectively. Such values for pH have been reported to be < 7.0 , $7.0-8.0$ and > 8.0 . (Patil, 2001).

Table 23: Extent of Soil Salinity (in sampled states) and Beneficiary's Responses on Soil and Water Testing

State	Status (000' ha)			Total Beneficiaries	Percent Response of the sample beneficiaries on soil & water testing	
	Saline soils	Sodic Soil	Total		Yes	No
AP	77.60	196.61	274.21	672	61.46	38.54
Bihar	47.30	105.85	153.15	516	67.05	32.95
Chhattisgarh	NA	NA	NA	384	64.58	35.42
Gujarat	1680.57	541.43	2222.00	576	69.27	30.73
Haryana	49.16	183.40	232.56	320	77.81	22.19
Karnataka	1.89	148.14	150.03	576	69.10	30.90
Maharashtra	184.09	422.67	606.76	672	73.36	26.64
Odisha	147.14	0.00	147.14	480	63.75	36.25
Rajasthan	195.57	179.37	374.94	574	79.13	20.87
Sikkim	NA	NA	NA	50	54.00	46.00
Tamil Nadu	13.23	354.78	368.01	455	57.58	42.42
UP	21.99	1346.97	1368.96	527	52.75	47.25
Uttarakhand	0.00	0.00	0.00	90	77.78	22.22
Total	2418.54	3479.22	5897.76	5892	68.87	31.13

*Source: Central Soil Salinity Research Institute, Karnal, Haryana-2010^b

In the sampled states magnitude of soil salinity was noted to be highest in Gujarat followed by UP which was followed by Maharashtra and Rajasthan. There is thus a strong need to launch special drives to motivate the farmers to get their soil and water samples tested. This may enable them to adopt the recommended measures to prevent the clogging of emitters and enhance the crop productivity with the adoption of MI systems. As per the guidelines of NMMI, It is mandatory to conduct soil and water tests by MI system suppliers registered under the scheme. Though, about 68.87% of sampled beneficiaries of all the 13 sampled states have got their soil & water tested. In Gujarat, UP, Maharashtra & Rajasthan, soil testing adopted by 69.27%, 52.75%, 73.37% and 79.13 % of respondents respectively.

It was further investigated if beneficiaries are aware about the importance of soil and water quality on the performance of the MI systems; the results are presented in the table below:

^bTechnical Bulletin: CSSRI/Karnal/2/2010, Computerized Database on Salt Affected Soils in India, A.K. Mandal, R.C. Sharma, Gurbachan Singh and J.C. Dagar, 2010

Table 24: Extent of Awareness about Important Soil and Water Quality Parameters

State	Total Beneficiary	Soil quality testing				Water quality testing			
		pH		EC		pH		EC	
		Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
AP	672	2.38	97.62	0.30	99.70	0.00	100.00	0.00	100.00
Bihar	516	0.97	99.03	0.58	99.42	0.58	99.42	0.58	99.42
Chhattisgarh	384	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Gujarat	576	5.21	94.79	3.82	96.18	4.34	95.66	4.34	95.66
Haryana	320	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Karnataka	576	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maharashtra	672	3.13	96.88	2.38	97.62	2.83	97.17	2.38	97.62
Odisha	480	3.33	96.67	3.33	96.67	1.46	98.54	1.46	98.54
Rajasthan	574	99.13	0.87	99.13	0.87	98.61	1.39	98.43	1.57
Sikkim	50	14.00	86.00	0.00	100.00	0.00	100.00	0.00	100.00
Tamil Nadu	455	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UP	527	52.75	47.25	32.26	67.74	35.29	64.71	42.88	57.12
Uttarakhand	90	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Total	5892	15.99	66.51	13.54	68.96	13.68	68.82	14.29	68.21

Source: GAPL Survey

It has also been noted that farmers in most of the sampled states were not even aware of the importance of soil and water testing (Table 24). There is thus, a dire need to create awareness about the importance of soil and water testing among farmers and make them aware of consequent clogging of emitters.

4.2.2 Sources of Irrigation

There are number of water sources in different parts of the states/ country such as bore well, canals, ponds, tube wells etc. from which the farmers get the irrigation water for their fields. In this context, information on the availability of water sources was compiled. The following inferences have been drawn:

- Bore well is the most preferred source of water supply among the users of MI systems, proportion being about 82% as may be seen from the table below.
- Further, it may be seen that 100 percent of the farmers of Karnataka and AP have own bore wells followed by the farmers of Bihar, UP, Tamil Nadu, Odisha, Chhattisgarh, Rajasthan and Gujarat. The other important sources are canal, well and spring water.
- Over 62 percent farmers of Sikkim reported to have farm ponds at their farms and remaining 38 percent from spring water which is an exception as compared to other states covered in the survey.

- It may also be inferred that more than 92 percent (bore well, well and farm pond) of the beneficiaries have owned water sources which facilitates them to operate the MI systems as per the crop needs.

Table 25: Source of Irrigation Water (%)

State	Total Beneficiary	Bore well	Well	Farm Ponds	Canals	Bore well & Canals	Canals & Farm Ponds	Others
AP	672	99.70	0.00	0.00	0.00	0.00	0.00	0.30
Bihar	516	98.45	0.00	0.19	0.58	0.78	0.00	0.00
Chhattisgarh	384	84.64	0.00	0.26	0.00	0.00	0.00	15.10
Gujarat	576	75.17	23.09	0.35	0.69	0.00	0.00	0.69
Haryana	320	46.25	0.00	2.81	3.13	7.81	14.06	25.94
Karnataka	576	100.00	0.00	0.00	0.00	0.00	0.00	0.00
Maharashtra	672	39.58	53.42	1.19	4.46	0.74	0.00	0.60
Odisha	480	92.50	7.50	0.00	0.00	0.00	0.00	0.00
Rajasthan	574	76.31	9.76	0.00	6.97	3.14	2.79	1.05
Sikkim	50	0.00	0.00	62.00	0.00	0.00	0.00	38.00
Tamil Nadu	455	94.95	2.64	0.00	2.42	0.00	0.00	0.00
UP	527	96.96	3.04	0.00	0.00	0.00	0.00	0.00
Uttarakhand	90	76.67	0.00	0.00	0.00	0.00	0.00	23.33
Total	5892	81.81	10.39	0.88	1.66	0.88	1.04	3.34

Source: GAPL Survey

4.2.3 Water Table

The cost of irrigation depends on the depth of the water available from the ground water sources. In this regard the beneficiaries were asked to narrate the depth of the water table at their farms. The pertinent data has been summarized in Table 26 which helps in the selection of appropriate capacity of the pump for smooth and efficient functioning of the system.

Table 26: State wise Water Table Depth

State	Total Beneficiaries	Water availability depth (%)					
		0-50 Ft	50-100 Ft	100-150 Ft	150-200 Ft	200-250 Ft	>250 Ft
AP	672	0.30	0.60	1.04	18.45	77.23	2.38
Bihar	516	45.74	50.00	4.26	0.00	0.00	0.00
Chhattisgarh	384	11.98	15.63	46.61	16.15	7.03	2.60
Gujarat	576	8.33	30.90	13.37	14.24	6.60	26.56
Haryana	320	28.75	34.38	16.25	10.00	4.38	6.25
Karnataka	576	0.00	5.38	9.72	17.71	64.93	2.26
Maharashtra	672	46.13	26.49	9.97	12.80	3.57	1.04
Orissa	480	97.92	2.08	0.00	0.00	0.00	0.00
Rajasthan	574	7.67	17.60	33.97	14.46	3.48	22.82
Sikkim	50	-	-	-	-	-	-
Tamil Nadu	455	0.00	13.19	23.96	57.58	4.84	0.44
UP	527	33.97	50.28	14.80	0.76	0.19	0.00
Uttarakhand	90	8.89	24.44	6.67	0.00	7.78	52.22
Total	5892	24.36	21.67	14.39	14.21	17.75	6.77

Note: The beneficiaries of Sikkim are not aware of the depth of water availability

Source: GAPL Survey

4.2.4 Sources of Awareness about NMMI Scheme

The Table 27 shows that the mix trend among the farmers and the major sources of awareness was through fellow farmers, service providers/ suppliers, extension workers etc. The highest proportion of awareness revealed in Chhattisgarh was through fellow farmers in Uttarakhand, UP and Sikkim through extension workers. It is interesting to note that the suppliers/representatives of the manufacturers are the major sources of awareness to the beneficiaries. This may be due to the reason that the supplier of the system have their own interest in this competitive trade and motivate as well as facilitate the farmers in applying for the benefit.

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Table 27: Sources of Awareness Reported by Beneficiaries (%)

State	Total Beneficiaries	Fellow Farmers	Radio	Newspaper	TV	Pamphlet	Extension worker	Supplier	Fellow Farmers & Supplier	Fellow Farmers & Extension worker	Fellow Farmers & Newspaper	Extension worker & Supplier	Others
AP	672	26.64	0.00	0.15	0.60	0.30	22.17	46.28	1.49	1.49	0.00	0.89	0.00
Bihar	516	25.97	0.00	0.19	0.00	0.00	5.62	34.50	16.67	4.07	0.00	1.55	11.43
Chhattisgarh	384	53.65	0.00	0.00	0.00	0.00	1.30	34.11	8.59	0.78	0.00	0.52	1.04
Gujarat	576	21.53	0.00	1.22	1.56	0.69	2.26	15.63	39.41	6.94	2.26	0.35	8.16
Haryana	320	18.13	0.94	0.00	0.00	0.00	69.38	5.31	1.25	2.50	0.94	0.00	1.56
Karnataka	576	23.96	0.17	0.17	0.17	0.00	0.69	16.84	36.63	6.94	11.11	2.78	0.52
Maharashtra	672	25.15	0.45	1.19	0.45	0.00	9.08	22.47	30.51	5.51	2.53	1.64	1.04
Orissa	480	24.79	0.21	2.50	1.46	0.00	2.08	20.21	34.79	5.83	3.54	3.33	1.25
Rajasthan	574	31.36	0.00	1.22	0.17	1.05	25.96	39.72	0.17	0.00	0.17	0.00	0.17
Sikkim	50	16.00	0.00	0.00	0.00	0.00	40.00	2.00	12.00	14.00	10.00	0.00	6.00
Tamil Nadu	455	15.16	1.54	0.00	0.00	0.00	0.88	15.82	39.34	7.03	14.07	2.42	3.74
UP	527	22.20	0.00	0.00	0.00	0.00	56.74	17.27	2.28	0.57	0.19	0.19	0.57
Uttarakhand	90	8.89	4.44	3.33	0.00	2.22	54.44	18.89	0.00	1.11	0.00	0.00	6.67
Total	5892	25.61	0.32	0.68	0.42	0.24	17.21	25.14	19.37	3.90	3.14	1.24	2.73

Note: Other source of awareness includes multiple sources of different combinations

Source: GAPL Survey

Following the same pattern of the sources of awareness for beneficiary farmers, the same was asked from the non-beneficiary farmers and their responses are summarized in the Table 28.

Almost 1149 non adopters out of sampled 1508 are aware about the scheme that is about 76 percent. It may be seen from the following table that the major sources of awareness for no adopters are other farmers, suppliers and extension workers. It may also be seen here that the awareness in most of the states is more than 70 percent except for Uttarakhand, Rajasthan and Gujarat.

Table 28: Source of Awareness of Scheme Reported by Non-beneficiary (%)

State	Total Beneficiaries	Other Farmers	Radio	Newspaper	TV	Extension worker	Supplier	Other Farmers and Supplier	Other Farmers & Newspaper	Others
AP	116	46.55	1.72	6.90	0.86	12.07	16.38	5.17	4.31	6.03
Bihar	95	56.84	0.00	0.00	0.00	5.26	26.32	9.47	2.11	0.00
Chhattisgarh	53	94.34	0.00	0.00	0.00	0.00	1.89	0.00	1.89	1.89
Gujarat	95	47.37	1.05	0.00	1.05	0.00	3.16	33.68	4.21	9.47
Haryana	69	79.71	0.00	0.00	0.00	10.14	4.35	2.90	2.90	0.00
Karnataka	126	57.94	0.00	0.00	0.00	0.00	3.97	23.81	13.49	0.79
Maharashtra	154	50.00	0.65	1.95	0.65	5.84	14.29	18.83	5.84	1.95
Odisha	98	48.98	0.00	1.02	0.00	2.04	7.14	25.51	11.22	4.08
Rajasthan	95	66.32	0.00	3.16	0.00	9.47	20.00	1.05	0.00	0.00
Sikkim	10	50.00	0.00	0.00	0.00	0.00	20.00	30.00	0.00	0.00
Tamil Nadu	106	37.74	0.00	0.00	0.00	0.00	12.26	26.42	23.58	0.00
UP	120	75.83	0.00	0.00	1.67	19.17	0.83	2.50	0.00	0.00
Uttarakhand	12	0.00	0.00	0.00	0.00	50.00	50.00	0.00	0.00	0.00
Total	1149	57.01	0.35	1.31	0.44	6.53	10.97	14.62	6.61	2.18

Note: The total number of non-beneficiaries in the above table is only those who are aware about the NMMI scheme

Source: GAPL Survey

4.2.5 Reasons for Non-adoption of Micro Irrigation Systems

The non-beneficiaries farmers were further asked the reasons for not adopting this technology. Table 29 reveals following mix responses such as:

- Lack of awareness regarding subsidies, lack of technical knowledge, high capital cost, and system is not required, perception that the system is not economical therefore not required for the cropping pattern adopted by them.
- The 50 percent farmers from Sikkim reported that they have applied for the benefit but have not received the sanction so far.
- The farmers of Sikkim (50%), Tamil Nadu (30%), Odisha & Rajasthan (23%) and Karnataka (20%) also reported that they have applied for the grant of subsidy for the installation of the system, but have yet to receive the sanction.

Table 29 : Reasons for Non-adoption of NMMI Scheme (%)

State	Total non-Beneficiaries	Less awareness about subsidy	Lack of technical knowledge	Lengthy procedure	High capital cost	Application pending for clearance	Not required	Less awareness about subsidy & technical knowledge	Less awareness about subsidy & Lengthy procedure	Others
AP	168	5.95	5.36	0.00	30.36	5.36	0.60	19.64	1.79	30.95
Bihar	128	9.38	22.66	1.56	12.50	9.38	3.13	13.28	2.34	25.78
Chhattisgarh	96	2.08	2.08	0.00	44.79	0.00	0.00	6.25	0.00	44.79
Gujarat	144	1.39	2.78	0.69	38.89	10.42	2.08	0.69	9.03	34.03
Haryana	81	19.75	0.00	0.00	19.75	0.00	7.41	38.27	0.00	14.81
Karnataka	144	18.75	20.14	19.44	22.22	19.44	0.00	0.00	0.00	0.00
Maharashtra	169	2.37	11.24	0.59	38.46	23.67	1.18	7.69	5.92	8.88
Odisha	120	1.67	22.50	0.00	31.67	23.33	0.00	0.83	1.67	18.33
Rajasthan	138	10.87	12.32	1.45	20.29	0.72	0.00	19.57	3.62	31.16
Sikkim	10	0.00	40.00	0.00	0.00	50.00	10.00	0.00	0.00	0.00
Tamil Nadu	120	10.00	29.17	15.83	15.00	30.00	0.00	0.00	0.00	0.00
UP	168	5.95	1.19	0.00	26.79	0.60	1.79	33.33	1.79	28.57
Uttarakhand	22	9.09	0.00	9.09	4.55	9.09	0.00	0.00	22.73	45.45
Total	1508	7.56	11.74	3.65	27.12	11.74	1.33	12.27	2.92	21.68

Source: GAPL Survey

4.2.6 Willingness of Non Beneficiaries to Adopt MI System

In order to understand willingness of the non-beneficiary farmers for installation of micro irrigation system in their farms, a specific question was raised during interviews. The responses have been compiled in the following table, which, shows that more than three-fourth of the farmers of all the states are willing to install micro irrigation systems except in case of Chhattisgarh where more than half of the respondents reported that they are not willing to adopt the system. This response shows that when awareness of the benefits of micro irrigation systems is created (it seems during the interview respondents realized the advantages), most non-beneficiaries indicated their willingness to adopt MI.

Table 30: Willingness of Non-beneficiaries to Install MI System (%)

State	Total Non-Beneficiaries	Response in Percent	
		Yes	No
AP	168	97.62	2.38
Bihar	128	99.22	0.78
Chhattisgarh	96	45.83	54.17
Gujarat	144	77.08	22.92
Haryana	81	91.36	8.64
Karnataka	144	97.92	2.08
Maharashtra	169	97.04	2.96
Odisha	120	96.67	3.33
Rajasthan	138	92.03	7.97
Sikkim	10	80.00	20.00
Tamil Nadu	120	89.17	10.83
UP	168	80.36	19.64
Uttarakhand	22	95.45	4.55

Source: GAPL Survey

4.2.7 Progress of Installation of MI System

The sampled beneficiaries were asked when they installed the system in their respective fields. The results are presented in the following table:

Table 31: Year of Installation of MI System (%)

States	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
AP	1.04	1.49	0.60	5.21	16.67	31.70	30.80	12.50
Bihar	NA	NA	NA	NA	3.29	18.60	72.87	5.23
Chhattisgarh	NA	9.11	21.88	14.58	8.59	25.78	19.79	0.26
Gujarat	0.17	1.91	9.03	11.46	12.33	24.65	37.33	3.13
Haryana	NA	4.69	9.69	8.13	9.69	20.31	47.50	NA
Karnataka	NA	3.82	9.38	14.06	17.19	14.76	29.51	11.28
Maharashtra	NA	6.99	5.95	12.05	23.96	28.57	21.58	0.89
Odisha	NA	3.54	3.96	8.54	11.25	13.33	42.71	16.67
Rajasthan	NA	5.05	5.40	5.75	8.36	25.09	48.08	2.26
Sikkim	NA	NA	NA	NA	NA	NA	74.00	26.00
UP	NA	15.75	19.73	4.74	11.20	7.02	35.10	6.45
Uttarakhand	NA	NA	NA	NA	NA	NA	28.89	71.11
Tamil Nadu	NA	NA	0.88	22.64	8.79	20.44	23.30	23.96

Source: GAPL Survey

The above table reveals that in the beginning of the scheme, the response was slow and gradually picked up. The momentum of adoption got accelerated after the up gradation of the scheme into the mission mode in 2010.

4.2.8 Average Cost of Installing the MI System

The state wise average system costs as reported by the respondents have been compiled in the table below.

Table 32: Average Cost of Installing MI System (Rs./ha)

State	Drip	Sprinkler
AP	61474	20572
Bihar	61109	21380
Chhattisgarh	68797	25418
Gujarat	72086	26390
Haryana	66355	25699
Karnataka	59452	27062
Maharashtra	60531	21102
Odisha	54457	20860
Rajasthan	63258	28171
Sikkim	59654	22143
Tamil Nadu	60676	24450
UP	61766	20481
Uttarakhand	59373	25932

Source: GAPL Survey

The following facts may be observed by analyzing the responses of sampled beneficiaries:

- On an average, the cost of system incurred by the beneficiaries of various states ranged between Rs. 54,457.36 Rs./ha to Rs. 72,086.31 Rs./ha for drip system, depending on the crop type/ spacing, material/ components used etc.
- As per the NMMI guidelines, the indicative cost for installation of drip system for wide space crops varies from Rs. 18,820 to Rs. 63,598 per hectare whereas, for close space crops, it falls in the range of Rs. 74,437 to Rs. 97,598 per hectare.
- Comparatively high cost incurred by the sampled farmers in Gujarat is probably attributed to the fact that more area under drip is occupied by close spaced (0-10 m² spacing) crops. Detailed analysis of higher average cost of drip in Gujarat is given in annexure IV. The average cost of sprinkler in the sampled states varied between Rs. 20,481 to Rs. 28,171 per hectare which falls near the specified indicative cost of overhead sprinkler systems.

4.2.9 Factors Influencing Farmers to Adopt MI system

To validate the outcome of the slated objectives of the scheme, the beneficiaries were asked to give the reasons for adoption of the scheme and the same are presented in the following table.

Table 33: Reasons for Adoption of Micro Irrigation Systems (%)

State	Total Beneficiaries	Because of Subsidy	Quality of Produce	Water Saving	Proper Utilization of Land	Labor Saving	Time Saving	Fertilizer Saving	Early Fruiting	Higher Production
AP	672	21.13	16.22	52.98	29.17	33.33	57.44	20.54	16.37	12.95
Bihar	516	20.54	11.43	90.12	14.15	40.89	92.44	25.00	1.16	37.79
Chhattisgarh	384	5.99	6.51	97.66	16.93	23.70	84.64	40.63	16.67	70.83
Gujarat	576	35.24	16.67	80.90	9.38	54.86	21.18	35.07	0.52	29.69
Haryana	320	98.13	59.38	99.69	57.19	93.13	96.56	95.63	42.81	85.00
Karnataka	576	4.69	7.12	84.55	23.96	67.19	54.34	37.15	4.34	22.92
Maharashtra	672	30.06	10.42	75.89	14.58	43.75	45.24	28.13	6.99	21.13
Odisha	480	12.29	6.67	78.13	19.38	38.96	48.96	18.54	4.58	44.38
Rajasthan	574	5.23	13.59	77.35	29.79	48.43	30.66	19.69	5.57	2.44
Sikkim	50	0.00	8.00	96.00	44.00	72.00	50.00	44.00	6.00	18.00
Tamil Nadu	455	13.19	12.97	71.21	20.00	50.99	65.71	43.08	4.62	23.08
UP	527	56.17	34.35	82.35	34.16	70.02	69.83	59.77	27.32	56.17
Uttarakhand	90	31.11	12.22	51.11	5.56	1.11	0.00	30.00	0.00	66.67
Total	5892	25.29	16.21	78.90	23.23	49.63	56.67	35.57	10.42	33.40

Note: Multiple Responses have been given to this question

It may be seen from the above table that in all nine reasons were revealed by the farmers for adopting the scheme which include: (a) water saving (b) time saving (c) labor saving (d) fertilizer saving (e) higher production (f) because of subsidy (g) proper utilization of land (h) quality of produce and (i) early fruiting.

It may further be observed that majority of the farmers reported that due to MI system they are able to save the water, time and labor. It is also revealed that the farmers are not installing the system because of subsidy only, but also on account of other benefits. In Haryana (98%) & UP (56%), farmers have installed MI system due to the subsidy. It is therefore, concluded from here that higher amount of subsidy is not leading to more area under micro irrigation but it is due to other reasons such as reduction in cost of cultivation and higher production because of judicious use of irrigation as well as shifting towards high value/ income crops.

4.2.10 Subsidy Disbursement

As per the operational guidelines of NMMI scheme, the system in the beneficiaries' field should be installed within sixty days from the date of filing the application. Similarly, the amount of subsidy should also be released to the suppliers/ service providers within 60 days. Most of the farmers of Chhattisgarh (96%) followed by Haryana, Karnataka, Tamil Nadu and Sikkim have reported that their applications are processed in less than 20 days and more than 90 percent of the farmers across states have reported that they got the sanction letter less than 40 days. Only in case of Uttarakhand 50 percent of the farmers reported they got sanction after 100 days which resulted mainly due to the delayed receipt of money from the concerned quarters. The following table further reveals that the 97 percent of the farmers of Bihar followed by Chhattisgarh (90%), Haryana (85%) & Karnataka (78%) and about 70 percent of the farmers of Odisha and Sikkim got their system installed in less than 20 days. About 60 percent of Gujarat farmers, 50 percent of Maharashtra followed by Tamil Nadu (48%) and AP (45%) reported that they got their system installed in 20-40 days.

Table 34: Farmer's Responses for Time Taken to Sanction Subsidy (%)

State	Total Beneficiary	Application to Sanction(Days)						Sanction to installation (Days)					
		0-20	20-40	40-60	60-80	80-100	>100	0-20	20-40	40-60	60-80	80-100	>100
AP	672	53.42	45.83	0.74	0.00	0.00	0.00	49.55	45.24	5.06	0.00	0.00	0.15
Bihar	516	52.52	41.28	3.88	1.74	0.58	0.00	96.90	2.91	0.00	0.19	0.00	0.00
Chhattisgarh	384	95.83	4.17	0.00	0.00	0.00	0.00	89.84	9.11	0.78	0.00	0.00	0.26
Gujarat	576	48.78	48.26	2.43	0.52	0.00	0.00	32.81	60.24	4.34	1.74	0.00	0.87
Haryana	320	90.00	7.50	0.00	1.56	0.94	0.00	84.69	13.44	0.00	1.88	0.00	0.00
Karnataka	576	85.59	14.41	0.00	0.00	0.00	0.00	78.30	15.97	5.56	0.00	0.00	0.17
Maharashtra	672	46.28	53.72	0.00	0.00	0.00	0.00	48.07	49.26	2.53	0.15	0.00	0.00
Odisha	480	62.29	34.17	2.29	1.25	0.00	0.00	71.04	28.54	0.21	0.21	0.00	0.00
Rajasthan	574	56.10	43.38	0.52	0.00	0.00	0.00	50.35	46.69	2.44	0.52	0.00	0.00
Sikkim	50	66.00	34.00	0.00	0.00	0.00	0.00	72.00	28.00	0.00	0.00	0.00	0.00
Tamil Nadu	455	73.85	25.27	0.88	0.00	0.00	0.00	45.93	47.91	5.05	1.10	0.00	0.00
UP	527	48.58	50.47	0.76	0.00	0.00	0.19	25.43	42.69	11.39	15.37	2.85	2.28
Uttarakhand	90	0.00	2.22	6.67	13.33	23.33	54.44	4.44	11.11	61.11	23.33	0.00	0.00
Total	5892	61.39	35.57	1.14	0.59	0.46	0.85	58.13	34.61	4.48	2.19	0.25	0.34

Source: GAPL survey

4.2.11 Sources of Margin Money

The contribution of the cost of MI system has to be borne by the farmers depending on the quantum of the subsidy available. It was observed that in almost all the states, beneficiary farmers contribute their own funds for contributing margin money. Other sources albeit a small proportion constitutes banking, KCC & money lenders. It may be seen from the following table that a very few beneficiaries have availed the bank loan for margin money.

Table 35: Source of Finance for Meeting Beneficiary Share for Installation of MI System

State	Total Beneficiary	Source of Beneficiary Share of MI (%)			
		Own sources	Bank	KCC	Money Lenders
AP	672	98.07	0.00	1.04	0.89
Bihar	516	100.00	0.00	0.00	0.00
Chhattisgarh	384	100.00	0.00	0.00	0.00
Gujarat	576	95.83	4.17	0.00	0.00
Haryana	320	93.44	0.31	4.38	0.63
Karnataka	576	100.00	0.00	0.00	0.00
Maharashtra	672	99.11	0.60	0.30	0.00
Odisha	480	99.79	0.00	0.21	0.00
Rajasthan	574	100.00	0.00	0.00	0.00
Sikkim	50	100.00	0.00	0.00	0.00
Tamil Nadu	455	100.00	0.00	0.00	0.00
UP	527	97.34	0.00	1.33	1.33
Uttarakhand	90	100.00	0.00	0.00	0.00
Total	5892	98.66	0.49	0.53	0.25

Source: GAPL Survey

4.2.12 Interest Rates on Borrowing

The number of beneficiaries who borrowed funds from different sources was less than 2 percent and only 0.49 percent borrowed from banks as stated above. The beneficiaries borrowed money from various sources on differential rates of interest and their responses have been summarized in the following table which reveals that most of the farmers who borrowed money at less than 10 percent of rate of interest from banks & KCCs.

Table 36: Rate of Interest Paid by the Beneficiaries on Borrowed Funds

State	No. of Beneficiaries			
	10% & less	10-12%	12-15%	>15%
AP	13	0	0	0
Bihar	0	0	0	0
Chhattisgarh	0	0	0	0
Gujarat	4	16	4	0
Haryana	14	3	2	1
Karnataka	0	0	0	0
Maharashtra	4	1	1	0
Odisha	1	0	0	0
Rajasthan	0	0	0	0
Sikkim	0	0	0	0
Tamil Nadu	0	0	0	0
UP	14	0	0	0
Uttarakhand	0	0	0	0
Total	50	20	7	1

4.2.13 Type of MI system and Area Coverage

4.2.13.1 Technology wise area coverage

The emitting devices (inline or online emitters) are designed to discharge water at prescribed rates depending on the specific requirements of various crops. In the sprinkler irrigation system water is discharge under pressure in the air through a set of nozzles attached to a network of high density polyethylene (HDPE) pipes, simulating rainfall and are suitable where the plant density is very high. It is widely used in field crops. The sprinkler irrigation system may be portable, semi-permanent or large systems (Rain guns). The cost of all the system varies across the states.

Table 37: Proportion of Farmers having Drip and Sprinkler MI Systems

State	Total	No of Beneficiaries				
		Drip	%	Sprinkler	%	Both
AP	672	499	74.26	166	24.70	7
Bihar	516	6	1.16	450	821	60
Chhattisgarh	384	152	39.58	227	59.11	5
Gujarat	576	452	78.47	115	19.97	9
Haryana	320	228	71.25	82	25.63	10
Karnataka	576	571	99.13	4	0.69	1
Maharashtra	672	589	87.65	72	10.71	11
Odisha	480	114	23.75	349	72.71	17
Rajasthan	574	354	61.67	216	37.63	4
Sikkim	50	40	80.00	9	18.00	1
Tamil Nadu	455	385	84.62	69	15.16	1
UP	527	311	59.01	214	40.61	2
Uttarakhand	90	58	64.44	32	35.56	0
Grand Total	5892	3759	63.80	2005	34.03	128
						2.17

Source: GAPL Survey

The data on area coverage under drip and sprinkler irrigation system with the beneficiary farmers in the sampled states are cited in Table 37. It is evident that drip system is more popular than sprinkler in most of the states under study. The data documents that on average area coverage under drip was about to 64 %. 34 % sprinkler and about 2 % of the beneficiaries have reported both the system. The respective area coverage under drip in Karnataka, Tamil Nadu, Sikkim, AP, Gujarat and Maharashtra reported more than 75 % area under drip. However, in case of sprinkler irrigation system, Bihar registered highest area under the system followed by Odisha and Chhattisgarh. The inference may be drawn here that the technology wise area coverage is shifting more towards the horticulture crops and less for the field crops.

Table 38: Drip & Sprinkler System wise Area Coverage by Sampled Beneficiaries

Technology wise area coverage (ha)					
State	Total Area under MI	Area under Drip	% Area under Drip	Area under Sprinkler	% Area under Sprinkler
AP	724.31	548.69	75.75	175.62	24.25
Bihar	780.34	73.57	9.43	706.76	90.57
Chhattisgarh	679.33	271.61	39.98	407.73	60.02
Gujarat	1202.59	871.56	72.47	331.03	27.53
Haryana	648.00	537.41	82.93	110.58	17.07
Karnataka	761.13	761.13	100.00	0.00	0.00
Maharashtra	864.33	762.10	88.17	102.22	11.83
Odisha	852.21	292.12	34.28	560.09	65.72
Rajasthan	671.01	585.54	87.26	85.46	12.74
Sikkim	31.32	27.28	87.08	4.05	12.92
Tamil Nadu	539.53	474.68	87.98	64.85	12.02
UP	819.32	550.69	67.21	268.64	32.79
Uttarakhand	83.47	70.21	84.12	13.25	15.88

Source: GAPL Survey

4.2.13.2 The Crop wise Area Coverage

The crop wise area coverage was computed from the total area under drip and sprinkler irrigation system, the pertinent results are enumerated in table below.

Andhra Pradesh

In the state of AP, major fruit crops under drip system were noted to be mango, citrus and banana, which covered around 54.91% of total area under drip. Among vegetable crops, brinjal, chilli and tomato occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 34.24% area under drip. Flower, maize, and sugarcane covered around 10.85% of area under drip irrigation with sampled beneficiaries. Out of total area under MI in AP 24.24% of the area was noted under sprinkler system. About 44.06% of area under sprinkler was occupied by vegetable crops, whereas other

crops such as cotton, maize and ground nut consists of about 55.94% of the total area under sprinkler.

Table 39: Crop wise Area Coverage under Drip and Sprinkler Systems in AP (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area(ha)	% of Area	Name	Area(ha)	% of Area	Name	Area(ha)	% of Area
Mango	78.85	14.37	Brinjal	95.52	17.41	Flower	0.96	0.17
Banana	48.98	8.93	Chilli	35.24	6.42	Maize	22.68	4.13
Citrus Fruits	143.79	26.21	Tomato	32.93	6.00	Sugarcane	13.46	2.45
Others	29.64	5.40	Others	24.20	4.41	Pulses	9.33	1.70
						Cotton	4.55	0.83
						Other	8.57	1.56
Total	301.26	54.91		187.89	34.23		59.54	9.14
Sprinkler								
			Name	Area(ha)	% of Area	Name	Area(ha)	% of Area
			Brinjal	32.19	18.33	Groundnut	25.50	14.52
			Chilli	15.50	8.83	Cotton	42.49	24.20
			Okra	12.30	7.01	Maize	9.11	5.18
			Tomato	17.38	9.90	Other	21.15	12.04
			Total	77.38	44.06		98.24	55.94

Source: GAPL Primary Survey, 2013

Bihar

In the state of Bihar, major fruit crops under drip system were noted to be mango, which covered around 60% of total area under drip. Among vegetable crops, Okra and potato have occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 34% area under drip. Sugarcane has covered around 2.75% of area under drip irrigation with sampled beneficiaries.

Table 40: Crop wise Area Coverage under Drip and Sprinkler Systems in Bihar (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Mango	43.83	59.57	Potato	8.34	11.33	Marigold	0.40	0.55
Litchi	0.93	1.27	Okra	9.31	12.65	Sugarcane	2.02	2.75
Kadam	0.61	0.83	Others Crop	7.32	9.96			
Others	0.81	1.10						
Total	46.18	62.76		24.97	33.94		2.43	3.30
Sprinkler								
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Blackberry	1.21	0.17	Potato	112.51	15.92	Wheat	135.33	19.15
			Brinjal	24.08	3.41	Sugarcane	108.46	15.35
			Cauliflower	23.11	3.27	Maize	164.75	23.31
			Okra	18.01	2.55	Menthol	21.37	3.02
			Tomato	17.40	2.46	Other Crop	61.60	8.72
			Others Crop	18.94	2.68			
Total	1.21	0.17		214.04	30.28		491.51	69.54

Source: GAPL Primary Survey, 2013

Chhattisgarh

In the state of Chhattisgarh, major fruit crops under drip system were noted to be banana, Papaya and watermelon which covered around 3.45% of total area under drip. Among vegetable crops, Cucumber, brinjal, tomato and bitter gourd occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 96.55% area under drip. Out of total area under MI in Chhattisgarh 39.98% of the area was noted under sprinkler system. About 25.62% of area under sprinkler was occupied by vegetable crops whereas other crops such as wheat, gram and soybean consist of about 74.38% of the total area.

Table 41: Crop wise Area Coverage under Drip and Sprinkler Systems in Chhattisgarh (Sampled Beneficiaries)

Drip			Sprinkler								
Fruit		Vegetable		Vegetable			Other Crop				
Name	Area (ha)	% of Area	Name	Area(ha)	% of Area	Name	Area (ha)	% of Area	Name	Area (ha)	% of Area
Banana	3.40	1.25	Tomato	64.62	23.79	Okra	28.65	7.03	Wheat	93.48	22.93
Papaya	3.74	1.38	Cucumber	38.87	14.31	Tomato	31.15	7.64	Pulses	95.76	23.49
Watermelon	2.23	0.82	Brinjal	24.14	8.89	Bottle Gourd	13.19	3.24	Other Crop	114.02	27.96
			Bitter Gourd	34.16	12.58	Others Crop	31.48	7.72			
			Others Crop	100.45	36.98						
Total	9.37	3.45		262.24	96.55		104.47	25.62		303.25	74.38

Source: GAPL Primary Survey, 2013

Gujarat

In the state of Gujarat, major fruit crops under drip system were noted to be banana, Papaya and pomegranate which covered around 12.25% of total area under drip. Among vegetable crops, Chili, tomato, potato and onion occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 16.36% area under drip. Flower, cotton, sugarcane and caster covered around 71.39% of area under drip irrigation with sampled beneficiaries. Out of total area under MI in Gujarat 27.52% of the area was noted under sprinkler system. About 25.74% of area under sprinkler was occupied by fruits and vegetable crops whereas other crops such as flower, cotton, groundnut and caster consist of about 74.27% of the total area.

Table 42: Crop wise Area Coverage under Drip and Sprinkler Systems in Gujarat (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area(ha)	% of Area	Name	Area(ha)	% of Area	Name	Area(ha)	% of Area
Banana	63.03	7.23	Chilli	52.74	6.05	Flower	0.20	0.02
Papaya	11.13	1.28	Tomato	33.37	3.83	Caster	64.14	7.36
Pomegranate	10.72	1.23	Potato	21.13	2.42	Cotton	498.59	57.21
Others	21.85	2.51	Onion	24.08	2.76	Sugarcane	14.17	1.63
			Others Crop	11.29	1.30	Other Crop	45.12	5.18
Total	106.74	12.25		142.60	16.36		622.22	71.39
Sprinkler								
Name	Area(ha)	% of Area	Name	Area(ha)	% of Area	Name	Area(ha)	% of Area
Pomegranate	8.90	2.69	Potato	63.22	19.10	Flower	1.82	0.55
Water Melon	1.01	0.31	Others Crop	12.04	3.64	Cotton	50.99	15.40
						Ground nut	48.00	14.50
						Caster	32.17	9.72
						Bajra	57.83	17.47
						Other Crop	55.03	16.62
Total	9.92	3.00		75.26	22.74		245.85	74.27

Source: GAPL Primary Survey, 2013

Haryana

In the state of Haryana, major fruit crops under drip system were noted to be Kinnow, lemon, strawberry and watermelon which covered around 77.71% of total area under drip. Among vegetable crops, tomato, potato and cucumber occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 19.05% area under drip. Flower and cotton covered around 3.24% and 3.96% of area respectively under drip irrigation with sampled beneficiaries. Out of total area under MI in Haryana 17.06% of the area was noted under sprinkler system. About 92.50% of area under sprinkler was occupied by fruits and vegetable crops whereas other crops such as cotton and wheat consist of about 7.50% of the total area under sprinkler.

Table 43: Crop wise Area Coverage under Drip and Sprinkler Systems in Haryana (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area(ha)	% of Area	Name	Area(ha)	% of Area	Name	Area(ha)	% of Area
Kinnow	363.21	67.59	Tomato	24.08	4.48	Flower	3.44	0.64
Lemon	17.81	3.31	Cucumber	15.68	2.92	Cotton	13.96	2.60
Water Melon	13.96	2.60	Potato	23.55	4.38			
Strawberry	10.12	1.88	Others Crop	39.05	7.27			
Other Crops	12.55	2.33						
Total	417.64	77.71		102.37	19.05		17.40	3.24
Sprinkler								
Name	Area(ha)	% of Area	Name	Area(ha)	% of Area	Name	Area(ha)	% of Area
Musk Melon	2.83	2.56	Tomato	36.93	33.39	Cotton	3.64	3.29
Water Melon	1.52	1.37	Potato	11.94	10.80	Wheat	4.65	4.21
			Chilli	11.13	10.06			
			Others Crop	37.94	34.31			
Total	4.35	3.93		97.94	88.56		8.30	7.50

Source: GAPL Primary Survey, 2013

Karnataka

In the state of Karnataka, major fruit crops under drip system were noted to be banana, areca nut, pomegranate and mango which covered around 84.25% of total area under drip. Among vegetable crops, tomato, chilli and ginger occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 11.61% area under drip. Turmeric, Pepper and others crops covered around 13.96%, 13.31 and 4.25% of area under drip irrigation with sampled beneficiaries.

Table 44: Crop wise Area Coverage under Drip and Sprinkler Systems in Karnataka (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Banana	267.16	35.10	Tomato	37.90	4.98	Turmeric	13.96	1.83
Pomegranate	76.84	10.10	Chilli	22.52	2.96	Pepper	13.31	1.75
Areca nut	85.03	11.17	Ginger	10.76	1.41	Other Crop	4.25	0.56
Mango	57.04	7.49	Others Crop	17.18	2.26			
Others	155.16	20.39						
Total	641.24	84.25		88.37	11.61		31.53	4.14

Source: GAPL Primary Survey, 2013

Maharashtra

In the state of Maharashtra, major fruit crops under drip system were noted to be banana, mango, citrus fruits and grapes which covered around 42.83% of total area under drip. Among vegetable crops, tomato, brinjal and chili occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 7.57% area under drip. Flower, sugarcane, cotton and other crops covered around 0.61%, 20.12%, 26.97% and 1.90% of area under drip irrigation with sampled beneficiaries. Under sprinkler system, about 1.58% of area occupied by vegetable crops whereas other crops such as flower, cotton, ground nut, black gram and soybean consist of about 98.42% of the total area.

Table 45: Crop wise Area Coverage under Drip and Sprinkler Systems in Maharashtra (Sampled Beneficiaries)

Drip						Sprinkler								
Fruit			Vegetable			Other Crop			Vegetable			Other Crop		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Banana	120.43	15.80	Brinjal	25.90	3.40	Flower	4.65	0.61	Brinjal	0.51	0.49	Flower	0.81	0.79
Mango	78.38	10.28	Tomato	17.18	2.25	Cotton	205.53	26.97	Peas	0.40	0.40	Cotton	34.97	34.21
Grapes	5.87	0.77	Chilli	10.55	1.38	Sugarcane	153.34	20.12	Tomato	0.71	0.69	Soybean	29.29	28.65
Citrus Fruits	41.10	5.39	Others	4.05	0.53	Other Crop	14.46	1.90				Ground nut	9.46	9.25
Others	80.66	10.58										Black Gram	13.84	13.54
												Others	12.24	11.98
Total	326.43	42.83		57.68	7.57		377.99	49.60		1.62	1.58		100.60	98.42

Source: GAPL Primary Survey, 2013

Odisha

In the state of Odisha, major fruit crops under drip system were noted to be mango, banana and cashew nut which covered around 70.90% of total area under drip. Among vegetable crops, tomato, brinjal and Okra occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 25.15% area under drip. Flower, moong and sugarcane covered around 3.95% of area under drip irrigation with sampled beneficiaries. Under sprinkler system, about 87.41% of area was occupied by fruits and vegetable crops whereas other crops such as moong, maize, sugarcane and others crop consist of about 4.55%, 1.48%, 2.17% and 4.39% of the total area.

Table 46: Crop wise Area Coverage under Drip and Sprinkler Systems in Odisha (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Mango	87.71	30.02	Tomato	18.03	6.17	Flower	1.21	0.42
Banana	36.02	12.33	Brinjal	14.97	5.13	Moong	3.64	1.25
Cashew nut	21.65	7.41	Okra	10.42	3.57	Sugarcane	2.02	0.69
Others	61.74	21.13	Others Crop	30.05	10.29	Other Crop	4.65	1.59
Total	207.11	70.90		73.47	25.15		11.53	3.95
Sprinkler								
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Pineapple	1.82	0.33	Brinjal	103.50	18.48	Moong	25.50	4.55
Watermelon	3.24	0.58	Tomato	94.10	16.80	Maize	8.30	1.48
			Okra	62.97	11.24	Sugarcane	12.14	2.17
			Cauliflower	55.85	9.97	Other Crop	24.59	4.39
			Others Crop	168.09	30.01			
Total	5.06	0.90		484.51	86.51		70.52	12.59

Source: GAPL Primary Survey, 2013

Rajasthan

In the state of Rajasthan, major fruit crops under drip system were noted to be kinnow, orange and mango which covered around 43 % of total area under drip. Among vegetable crops, onion, carrot and tomato occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 24 % area under drip. Flower, cotton, arandi and guar covered around 32 % of area under drip irrigation with sampled beneficiaries. Out of total area under MI in Rajasthan more of the area was noted under sprinkler system. About 56 % of area under sprinkler was occupied by fruits and vegetable crops whereas other crops such as flower, wheat, Mustard and cotton consist of about 44 % of the total area.

Table 47: Crop wise area Coverage under Drip and Sprinkler Systems in Rajasthan (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area	% of Area	Name	Area	% of Area	Name	Area	% of Area
Kinnow	65.23	11.14	Onion	53.15	9.08	Flower	6.56	1.12
Orange	130.19	22.23	Tomato	28.32	4.84	Cotton	118.81	20.29
Lemon	18.54	3.17	Cauliflower	15.10	2.58	Arandi	17.30	2.95
Mango	10.17	1.74	Others Crop	43.96	7.51	Guwar	14.63	2.50
Other Crops	31.49	5.38				Other Crop	32.09	5.48
Total	255.63	43.66		140.52	24.00		189.39	32.34
Sprinkler								
Name	Area	% of Area	Name	Area	% of Area	Name	Area	% of Area
Lemon	2.02	2.37	Carrot	39.54	46.26	Mustard	24.88	29.12
			Others Crop	6.23	7.29	Wheat	6.47	7.57
						Other Crop	6.31	7.39
Total	2.02	2.37		45.77	53.56		37.67	44.07

Source: GAPL Primary Survey, 2013

Sikkim

In the state of Sikkim, major fruit crops under drip system were noted to be orange and guava which covered around 41% of total area under drip. Among vegetable crops, tomato and brinjal occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 42 % area under drip. Wheat and mustard covered around 3.13% of area under drip irrigation with sampled beneficiaries. Out of total area under MI in About 70 % of area under sprinkler was occupied by the vegetable crops whereas other crops such as wheat and turmeric consist of about 30 % of the total area.

Table 48: Crop wise Area Coverage under Drip and Sprinkler Systems in Sikkim (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Orange	9.39	34.42	Tomato	5.55	20.36	Large Cardamom	1.42	5.19
Guava	1.82	6.68	Brinjal	2.63	9.64	Turmeric	2.43	8.90
			Other Crop	3.33	12.20	Other Crop	0.71	2.60
Total	11.21	41.10		11.51	42.21		4.55	16.69
Sprinkler								
Name	Area	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
			Tomato	0.81	20.00	Turmeric	0.81	20.00
			Cauliflower	0.81	20.00	Other Crop	0.40	10.00
			Barackoli	0.81	20.00			
			Others Crop	0.40	10.00			
Total				2.83	70.00		1.21	30.00

Source: GAPL Primary Survey, 2013

Tamil Nadu

In the state of Tamil Nadu, major fruit crops under drip system were noted to be banana, tapioca, coconut and aonla which covered around 55.28% of total area under drip. Among vegetable crops, tomato, chili and brinjal occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 17.80% area under drip. Turmeric and sugarcane covered around 26.92% of area under drip irrigation with sampled beneficiaries. Out of total area under MI in Tamil Nadu 12.02% of the area was noted under sprinkler system. About 99.23% of area under sprinkler was occupied by fruits and vegetable crops whereas other crops such as turmeric consist of about 0.78% of the total area.

Table 49: Crop wise Area Coverage under Drip and Sprinkler Systems in Tamil Nadu (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Banana	78.75	16.59	Chilli	20.25	4.27	Turmeric	95.01	20.02
Tapioca	49.94	10.52	Brinjal	17.20	3.62	Sugarcane	32.78	6.91
Coconut	49.53	10.44	Tomato	17.61	3.71		0.00	
Aonla	34.58	7.28	Others Crop	29.44	6.20			
Others Crop	49.58	10.45						
Total	262.38	55.28		84.51	17.80		127.79	26.92
Sprinkler								
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Carrot	0.81	1.25	Chilli	31.97	49.30	Turmeric	0.51	0.78
			Potato	17.40	26.83			
			Carrot	12.34	19.03			
			Others Crop	1.82	2.81			
Total	0.81	1.25		63.54	97.97		0.51	0.78

Source: GAPL Primary Survey, 2013

Uttar Pradesh

In the state of UP, major fruit crops under drip system were noted to be banana, mango, and guava which covered around 81 % of total area under drip. Among vegetable crops, tomato, potato and chili occupied comparatively higher area under drip than other vegetable crops. Vegetables occupied around 19 % area under drip. Maize wheat and other crops covered around 1.44% of area under drip irrigation with sampled beneficiaries. Out of total area under MI in UP about one-third of the area was noted under sprinkler system. About 88 % of area under sprinkler was occupied by fruits and vegetable crops whereas other crops such as wheat consist of about 12 % of the total area.

Table 50: Crop wise Area Coverage under Drip and Sprinkler Systems in UP (Sampled Beneficiaries)

Drip								
Fruit			Vegetable			Other Crop		
Name	Area	% of Area	Name	Area	% of Area	Name	Area	% of Area
Banana	131.73	23.92	Potato	27.52	5.00	Maize	2.63	0.48
Guava	123.63	22.45	Tomato	28.63	5.20	Sunflower	0.20	0.04
Mango	164.31	29.84	Chilli	12.95	2.35			
Litchi	15.38	2.79	Cabbage	9.11	1.65			
Others Crop	9.51	1.73	Others Crop	25.09	4.56			
Total	444.56	80.73		103.30	18.76		2.83	0.51
Sprinkler								
Name	Area	% of Area	Name	Area	% of Area	Name	Area	% of Area
Strawberry	0.40	0.15	Peas	96.11	35.78	Flower	0.81	0.30
			Tomato	40.37	15.03	Wheat	27.03	10.06
			Brinjal	25.29	9.42	Other Crop	3.14	1.17
			Okra	14.57	5.42			
			Others Crop	60.91	22.67			
Total	0.40	0.15		237.25	88.32		30.98	11.53

Source: GAPL Primary Survey, 2013

Uttarakhand

In the state of Uttarakhand, major fruit crops under drip system were noted to be peach, mango, litchi and guava which covered around 96% of total area under drip. Among vegetable crops, only peas occupied around 2.01% area under drip. Out of total area under MI in Uttarakhand about one-fourth of the area was noted under sprinkler system. About 100 % of area under sprinkler was occupied by vegetable crops.

Table 51: Crop wise Area Coverage under Drip and Sprinkler Systems in Uttarakhand (Sampled Beneficiaries)

Drip						Sprinkler		
Fruit			Vegetable			Vegetable		
Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area	Name	Area (Ha)	% of Area
Mango	32.17	45.82	Peas	1.01	1.44	Popular Tree	2.02	2.88
Peach	13.56	19.31					Peas	10.62
Guava	14.77	21.04					Tomato	2.63
Litchi	6.68	9.51						19.85
Total	67.18	95.68		1.01	1.44		2.02	2.88
							13.25	100.00

Source: GAPL Primary Survey, 2013

The above tables also shows that crops as brinjal, chilli, Okra, flower, tomato, bottle gourd, pomegranate etc. are irrigated with micro sprinkler irrigation system by the beneficiaries. However, during the course of discussion with experts, it was observed that irrigation through this system is not recommended because it harms the crop at the flowering stage. Therefore, it is recommended that farmers should be advised at the time of installation to use drip irrigation for such crops or they may avoid use of sprinkler during flowering stage and irrigate through alternative means.

4.2.14 System Demonstration

The outcome demonstration particularly in rural area where exposure is limited, remains an important instrument in educating the rural folks because "only physical or concrete evidence is convincing" for them. Seen evidence can be easily and correctly interpreted, when in fact, interpretation may be difficult, thus, gives better results. NMMI scheme has a component of demonstrations at the farmers' fields to educate the farmers of that particular cluster. In this regard the farmers were asked whether they have exposure to any field visit demonstration MI system.

Table 52: Exposure of Beneficiary Farmers to MI Demonstrations

State	Participated (%)	
	Yes	No
AP	12.50	87.50
Bihar	37.21	62.79
Chhattisgarh	48.96	51.04
Gujarat	28.30	71.70
Haryana	98.44	1.56
Karnataka	27.26	72.74
Maharashtra	47.47	52.53
Odisha	41.67	58.33
Rajasthan	64.63	35.37
Sikkim	80.00	20.00
Tamil Nadu	23.30	76.70
UP	21.44	78.56
Uttarakhand	63.33	36.67

Source: GAPL Survey

It may be seen from the above table that the beneficiaries of Haryana (98%) followed by Sikkim (80%), Rajasthan (64%) and Uttarakhand (63%) attended the demonstration nearby their areas. Whereas, majority of the farmers AP, UP, Tamil Nadu, Karnataka, Gujarat, Bihar have reported that they have not visited any demonstration. It is therefore suggested that more efforts may be put to expose the farmers regarding demonstration of MI system and its benefits.

4.2.15 Training and Capacity Building

The training and capacity building is an integral component of the MI initiatives. This component has been inbuilt to upgrade the capacity building of farmers and field functionaries through training and demonstrations carried out by state agricultural universities, Precision Farming Development Centers (PFDCs) and the industry. In light of

these observations, our survey gave due attention to the training component and the obtained results are enumerated in table 53.

The data revealed that almost all the respondents of Tamil Nadu, UP, Chhattisgarh, Haryana were given training materials during the training while few beneficiaries of the Bihar, Uttarakhand & Karnataka received such training/ materials. It has also been noted that farmers were imparted training on operation and maintenance of the system, adoption of package practices under MI, opportunities for introducing new crops with the help of micro irrigation system. As far as field visits are concerned most of the beneficiaries reported that they have visited the fields of progressive farmers and demonstration fields except for Chhattisgarh, Rajasthan and Uttarakhand where few farmers have reported that they have visited the demonstration fields.

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Table 53: Topic Covered in Training for Beneficiary Farmers (%)

State	Total Beneficiary	Training Material Provided		Topic Covered in the Training										Joined Any Field Visit		Satisfied with the Learning	
				Operation of the System		Maintenance of the System		Package of Practices for the Crops		Opportunities for Introduction of New Crop		Other Related Schemes					
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
AP	672	71.88	8.78	79.91	0.74	79.17	1.49	71.13	9.52	55.80	24.85	65.92	14.73	66.96	33.04	73.07	7.59
Bihar	516	9.50	10.47	19.77	0.19	19.77	0.19	14.53	5.43	6.01	13.95	1.94	18.02	4.46	93.60	6.20	0.19
Chhattisgarh	384	97.14	2.08	99.22	0.00	98.96	0.26	97.66	1.56	70.57	28.65	70.83	28.39	80.73	19.27	79.95	0.78
Gujarat	576	45.31	3.13	47.05	1.39	46.53	1.74	32.64	15.80	10.94	37.50	15.10	33.33	37.67	62.33	37.15	0.52
Haryana	309	93.63	6.37	93.85	6.15	93.41	6.59	90.99	9.01	62.86	37.14	61.54	38.46	83.30	16.70	93.19	6.81
Karnataka	576	26.38	63.57	89.37	0.57	87.48	2.47	44.59	45.35	29.79	60.15	15.75	74.19	45.92	54.08	50.47	3.42
Maharashtra	672	71.88	8.78	79.91	0.74	79.17	1.49	71.13	9.52	55.80	24.85	65.92	14.73	66.96	33.04	73.07	7.59
Odisha	480	58.78	2.53	61.31	0.00	61.16	0.15	51.93	9.38	39.29	22.02	49.26	12.05	57.44	42.56	60.86	0.45
Rajasthan	574	81.71	2.61	84.32	0.00	82.23	2.09	80.31	4.01	67.07	17.25	70.38	13.94	6.79	27.35	69.51	3.14
Sikkim	50	47.71	4.38	51.46	0.63	51.67	0.42	44.79	7.29	23.96	28.13	28.33	23.75	43.33	56.67	50.00	2.08
Tamil Nadu	455	99.65	0.35	99.65	0.35	99.31	0.69	90.80	9.20	60.59	39.41	59.55	40.45	85.07	14.93	96.70	3.30
UP	527	98.00	0.00	98.00	0.00	98.00	0.00	84.00	14.00	50.00	48.00	48.00	50.00	80.00	20.00	98.00	0.00
Uttarakhand	90	6.67	26.67	28.89	4.44	28.89	4.44	7.78	25.56	5.56	27.78	4.44	28.89	11.11	22.22	15.56	17.78

Source: GAPL Survey

The farmers were asked whether they are satisfied from the training they received. The beneficiaries of almost all the states gave positive response in this regard.

It is recommended that training on innovative techniques relevant to the MI Systems should cover topics such as high density plantation, canopy management, intercropping and use of mulch materials.

The beneficiaries were further asked about the institutions from which they have got the training about the MI system. The obtained responses of the sampled beneficiaries are presented in the following table:

Table 54: Institution for Training as Reported by Respondents (% Beneficiaries)

State	Total Responses	SAUs/ KVKs/ PFDC	State Govt. Agencies	System Supplier	Others	SAUs/ KVKs & State Govt. Agencies	SAUs/ KVKs & System Supplier	State Govt. Agencies & System Supplier
AP	542	0.73	32.29	66.05	0.18	0.00	0.00	0.74
Bihar	103	13.59	2.91	79.61	0.00	0.00	2.91	0.97
Chhattisgarh	381	13.65	0.79	43.31	0.00	1.31	38.32	2.62
Gujarat	279	3.59	4.30	91.76	0.00	0.36	0.00	0.00
Haryana	309	1.94	9.06	86.41	0.32	0.00	0.32	1.94
Karnataka	575	5.04	5.22	89.74	0.00	0.00	0.00	0.00
Maharashtra	412	13.60	4.37	75.97	0.24	0.24	0.97	4.61
Odisha	250	2.40	1.60	88.00	0.40	0.40	6.80	0.40
Rajasthan	484	5.34	3.31	90.29	0.00	0.00	0.00	1.03
Sikkim	49	6.12	65.31	24.49	0.00	0.00	2.04	2.04
Tamil Nadu	427	2.11	0.00	97.89	0.00	0.00	0.00	0.00
UP	474	2.11	2.11	95.57	0.00	0.00	0.00	0.21
Uttarakhand	30	3.33	6.67	86.67	0.00	0.00	0.00	3.33

Source: GAPL Survey

*sharing of source/ technical Information regarding micro irrigation system/ scheme

Note: The duration of training has been reported to be of 1-2 days as revealed by the participant beneficiaries

It may be seen from the above table that the system suppliers / manufacturers are the major sources who imparted the training as more than 90 percent of the farmers of Tamil Nadu, UP, Gujarat, Rajasthan and Karnataka received the training from suppliers. Other sources of training are state government agencies and SAUs/KVKs/ PFDC etc. Most of the manufacturers imparted training at the time of system installation. However, it was revealed by the beneficiaries that after installation, training on system operation is not provided to them as per their needs. As such most of the farmers fail to draw full advantage of the MI system. There is thus, a dire need to provide technical support for system operation after installation. It is recommended that regular trainings under MI system may be made mandatory on the part of system suppliers after the installation of the system as they are closely associated with the beneficiaries and have in-depth knowledge of the installed system.

4.2.16 Availability of Electricity

The micro irrigation system runs on power and is a pre requisite for the installation of system, therefore, availability of power is an important parameter in this regard. The following table shows the availability of electricity among all the states.

Table 55: Availability of Electricity (Beneficiaries and Non Beneficiaries)

State	Total Benefi- ciary	Beneficiaries						Non Beneficiaries					
		Availability of electricity (%)						Availability of electricity (%)					
		0-4 Hrs/Day	4-8 Hrs/Day	8-12 Hrs/Day	12-16 Hrs/Day	16-20 Hrs/Day	20-24 Hrs/Day	Total Non- beneficiaries	0-4 Hrs/Day.	4-8 Hrs/Day.	8-12 Hrs/Day.	12-16 Hrs/Day.	16-20 Hrs/Day.
AP	672	1.04	71.13	27.68	0.15	0.00	0.00	168	1.79	75.60	22.02	0.60	0.00
Bihar	516	14.92	78.88	5.81	0.39	0.00	0.00	128	10.94	48.44	25.78	14.84	0.00
Chhattisgarh	384	79.43	19.79	0.00	0.78	0.00	0.00	96	0.00	3.13	20.83	57.29	18.75
Gujarat	576	0.00	90.10	5.73	2.60	1.56	0.00	144	1.39	0.69	97.22	0.69	0.00
Haryana	320	0.94	17.19	67.19	14.38	0.00	0.31	81	1.23	17.28	72.84	8.64	0.00
Karnataka	576	0.00	94.10	5.90	0.00	0.00	0.00	144	1.39	94.44	5.56	0.00	0.00
Maharashtra	672	0.15	19.94	73.66	6.25	0.00	0.00	169	0.59	30.18	63.31	5.92	0.00
Odisha	480	0.83	15.63	31.04	43.54	8.96	0.00	120	2.50	22.50	27.50	45.00	2.50
Rajasthan	574	16.90	64.29	13.76	5.05	0.00	0.00	138	1.45	93.48	4.35	0.72	0.00
Sikkim	50	0.00	100.00	0.00	0.00	0.00	0.00	10	0.00	80.00	0.00	0.00	0.00
Tamil Nadu	455	0.00	100.00	0.00	0.00	0.00	0.00	120	0.00	100.00	0.00	0.00	0.00
UP	527	0.00	20.68	70.78	8.16	0.38	0.00	168	1.19	21.43	69.05	8.33	0.00
Uttarakhand	90	3.33	87.78	0.00	0.00	8.89	0.00	22	13.64	59.09	22.73	0.00	4.55

Source: GAPL Survey

It may be seen that the supply of electricity in different states, only one farmer among the beneficiaries that two of Haryana reported that the electricity available for 24 hrs. It may further be seen that 100 percent of the farmers of Sikkim and Tamil Nadu reported to get electricity for 4-8 hrs in a day. In other states, it was observed that electricity is available for less than 16 hrs a day and out of which maximum reported to be between 12-16 hrs a days.

It may further be seen that farmers of Tamil Nadu, Karnataka, Rajasthan, Sikkim and AP reported that they are getting electricity for 8 hrs whereas rest of the farmers reported that they are getting electricity up to 16 hrs a day. The availability of electricity to beneficiaries and non-beneficiaries are showing the same trend.

4.2.17 Capacity of Pump Sets

It may be seen from the following table that the majority of the farmers are using pump sets ranging upto 5 hp. In AP and Maharashtra about 74 and 63 percent of beneficiaries reported that they are using the pump sets of 5-10 hp at their farms. However, about 59, 54, 41 percent farmers of Gujarat, Haryana, and UP respectively revealed that that they are having the pump sets of more than 10 hp. The variations in the capacities of installed pump sets are attributed to the depth of water, farm size, type of MI system installed. Most of the farmers reported that pump sets of appropriate capacity have been installed which thoroughly meet the system requirements and they are not facing any problem to irrigate the crops as per their requirements.

Table 56: Capacity of Pump Sets Used by Beneficiaries

States	Total Beneficiary	Power of the Pump Set (%)		
		0-5 hp	5-10 hp	10-15 hp
AP	672	23.07	74.26	2.67
Bihar	516	98.45	0.97	0.58
Chhattisgarh	384	98.96	0.00	1.04
Gujarat	576	3.47	37.15	59.38
Haryana	320	4.69	40.94	54.37
Karnataka	576	63.19	36.81	0.00
Maharashtra	672	28.42	62.95	8.63
Odisha	480	67.71	30.00	2.29
Rajasthan	574	84.49	4.36	11.15
Sikkim	50	62.00	38.00	0.00
Tamil Nadu	455	32.75	67.25	0.00
UP	527	4.93	54.46	40.61
Uttarakhand	90	41.11	44.44	14.45

Source: GAPL Survey

4.2.18 Irrigation Filters

Clean water is crucial for proper and effective long term operation of micro irrigation systems. Water filtration is important for all irrigation systems. Clogging of nozzles, emitters/drippers reduce the efficiency of the MI system which ultimately results in increase in energy consumption and maintenance as well as cost of irrigation. Filters can help extend the life of, and lower the maintenance on sprinkler system. For drip systems they are a necessity to prevent emitters from becoming plugged. The yield is also affected because of clogging. In drip and sprinkler irrigation, the quality of water being pumped into the irrigation system is the most important factor in filter selection. Filtration may be accomplished through use of filters. They are sand separators, media filter, screen filter, disc filter and settling basin.

Sand separator or hydro cyclone filter is a type of filter that separates the particles from water according to the principle of gravitational settling and centrifugal force. These are effective to remove suspended particles which have specific gravity more than 2.65 g/cc (JISL) and are larger than 75 micron. Such filters are suited for water type where a lot of sand is present in the water as they don't clog up nearly as quickly as other types of filters. The dirty water enters the filter where it is swirled around the inside of a cylinder. These filters are reasonably inexpensive, very simple, and are very effective for removing sand from water.

Screen filters are probably the most common filters and in most case the least expensive and are excellent for removing hard particulates from water, such as sand. They are not so good at removing organic materials such as algae, mold, slime, and other unmentionables! These non-solid materials tend to embed themselves into the screen material from where they are very difficult to remove. In other cases, they simply slide through the holes in the screen by temporarily deforming their shape. Screen filters are cleaned by flushing them with a stream of water or removing the screen and cleaning it by hand.

Media filters clean the water by forcing it through a container filled with a small, sharp edged/granulated media. In most cases, the media material is uniform sized, crushed silica sand. The water passes through the small spaces between the media grains and the debris is stopped when it can't pass through these spaces. Media filters are best for removing organic material from the water. Media filters are the type of filters most commonly used for high volume cleaning of water from rivers and lakes. Disc filters are a cross between a screen filter and a media filter, with many of the advantages of both. Disc filters are good at removing both particulates, like sand, and organic matter. The pertinent information has been summarized in the following table below:

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Table 57: Type of Irrigation Filters Used by Farmers

State	Total Beneficiary	Total Responses	Type of Irrigation Filter/s used by the Farmers (%)											
			Hydro-cyclone Filter	Screen filters	Sand Media Filters	Disc Filters	Hydro-cyclone Filter & Screen filters	Hydro-cyclone Filter & Sand Media Filters	Hydro-cyclone Filter & Disc Filters	Screen filters & Sand Media Filters	Screen filters & Disc Filters	Sand Media Filters & Disc Filters	Hydro-cyclone Filter & Screen filters & Sand Media Filters	Hydro-cyclone Filter & Disc Filters
AP	672	672	0.15	95.83	4.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bihar	516	6	0.00	83.33	0.00	0.00	0.00	0.00	0.00	0.00	16.67	0.00	0.00	0.00
Chhattisgarh	384	156	4.49	31.41	0.00	54.49	0.00	0.00	3.85	0.00	5.77	0.00	0.00	0.00
Gujarat	576	517	22.44	18.76	0.19	19.73	3.48	0.19	23.40	0.19	11.03	0.58	0.00	0.00
Haryana	320	320	1.25	2.19	0.00	0.00	64.69	1.25	0.31	18.75	0.00	0.00	10.94	0.63
Karnataka	576	576	0.35	79.69	4.17	15.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maharashtra	672	670	1.49	84.78	0.75	10.45	0.00	0.00	0.00	0.60	0.30	1.64	0.00	0.00
Odisha	480	480	0.21	94.38	0.21	3.96	0.00	0.00	0.00	1.04	0.21	0.00	0.00	0.00
Rajasthan	574	568	1.41	86.80	10.56	0.00	0.00	0.18	0.00	0.53	0.35	0.18	0.00	0.00
Sikkim	50	50	0.00	98.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tamil Nadu	455	455	0.44	87.25	6.37	5.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UP	527	524	2.48	84.73	0.00	0.00	12.40	0.00	0.00	0.38	0.00	0.00	0.00	0.00
Uttarakhand	90	90	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: GAPL Survey

Different types of filters are mainly used for drip irrigation system whereas its use for sprinkler system is required under very specific water quality characteristics. Some beneficiaries reported that they were using filters in sprinkler systems to check the plugging etc. The beneficiary farmers using drip irrigation system were asked about the type of filters being used by them. It may be seen from the table 58 that farmers are using screen filters, centrifugal separators/ hydro-cyclone filter, disc filter, sand media filters depending on the need.

The data cited in the above table reveal that screen filters are being commonly used by the beneficiaries in most of the sampled states except Haryana where screen filters are being used in combination with hydrocyclone filters. The combined use of filters in Haryana is attributed to the fact that additional subsidy is being given on hydro-cyclone type of filters. In fact, a combination of three filters (hydro-cyclone, screen & sand filter) is also being used by some beneficiaries of Haryana. The use of such combinations may be ascribed to the fact that since, Haryana government is extending financial assistance to construct water storage tanks as such many farmers prefer to store the water in such structures. The incidence of different types of contaminations is higher in the stored water thus farmers are using combination of three types of filters to ensure the removal of all types of organic and inorganic materials. Disc filters are used by about 55 percent farmers of Chhattisgarh followed by Gujarat (20%), Karnataka (16%). About 10 percent of the farmers of Rajasthan followed by 6 percent Tamil Nadu and 4 % from AP are using sand filters may be because they are getting water from canals which has high dirt load of organic and inorganic materials. The size of filter installed with MI system depends on the area being irrigated and the quantum of water being pumped. It has been noted by the field staff that in most of the cases size of filters was appropriate as per the area, soil and water quality characteristics.

4.2.19 Type of Emitters in drip system

There are two categories of emitters usually installed with drip system in the field:

- a) **In-line emitters:** These are used in row crops such as vegetables where water needs to be applied effectively near the root zone area.
- b) **On-line emitters:** These are suitable to orchard crops such as apples, mangoes etc. These drippers are fixed on the laterals and can be opened for cleaning. It provides uniform water distribution in the root zone. The drippers may clog with physical impurities like minerals & salts and also due to poor maintenance. Further, rodents and insects can damage lateral pipes of the drip irrigation system.

Drip irrigation system left above the ground tends to clog less as in underground system chances of deposition of algae and soil particles is high. It is also easy to lift while

preparing the fields for seed sowing or transplantation of seedlings. Use of plastic mulch in conjunction with drip irrigation system has been reported to be more beneficial in saving water and improving the crop yields. It was assessed during the course of study whether the sampled beneficiaries were using in-line or on-line drip system; the pertinent data on type of emitters are cited in the following table.

Table 58: Type of Emitters Used by Beneficiaries

State	Total Responses	Inline	Online	in %	
				Inline	Online
AP	512	414	98	80.86	19.14
Bihar	6	4	2	66.67	33.33
Chhattisgarh	153	98	55	64.05	35.95
Gujarat	450	344	106	76.44	23.56
Haryana	236	128	102	54.24	45.76
Karnataka	575	359	216	62.43	37.57
Maharashtra	577	366	211	63.43	36.57
Odisha	118	84	34	71.19	28.81
Rajasthan	118	79	39	66.95	33.05
Sikkim	45	34	11	75.56	24.44
Tamil Nadu	384	256	128	66.67	33.33
UP	322	220	102	68.32	31.68
Uttarakhand	30	12	18	40.00	60.00

Source: GAPL Survey

It may be seen from the above table that more than 70 percent of the respondent farmers of AP, Gujarat, Sikkim and Odisha were using in-line drip irrigation system, whereas, more than 45 percent beneficiaries of Haryana and Uttarakhand reported to practice on-line drip irrigation system.

4.2.20 Type of Sprinkler

Under sprinkler irrigation, water is sprinkled under pressure on to the crop through a set of nozzles attached to network of pipes in the form of rainfall. The sprinkler system sets, unlike drip system are moveable. Hence one sprinkler set could cover more than one hectare by shifting from one place to another. Assistance for sprinkler irrigation is limited to only those crops where drip irrigation is uneconomical.

Table 59: Type of Sprinklers Used by Beneficiaries

State	Total Responses	Percentage		
		Portable	Mini/Micro	Rain gun
AP	160	20.72	79.28	0.00
Bihar	510	94.71	5.29	0.00
Chhattisgarh	231	77.45	22.51	0.00
Gujarat	126	88.10	11.11	0.79
Haryana	84	95.24	4.76	0.00
Karnataka	87	32.18	66.67	1.14
Maharashtra	95	93.68	6.32	0.00
Odisha	362	96.13	3.87	0.00
Rajasthan	356	75.56	24.44	0.00
Sikkim	10	80.00	20.00	0.00
Tamil Nadu	71	97.18	2.82	0.00
UP	205	97.07	2.93	0.00
Uttarakhand	60	88.33	11.67	0.00

Source: GAPL Survey

It may be seen from the above table that majority of the beneficiaries of Tamil Nadu, Rajasthan, Odisha, Bihar, Maharashtra, Gujarat and Uttarakhand states were using portable sprinkler irrigation system. The use of rain gun was reported by one farmer only in Gujarat as it is most suitable to the large area under cultivation. It is noted to be appropriate type of sprinkler system for larger areas as it can rotate 30 to 360 circle covering 25 meter radius with a discharge rate 1.75 lps.

4.2.21 Farmers' opinion on System Supply and Installation related constraints

The farmers were asked to reveal the difficulties faced by them right from the filing of application till receiving the after sales service, including procedures, quality of the systems supplied, prices charged by empanelled system suppliers, delay in installation after the placement of orders and any additional charges claimed by the supplies. The response of the beneficiaries has been summarized in the table below.

Table 60: Constraints Faced by Beneficiary Farmers (%)

State	Total Beneficiaries	Procedure Related		Quality Issues		Higher Prices Charged under Scheme then Available in Market		Delay in System Supply (Committed date vs. Actual date)		Other Charges (Not covered in the scheme/ additional money paid)	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
AP	672	0.00	100.00	0.60	99.40	0.60	99.40	0.60	99.40	0.15	99.85
Bihar	516	0.78	99.22	1.55	98.45	1.55	98.45	2.52	97.48	7.17	92.83
Chhattisgarh	384	0.26	99.74	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Gujarat	576	2.5	97.5	3.13	96.88	1.91	98.09	2.78	97.22	1.39	98.61
Haryana	320	0.94	99.06	0.94	99.06	0.63	99.38	2.81	97.19	0.00	100.00
Karnataka	576	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
Maharashtra	672	0.30	99.70	0.89	99.11	0.74	99.26	1.04	98.96	0.74	99.26
Odisha	480	0.00	100.00	0.00	100.00	0.00	100.00	4.79	95.21	0.21	99.79
Rajasthan	574	13.59	86.41	8.54	91.46	10.45	89.55	10.45	89.55	10.45	89.55
Sikkim	50	0.00	100.00	2.00	98.00	0.00	100.00	0.00	100.00	0.00	100.00
Tamil Nadu	455	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00
UP	527	1.52	98.48	2.09	97.91	1.14	98.86	2.85	97.15	0.19	99.81
Uttarakhand	90	35.56	64.44	38.89	61.11	54.44	45.56	35.56	64.44	8.89	91.11
Total	5892	2.33	97.67	2.29	97.71	2.46	97.54	3.04	96.96	2.05	97.95

Source: GAPL Survey

It is evident from the data that in most of the sample states, beneficiaries did not face much of the difficulties related to the procedures, quality, prices, delay in system installation etc.

4.2.22 After Sales Service

The information on magnitude and quality of after sales services being provided by the suppliers has been summarized in table 61. On an average, 91 percent of the beneficiaries across the sampled states reported that after sales services are being provided to them. However, about 34 percent beneficiaries from Bihar and 22 percent beneficiaries from Gujarat & Maharashtra each informed that they did not receive the after sales services. As for the timely and regular availability of after sales services is concerned, about 87 percent beneficiaries reported that they receive the services at the required time.

Table 61: Status Reported by Beneficiaries Regarding ‘After Sales Services’

State	Total Beneficiary	Provided by the vendor (%)		If yes then (%)		
		Yes	No	Timely	Late	Irregular
AP	672	100.00	0.00	80.51	19.49	0.00
Bihar	516	65.70	34.30	83.78	15.63	0.59
Chhattisgarh	384	100.00	0.00	100.00	0.00	0.00
Gujarat	576	77.78	22.22	89.73	5.58	4.69
Haryana	320	100.00	0.00	91.56	4.38	4.06
Karnataka	576	98.96	1.04	90.45	9.20	0.35
Maharashtra	672	77.68	22.32	78.54	18.97	2.49
Odisha	480	92.29	7.71	88.71	8.80	2.48
Rajasthan	574	95.82	4.18	93.27	6.18	0.55
Sikkim	50	100.00	0.00	98.00	2.00	0.00
Tamil Nadu	455	98.90	1.10	88.13	11.87	0.00
UP	527	97.72	2.28	88.54	11.26	0.19
Uttarakhand	90	100.00	0.00	20.00	22.22	57.78
Total	5892	90.85	9.15	86.97	10.83	2.20

Source: GAPL Survey

The respondents were further enquired regarding the level of satisfaction with respect to after sale services and their responses are given in the Figure 8. It is well evident that on an average, 87 percent of the beneficiaries across the entire 13 states received the after sales services to their complete satisfaction.

During the course of field survey, the respondents were asked whether this system supplier have given after sale service for the MI system installed at their farms. The results regarding this issue have been summarized in above table. It may be seen from the table that the farmers of Chhattisgarh, AP, Sikkim and Uttarakhand have reported that 100 percent after sale service was provided to them whereas two-third of the farmers reported regarding after sale service. The farmers of the most of the states have got the benefit of this service.

It is suggested that the implementing agencies should be more vigilant regarding warranty and after sales service of the system provided by the suppliers. The question of releasing 10 percent of the cost of the system after one year subject to satisfactory performance of the system as certified by the beneficiary may be considered. Maintenance manual in vernacular language should be made available to the beneficiaries at the time of installation of the system.

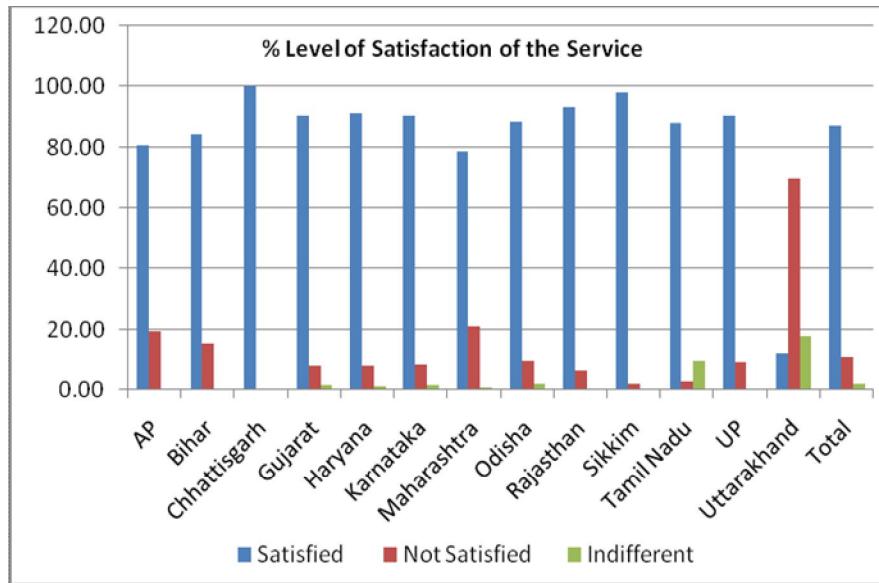


Figure 8: Level of Satisfaction regarding ‘After Sale Services’

Source: GAPL Survey

4.2.23 Warranty

As per the norms of NMMI, the system suppliers are supposed to extend warranty to the beneficiaries regarding MI system installed at their farms. In this regard the beneficiaries were asked regarding issue of warranty to them and their replies are summarized in table 62.

Table 62: Status of Warranty for MI System (%)

State	Total Beneficiary	Warranty (%)		If yes then (%)				
		Yes	No	<6 Months	1 Yr	1-2 Yr	2-3 Yr	>3 Yr
AP	672	100.00	0.00	0.00	1.04	5.65	65.33	27.98
Bihar	516	35.27	64.73	0.00	1.65	2.75	57.69	37.91
Chhattisgarh	384	99.48	0.52	0.00	0.00	0.52	8.90	90.58
Gujarat	576	99.48	0.52	0.00	0.17	0.35	0.70	98.78
Haryana	320	100.00	0.00	0.00	0.00	0.31	99.69	0.00
Karnataka	576	100.00	0.00	0.00	0.17	0.87	89.06	9.90
Maharashtra	672	100.00	0.00	0.00	2.38	4.91	35.57	57.14
Odisha	480	100.00	0.00	0.00	0.21	1.67	20.42	77.71
Rajasthan	574	100.00	0.00	0.00	0.87	31.01	9.76	58.36
Sikkim	50	100.00	0.00	0.00	90.00	0.00	8.00	2.00
Tamil Nadu	455	100.00	0.00	0.00	0.22	0.44	77.36	21.98
UP	527	99.81	0.19	0.00	0.19	6.46	84.22	9.13
Uttarakhand	90	100.00	0.00	6.67	35.56	16.67	41.11	0.00

Source: GAPL Survey

It may be seen from the above table that the beneficiaries of all the states under study have reported that they have got the warranty as per the requirement except for Bihar

were majority of the farmers reported that they did not get this benefit . The farmers were further asked the duration of the warranty issue to them by the company. Almost all the farmers of Chhattisgarh and Gujarat have reported that they received this facility for three years and the farmers of other state reported that they got warranty for their system for less than two years.

It is important that system suppliers should give two years warranty as per the guidelines of the scheme and it is proposed that in order to enforce this clause 5 percent subsidy may be released after the completion of warranty period.

4.2.24 Promotional Activities

NMMI agencies are promoting the adoption of micro irrigation and its benefits to the growers' awareness through various promotional tools such as publicity through newspapers, radios, TV, and other sources which are summarized in the following table:

Table 63: Awareness about Promotional Activities (%)

State	Total Beneficiary	Publicity of the MI Scheme in local language		Awareness of the dedicated website for MI Scheme in the State		Awareness of the package of practices being adopted for MI	
		Yes	No	Yes	No	Yes	No
AP	672	98.66	1.34	92.26	7.74	99.40	0.60
Bihar	516	91.28	8.72	0.00	100.00	97.29	2.71
Chhattisgarh	384	99.48	0.52	94.53	5.47	98.44	2.08
Gujarat	576	76.04	23.96	71.18	28.82	88.54	11.46
Haryana	320	97.19	2.81	66.88	33.13	96.56	3.44
Karnataka	576	99.65	0.35	25.87	74.13	99.65	0.35
Maharashtra	672	96.28	3.72	90.03	9.97	99.40	0.60
Odisha	480	98.13	1.88	0.83	99.17	99.17	0.83
Rajasthan	574	98.26	1.74	6.45	93.55	93.03	6.97
Sikkim	50	100.00	0.00	2.00	98.00	98.00	2.00
Tamil Nadu	455	100.00	0.00	98.68	1.32	99.56	0.44
UP	527	82.35	17.65	26.94	73.06	91.27	8.73
Uttarakhand	90	94.44	5.56	80.00	20.00	84.44	15.56
Total	5892	94.11	5.89	52.04	47.96	96.37	3.67

Source: GAPL Survey

It may be seen from the above table that the farmers of the majority of the states that the implement agencies are promoting NMMI schemes in local language and almost 100 percent results were observed in Tamil Nadu, Sikkim , Odisha , Rajasthan, Chhattisgarh, Karnataka and Maharashtra. It is interesting to note that awareness of the dedicated website for MI scheme was limited.

The beneficiaries were further asked whether they are aware of the package and practices being adopted for MI and the response were found to be very positive. This reveals that the beneficiaries who have installed micro irrigation in their farm are aware of the package and practices to be followed for taking full advantage of the MI system supported cultivation.

4.3 Observations of Field Staff on MI System

In addition to farmers' investigation, the field survey team also visited the fields to observe the design and working of the system. The field investigators have highlighted their observations regarding the condition of the MI system, overall designing of the system installed, and general conditions of the field. The results regarding the observations of the field staffs are given in the following table below:

Table 64: Observations of Surveyors regarding MI System Status at the Time of Field Visit

State	Overall Design			Drip/ Sprinkle MI System match crop requirement		General Condition of the System			Flood Irrigation along with MI System	
	Design (%)			()		System Condition (%)			()	
	Good	Satisfactory	Bad	Yes	No	Good	Average	Bad	Yes	No
AP	59.82	40.18	0	97.77	2.23	57.59	42.26	0.15	62.05	37.95
Bihar	62.98	37.02	0	77.91	22.09	49.42	50.19	0.39	75.58	24.42
Chhattisgarh	77.60	22.40	0	97.92	2.08	71.88	28.13	0	98.44	1.56
Gujarat	68.92	30.38	0.69	96.88	3.13	60.94	37.85	1.22	52.78	47.22
Haryana	96.56	3.44	0	100.00	0	98.75	1.25	0	97.81	2.19
Karnataka	55.38	44.62	0	99.83	0.17	54.17	45.83	0	80.90	19.10
Maharashtra	66.37	33.63	0	98.81	1.19	55.36	43.60	1.04	49.70	50.30
Odisha	49.17	50.83	0	96.25	3.75	65.00	34.79	0.21	78.13	21.88
Rajasthan	88.33	11.67	0	91.46	8.54	76.48	23.52	0	81.53	18.47
Sikkim	36.00	64.00	0	100.00	0	66.00	34.00	0	66.00	34.00
Tamil Nadu	55.82	44.18	0	99.12	0.88	45.49	54.51	0	80.44	19.56
UP	73.81	25.81	0.38	97.91	2.09	51.42	48.01	0.57	88.61	11.39
Uttarakhand	96.67	3.33	0	92.22	7.78	85.56	14.44	0	95.56	4.44
Total	67.67	32.23	0.10	95.71	4.29	61.24	38.41	0.36	74.63	25.37

Source: GAPL Survey

It may be seen from the above table that in almost all the states under study, the overall designing of the system was found to be satisfactory. Majority of the field staff observed that system designs met the farmers' requirements, however in the state of Bihar only about 78 percent of the MI Systems were designed which could meet the crop requirements. Remaining 22 percent of the systems have not been designed perfectly which could meet the water requirements of different crops. It has also been observed by

the field investigators that some of the farmers have adopted innovative plant management techniques especially high density plantation in fruit crops and intercropping.

In almost all the states, the sampled beneficiaries also revealed that no technical support/guidance on agronomic practices are extended to the users by MI system suppliers as they generally tell the beneficiaries to take the help of extension agencies.

It was also observed that most of the beneficiary farmers have been using both the techniques of water application that is flood and the micro irrigation.

4.4 Assessment of the System Design

Selection of MI Companies participating in NMMI at State level are based on the following parameters:

- a. Manufacturing capacities of various equipment
- b. Financial strength of the company
- c. Dealer network
- d. Working experience in projects
- e. Availability of technical manpower

At the time of registration of the manufacturers, it is mandatory that the quality of the system should be of BIS standards and the design must meet the requirements of the farmers in terms of its suitability to crops and field situations. The conditions for providing after sale service and the warranty of the system are also laid at the time of registration. To validate these parameters, the beneficiaries were inquired regarding such issues and their responses are summarized in the table 65.

The data indicate that the farmers in almost all the states reported that components of MI System met the BIS norms. The average figure for all the sample states where system components were as per the BIS norms came out to be around 98 percent. There is a need that variations reported in terms of not having BIS components as per NMMI guidelines may be brought to the notice of respective implementing agencies for further necessary action. In more than 95 percent cases, size of pumps was reported to be as per crop water & plot size requirements except for the state of Bihar where around 18 percent respondents gave a negative reply.

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Table 65: Assessment of the System Design (%)

State	Total Beneficiary	System components supplied are as per the BIS		Pump size is proper to the field/ plot size w.r.t crop water requirements.		MI system meets requirements		Design layout is as per project proposal		After sales service has been provided by the MI system suppliers		MI systems found to be functional in the field	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
AP	672	99.70	0.30	99.55	0.45	99.55	0.45	99.70	0.30	99.40	0.60	99.26	0.74
Bihar	516	94.76	5.24	82.17	17.83	98.45	1.55	87.40	10.47	63.37	36.63	68.80	31.20
Chhattisgarh	384	99.74	0.26	100.00	0.00	99.74	0.26	100.00	0.00	73.96	26.04	75.52	24.48
Gujarat	576	97.22	2.78	98.61	1.39	96.35	3.65	96.18	3.65	95.20	4.80	94.27	5.73
Haryana	320	100.00	-	99.38	0.63	98.75	1.25	100.00	0.00	93.75	6.25	92.81	7.19
Karnataka	576	100.00	-	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	95.49	4.51
Maharashtra	672	97.32	2.68	99.70	0.30	99.85	0.15	97.17	2.83	78.42	21.58	98.21	1.79
Odisha	480	98.96	1.04	99.58	0.42	99.58	0.42	98.96	1.04	86.46	13.54	66.67	33.33
Rajasthan	574	95.99	4.00	94.25	5.75	90.77	9.23	94.08	6.10	91.81	8.36	87.98	12.02
Sikkim	50	96.00	4.00	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	90.00	10.00
Tamil Nadu	455	100.00	-	100.00	0.00	100.00	0.00	100.00	0.00	100.00	0.00	90.55	9.45
UP	527	95.26	4.74	99.62	0.38	98.29	1.71	99.43	0.57	97.91	2.09	66.03	14.99
Uttarakhand	90	97.78	2.22	87.78	12.22	72.22	27.78	92.22	7.78	48.89	51.11	82.22	17.78

Source: GAPL Survey

It was also observed by the field investigators that more than 15 percent reported that the MI system were non-functional in Bihar, Chhattisgarh, Odisha & Uttarakhand due to crop season and fear of theft & damage from rodents.

It was found that standard designs as regards spacing, layout etc. have been used in almost all the cases without any variation taking into account the shape, size, water quality, soil conditions etc. On an average 98 percent of the farmers reported that MI System installed in their fields meet their requirements however, around 28 percent of the farmers in Uttarakhand responded that systems has not been installed as per their requirements. Almost 100 percent of the beneficiaries reported that the system design layout is as per project proposal except farmers of Bihar where 10 percent farmers reported that system has not been laid out as per the design in the project proposal.

In the states of Bihar, Chhattisgarh & Uttarakhand the beneficiaries about 40-50 percent of the beneficiaries reported that they are not being provided after sales service.

4.5 System Suppliers

The global micro irrigation systems market is one of the fastest growing segments of agriculture sector. The growth of this market is fueled by the government initiatives for adoption of micro irrigation systems in order to conserve water for optimum use. The growth of micro irrigation systems is particularly higher in Asia Pacific and Africa due to the increased problems of water scarcity, and farmer awareness towards increasing the crop yield with the help of micro irrigation systems. India and China are expected to drive growth in the global micro-irrigation systems market, which is seen reaching \$4.8 billion by 2018 at a CAGR of 18 per cent from 2012 to 2018. Out of the total 69.5 million hectares (42.5 million ha sprinkler and 27 million ha drip) of cultivated area in India, only 5.71 percent of the area is under drip and sprinkler irrigation. This represents strong potential for the growth of micro irrigation systems in this region⁶.

This low penetration offers growth opportunities in future. All the benefits provided by the micro irrigation systems over flood irrigation, coupled with the governmental initiatives to increase the MI system penetration are responsible for the MIS growth in India. Also all such drivers are likely to help the market to grow in future as well.

⁶As per Indian Taskforce Report of 2004

After initial scrutiny, a committee consisting of experts examines the facilities at manufacturing site for verification of establishment details. The list of the registered system suppliers is given below in table:

Table 66: State Wise List of Registered MI System Suppliers

S.No	State Name	Suppliers Name
1	Andhra Pradesh	M/s EPC Industries Ltd. (A Mahindra Group of Company)
		M/s Jain Irrigation Systems Ltd.
		M/s Premier Irrigation Equipment Ltd.
		M/s Rungta Irrigation Ltd.
		M/s Greenfield Irrigation Ltd.
		M/s Sudhakar Plastic Ltd.
		M/s Nagarjuna Palma India Ltd.
		M/s Kumar Enterprises
		M/s Nandi Plasticisers Ltd
		M/s Godavari Polymers Pvt. Ltd
		M/s Haritha Irrigation Products Pvt. Ltd
		M/s Netafem Irrigation India Pvt. Ltd.
		M/s Megha Agrotech Private Ltd.
		M/s Satya Sai Polymers
2	Bihar	M/s Jain Irrigation Systems Ltd.
		M/s EPC Industries Ltd. (A Mahindra Group of Company)
		M/s Aaram Plastics Pvt Ltd
		M/s Sai Irrigation
		M/s Kishan Enterprise
		M/s Venkatesh Irrigation
		M/s Premier Irrigation Adritec Pvt Ltd
3	Chhattisgarh	M/s Netafim Irrigation India Pvt. Ltd.
		M/s Paras Drip Irrigation
		M/s Jain Irrigation Systems Ltd
4	Gujarat	M/s Dutron Polymers Ltd.
		M/s Harvel Agua India Pvt. Ltd.
		M/s Jain Irrigation Systems Ltd.
		M/s Netafim Irrigation India Pvt. Ltd.
		M/s Paragon Synthetics & Polymers Ltd.
		M/s Parixit Industries Limited
		M/s EPC Industries Ltd. (A Mahindra Group of Company)
		M/s Plastro Plasson Industries (I) Ltd.
		M/s Captain Irrigation System
		M/s Finolex Plasson Industries Pvt Ltd
		M/s Kothari Industries
		M/s Premier Irrigation Adritec Private Ltd.
5	Haryana	M/s Jain Irrigation Systems Ltd.
		M/s Netafim Irrigation India Pvt. Ltd.

		M/s Balaji Agro-Systems Pvt. Ltd M/s Ajay Industrial CorporationLtd M/s Apollo Pipes Ltd. M/s Pioneer Plastics Industries Ltd M/s Rungta Irrigation Ltd M/s Nagarjuna fertilizers and chemicals limited M/s Harwel Agro India Limited M/s Finolex Plastic India Ltd M/s Vindhya Pipes & plastics Ltd M/s Rungta Irrigation Ltd M/s Nirmal Polyfab Pvt. Ltd
6	Karnataka	M/s Finolex Plasson Industries Ltd M/s Metro Drip Irrigation (P) Limited M/s EPC Industries Ltd. (A Mahindra Group of Company) M/s Megha Agro Tech Pvt Ltd M/s Pioneer Plastic Industries Ltd M/s Jain Irrigation Systems Ltd. M/s Agroplast, Karnataka
7	Maharashtra	M/s Alphaplast Irrigation System M/s Aquaguard Plastics And Polymers M/s Datta Irrigation Company M/s Donga Watertech M/s Drip India M/s EPC Industries Ltd. (A Mahindra Group of Company) M/s Finolex Plasson Industries Ltd M/s Godavari Polymers M/s Greengold Irrigation M/s Jain Irrigation Systems Ltd. M/s Jaldhara Drip Irrigation Pvt Ltd M/s Kothari Agritech Pvt Ltd M/s Mohak Agro Industries M/s Nagarjuna fertilizers and chemicals limited M/s Neer Irrigation M/s Netafim Irrigation India Pvt Ltd M/s Nimbus Pipes Ltd M/s Paras Drip Irrigation
		M/s Jain irrigation system Ltd M/s Netafim Irrigation India Pvt. Ltd. M/s Premier Irrigation Adritec Pvt. Ltd M/s Rungta Irrigation Ltd M/s Oasis Irrigation Equipment Co. Ltd M/s Nagarjuna Fertilizers & Chemicals Limited M/s Sujay Irrigation Pvt. Ltd M/s Finolex Plasson Industries Pvt Ltd M/s Kirti Industries (India) Ltd M/s Relpol Plastic Products Ltd
9	Rajasthan	M/s Netafim Irrigation India Pvt. Ltd.

		M/s Khushboo Polymers Pvt. Ltd M/s Shree Irrigation Systems P Ltd M/s Excellent Irrigation P Ltd M/s EPC Industries Ltd. (A Mahindra Group of Company) M/s Purma Plast Ltd M/s Jamna Industries M/s Dinesh Irrigation P Ltd M/s Aaram Plastic Pvt Ltd M/s Jain irrigation system Ltd
10	Sikkim	M/s Jain Irrigation Systems Ltd M/s Netafim Irrigation India Pvt. Ltd.
11	Tamil Nadu	M/s Agro Plast M/s AGS Irrigation (P) Ltd M/s Alpha Irritech Pvt Ltd M/s EPC Industries Ltd. (A Mahindra Group of Company) M/s Elgi Ultra Industries Ltd M/s Finolex Plasson Industries Ltd M/s Jain Irrigation Systems Ltd M/s Krishi Irrigation Pvt Ltd M/s Mega Agrotech Pvt Ltd M/s Netafim Irrigation India Pvt. Ltd. M/s Parixit Industries Limited M/s Pragati Irrigation Systems Pvt Ltd M/s Premier Irrigation Adritec Pvt Ltd M/s Rungta Irrigation Ltd M/s Sujay Irrigation Private Limited
12	Uttar Pradesh	M/s Jain irrigation system Ltd M/s Nagarjuna fertilizers and chemicals limited M/s Sterling Irrigation Ltd M/s EPC Industries Ltd. (A Mahindra Group of Company) M/s Netafim Irrigation India Pvt. Ltd.
13	Uttarakhand	M/s Jain Irrigation Systems Ltd. M/s Netafim Irrigation India Pvt. Ltd. M/s Harvel Agua India Pvt. Ltd. M/s Pioneer Plastics Industries Ltd M/s Premier Irrigation Adritec Private Ltd.

The success of the micro irrigation system is solely dependent on the quality of material used and after sale service. Therefore, the NMMI guidelines have given due consideration to this very component and have made it mandatory to register the system manufacturers and the same is done by State Micro Irrigation Committee (SMIC). Only those manufacturing companies which insure the quality of the product as per BIS and can promptly provide after sale service are registered for three years. The registered company need to declare the technical details of the components proposed to be supplied and which would be verified by the technical committee. Further, frequent surveillance by

inspection team comprising from NCPAH /PFDC, CIPET, Irrigation Association of India is necessary.

The Manufacturers have to insure the network for providing after sale services in their area of operation. They have to further provide operation and maintenance manuals in vernacular language at the time of installation. They should also have the facilities to provide technical guidance on agronomic practices, system maintenance schedules, spare parts, warranty etc. Free after sale service shall be provided by manufacture or authorized distributors for at least three years.

It has been observed almost all the states that the material supplied to the farmers/beneficiaries is of BIS and also gives warranty for three years. However, during the course of the investigation it was reported by beneficiaries that the after sale service is provided only in the initial phase and simple instructions are given for using the system. No technical support/ guidance on agronomic practices are extended to the users as they generally tell the beneficiaries to take the help of extension agencies.

The distributors /dealers operating in various sampled states reported that they get the subsidy within 15-20 days of applying but sometime they face the delay in release of subsidy due to non-availability of funds under scheme at district/ state level. Further they also reported that due to delay in trial run/ inspection also leads to delay in release of the subsidy. It is suggested that it would be better if subsidy is directly passed on to the beneficiaries to expedite the release/ disbursement of subsidy under the scheme.

5 Impact Evaluation

A number of studies have been conducted to assess the impact of micro irrigation particularly that of drip which have shown encouraging results of farm variables. It has also helped in bringing crop diversification from rain fed crops to horticulture crops and have also brought cultivable wastelands under high value such as horticulture crops reduction in cost of production, higher yield etc. The impact of the scheme on various parameters detailed below has been evaluated to arrive at conclusion about achievement of the scheme objectives as well as general benefit to the agricultural economy of the country. Some sequences are in following paragraphs:

1. Area Expansion under MI and additional area irrigated by installing MI in place of conventional irrigation and waste/ marginal land development with the same amount of water
2. Savings in labor, fertilizers and electricity thereby reducing cost of cultivation
3. Study of productivity enhancement for various crops
4. Whether the adoption of MI has given rise to crop diversification, adoption of high value crops etc.
5. Innovative crop management techniques facilitated through adoption of MI which are canopy management, high density plantation, inter cropping etc.
6. Contribution of MI towards National food security

5.1 Crop Diversification

Crop diversification in India is generally viewed as a shift from traditionally grown crops to more remunerative crops. With the advent of modern agricultural technology, especially during the period of the Green Revolution in the late sixties and early seventies, there is a continuous surge for diversified agriculture in terms of crops, primarily on economic considerations.

Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to minimize risk. The survey has measured impact of installation of MI systems on crop diversification. The result of the beneficiaries' responses is summarised in the following table:

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Table 67: Impact on Crop Diversification and Usage of Marginal and Degraded Land by Beneficiary's data

S.No	State	Total cultivable area (Ha)	Horticulture Crop Area (Ha)			Field crop Area (Ha)			Marginal/ degraded Land (Waste Land) (Ha)		
			Area Before MI	Area After MI	% Change in Area	Area Before MI	Area After MI	% Change in Area	Area Before MI	Area after MI	% Change in area
1	AP	1491.22	393.88	880.38	123.51	689.32	595.50	-13.61	169.53	15.34	-90.95
2	Bihar	1407.42	379.89	540.02	42.15	956.41	866.19	-9.43	2.02	1.21	-40.00
3	Chhattisgarh	584.06	87.19	334.95	284.15	465.02	242.11	-47.94	10.16	7.00	-31.08
4	Gujarat	1676.39	320.40	441.31	37.73	1229.83	1200.72	-2.37	83.73	34.36	-58.97
5	Haryana	1359.90	196.28	649.72	231.02	1336.13	710.18	-46.85	7.69	0.00	-100.00
6	Karnataka	1110.46	685.71	858.18	25.15	349.08	234.47	-32.83	25.70	17.81	-30.71
7	Maharashtra	1336.67	173.84	433.04	149.10	962.25	824.88	-14.28	226.59	78.75	-65.24
8	Odisha	1413.09	581.79	921.07	58.32	762.76	444.35	-41.74	76.57	47.67	-37.74
9	Rajasthan	1623.65	656.43	1020.36	55.44	838.81	525.39	-37.36	164.10	77.90	-52.53
10	Sikkim	73.27	61.49	66.39	7.97	10.20	5.87	-42.46	1.01	1.01	0.00
11	Tamil Nadu	764.88	448.87	531.42	18.39	328.62	233.06	-29.08	2.99	0.40	-86.49
12	UP	1646.62	230.78	792.51	243.41	1342.78	852.49	-36.51	29.42	1.62	-94.50
13	Uttarakhand	322.95	90.75	92.78	2.23	187.07	187.27	0.11	45.73	42.90	-6.19

Source: GAPL Survey

It may be observed from above table that the farmers of all the states have shown increase in area under horticulture crops after the adoption of the system. The highest increase has been observed in Haryana followed by Chhattisgarh, UP, Maharashtra and AP whereas the lowest in case of Uttarakhand and Sikkim, which may be because of the reason that both the states have proportionately higher area under horticulture crops.

5.2 Area Expansion under Micro Irrigation

The Gol MI scheme has succeeded in bringing around 38.12 lakh ha under micro irrigation with total subsidy amounting to Rs. 5468.01 crores since the launch of the scheme in 2005-06 in India. This represents about 2.57% of the total cultivated area in the country and 5.69% of the total irrigated area of the country. The area expansion under MI system in the country has grown at 36%, 23% and 18% respectively for last three years (as per official records). Eventually, the growth trend is quite impressive, yet overall proportion of land under MI is quite low and as such more efforts such as creating awareness among the farmers through electronic and print media, exhibition fares, PRIs etc. need to be initiated to bring the significant area under MI.

5.3 Increase in Irrigated Area due to Water Saving

Drip irrigation is being practiced in the different parts of the country since 80s to improve the water use efficiency, water savings and productivity enhancement. Through the saving of water due to adoption of MI technologies, it is possible for beneficiaries to increase the area under cultivation by way of efficient use of water. In order to understand that how much additional area has been brought under irrigation, the irrigated area before and after installation of MI was taken into consideration (Table 68). In order to have better comprehension of area increased due to MI, the percent increase in different schemes was given a graphical shape (Figure 9). After adoption of MI system, sampled beneficiaries were able to bring their irrigated area under irrigation from same source of water, which otherwise was not being utilized for cultivation due to limited availability of water. The Irrigated area within the 5892 sampled beneficiaries of the 13 states before adoption of MI system was found to be 13320.86 ha which 14441.47 became ha after adoption of MI system. It is therefore concluded that total percentage increase in irrigated area with the sampled beneficiaries in 13 states after adoption of MI system was noted to be 8.41%.

Table 68: Increase reported by Beneficiaries in Irrigated Area (ha) after Installation of MI System

State	Total Irrigated Area before installation of Micro Irrigation system (ha)	Total Irrigated Area after installation of Micro Irrigation system (ha)	% increase in irrigated Area
AP	1013.43	1139.41	12.43
Bihar	2296.56	2368.02	3.11
Chhattisgarh	494.74	571.96	15.61
Gujarat	1358.91	1550.07	14.07
Haryana	1233.68	1362.63	10.45
Karnataka	1038.05	1064.92	2.59
Maharashtra	1025.51	1254.00	22.28
Odisha	1241.89	1383.10	11.37
Rajasthan	1005.77	1078.50	7.23
Sikkim	60.40	60.81	0.67
Tamil Nadu	709.56	741.16	4.45
Uttar Pradesh	1583.70	1604.15	1.29
Uttarakhand	258.62	262.75	1.60
Grand Total	13320.86	14441.47	8.41

Source: GAPL Survey

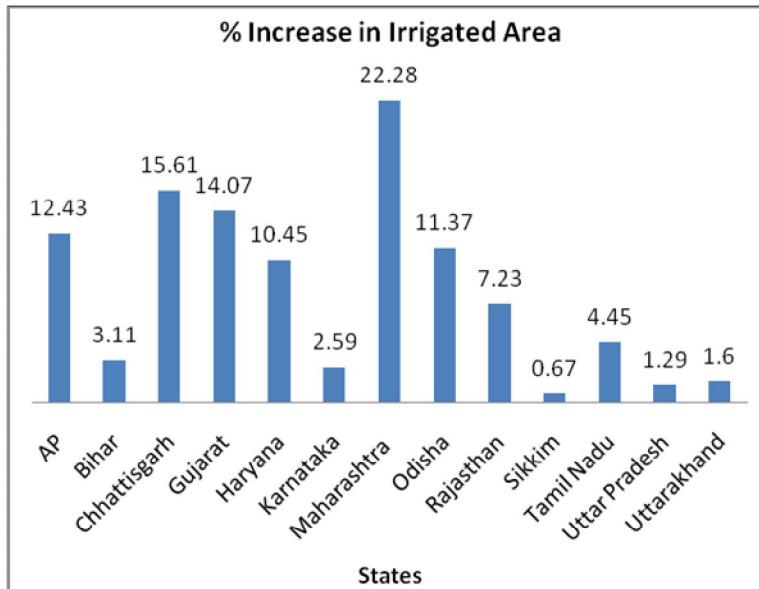


Figure 9: Increase in Irrigated Area (%) among Beneficiaries after Adoption of MI

5.4 Development of marginal and wasteland by beneficiaries

Degraded land which can be brought under vegetative cover, with reasonable effort, and which is currently under-utilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. The total cultivable waste land in the country at present is about 12.83 million hectares.

Based on the feedback received from the sampled beneficiaries, it was observed that during survey in the sampled states, beneficiaries sampled farmers were able to convert

their marginal & rainfed land into cultivable land due to efficient use of water resources available with them. In 13 surveyed states, 5892 sampled farmers holding 14810.58 hectares of land reveals that around 845.40 ha of land was not being used for cultivation as they were either waste or degraded land. Farmers reported that after adoption of MI system they were able to bring around 519.43 ha of land under cultivation. The data reveals that adoption of MI system has helped the sampled beneficiaries in bringing around 3.71% of land under cultivation. Maximum and minimum area conversion with the beneficiaries was noted in Andhra Pradesh and Sikkim respectively.

Table 69: Marginal/ Degraded Land brought under Cultivation after Installation of MI System by Beneficiaries

States	Total no. of Sampled Beneficiaries	Total area of Sampled beneficiaries (Ha)	No. of sampled farmer with waste/degraded	Area under waste/degraded land before NMMI (ha)	Converted area after adoption of NMMI (ha)
AP	672	1491.22	242	169.53	154.19
Bihar	516	1407.42	2	2.02	0.81
Chhattisgarh	384	584.06	8	10.16	3.18
Gujarat	576	1676.39	57	83.74	49.39
Haryana	320	1359.9	2	7.69	7.69
Karnataka	576	1110.46	11	25.72	7.89
Maharashtra	672	1336.67	126	226.66	147.91
Odisha	480	1413.09	70	76.60	28.93
Rajasthan	574	1623.65	39	164.10	86.20
Sikkim	50	73.27	4	1.01	0.00
UP	527	764.88	32	29.42	27.80
Uttarakhand	90	1646.62	46	45.75	2.84
Tamil Nadu	455	322.95	10	3.00	2.60
Total	5892	14810.58	649	845.40	519.43

Source: GAPL Survey

5.5 Dripper spacing

The dripper spacing is important as it accommodates higher plant population, resulting more number of fruits which increases total yield and net returns. It is also a factor to commensurate water requirement and root zone of the plant. However, wide dripper spacing saves more water, total irrigation time, minimized the diseases and weeds incidence as compared to closer dripper spacing in each years. The recommended spacing for different crops under Micro Irrigation system has been presented in the following tables below. During the course of field survey, the beneficiary farmers were asked to specify the spacing of the crops they are following. The responses of the farmers are given in the table 70 & 71 for different crops in sampled states.

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Table 70: Spacing followed by Sampled Beneficiaries for Fruit Crops (m)

S.No	State	Fruits												
		Banana	Lemon	Mango	Papaya	Watermelon	Orange	Litchi	Guava	Pomegranate	Grapes	Coconut	Cashewnut	Aonla
1	AP	1.5 * 1.5	5*5	9*9	1.8*1.8		6*6							
2	Bihar			10*10				5*5						
3	Chhattisgarh				1.8*1.8	1.5*0.6								
4	Gujarat	1.8*1.8			1.8*1.8									
5	Haryana					0.4*0.4			10*10			8*8		
6	Karnataka	2*2		8*8	2*2					4*4	3*1.5			
7	Maharashtra	1.5*1.5		10*10						3*3		8*8	7*7	
8	Odisha	2*2	6*6	5*5	2*2							7.5*7.5	7*7	
9	Rajasthan		6*6	6*6			5.5*5.5		6*6	5*5				
10	Sikkim	1.5*1.5					5*5		3*3					
11	Tamil Nadu	2*2	5*5	6*6								6*6		5*5
12	UP	1.5*1.5	6*6	10*10				10*10	10*10					
13	Uttarakhand			8*8					3*3					

Source: GAPL Survey

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Table 71: Spacing followed by Sampled Beneficiaries for Vegetables, Flowers and Other Crops (m)

S.No	State	Vegetables, Flowers and other important Crops													
		Brinjal	Okra	Tomato	Potato	Cucumber	Onion	Cabbage	Cauliflower	Chili	Cotton	Sugarcane	Groundnut	Lilli	Rose
1	AP	0.6*0.6	0.4*0.4	1.2*0.4						1.2*1.2	1.2*0.5	1.5*1.5		1*1	
2	Bihar	2*1			0.55*0.22							1.5*0.9			
3	Chhattisgarh		1.5*0.3	0.5*0.2		1.5*0.3									
4	Gujarat			1.4*0.4	0.6*0.15		0.7*0.15			1.4*0.4	1.5*0.5		0.7*0.05		
5	Haryana			1*0.5	1*0.2	0.5*0.1				0.6*0.6	1*0.3			0.5*0.5	
6	Karnataka	1.2*0.6		1.2*0.6						1.8*0.6		0.6*0.9			
7	Maharashtra	0.6*0.6		1.2*0.4						1.2*0.4	1.5*0.3	1.5*0.75			1.2*0.5
8	Odisha	0.6*0.45	0.45*0.45					0.6*0.3	0.45*0.30	0.6*0.3					
9	Rajasthan		1*0.30		1*0.20		0.25*0.25		0.55*0.55	0.66*0.66	1*0.30				
10	Sikkim			1*0.8					6*6	1*0.8					
11	Tamil Nadu	0.6*0.6	0.6*0.45		1.5*0.3					1.2*1.2		2.4*0.75			
12	UP	0.6*0.75		0.6*0.4	1.2*0.4					0.75*0.3		1.5*0.9			
13	Uttarakhand														

Source: GAPL Survey

It may be seen that crop spacing is more or less as per recommendations. In few cases, the spacing is even less. It is clearly indicates that farmers adopting MI system also adopt proper practices.

5.6 Reduction in Cost of Irrigation

The data cited in table 73 indicate the cost of irrigation incurred by beneficiary farmers before and after installation of MI system. It is well evident that Irrigation cost was reduced by 20-50 percent with the use of MI system. The states of Gujarat, Haryana, and Rajasthan have witnessed more than 40% cost reduction. The reduction in cost resulted primarily because of savings in the man power and electricity consumption.

Table 72: Reduction in Cost of Irrigation with MI system

State	Cost of Irrigation before MI (Rs/ ha)	Cost of irrigation after MI (Rs./ ha)	% decrease in cost
AP	7200	5721	20.50
Bihar	8734	6234	28.60
Chhattisgarh	5602	3557	36.50
Gujarat	11046	5599	49.30
Haryana	7346	3749	49.00
Karnataka	8215	6182	24.70
Maharashtra	11204	7736	31.00
Odisha	8895	6541	26.50
Rajasthan	7193	3925	45.40
Sikkim	3932	2836	27.90
Tamil Nadu	6368	4792	24.80
UP	6657	4819	27.60
Uttarakhand	10693	8203	23.30

Source: GAPL Survey

5.7 Electricity Consumption

The figures on consumption of electricity before and after installation of MI system by the beneficiary farmers have been tabulated in Table 73. The data clearly indicate that savings of electricity across the sampled states varied from 15.1 to 49.4 percent, average being 30.6 percent. It is pertinent to mention here that in the states of Bihar and Chhattisgarh; almost all the beneficiaries have been using diesel/ kerosene to operate their pump sets. For these two states, reduction in consumption of electricity has been computed considering the reduction in use of diesel/ kerosene. The variations in the extent of electricity savings among different states may be attributed to the type of system installed besides depth of water and area brought under MI.

Table 73: Reduction in Electricity Consumption

State	Electricity used before MI(hr/day)	Electricity used after MI(hr/day)	% saving of electricity
AP	6.79	5.28	22.33
Bihar*	50.00	30.00	40.00
Chhattisgarh*	45.00	28.00	37.78
Gujarat	6.78	4.07	39.92
Haryana	8.35	4.23	49.39
Karnataka	5.90	4.32	26.75
Maharashtra	7.03	4.68	33.48
Odisha	7.98	6.19	22.46
Rajasthan	8.64	5.01	42.08
Sikkim	2.62	1.70	35.11
Tamil Nadu	5.78	4.91	15.10
UP	2.25	1.84	18.43
Uttarakhand	3.01	2.11	29.89
Total	5.37	3.73	30.65

Source: GAPL Survey

* Diesel / Kerosene consumed (ltrs/ day) for Bihar and Chhattisgarh

5.8 Economy in Fertilizer Use

The information on use of fertilizers before and after installation of MI system was sought from the beneficiary farmers, the obtained data have been enumerated in Table 74. In order to comprehend the information on fertilizers saving across the 13 states, the data on fertilizer saving was given a graphical presentation (Figure 10). It is well evident that MI system resulted in significant savings of fertilizers. The extent of fertilizer saving in the states under study varied from 7.59 to 43.83 percent with an average savings of about 28 percent. The obtained results are in-conformity with the various research findings wherein fertilizer savings through drip fertigation have been reported in the range of 30-35 percent (Raina et al, 2013). The exceptionally low fertilizer savings observed in Bihar are attributed to the fact that more than 90 percent area in Bihar is under sprinkler irrigation.

Table 74: Reduction in Fertilizer Consumption

States	Fertilizer Consumption(Kg/ha) Before MI	Fertilizer Consumption(Kg/ha) after MI	% saving of Fertilizer
AP	241.52	171.85	28.85
Bihar	181.98	168.16	7.59
Chhattisgarh	288.72	172.19	40.36
Gujarat	158.93	91.03	42.73
Haryana	202.97	126.82	37.52
Karnataka	215.49	154.71	28.21
Maharashtra	310.05	238.87	22.96
Odisha	272.40	215.47	20.90
Rajasthan	295.23	165.82	43.83
Sikkim	158.60	93.80	40.86
Tamil Nadu	211.47	154.21	27.08
UP	242.20	187.04	22.77
Uttarakhand	106.20	87.12	17.96
Total	235.26	168.26	28.48

Source: GAPL Survey

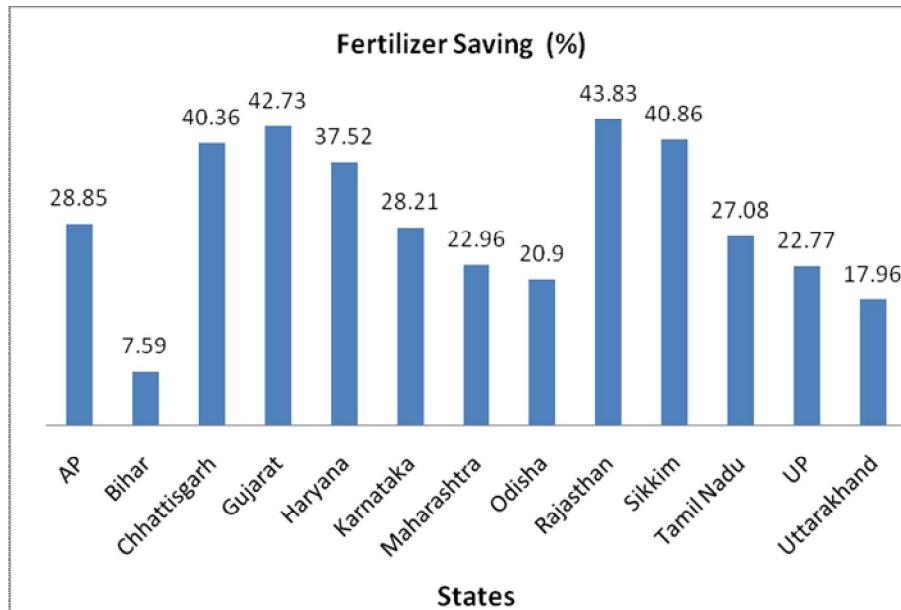


Figure 10: Reduction in Fertilizer Consumption (%)

5.9 Increase in Crop Productivity

Micro irrigation has generated benefits to the farmers in terms of enhancement of the productivity. The average productivity Fruit crops have increased about 42.3 percent (Table 75) with maximum enhancement in the state of Gujarat followed by Rajasthan which was followed by Chhattisgarh. In fact, the productivity enhancement in these states was comparable.

Table 75: Productivity Enhancement of Fruit Crops (MT/ha)

State	Before MI	After MI	% increase
AP	7.32	8.74	19.37
Bihar	2.73	3.15	15.18
Chhattisgarh	0.12	0.20	62.00
Gujarat	5.15	8.93	73.48
Haryana	5.86	8.10	38.25
Karnataka	45.32	58.10	28.20
Maharashtra	21.66	32.32	49.18
Odisha	27.41	36.99	34.97
Rajasthan	5.38	9.17	70.56
Sikkim	5.43	5.80	6.82
Tamil Nadu	24.73	29.02	17.36
UP	7.10	9.53	34.14
Uttarakhand	5.85	7.75	32.42
Total	13.52	19.25	42.34

Source: GAPL Survey

The average productivity of the vegetables has increased by 52.8% after using the MI irrigation system (Table 76). The states of Chhattisgarh, Gujarat and Sikkim registered tremendous increase in vegetable productivity after using micro irrigation system.

Table 76: Productivity Enhancement of Vegetable Crops (MT/ha)

State	Before MI	After MI	% increase
AP	9.91	13.29	34.09
Bihar	11.22	14.76	31.62
Chhattisgarh	27.79	55.26	98.85
Gujarat	7.09	11.96	68.59
Haryana	20.66	25.23	22.13
Karnataka	11.09	14.30	29.00
Maharashtra	3.48	4.48	28.76
Odisha	10.88	13.95	28.19
Rajasthan	6.07	8.46	39.42
Sikkim	18.94	31.57	66.62
Tamil Nadu	11.37	14.37	26.40
UP	8.25	10.79	30.71
Uttarakhand	3.17	4.75	49.65
Total	11.40	17.41	52.76

Source: GAPL Survey

The data on crop wise productivity enhancement in different states has also been enumerated and explained in the next section.

5.10 Reduction in these Cost of Inputs of Irrigation & Productivity Enhancement: Crop-wise

MI technology is introduced mainly to increase the water use efficiency in agriculture and also provides many other socio-economic benefits in the society. The use of MI has led to significant reduction cost of irrigation, electricity saving, fertilizer saving & productivity enhancement. As per the data collected from the sample beneficiaries, significant increase has been observed in terms of reduction in different costs for different crops and enhancing the productivity. The same trend is observed in fruits, vegetables, flowers and other non-horticulture crops. The detailed state and crop wise impact percentages of the reduction in irrigation cost, electricity savings, fertilizer saving and increase in productivity of the sampled beneficiaries are as follows:

Table 77: Crop wise Details of Reduction in Cost - Fruits

State	Fruit	Reduction in Irrigation Cost (%)	Electricity saved (%)	Fertilizer saved (%)	Productivity enhancement (%)
AP	Banana	29.87	36.60	28.33	20.89
	Guava	10.87	28.30	26.51	35.21
	Lemon	28.39	33.39	26.76	17.08
	Mango	23.38	33.01	31.57	30.51
	Orange	31.60	35.71	32.33	34.78
Bihar	Guava	23.08	18.27	20.00	12.50
	Kadam	12.28	22.50	13.85	15.63
	Mango	17.31	14.50	11.67	12.11
	Litchi	28.57	11.80	14.29	10.77
Chhattisgarh	Banana	25.00	24.60	16.67	50.00
	Papaya	38.89	28.50	33.33	87.50
Gujarat	Banana	44.90	47.12	39.54	43.44
	Papaya	46.92	40.00	45.65	62.35
	Pomegranate	45.65	28.95	44.07	40.00
	Watermelon	56.82	57.50	40.68	50.00
Haryana	Kinnow	48.47	40.05	39.45	25.00
	Strawberry	41.96	38.37	41.10	20.00
	Watermelon	34.21	45.65	41.50	50.00
Karnataka	Banana	27.69	20.30	27.43	33.80
	Mango	25.76	34.72	26.36	26.73
	Papaya	28.36	36.22	29.07	24.41
	Pomegranate	22.50	23.63	30.38	35.20
	Fig	12.50	33.33	22.22	25.00
	Areca nut	29.18	32.76	30.85	22.05
Maharashtra	Banana	30.70	30.69	31.22	52.15
	Cashew nut	31.17	19.40	42.47	40.00
	Grapes	30.16	20.69	20.47	71.43
	Mango	35.53	28.15	28.95	16.72
	Mousami	43.75	20.00	20.00	87.50
	Orange	46.89	30.59	27.66	30.00
	Sweet Orange	35.53	31.37	21.98	36.27
	Areca nut	18.33	35.00	50.00	33.33

Odisha	Aonla	35.29	38.89	25.00	33.33
	Banana	35.77	33.91	31.24	24.47
	Cashew nut	27.13	31.31	31.20	30.62
	Guava	34.81	36.92	32.16	44.30
	Mango	35.76	35.51	30.27	30.39
	Papaya	28.06	29.03	35.32	17.68
	Chikoo	6.67	25.00	40.00	11.11
	Bel	57.14	50.00	57.14	15.50
Rajasthan	Guava	19.65	47.46	40.77	50.00
	Kinnow	58.69	49.82	49.04	46.48
	Lemon	30.52	45.19	35.60	41.18
	Mango	30.53	48.39	32.82	60.00
	Orange	25.65	41.87	35.35	42.29
	Banana	37.50	40.00	30.00	0.00
Sikkim	Orange	39.33	27.66	40.87	40.00
	Litchi	50.00	20.00	40.00	0.00
	Aonla	23.13	32.98	28.17	40.32
Tamil Nadu	Banana	36.84	34.95	26.07	29.90
	Cashew nut	35.79	33.33	22.22	33.33
	Coconut	28.82	35.11	27.14	33.33
	Mango	24.10	34.18	29.26	26.97
	Tapioca	32.58	34.22	24.29	33.27
	Banana	29.61	60.00	27.46	47.92
UP	Guava	25.55	36.36	23.50	21.47
	Mango	24.63	39.57	24.15	33.73
	Litchi	27.53	41.67	27.17	33.93
	Guava	21.67	NA	16.38	NA
Uttarakhand	Mango	22.81	36.36	16.33	NA
	Peach	22.93	NA	28.55	NA
	Litchi	28.92	33.33	20.44	NA

Source: GAPL Survey

It may be seen from the above table that among the fruit crops, highest reduction in irrigation cost was observed in Kinnow crop in Rajasthan & lowest in guava in AP, whereas maximum saving in electricity was observed in Haryana and saving in fertilizer in a Bel in Rajasthan and further highest increase in productivity is witnessed in Papaya in Chhattisgarh.

Table 78: Crop wise Details of Reduction in Cost - Vegetables

State	Vegetables Name	Reduction in Irrigation Cost (%)	Electricity Saved (%)	Fertilizer saved (%)	Productivity enhancement (%)
AP	Brinjal	24.70	34.50	29.32	19.50
	Chilli	21.04	32.13	26.62	25.80
	Okra	15.45	30.79	33.37	26.54
	Tomato	21.00	34.58	32.80	28.37
Bihar	Brinjal	19.31	27.80	10.73	15.22
	Cauliflower	18.50	32.44	14.15	7.60
	Okra	21.88	22.50	12.83	16.71
	Potato	22.82	46.55	10.06	11.05
Chhattisgarh	Cauliflower	34.38	34.80	40.65	73.77
	Tomato	44.20	47.50	45.80	114.54

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	Bitter Gourd	49.34	36.90	47.46	110.81
	Okra	43.65	42.50	44.84	86.42
Gujarat	Chilli	45.32	43.41	43.93	47.08
	Fennel	30.00	50.00	56.25	20.00
	Onion	49.83	47.92	40.94	24.35
	Potato	45.23	45.47	36.02	35.04
	Tomato	51.02	46.20	42.45	79.62
Haryana	Chilli	43.64	44.70	32.64	50.00
	Cucumber	54.94	60.81	39.89	41.22
	Potato	44.06	58.09	33.21	16.51
	Tomato	48.33	51.61	35.56	56.32
Karnataka	Chilli	30.88	30.21	28.39	31.87
	Ginger	29.41	36.51	29.06	24.50
	Tomato	22.75	32.18	29.71	18.70
Maharashtra	Brinjal	30.41	38.70	26.04	21.95
	Chilli	27.02	32.68	36.72	33.10
	Tomato	27.63	36.41	29.40	31.84
Odisha	Bitter Gourd	36.29	36.60	30.24	28.26
	Bottle Gourd	40.40	34.35	27.00	29.16
	Brinjal	29.79	31.64	30.84	28.04
	Cauliflower	31.41	32.91	29.80	25.42
	Okra	33.99	33.02	29.82	32.16
	Tomato	29.78	31.79	32.25	35.34
Rajasthan	Brinjal	64.52	25.00	54.29	NA
	Carrot	57.18	29.65	47.89	20.97
	Onion	37.13	38.40	39.92	31.17
	Tomato	29.50	45.26	35.20	46.19
Sikkim	Brinjal	22.00	41.18	38.18	69.49
	Cauliflower	45.00	20.00	42.50	7.69
	Tomato	35.42	37.29	41.61	68.89
Tamil Nadu	Brinjal	29.30	32.64	29.73	34.07
	Chilli	30.49	36.33	29.02	25.51
	Tomato	25.45	34.95	31.67	21.76
UP	Brinjal	23.36	40.32	21.53	24.81
	Chilli	24.73	50.00	20.52	31.30
	Peas	21.55	37.52	30.05	32.54
	Potato	28.97	44.12	25.91	28.02
	Tomato	25.21	37.21	24.20	28.22
Uttarakhand	Peas	25.72	NA	16.72	NA
	Tomato	NA	33.33	20.18	NA

Source: GAPL Survey

It may be seen from the above table that among the vegetable crops, highest reduction in irrigation cost was observed in brinjal in Rajasthan & lowest in lady finger in AP, whereas maximum saving in electricity was observed in Haryana for cucumber & potato and saving in fertilizer for fennel in Gujarat and further highest increase in productivity is witnessed in Chhattisgarh for tomato.

Table 79: Crop wise Details of Reduction in Cost - Flowers

State	Crop	Reduction in Irrigation Cost (%)	Electricity saved(%)	Fertilizer saved (%)	Productivity enhancement (%)
AP	Lilli	33.33	37.50	41.82	45.60
Bihar	Marigold	46.43	31.00	33.33	50.00
Gujarat	Jasmine	50.00	62.50	33.33	33.33
	Marigold	20.00	75.00	55.56	42.00
Haryana	Gerbera	67.25	86.36	32.50	36.70
	Rose	43.16	59.38	56.76	46.90
Maharashtra	Marigold	34.48	35.71	27.61	42.50
	Rose	10.45	21.43	43.75	46.90
Odisha	Rajanigandha	46.67	50.00	30.00	24.00
Rajasthan	Rose	36.11	50.00	29.70	25.00
UP	Marigold	20.00	34.00	20.00	27.50

Source: GAP Survey

It may be seen from the above table that among the flowers, highest reduction in irrigation cost & electricity saving was observed in Gerbera in Haryana, whereas saving in fertilizer for rose in Haryana and highest increase in productivity was witnessed in Bihar for marigold.

Table 80: Crop wise Details of Reduction in Cost - Non-horticulture Crops

State	Non Horticulture Crops	Reduction in Irrigation Cost (%)	Electricity saved(%)	Fertilizer saved (%)	Productivity enhancement (%)
AP	Cotton	28.20	35.24	23.54	17.70
	Ground nut	29.24	38.28	21.36	22.74
	Maize	15.79	30.67	30.96	21.99
	Sugarcane	22.85	33.25	31.30	18.53
Bihar	Maize	18.74	15.75	11.26	14.84
	Sugarcane	20.96	22.50	15.53	0.50
	Wheat	17.21	18.60	9.98	8.52
Chhattisgarh	Gram	27.99	14.50	28.30	20.50
	Soybean	39.78	16.35	43.56	18.05
	Wheat	23.13	21.45	20.17	44.43
Gujarat	Caster	46.17	51.72	37.57	35.80
	Cotton	45.40	46.59	43.96	37.19
	Ground nut	48.71	46.84	40.27	34.96
	Sugarcane	48.75	48.65	42.16	216.11
	Wheat	40.82	40.15	36.81	30.25
Haryana	Cotton	44.35	44.39	30.93	1.01
	Mustard	41.67	42.86	36.11	0.00
	Wheat	49.35	44.97	38.58	2.12
Karnataka	Sugarcane	27.71	25.68	27.23	12.64
Maharashtra	Cotton	33.70	29.28	29.91	34.75
	Ground nut	33.55	33.33	33.12	25.87
	Soybean	35.28	22.80	30.85	40.80
	Sugarcane	37.12	38.15	28.48	38.77
Odisha	Moong	21.78	28.69	35.89	36.89
	Sugarcane	26.24	33.09	32.01	48.49
Rajasthan	Arandi	36.84	40.00	39.16	43.13

	Cotton	51.18	37.50	47.08	27.65
	Guwar	56.05	43.75	52.50	48.89
	Mustard	32.83	43.73	43.13	34.33
	Wheat	30.25	36.66	39.23	36.31
Sikkim	Mustard	42.86	20.00	36.00	0.00
	Wheat	33.33	27.59	36.00	5.56
Tamil Nadu	Sugarcane	28.79	34.27	28.73	9.90
UP	Maize	27.32	46.62	23.34	4.70
	Sugarcane	23.16	22.00	30.50	28.77
	Wheat	25.38	37.76	24.84	41.16
Uttarakhand	Sugarcane	25.62	23.85	20.88	29.50

Source: GAPL Survey

It may be seen from the table 77 that among the non-horticulture crops also reduction in irrigation cost, saving in electricity, saving in fertilizer and increase in productivity was witnessed.

From the above, it may be concluded that with the adoption of micro irrigation technologies, significant increase has been observed in productivity enhancement in all the states for all the major crops being cultivated under the scheme. Further, reduction in input factors such as irrigation cost, saving in electricity & saving in fertilizer was also observed.

5.11 Introduction of New Crops

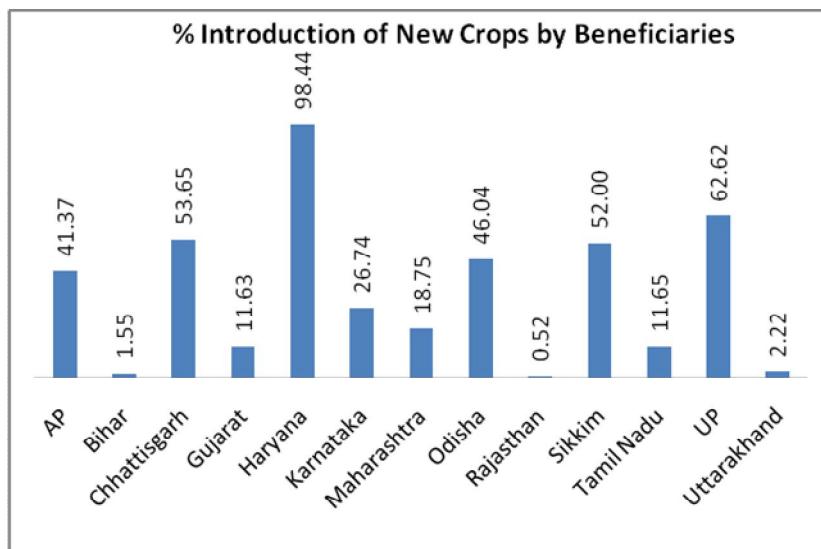
During the course of the study and field survey it was observed that the beneficiaries have switched to new crops mostly high value as enlisted in table 82 below with the adoption of micro irrigation technology. In the fruit crops, high density plantations having drip irrigation system have been adopted by some of the farmers.

Table 81: Crops Adopted after Installation of MI System

Fruits	Aonla, Areca nut, Banana, Cashew nut, Sapota, Coconut, Grapes, Guava, Litchi, Mango, Mosambi, Orange, Papaya, Pineapple, Pomegranate, Strawberry, Sweet orange, watermelon
Vegetables	Broccoli, Bitter gourd, Bottle gourd, Brinjal, Cabbage, Capsicum, Cauliflower, Cucumber, Chilli, Ginger, Okra, Onion, Spinach, Papaya, Potato, Radish, Tomato
Floricultural	Marigold, Tuberose (Rajnigandha), Rose, Lilly
Other crop	Cotton, Groundnut, Sunflower, Turmeric, Arhar, Black gram, Maize, Moong, Mustard, Pulses, Soyabean, Sugarcane, Urad, Wheat

Table 82: Extent of Adoption of New Crops after Installation of MI System

State	Total Beneficiary	No. of Farmers Introduced New Crops	Farmers Introduced New Crop (%)
AP	672	278	41.37
Bihar	516	8	1.55
Chhattisgarh	384	206	53.65
Gujarat	576	67	11.63
Haryana	320	315	98.44
Karnataka	576	154	26.74
Maharashtra	672	126	18.75
Odisha	480	221	46.04
Rajasthan	574	3	0.52
Sikkim	50	26	52.00
Tamil Nadu	455	53	11.65
UP	527	330	62.62
Uttarakhand	90	2	2.22
Total	5892	1789	30.36

**Figure 11: Extent of Adoption of New Crops by Beneficiaries (%)**

It may be seen from the above table that almost all the beneficiaries of Haryana have shifted towards new crops with the adoption MI system followed by UP, Sikkim, Chhattisgarh, Odisha and AP. The lowest response was observed in Rajasthan, Bihar and Uttarakhand which is due to the fact that MI systems in majority of the cases have been installed to irrigate horticultural crops.

It is therefore, recommended that special drives be taken to motivate the farmers in the state of Bihar, Uttarakhand & Rajasthan for crop diversification to accrue the full advantage of MI system.

5.12 Increase in Farmer's Income

The overall benefits accrued from the micro irrigation system are reflected in the income enhancement of the farmers. All the surveyed states reported increase in farmer's income by 20%- 68% with an average increase of 48.5%. The maximum increase in income has been reported in Gujarat followed by Chhattisgarh.

Table 83: Increase in Farmer's Income

State	Income (Rs./ ha) before MI	Income (Rs./ ha) after MI	% Increase in Income
AP	60273	79929	32.61
Bihar	31132	41333	32.77
Chhattisgarh	62785	105059	67.33
Gujarat	55703	93593	68.02
Haryana	73917	117532	59.01
Karnataka	82303	105061	27.65
Maharashtra	68459	99786	45.76
Odisha	61846	85660	38.50
Rajasthan	125753	191731	52.47
Sikkim	81510	111891	37.27
Tamil Nadu	74100	98800	33.33
UP	58495	87391	49.40
Uttarakhand	140098	168234	20.08
Total	976374	1386001	41.95

Source: GAPL Survey

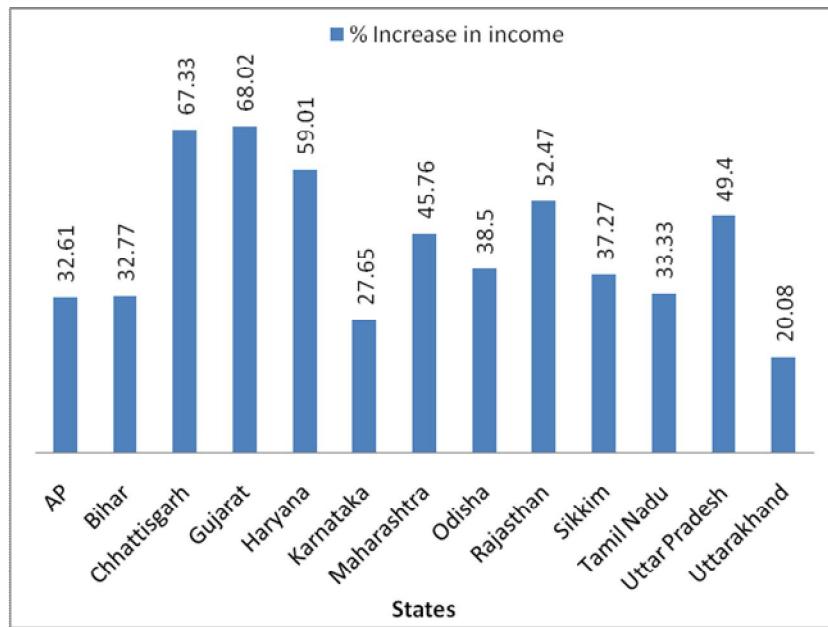


Figure 12: Increase in the Income of Beneficiaries (%)

5.13 Benefit-Cost Ratio

The BC ratio has been based on the estimates of incremental return/ income from MI system that is taken into account the increase in individual farmer's income and MI system cost and crop wise average increase in income and average MI cost for each state were worked out from the same. MI system cost has been amortized equally for 10 years, considering the economic life of the system for the same period. The income enhancement of the beneficiary farmers after installation of the MI system has been attributed to MI system. The Benefit-cost analysis was carried out for important crops in all the 13 states under study on the basis of data collected from sampled beneficiaries. This ratio gives the estimates of returns on the investment made in MI system.

Performance in term of BC ratio varies from state to state, even for the same crop due to varied reasons like agro-climatic conditions, agronomic practices, soil productivity, system cost; marketing of produce etc. the BC ratio of installing micro irrigation system is above one across the states and across the crops which signifies the importance of MI system in net income enhancement of the farmers.

The state wise BC ratio of installing MI system for different crops is given in the table for important fruits, vegetables & flowers grown in the states under study.

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Table 84: Benefit Cost Ratio of MI System for Important Fruit Crops

Fruits	AP	Bihar	Chhattisgarh	Gujarat	Haryana	Karnataka	Maharashtra	Odisha	Rajasthan	Sikkim	Tamil Nadu	UP	Uttarakhand
Aonla	-	-	-	-	-	-	-	-	2.69	-	2.94	2.34	-
Areca nut	-	-	-	-	-	2.59	2.21	-	-	-	-	-	-
Banana	2.66	-	2.66	1.87	-	2.77	2.91	1.82	-	2.72	2.90	2.76	-
Bel	-	-	-	-	-	-	-	-	2.09	-	-	-	-
Blackberry	-	1.71	-	-	-	-	-	-	-	-	-	-	-
Carrot	-	-	-	-	-	-	-	-	-	-	2.91	-	-
Cashew nut	-	-	-	-	-	-	2.70	2.59	-	-	2.64	-	-
Coconut	2.26	-	-	-	-	2.63	2.44	2.72	-	-	2.51	-	-
Cucumber	-	-	-	-	2.06	1.31	-	-	-	-	-	-	-
Custard Apple	-	-	-	-	-	2.19	-	-	-	-	-	-	-
Fig	-	-	-	-	-	2.66	-	-	-	-	-	-	-
Grapes	-	-	-	-	-	2.58	2.93	-	-	-	-	-	-
Guava	2.42	2.97	-	2.69	2.12	2.04	2.94	2.56	2.29	2.94	-	2.86	2.76
Kadam	-	1.21	-	-	-	-	-	-	-	-	-	-	-
Kinnow	-	-	-	-	2.84	-	-	-	2.31	-	-	-	-
Lemon	2.67	-	-	2.80	-	2.88	1.48	2.98	2.31	-	2.09	2.36	-
Litchi	-	1.11	-	-	-	-	-	2.52	-	2.67	-	2.72	2.27
Mango	2.84	2.26	-	2.92	-	2.57	2.65	2.45	2.73	-	2.75	2.95	2.87
Musk Melon	-	-	-	-	2.27	-	-	-	-	-	-	-	-
Oil Palm	2.29	-	-	-	-	-	-	2.78	-	-	-	-	-
Orange	2.40	-	-	-	-	-	2.15	-	2.87	2.80	-	-	-
Papaya	1.33	1.25	2.42	-	-	2.79	2.34	2.68	-	-	2.30	2.74	-
Peach	-	-	-	-	-	-	-	-	-	-	-	-	2.19
Pineapple	-	-	-	-	-	-	2.41	2.98	-	-	-	-	-
Pomegranate	2.34	-	-	2.42	-	2.09	2.66	2.31	2.97	-	-	-	-
Sapota	-	-	-	-	-	2.94	-	2.99	-	-	2.45	-	-
Strawberry	-	-	-	-	1.19	-	-	-	-	-	-	2.97	-
Tapioca	-	-	-	-	-	-	-	-	-	-	2.23	-	-
Water Melon	-	-	2.57	2.11	2.21	2.88	2.67	2.98	-	-	-	-	-

Source: GAPL Survey

Impact Evaluation Study on “National Mission on Micro Irrigation (NMMI)”

Table 85: Benefit Cost Ratio of MI System for Important Vegetable Crops

Vegetable	AP	Bihar	Chhattisgarh	Gujarat	Haryana	Karnataka	Maharashtra	Odisha	Rajasthan	Sikkim	Tamil Nadu	UP	Uttarakhand
Alovera		1.45	-	-	-	-	-	-	-	-	-	-	-
Arabi		-	-	-	-	-	-	1.78	-	-	-	-	-
Bitter Gourd	2.00	2.68	2.14	2.95	-	-	2.39	-	-	2.86	2.58	-	-
Boda	1.12	2.51	-	-	-	-	-	-	-	-	-	-	-
Bottle Gourd	1.24	1.90	2.34	2.39	-	-	2.67	1.33	-	-	2.57	-	-
Brinjal	2.15	2.18	1.44	1.45	1.85	2.15	2.98	2.38	2.30	2.57	1.66	2.57	-
Broccoli		-	-	0.17	-	-	-	-	-	-	-	-	-
Cabbage		-	2.74	2.17	-	-	2.50	2.18	-	1.67	2.75	2.22	-
Capiscum	2.62	2.62	-	2.74	-	-	1.61	-	-	-	2.29	-	-
Carrot		-	-	-	2.06	-	-	-	2.51	-	-	-	-
Cauliflower		1.17	-	-	2.88	2.68	-	2.56	2.29	2.29	2.85	2.74	-
Chilli	1.56	1.72	2.10	2.65	2.58	2.33	2.73	2.28	1.79	2.59	1.81	2.82	-
Cucumber		-	1.62	-	1.32	1.98	-	1.49	2.22	-	-	-	-
Fennel		-	-	2.81	-	-	-	-	-	-	-	-	-
Garlic		-	-	-	0.69	-	-	-	2.46	-	-	-	-
Ginger	2.20	-	-	-	-	2.36	-	2.26	-	-	-	-	-
Kundru		-	1.25	-	-	-	-	-	-	-	-	-	-
Okra	1.70	2.19	2.38	1.89	1.74	2.81	2.71	2.87	-	2.25	2.32	2.79	-
Lemon		-	-	-	-	-	-	2.24	-	-	-	-	-
Methi		-	-	-	1.90	-	-	-	-	-	-	-	-
Onion		-	2.36	1.76	2.10	-	2.70	2.93	2.39	-	2.51	1.93	-
Palak		-	-	-	-	-	-	-	-	-	-	1.83	-
Pointed Gourd		-	-	1.82	-	-	-	-	-	-	-	-	-
Peas		-	-	-	1.97	-	2.36	2.98	-	-	-	2.35	2.69
Potato	1.82	2.48	2.60	2.26	2.70	2.33	-	2.61	2.82	-	1.58	2.86	-
Pumpkin		1.35	1.46	0.13	-	-	-	-	1.82	-	1.59	-	-
Radish		-	-	-	-	-	-	-	-	-	-	2.38	-
Cluster Bean		-	1.74	-	-	-	-	-	-	-	-	-	-
Round Guard		-	-	-	2.54	-	-	-	-	-	-	-	-
Tomato	2.52	2.65	2.42	2.00	2.30	2.08	2.94	2.14	2.94	2.38	2.32	2.78	-
Sponge Guard		-	1.37	-	-	-	-	-	2.74	-	-	-	-
Turmeric	1.79	-	-	-	-	-	-	-	-	-	-	-	-

Source: GAPLSurvey

Table 86: Benefit Cost Ratio of MI System for Important Floriculture Crops

State	Flower Name	BC Ratio
AP	Lilli	1.21
Bihar	Marigold	2.18
Gujarat	Jasmine	2.72
	Marigold	1.67
Haryana	Gerbera	2.92
	Rose	1.41
Karnataka	Marigold	2.25
	Rose	1.60
Odisha	Rajnigandha	2.55
Rajasthan	Rose	2.94
UP	Marigold	2.76
Uttarakhand	Gladiolus	2.72

Performance in terms of BC ratio varies from state to state and crop to crop. Thus, it may be concluded that these analysis confirm that the farmers are getting higher income with the adoption of MI technology.

5.14 Increase in Area

The irrigated area has increased in all the surveyed states after the introduction of NMMI Scheme. Irrigated area has been increased by 8.41% for total surveyed farmers in the given states. The state of Maharashtra has topped the list with 22.28% growth in irrigated area, followed by Chhattisgarh. There has been very little growth in case of Sikkim, UP, Uttarakhand & Karnataka.

Table 87: Percent Increase in Irrigated Area on Installation of MI System

State	Irrigated Area (Ha)		Percent Increase in Irrigated Area
	Before MI	After MI	
AP	1013.02	1138.95	12.43
Bihar	1294.82	1409.35	8.85
Chhattisgarh	494.54	571.72	15.61
Gujarat	1358.37	1549.44	14.07
Haryana	1233.18	1362.08	10.45
Karnataka	1037.63	1064.49	2.59
Maharashtra	1025.10	1253.49	22.28
Odisha	1241.39	1382.54	11.37
Rajasthan	1005.36	1078.06	7.23
Sikkim	60.38	60.79	0.67
Tamil Nadu	709.28	740.86	4.45
UP	1583.06	1603.50	1.29
Uttarakhand	258.52	262.65	1.60

5.15 Potential area that can be brought under Micro Irrigation

The potential for Micro Irrigation for each surveyed district has been worked out on the basis of field survey and secondary information.

The following information has been taken account to work out MI potential from Secondary sources;

- A. Total Irrigated area
- B. Paddy area
- C. Area under MI

Total Potential area has been worked out by subtracting the area under MI and Paddy from total irrigated area of the district, considering that paddy area has no potential for the MI system. This potential area has been depicted as percentage of total irrigated area.

The district wise potential for MI as well as the crop potential is given in the table below:

Table 88: District wise Potential for Installation of MI System in Study Area

State	District	Area Based on Secondary Data				Potential Crops Under MI		
		Irrigated Area ("000 ha)	Area under MI ("000 ha)	MI Potential Area ("000 ha)	MI Potential Area (%)	Fruits	Vegetables	Other Crops
AP	Adilabad	101.52	25.44	76.08	74.94	Mango, Citrus and Banana	Brinjal, Chilli, Tomato and Okra	Maize, Sugarcane, Cotton and Ground Nut
	Anantpur	247.21	127.73	119.48	48.33			
	Krishna	180.67	15.72	164.95	91.30			
	Medak	99.55	49.46	50.09	50.31			
	Nalgonda	275.70	71.80	203.90	73.96			
	Nellore	84.64	21.58	63.06	74.50			
	Vishakhapatnam	220.77	8.25	212.52	96.27			
Bihar	Gaya	49.79	2.53	47.26	94.92	Mango, Kadamb and Litchi	Okra, Potato, Cauliflower and Brinjal	Sugarcane, Wheat and Maize
	Madhepura	487.88	0.95	486.93	99.80			
	Rohtas	86.01	3.39	82.62	96.05			
	W. Champaran	62.38	5.42	56.96	91.31			
Chhattisgarh	Durg	77.50	27.68	49.82	64.28	Banana, Papaya and Watermelon	Cauliflower, Tomato, Bitter Gourd and Okra	Wheat, Gram and Soybean
	Jashpur	11.09	0.68	10.41	93.87			
	Kanker	13.77	12.22	1.55	11.30			
	Sarguja	11.94	3.03	8.91	74.62			
Gujarat	Anand	104.10	2.38	101.72	97.71	Banana, Papaya, Pomegranate and Watermelon	Chilli, Tomato, Onion, Potato and Fennel	Cotton, Sugarcane, Wheat, Groundnut and Caster
	Banaskantha	396.30	81.50	314.80	79.43			
	Bharuch	92.64	10.73	81.91	88.42			
	Bhavnagar	168.80	27.88	140.93	83.49			
	Jamnagar	83.30	17.28	66.02	79.26			
	Mehsana	196.98	6.24	190.74	96.83			
Haryana	Bhiwani	249.37	24.29	225.08	90.26	Kinnow, Lemon, Watermelon and Muskmelon	Tomato, Cucumber and Potato	Cotton and Wheat
	Fatehabad	114.43	1.10	113.33	99.04			
	Karnal	129.60	0.86	128.74	99.34			
	Sirs	145.87	6.31	139.56	95.67			
Karnataka	Belgaum	455.94	43.94	412.00	90.36	Banana, Areca	Tomato,	Pepper and

	Bellary	73.48	3.97	69.51	94.59	nut, Pomegranate, Mango and Papaya	Chilli and Ginger	Turmeric
	Bidar	58.73	23.22	35.51	60.46			
	Chitradurga	22.43	29.63	15.20	67.88			
	Hassan	86.61	11.75	74.86	86.43			
	Mysore	131.94	13.76	118.18	89.57			
Maharashtra	Ahemadnagar	260.00	30.49	229.51	88.27	Banana, Mango, Citrus and Grapes	Tomato, Chilli and Brinjal	Cotton, Sugarcane and Soybean
	Jalgaon	239.09	76.11	162.98	68.17			
	Jalna	78.50	26.60	51.80	66.11			
	Kolhapur	275.00	4.53	270.47	98.35			
	Ratnagiri	15.00	1.11	13.89	92.62			
	Wardha	16.30	16.30	8.10	49.71			
Odisha	Bhadrak	27.75	1.04	26.71	96.25	Mango, Banana, Cashew nut and Papaya	Tomato, Brinjal, Okra, Bottle gourd and Cauliflower	Moong and Sugarcane
	Ganjam	36.00	2.99	33.01	91.68			
	Mayurbhanj	41.05	5.53	35.52	86.54			
	Nayagarh	29.66	1.64	28.02	94.47			
	Boudh	NA	2.01	NA	NA			
Rajasthan	Hanumangarh	310.71	15.05	295.66	95.16	Orange, Kinnow, Mango, Bel, Guava and Lemon	Onion, Carrot and Tomato	Cotton, Arandi, Guar, Mustard and Wheat
	Jalore	290.81	118.97	171.84	59.09			
	Jhalawar	233.49	15.69	217.80	93.28			
	Jodhpur	310.00	57.12	252.88	81.57			
	S. Madhopur	194.48	6.76	187.72	96.52			
	Udaipur	71.39	5.80	65.59	91.87			
Sikkim	East Gangtok	6.97	NA	N/A	N/A	Orange and Guava	Tomato, Brinjal, Cauliflower and Barackoli	Wheat, Mustard and Turmeric
	Mangaon	1.35	NA	NA	NA			
Tamil Nadu	Erode	131.95	10.90	121.05	91.74	Banana, Tapioca, Coconut, Aonla and Carrot	Chili, Brinjal, Tomato, Potato, Carrot and Turmeric	Sunflower
	Nilgiri	6.50	2.13	4.37	67.29			
	Thiruvarur	60.36	0.94	59.42	98.44			
	Tirunelveli	64.29	2.99	61.30	95.34			
	Villupuram	141.67	5.50	136.17	96.11			
UP	Aligarh	164.41	0.05	164.36	99.97	Banana, Mango and Guava	Tomato, Potato, Chilli, Peas, Brinjal and Arbi	Maize and Wheat
	Ballia	115.78	0.25	115.53	99.79			
	Jhansi	179.20	0.99	178.21	99.44			
	Kannauj	130.16	0.19	129.97	99.85			
	Saharanpur	215.67	0.78	214.89	99.64			
	Siddharth Nagar	102.12	0.38	101.74	99.63			
Uttarakhand	Udhamsingh Nagar	153.30	NA	-	-	Mango, Peach, Litchi and Guava	Peas and Tomato	
	Haridwar	60.88	NA	-	-			
	Nainital	37.80	NA	-	-			

Source: Data Portal India and GAPL Field Survey Analysis

5.16 Employment Opportunities

The NMMI has helped to widen the food basket of the country with significant contributions coming from the bringing more area under irrigation and with judicious use of water. New farm practices and innovations with support of government have encouraged the farmers to shift toward high value a crop which in turn gives better income and more employment opportunities.

5.16.1 On Farm Employment Generation

Following are the sectors of on farm employment opportunities for farmers and related stakeholders, being generated through implementation of NMMI:

- Higher production requires more man days for operations like harvesting, on farm handling and logistics
- Soil, water quality and inputs testing laboratory service center
- Plant protection service center (Pest surveillance, diagnostic and control services including Integrated Pest Management)
- Maintenance, repairs and custom hiring of agricultural implements and machinery including micro irrigation systems (sprinkler and drip)
- Agri Service Centre includes at least the above three activities (Group Activity)

5.16.2 Off-Farm Employment Generation

With the initiation of National Mission on Micro Irrigation (NMMI) not only the farm employment has increased but it has generated lot of off-farm opportunities which would further give more employment in the future. This initiative also aims at farm mechanization which not only includes tractors and its implements but also use of other components such as pumps, micro irrigation etc. An attempt has been made in this section to estimate the additional employment generated from various initiatives available under mission. Apart from this, indirect labors for the logistic service are also generated to accomplish the above mentioned activities. Each of the suppliers has 5-7 skilled and semi-skilled employees to support in installation of the system, training, after sales service etc. Services of casual labor are also hired during the time of installing the system which results in indirect opportunities.

5.17 Impact on Employment

The implementation of NMMI scheme in the different states generated employment opportunities mainly due to increase in production which requires more of the man days as well as post handling operations micro irrigation resulted in considerable savings of labor as is evident from the data cited in table 93. This is true for pre-harvest practices. The increased yield due to MI systems called for involvement of more labor for handling the harvesting and post-harvest operations.

The basis for computing the manpower involved before and after installation of MI system related primarily to application of irrigations, hoeing/ weeding, fertilizer/ insecticide/ pesticide applications, harvesting/ threshing, assembling, cleaning, grading, packaging, transportation/ logistics etc. It may be seen from the above table that in all the states under study have shown decrease in utilization of the labor in pre-harvest practices that is labor saving on irrigation, weeding, fertilization and other operations. It shows that the use of

human labor after the use of micro irrigation has decrease significantly and ranges between 7.41 to 18.75 percent.

The employment generations through adoption of micro irrigation in the farms by the farmers before the adoption of the MI and after the installation and results have been presented in the following table below:

Table 89: Change in Manpower Requirement for Cultivation (per ha per crop cycle)

State	Pre harvest practices			Harvesting			Post-harvest handling			Total Man days/crops		
	No. of man days before NMMI	No. of man days after NMMI	Change in man Power (%)	No. of man days before NMMI	No. of man days after NMMI	Change in man Power (%)	No. of man days before NMMI	No. of man days after NMMI	Change in man Power (%)	No. of man days before NMMI	No. of man days after NMMI	Change in man Power (%)
AP	49	41	-16.33	36	42	16.67	16	19	18.75	101	102	0.99
Bihar	52	45	-13.46	29	35	20.69	13	16	23.08	94	96	2.13
Chhattisgarh	59	50	-15.25	31	36	16.13	20	24	20.00	110	110	0.00
Gujarat	48	39	-18.75	35	41	17.14	20	24	20.00	103	104	0.97
Haryana	40	35	-12.50	30	35	16.67	16	21	31.25	86	91	5.81
Karnataka	48	42	-12.50	34	40	17.65	19	23	21.05	101	105	3.96
Maharashtra	58	52	-10.34	33	39	18.18	23	29	26.09	114	120	5.26
Odisha	46	41	-10.87	32	37	15.63	18	19	5.56	96	97	1.04
Rajasthan	58	53	-8.62	25	33	32.00	18	20	11.11	101	106	4.95
Sikkim	54	50	-7.41	29	33	13.79	19	24	26.32	102	107	4.90
Tamil Nadu	50	44	-12.00	27	32	18.52	21	23	9.52	98	99	1.02
UP	55	46	-16.36	25	32	28.00	20	24	20.00	100	102	2.00
Uttarakhand	47	41	-12.77	29	36	24.14	23	29	26.09	99	106	7.07

The table further reveals that in post-harvest operations right from harvesting to handling and disposal of the produce there is an increase in labor utilization and it ranges between 21.19 to 50.23 percent. From here it may be concluded that the decrease in utilization of the labor in the pre harvest activities are offset by the increase in the production which requires more of the labor for harvesting, assembling and grading , handling , transportation and disposal of the produce.

6 Conclusions & Recommendations

Micro irrigation technologies are being promoted in India by the central and state governments, by providing different kinds of financial, institutional and technical support. These technologies are promoted primarily because of: (1) as a means to save water in irrigated agriculture, (2) as a strategy to increase income and reduce poverty, and (3) to enhance the food and nutritional security of rural households. Despite the reported significant economic advantages and the concerted support of the government and NGOs, the current micro irrigation area in India remains an insignificant proportion of its potential. Rising demand for irrigation water in the face of its inefficient use amid concerns of growing water scarcity has brought into renewed focus the need for conserving water and improving water use efficiency.

The real thrust on promoting MI adoption largely started with the recommendations of the Report of the Task Force on Micro Irrigation in 2004. Their report sought to increase the emphasis on MI technology and recommended a broader framework, viewing MI technologies as a part of the overall water management strategy. It also recommended that more financial resources for subsidies, with state governments taking up 10 percent of the cost, while the central funds would account for 40 percent and advised greater flexibility for states to determine their appropriate implementation structure and institutional mechanisms for subsidy disbursement (Ministry of Agriculture 2004). Based on these recommendations, in 2006, the Centrally Sponsored Scheme (CSS) on MI was launched. The ‘National Mission on Micro Irrigation’ (NMMI) in 2010, revising and reformulating the Centrally Sponsored Scheme (CSS) on Micro-Irrigation which was introduced.

In this study, an attempt is made to study the Impact Evaluation of micro irrigation in 13 states of India by using the available information and field surveys of 7400 respondents inclusive of both adopters and non-adopters.

Owing to promotional schemes introduced by the state and central governments, the area under micro irrigation has increased from 11,817 ha in 2005-06 to over 3.61 million ha in 2012-13. In spite of having many advantages over conventional method of irrigation, the area under micro-irrigation presently occupies only about 5.71 percent of the total irrigated area. As per the latest information, only 2.85 percent of total irrigated area under drip irrigation and 2.86 percent is under sprinkler irrigation.

Government of India, Ministry of Agriculture, Department of Agriculture and Cooperation assigned the study on **“Impact Evaluation of National Mission on Micro Irrigation”** (NMMI) scheme to access the performance of the programme implementation and access the impact of this scheme on increase in farmers' income through adoption of the MI system. The study was conducted in 13 states comprising of 64 districts from the sampled states namely AP, Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Maharashtra, Odisha,

Rajasthan, Tamil Nadu, Uttar Pradesh, Sikkim and Uttarakhand. The field survey to get the first hand information was conducted for a total sample of 7400, comprising beneficiary and non-beneficiary farmers in these selected states through adopting stratified-purposive-sampling design. Apart from this information was also collected from system suppliers, government officials.

Major Outcomes of the Study

A. Current Status

- i. The Scheme since its inception in 2005-06 has made rapid stride across the country. It has succeeded in bringing about 3.56 million ha area under micro irrigation in the sampled 13 states⁷. The physical targets for the period 2005-06 to 2012-13 were fixed to the extent of 3.83 million ha out of which 3.56 million ha has been brought under MI. The Targets and achievements for financial outlay were Rs.5012.8 and Rs.5006.5 crores respectively. The overall physical and financial achievements thus come out to be 92.99 & 99.87 percent. The extent of achievements however, varied among different states. States like Bihar, Karnataka, Odisha, Rajasthan and Sikkim achieved more than 90 percent of the set physical targets. Uttarakhand could achieve only 21 percent of physical and 31 percent of the financial targets. Other States such as AP, Chhattisgarh, Gujarat, Haryana, Maharashtra and Tamil Nadu succeeded to achieve more than 70% of their physical targets.
- ii. AP, Gujarat & Maharashtra are leading states in the every aspect of performance the different activities involved in the process streamlined in the guideline of NMMI. While Bihar, UP, Sikkim & Uttarakhand states are lacking in terms of the functions mentioned in the guidelines.

B. Pattern of Assistance

- i. Most of the states are giving subsidy of more than 70 percent for installation of MI system. However, comparison of various states and analysis clearly demonstrates that increased subsidy had no significant impact on the increase of area coverage under MI system. Farmers in Maharashtra, Gujarat and Haryana were 22.3, 14.0 and 10.0 percent respectively in case of sampled beneficiaries while pertinent subsidy component in these states was 60, 50 and 90 percent respectively. Similarly, area coverage in Rajasthan, Tamil Nadu and Bihar was noted to be 7.3, 4.5 and 3.1 percent respectively and the corresponding figures

⁷ Ministry of Agriculture

for subsidy were 90, 75 and 90 percent. The aforesaid observation clearly suggests that increase in subsidy component beyond a limit has little or no impact on area coverage under MI system. The relationship between area expansion under MI and quantum of subsidy has been computed considering beneficiaries' data on area expansion in different states before and after adoption of MI system. Hence, the relationship of subsidies with area expansion as such does not refer to any specific year.

- ii. The efficiency of scheme implementing agency is very high as most of the farmers have reported that their applications are processed and sanctioned in less than 40 days as against 60 days specified in the guidelines. Similarly, in most of the sample states, beneficiaries are reported to be satisfied with respect to the procedure for filing the application till disbursement of the subsidy amount.
- iii. Presently subsidy is limited to maximum area of 5 hectare per beneficiaries which is an impediment to the growth of area under micro-irrigation. The data on size and distribution of operational land holdings in the country also suggest that medium and large farmers accounted about 15 percent of total land holdings thus occupying approximately 55.42 percent of the total area.
- iv. All the states have reported convergence of Mission interventions with different schemes of the Government of India and State level programmes. Most of the districts have converged NFSM interventions with programmes such as RKVY, ICDP, Farm Mechanization, NHM and other programmes.

C. Sources of Awareness and Reasons of Non-adoption

- i. The major sources of awareness about the NMMI scheme were through service providers/ suppliers followed by fellow farmers, extension workers.
- ii. The non-beneficiaries farmers had mix responses for not adopting the scheme because of lack of awareness regarding subsidies, lack of technical knowledge, high capital cost, and system being not economical therefore not required.
- iii. As per primary survey of the sampled beneficiaries, about 59 percent of the respondents were small & marginal farmers and 13 percent were women farmers who have taken the advantage of the Scheme.

D. System Cost and Sources of Fund

- i. On an average, the cost of system per hectare incurred by the beneficiaries ranged between Rs. 54,457.36 to Rs. 72,086.31 in drip system and Rs. 20,481 to Rs. 28,171 in sprinkler irrigation system depending on the cropping pattern, crop spacing etc. in the states under study.
- ii. Almost in all states, farmer beneficiaries use their own funds for contributing margin money (98.66%). Other sources, albeit a small proportion constitutes banking, KCC & money lenders.
- iii. Most of the farmers borrowed money at less than 10 percent of rate of interest from banks and KCCs.

E. Technical Observations about MI System

- i. It was observed that about 64 percent of the beneficiaries installed drip system, 34 percent sprinkler system and 2 percent have installed both the systems in their fields. The highest proportion of drip was observed in Karnataka whereas adoption of sprinkler was higher in Bihar.
- ii. The majority of the beneficiaries (about 68.87%) farmers of all the 13 states have got their soil and water tested. In Gujarat, UP, Maharashtra & Rajasthan, soil testing adopted by 69.27%, 52.75%, 73.37% and 79.13 % of respondents respectively.
- iii. More than 70 percent of the respondent farmers of AP, Gujarat, Sikkim and Odisha were using in-line drip irrigation system, whereas, more than forty five percent beneficiaries of Haryana and Uttarakhand reported to practice on-line drip irrigation system.
- iv. The farmers were using screen filters, centrifugal separators/ hydro-cyclone filter, disc filter, sand media filters depending on the need. The data reveals that screen filters are being commonly used by the beneficiaries in most of the sampled states except Haryana where more than 65 percent beneficiaries are using hydro-cyclone and screen filters in combination due to the water quality as they are using canal water.
- v. There is an increasing emphasis on conserving water and using it more efficiently. Micro irrigation technologies based on drip and sprinkler irrigation systems provide some hope for achieving this. The government has been

providing substantial financial incentives in the form of capital cost subsidies to farmers to invest in these technologies. Most drip equipment sales in the study areas are subsidy driven. Manufacturers and market estimates suggest that most of the MI system sales are subsidy linked. Partly as a result of the existing subsidy delivery mechanism, drip technology has failed to capture the kind of market that would have been expected given the many advantages and water saving potential the technology offers.

- vi. The farmers in almost all the states reported that components of MI System met the BIS norms. The average figure for all the sampled states where system components were as per the BIS norms came out to be around 98 percent.
- vii. As far as overall designing of the system is concerned it was found that the systems were well designed except in case of Sikkim and Odisha where the systems were functional, but not able to meet the farmers' expectation. It is therefore suggested that extensive involvement of the extension staff may be ensured to install the system as per requirement of ground conditions and once the system is installed, regular monitoring particularly during the warranty period of the installation be carried out so that defects if any be got rectified by the suppliers.

F. After Sales Service

- i. On an average, 91% of the beneficiaries across the sampled states reported that after sales services are being provided to them & also they receive the services at the required time. Most of the sampled beneficiaries revealed that they are getting warranty of the MI system.
- ii. In almost all the states, the sampled beneficiaries revealed that no technical support/ guidance on agronomic practices are extended to the users as they generally tell to take the help of extension agencies.

G. Impact Analysis

- i. The irrigated area has increased in all the surveyed states after the introduction of NMMI Scheme. The Irrigated area within the 5892 sampled beneficiaries of the 13 states before adoption of MI system was found to be 13320.86 ha which became 14441.47 ha after adoption of MI system. It is therefore concluded that total percentage increase in irrigated area with the sampled beneficiaries in 13 states after adoption of MI system was noted to be 8.41% from same source of water. Maharashtra has topped the list with 22.28% growth in irrigated area.

- ii. Farmers of all the states have shown an increase in area under horticulture crops after the adoption of the system. The cropped area after implementation of NMMI has shown an increase which may be due to utilization of degraded/marginal land into cultivable land & increase in cropping intensity.
- iii. Scheme has performed well in terms of reduction in irrigation cost and significant cost saving has been observed for irrigation in all the surveyed states. Irrigation cost is reduced by 20%-50% with average of 32.3%. Reduction in electricity consumption after installation of MI system. Average electricity consumption has been reduced by about 31% after using the micro irrigation system. Saving of fertilizers with averages reduction of about 28% in total fertilizer consumption in the surveyed states. Fertilizer saving vary from 7%- 42%.
- iv. Micro irrigation has generated benefits to the farmers in terms of enhancement of the productivity. The average productivity of fruits and vegetables has increased about 42.3% and 52.8%, respectively.
- v. The overall benefits accrued from the micro irrigation system are reflected in the income enhancement of the farmers. All the surveyed states reported increase in farmer's income in the range of 20% to 68% with an average increase of 48.5%.
- vi. Given the high benefit-cost ratios which is more than one in almost all crops and states, we also find that the present form for delivery of public support in the nature of a capital cost subsidy is constraining both to the widespread adoption of the technology by farmers and to innovation in technology development and marketing. This has made the entire gamut of manufacturing, sales, adoption, and use of drip technology subservient to government support. The present study has put forward an alternate system wherein the subsidy is given directly to farmers willing to invest in a drip system. With a given amount of funds available, the proposed model can provide subsidies to a much larger number of farmers, can bring a much larger area under drip irrigation resulting in lower subsidy outgo per hectare of drip irrigated area, would still incentivise the farmers to invest in drip systems, lower the cost of subsidy outgo, easy to manage and govern, less prone to interference and whims and fancies of officials, and lead to more efficient use of available subsidy without distorting the market. Thus, on all indicators, the proposed subsidy scheme of direct delivery far outweighs the existing subsidy scheme of subsidizing the manufacturers in the name of the farmers. BC ratio of installing micro irrigation system is above one across the states and across the crops which signifies the importance of MI system in net income enhancement of the farmers. The BC ratio was observed to

be highest in Odisha among fruits & vegetables whereas, in flowers, Rajasthan & Haryana beneficiary farmers achieved higher BC ratio.

- vii. The positive outcomes have made the food security effective due to the increase in the production and productivity of different crops and increased area under irrigation from same source of water. Area under horticulture crops as well as nutritional security has also enhanced.
- viii. The NMMI has helped to widen the food basket of the country with significant contributions coming from the bringing more area under irrigation and with judicious use of water. New farm practices and innovations with support of government have encouraged the farmers to shift toward crops giving higher income.

H. Employment Generation

- i. Beneficiaries of all the states under study have shown decrease in utilization of the labor in pre-harvest practices that is labor saving on irrigation, weeding, fertilization and other operations. It shows that the use of human labor after the use of micro irrigation has decreased significantly and ranges between 7.41 to 18.75 percent. But in post-harvest operations, right from harvesting to handling and disposal of the produce, there is an increase in labor utilization and it ranges between 21.19 to 50.23 percent due to the increase in the production which requires more of the labor for harvesting, assembling and grading, handling, transportation and disposal of the produce.

I. Training and Capacity Building

- i. Among the surveyed states, more than 90 percent of the sampled beneficiary farmers in the state of Haryana, Karnataka, Sikkim & Tamil Nadu had training on different aspects of MI System whereas farmers of Bihar & Odisha, only 20 & 52 percent of the beneficiaries have received the training.
- ii. Results of survey revealed that the system suppliers / manufacturers are the major sources for imparting training as more than 90 percent of the farmers received training from them. Very less proportion of the respondents reported to have training from other sources such as SAUs, KVKS etc. The participant beneficiaries revealed that the duration of training period generally was of 1-2 days. Almost all the respondents of Tamil Nadu, UP, Chhattisgarh, Haryana were given training materials during the training while few beneficiaries of the Bihar and Uttarakhand, Karnataka were provided such training materials.

- iii. Key areas for training were operation and maintenance of the system, adoption of package practices under MI, and opportunities for introducing new crops. Demonstration was other means of motivation and capacity building. It was also found to be a good means of promotion.

J. Promotional Activities

- i. The farmers of the majority of the states acknowledged that the implementing agencies are promoting NMMI schemes in local language however, were not aware of the dedicated website for MI scheme in their state. It is due to the fact that farmers do not have access or willingness to use internet for information gathering.
- ii. On farm demonstrations particularly in rural area, where exposure is limited, are very important means in educating the rural folks. It was noted that maximum beneficiaries of Haryana (98%) followed by Sikkim (80%), Rajasthan (64%) and Uttarakhand (63%) have visited the demonstration laid out in the nearby areas. Whereas, majority of the farmers of AP, UP, TN, Karnataka, Gujarat, Bihar have reported that they have not visited any demonstration farm. It is therefore suggested that more efforts may be put to expose the farmers regarding demonstration of MI system and its benefits.

Thus, it may be concluded that positive outcomes in terms of crop productivity enhancement due to implementation of MI Scheme have contributed significantly to the food requirements. The NMMI has helped to widen the food basket of the country with significant contributions coming from bringing more area under irrigation and with judicious use of water. New farm practices and innovations with support of government have encouraged the farmers to shift forward crop giving higher income.

It is noteworthy that the incremental net returns were observed to be generally higher for cash crops such as fruits vegetables, ground nut, cotton, etc. than for food crops viz., bajra and wheat. This is in conformation with the results of research studies.

Key Recommendations and Policy Implications

For the food security and sustainability to match the growing population, priorities are to bring more area under irrigation through judicious use of irrigation water. Keeping this aspect in view the Government of India launched the Central Sponsored Scheme for Micro Irrigation in 2005-06 which was up scaled as National Mission on Micro Irrigation in 2010. Micro irrigation system being capital intensive in nature and the adoption cannot be increased without providing subsidy. Subsidy can be a necessary condition for encouraging the adoption of micro-irrigation, but cannot be a sufficient condition for sustaining the

growth of it, as many other factors determine the adoption of the same. Even though subsidy is not needed to enhance the economic viability of the system, it is still needed to enhance the incentive for the widespread adoption of MI particularly among the resource poor farmers (marginal and small categories). Therefore, there is a need to find out the ways and means to convince the farmers about the economic and social feasibility of micro-irrigation. Since it involves relatively higher amount of fixed investment, farmers often ask the questions regarding the payback period, viability, water saving, and the productivity gains. It appears that these questions arise mainly because of poor exposure about the social and economic advantages of the technology. Thus, efforts are needed to convince the farmers through quality extension network, as India's highly successful green revolution was also the result of extension innovations as much as technology. Considering the fast decline of irrigation potential and competing demand for water from different sectors, all possible efforts are needed to increase the adoption of water saving technologies so as to avoid water scarcity in the future.

Given the vast potential benefits of micro-irrigation and fast decline of availability of water for irrigation in the country, a number of technical and policy interventions are required to be introduced so as to increase the adoption of micro-irrigation in India. The needed recommendations and interventions are presented below:

A. Scheme Related

- 1) The rate of subsidy provided under NMMI through central government is fixed uniformly for different categories of farmer with a limit of 5 hectare. This needs to be restructured as about 15% of the large and medium farmers' accounts for more than 55.42 % of the land in India. Therefore, this limit of five hectares needs to be enhanced for extending the subsidy.
- 2) States often compete with each other to increase the subsidy component. However, it has been noted that higher subsidy does not necessarily lead to more area coverage under MI system as the highest increase in area under MI has been achieved by states which offer subsidy in the range of 50-75 percent e.g. Maharashtra, Chhattisgarh, Gujarat and Odisha In case of AP which increased subsidy from 70 to 90 percent in 2011-12, the additional area to come under MI in fact decreased as compared to the previous years. It is therefore, recommended that the states should be advised to seriously consider that the quantum of subsidy should preferably be not more than 50-70 percent including state and central share.
- 3) No uniform pattern is being followed by states for implementation of this scheme. It has been observed that in some states more than one department are involved in parallel, e.g. Karnataka where it is being implemented by both agriculture and horticulture departments. In such cases there is often lack of coordination which adversely affects

the outcome of the scheme. It has also been observed that where a single department is designated as the implementing agency (e.g. horticulture or agriculture) it does not pay adequate attention to the crops coming under the purview of other departments. Perhaps one of the best implementation strategies is to designate an independent Special Purpose Vehicle (SPV) on the pattern of Gujarat (GGRC) and AP (APMIP). States may be encouraged to replicate such a strategy.

- 4) One of the major reasons for the slow growth of micro-irrigation in India is the high initial investment. In spite of availability of subsidy from state agencies, majority of the farmers are reluctant to invest in micro-irrigation system even in horticulture crops, which is highly suitable for drip irrigation. Therefore, micro-irrigation system should be tailored made, i.e., planned and designed based firmly on location specific parameters to reduce the cost of installation.
- 5) Micro irrigation System is mostly promoted through subsidy schemes and not as an on-farm water and land management strategy. In certain states, under subsidy scheme, the requisite consideration have not been given in respect of field size, shape, topography, type and location of water source, seasonal fluctuations, type of soil and crop to be grown. As a result, in certain cases, the subsidy may not match the specific situation of an individual farmer, consequently the system may not match the site specific situations of an individual farmers consequently the system may not operate to the complete satisfaction of the farmer.

B. Technology Related

- 1) There is a need to establish a Central Testing Facility (CTF) to deal comprehensively with the design, development and testing of all equipments, devices, machines used in micro irrigation systems using state-of art technology. It is suggested that the Govt. may consider contacting regular and random technical audit of the system to cover about 2-3 percent beneficiaries within first and second year of the installation. This will keep check on to quality and suppliers will be more vigilant to supply good quality of system.
- 2) It is suggested that the implementing agencies should be more vigilant regarding warranty and after sales service of the system provided by the suppliers. The question of releasing 10 percent of the cost of the system after one year subject to satisfactory performance of the system as certified by the beneficiary may be considered. Maintenance manual in vernacular language should be made available to the beneficiaries at the time of installation of the system.
- 3) It is observed that the cost of micro-irrigation accessories such as emitters, filters, laterals, etc. vary between shops and places. Sometimes farmers do face problem in

getting spare parts in time. It is necessary to provide quality materials in time for farmers for the speedy adoption of micro-irrigation.

- 4) Inadequate information about the operation, maintenance as well as the usefulness of micro irrigation is one of the main reasons for its uneven spread across regions in India. Farmers still do not have full knowledge regarding the usefulness of the micro irrigation. Even the adopters do not know fully how much of subsidy is available per hectare for different crops.
- 5) Clogging of drippers mainly due to poor quality of water helps in bacterial growth which can be controlled by using chlorination which acts as a powerful oxidizing agent and vigorously attack micro-organisms such as algae, fungi and bacteria. Also acid is injected into drip irrigation system to lower the pH of the irrigation water and this helps in preventing the precipitation of salts such as calcium carbonate, magnesium carbonate or ferric oxide. It has been observed during the course of survey that the availability of sulphuric acid in the nearby towns is a major constraint and farmers are forced to purchase new spares by discarding clogged drippers. Recently, some farmers have started applying phosphoric acid to get dual benefit such as flushing of impurities and adding P fertilizer to the soil, but the same is not recommended and also not very effective. It is, therefore, recommended that system suppliers should make acid available to the growers as part of their after sales service obligation. It is realized that the normal acid treatment does not help to mitigate the problem. Therefore, studies need to be carried out to devise de-clogging measures in such areas.

C. Awareness and Capacity Building

- 1) The extension network currently operated mainly by government agencies does not seem to be making significant impact on the adoption of this technology. Therefore, there is a need to revamp the entire extension network by involving the MI system manufacturers in order to increase & improvise the existing quality of extension services.
- 2) System manufacturers should be involved intensively in promoting micro-irrigation by introducing frequent demonstration at farmers' field and strategic locations in the district/ state. The micro Irrigation system manufacturers should be involved in providing advice on agronomic packages to the farmers so as to encourage the adoption of micro irrigation at a large scale.
- 3) Since MI system suppliers are one of the major sources of creating awareness among potential beneficiaries, their involvement in laying down demonstration may be increased. Similarly, imparting training on technical and operational aspects of the system should be included as mandatory part of the training of the farmers by the

system suppliers. The training may also include aspects of packages of practices which may be standardized by the SAUs & other related organization and supplied to system suppliers for further dissemination to the farmers.

- 4) Awareness on MI system is low in states like Bihar, UP and Odisha. Special drive is needed for exposure visits/ trainings to make them aware about the benefits and operation of the system. The number of demonstration farms should also be increased.
- 5) It is understood from the field study that the officials who are involved in promoting micro-irrigation technology under the Gol Scheme have inadequate knowledge about the technical and other details of MI. Therefore, the state government extension staff need to undergo ‘Refresher Courses and exposure visits’ to have basics of micro-irrigation thereby enabling their role in the implementation of the scheme.

D. Follow up Action

- 1) Though micro-irrigation has been in use in different States since mid-eighties, State-wise potential area is not estimated as of today. Therefore, it is essential to prepare State-wise and crop-wise potential area for MI. A detailed estimate on State-wise potential would be useful to fix the target to be achieved and further to develop a road map for MP adoption in the country.
- 2) It is evident from field study that capital cost required to install micro irrigation system is relatively high. Because of this reason, considerable percentage of farmers have expressed that they are unable to adopt this technology for low value crops. There has been a significant development in the MI technology and efforts should be on developing and popularizing low cost technologies. This would help reducing the cost of the system and increasing the adoption of micro-irrigation at a large scale and at least one percent of the outlay on micro-irrigation needs to be earmarked for micro-irrigation research.

The information regarding all the activities under NMMI scheme at national and state level should be under public domain. The information available at NCPAH website is qualitative and it should be quantitative to make it more clear and informative. Similarly, information at state level is hardly available in the website and it should be mandatory for implementing agencies to host their websites as is being done in case of Tamil Nadu.

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Appendices

Annexure I: Processes of Implementation

Process for Implementation of Micro Irrigation Scheme

The Block Development Officer will receive Gram Sabha approved applications with the required documents on basis of “**first come first served**” basis, from the farmers interested in availing benefit under the scheme through Village Horticulture Extension Officer, Horticulture Development Officer and other sources such as regional workers/dealers of registered manufacturing companies. Action: Block Development Officer
At Block Development level, the compiled applications will be put in a register according to priority and registered number and date will be assigned. The registration number and date will be informed to beneficiary in written. (**Form-One**)

Action: Block Development Officer

Within three days of receiving the application, a visit to farmer’s field will be made with Village Horticulture Extension Officer to confirm the information entered in application and field notes will be compiled in a folder. (**Form-Two**)

Action: Block Development Officer

Time Limit: Three days

After the field visits, the applications will be arranged in an ordered list and sent to District Horticulture Office along with application form-three. A copy of list and application will remain with Block Development Officer. (**Form-Three**)

Action: Block Development Officer

Time Limit: Four days

At district level, development block wise received list will be registered and kept in same order in block wise registers. From every Block Development list each application will be accepted in order.

Time Limit: Three days

Action: Member Secretary, District Micro Irrigation Committee (DMIC)

The estimation of proposed area and cost will be made according to received applications, district level integrated Action Plan will be formulated and District Micro Irrigation Committee’s sanction proposal will be sent to State Micro Irrigation Committee.

Time Limit: Ten days

Action: Member Secretary, State Micro Irrigation Committee (SMIC)

On the basis of district level Action Plans, state level Action Plan will be prepared and after approval from State Micro Irrigation Committee (SMIC) will be sent to central government’s Department of Agriculture & Cooperation, New Delhi.

Time Limit: Ten days

Action: Member Secretary, State Micro Irrigation Committee (SMIC)

Part-Two

The information received about district wise Action Plan approved by central government’s Department of Agriculture & Cooperation will be shared with DMIC.

Time Limit: Three days

Action: Member Secretary, State Micro Irrigation Committee (SMIC)

(a) After receiving information about approved Action Plan for district, each block wise registered application will be forwarded to manufacturing companies which were selected by farmers for survey drawing/design etc., in an order. (**Form- Four**)

Time Limit: Three days

Action: Member Secretary, District Micro Irrigation Committee (DMIC)

(b) After getting the approval from the bank, bank loan application will be send to the micro irrigation Company for the further required action.

Micro Irrigation Company will prepare drawing, design, etc. of the farmer’s field in which system has to be established and make them available to Block Development Officer and Senior Horticulture Development Officer.

Time Limit: Three days

Action: Micro Irrigation Company

After receiving documents from Micro Irrigation Company, Block Development Officer will visit concerned farmer’s field and will make initial physical verification of irrigation water and available energy for the proposed system which is to be established.

After initial physical verification, required documents along with recommendation of Block Development Officer should be sent to Member Secretary, DMIC. (**Form: Five**)

Time Limit: Three days

Action: Block Development Officer

After receiving approved applications from Block Development Officer within stipulated time limit, Member Secretary, DMIC will issue administrative approval and give work orders to micro irrigation Company to accomplish work. (**Form- Six**)

Time Limit: Three days after receiving applications

Action: Member Secretary, District Micro Irrigation Committee (DMIC)

After receiving work direction from Member Secretary, District Micro Irrigation Committee (DMIC), Micro Irrigation Company will establish system in working condition at the site selected by concerned farmer. It will give required training to farmer and manual in Hindi.

The satisfaction certificate will then be obtained from farmer should be sent to Member Secretary along with bills. (**Form- Seven**)

Time Limit: Seven days

Action: Micro Irrigation Company

After receiving information about system establishment from micro irrigation companies, group of nominated officers from DMIC will physically verify the established system and report will be presented in prescribed form. After receiving correct physical verification report, the approved grant payment will be issued in prescribed form (**Form-Nine**) and action for payment will be ensured. (**Form- Eight**)

Time Limit: Ten days

Action: Nominated Group for physical verification

Note: (1) The process of making payments to the suppliers of materials under scheme should be made after physical verification and other necessary formalities have been completed. The payment should be made according to priority.

(2) During physical verification concerned officials will see that system has been established according to the drawing/design presented initially by micro irrigation Company. The standard material has been provided in prescribed quantity. The distribution of irrigated water is uniform at all the places. The farmer has been trained to operate the system, maintain it etc. and manual in Hindi has been provided. If during physical verification the facts are presented showing incomplete provision of system and supply of non-standard material, Member Secretary will have a responsibility to inform micro irrigation Company that it should establish the system according to the presented proposal. The physical verification of system should be done again before taking action to make payment to company.

Time Limit: 3 days

Action: Member Secretary, DMIC

It will be responsibility of Head, DMIC that the above action is taken in stipulated time.

Action: Head, DMIC

The person getting benefit out of micro irrigation scheme has to submit an affidavit on a 5 rupees stamp paper along with the necessary forms to the Assistant Director, Horticulture,

Joint Member Secretary, District Micro Irrigation Committee declaring that he will not transfer the drip/sprinkler system to any other farmer neither sells it. (**Form- Ten**)

Action: Beneficiary

Answerable: Block Development Officer

The beneficiaries of this scheme will have to give in written that they or any member of their family (if combined) has not taken benefit from any Govt/ state Govt scheme of providing drip/sprinkler for irrigation. (**Form- Eleven**)

Action: Beneficiary

Answerable: Block Development Officer

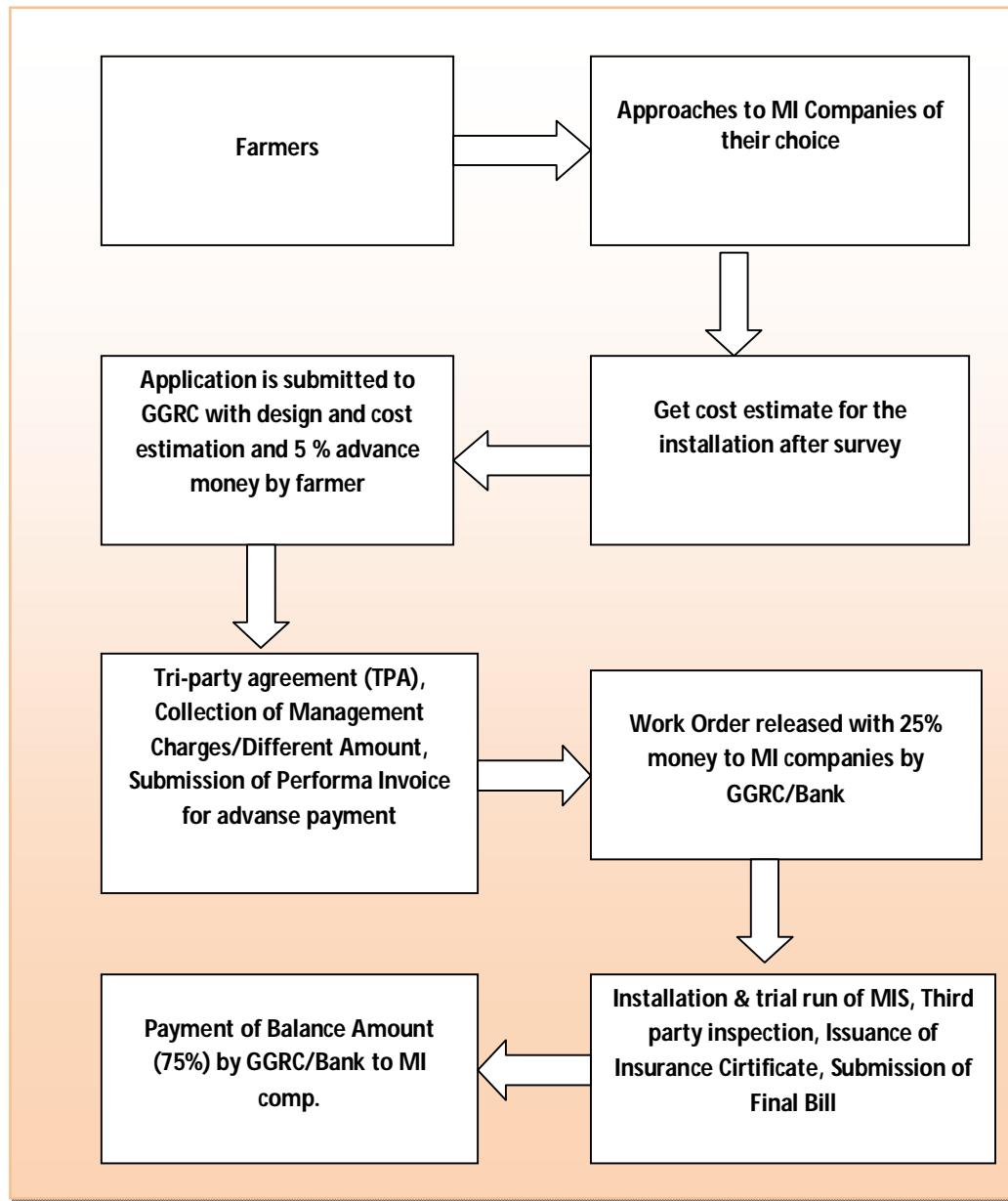


Figure 13: Subsidy Process under GGRC
Source: Kumar & Pullabhotla

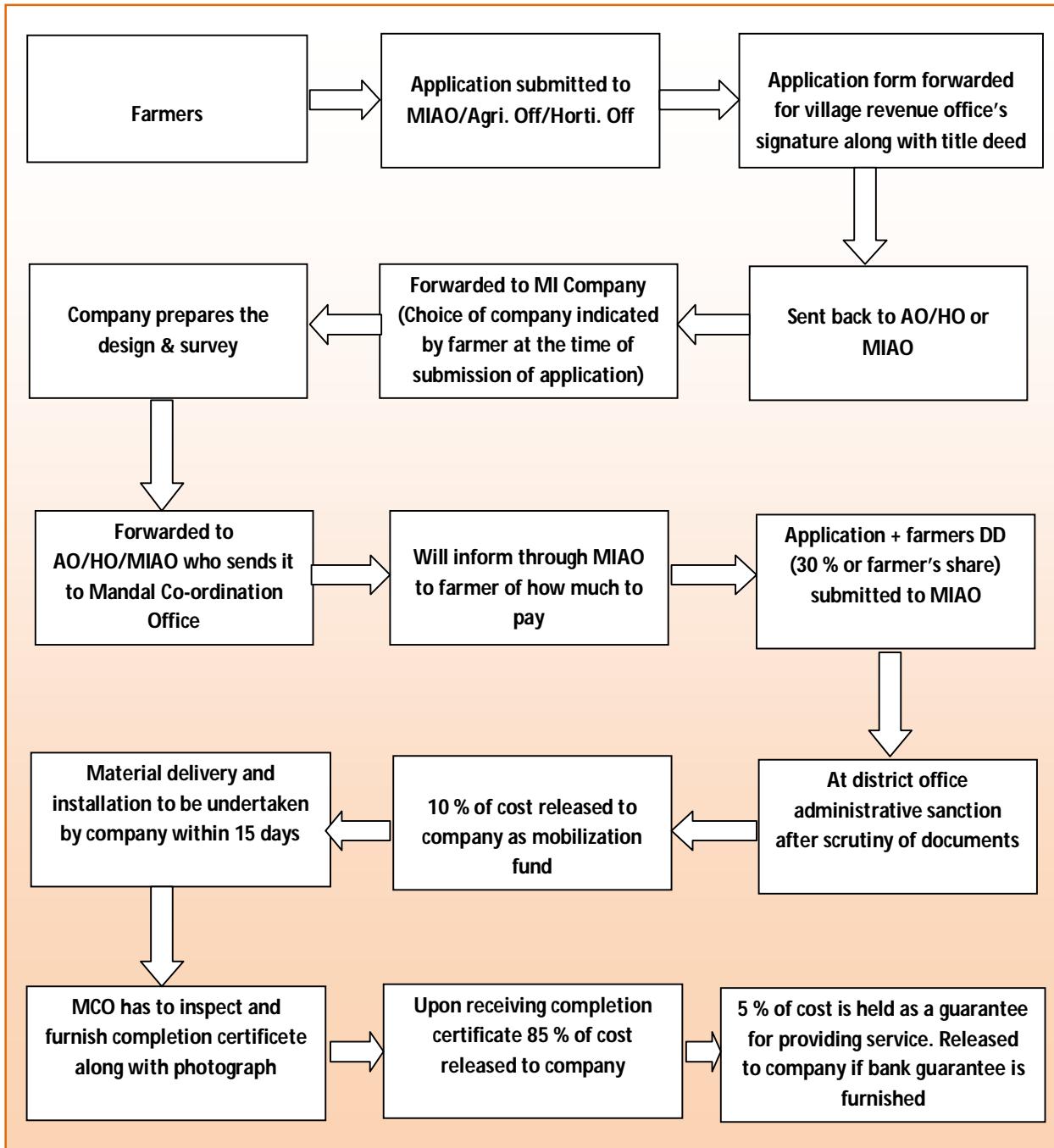


Figure 14: Subsidy Process under APMIP

Source: Adapted from Horticulture Department

Note: Abbreviations used: MIAO – Micro-irrigation Area Officer; AO/HO – Agriculture/Horticulture officer; MCO – Micro-irrigation coordinators

Box 1: Online Micro Irrigation Farmer’s Subsidy Management System in Tamil Nadu Subsidy Management System

Online Micro Irrigation Farmer’s Subsidy Management System in Tamil Nadu Subsidy Management System

With a mission to improve and increase the performance the Micro Irrigation (MI) for Horticulture and Non Horticulture crops across every region in all states of India, web based software for centralized subsidy allocation and management monitoring software is developed. This software was developed by Maruti Computers Private Limited (MCL), Chennai, is proved to be very successful after its implementation in the state of Tamil Nadu. This web based application software is an end-to-end tool which simplifies and facilitates the entire process of release of subsidy to the beneficiaries. This system provides required information to all stake holders in a very transparent manner and provides paperless office and e-governance functionalities. This software was developed with latest technologies and fully complies with current guidelines of Central Government MI Scheme. The software is continually updated with the changes in rules and regulations, and for the technology changes. This software addresses the core need for this application - speedy processing of farmer’s subsidy requests in a transparent manner.

Overview

The software was developed as per the guidelines of the MI Scheme. This software is available in multiple languages. For a specific state, this is available in bilingual languages for various applications and annexure. This will enable the beneficiary to understand the content of the application in the local language and fill without any errors.

To increase the accuracy and correctness of the information submitted by the farmers, software enables them to re-verify the entire data to be submitted by them. System helps the applicant to correct the data, before submitting to department. On completion of various applications at their convenience, the beneficiary can submit the application on-line.

Once the entire application is in complete form, system accepts the application for further processing. A unique 16 digit Application Id is generated by the system and with Id of the application. The authorities will be able to identify the district, taluka, block, etc., along with date & time seal. The Beneficiary farmers may also submit their application online, with the help of designated agencies (District Agriculture and Horticulture departments) or Sugar Mills or Micro Irrigation Companies, who are all one of the stake holders of the scheme.

The software and the data within the software are highly secured with access control privileges for various levels of users. Data within the system cannot be manipulated or altered where they lack authority. The software can generate various types of MIS reports and all stake holders. The Government of India, who is the sponsor of the scheme, can generate reports on demand for monitoring the scheme. The system has intelligence to identify and mark duplicate application. Through this facility, duplicate or fraudulent applicants are identified and removed from further processing. The software is user friendly, menu driven, open-ended for future enhancements, and is secure.

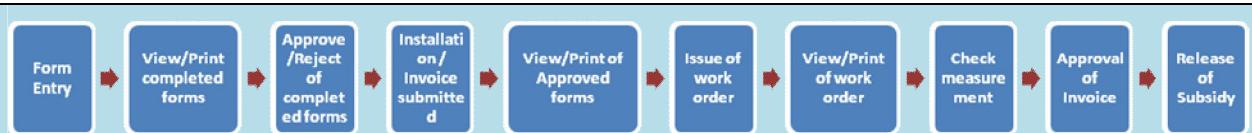
Subsidy Processing and Monitoring

The fully completed applications are then processed by the District Technical Committee. Their decision of approving or rejecting the applications is fed online. On approval, a work order for installing the system is issued to the respective Micro Irrigation companies. The Micro Irrigation companies after installing the system in the field, they submit the completion certificate and their Invoice online. Subsequently, check Measurement done for the implementation of the system is then fed online. Once check measurement is submitted, Invoice submitted by the MI Companies gets approved for release of their payment and subsidy to the beneficiary.

Process flow

The software is built with Business Process Management (BPM) concepts. BPM provides the workflow or process management capability – that helps an organization to formulate a step by step flow of a process and stipulate conditions for flow from one step to another. It also provides tight security as who can move from one step to another.

Box 2: Possibilities for Modifications



Possibilities for Modifications

The administrator of the system can make majority of operational changes without any programming changes. The system is built on a rule driven and data driven architecture. Hence, by changing the data and rules the system behavior can be modified. Process flow control can be managed by changing the business process flow with use of Ganges.

The software application will be continuously updated MCL for the following items.

- Central Government and state regulations
- Software upgrades for technology related items

Setting up of a company – Special Purpose Vehicle (SPV) to deal with the Micro Irrigation scheme in the states:

Both the APMIP and GGRC models are different to the other State Implementing Agencies (SIA) in nature, process and functioning. The key contrasting feature of this process between the two models is that under the GGRC system the farmer directly approaches the MI firm of his choice, usually through a dealer, whereas in the SIA/APMIP system, the farmer's point of contact is the local officer who has jurisdiction in the area. The farmer indicates his choice of the company at the time of submitting his application and a number of additional approvals are needed before the company receives the farmer's demand and proceeds to prepare the cost estimate. This feature adds another layer of delay and unnecessary scrutiny in the subsidy disbursement process. This is not the case under the GGRC model.

Both APMIP and GGRC are independent and are not under any specific state department such as agriculture or horticulture has no crop specific crop bias.

In many instances in these models, the MI dealer or firm has an incentive to take up the responsibility of much of the administrative procedures such as collecting the relevant documents, facilitating access to bank documentation (in case the farmer wants to avail of credit), submitting the application to the implementation authorities etc., in order to speed up their own business.

The GGRC encourages the suppliers to motivate the farmer for timely submission of application under MI Scheme' and educate the farmer for availing loan procedures of Bank

under MI scheme. This design reduces some transactional costs of availing the subsidy from farmers to MI suppliers and enhances efficiency.

The implementing agency as the private sector also encourages devoting some of its own resources to promote and educate the farmers about the subsidy scheme and its guidelines, in addition to the public extension efforts.

Both these models, however, allow for various checks to scrutinize such misappropriation of subsidy through their design of the payment process and via third party verification procedures.

Both APMIP and GGRC follow similar procedures for collecting the farmer's share of the cost of the MI system and incorporate provisions to safeguard farmers' interests. The farmer pays his share to the implementing agency, rather than directly to the MI firm. Both the agencies releases only some portion of the amount to the supplier prior to the delivery and installation of the system, as a mobilization fund.

Only after the system has been installed, a trial run undertaken and verified by a third party monitoring agency, and with the farmer acknowledging the system performance, is the complete amount (farmer's contribution along with the subsidy component) released to the supplier.

In view of above, the GGRC model, and to some extent the APMIP model, incorporate useful design elements that align incentives for suppliers (of MI technology as well as credit and insurance suppliers) in a manner that is advantageous to farmers.

Set up an SPV on the lines of GGRC (Gujarat) and APMIP (Andhra Pradesh)
<ul style="list-style-type: none"> • Dedicated and trained staff • Timely subsidy disbursal • Detailed information of the scheme to farmers • All the paper work • Demonstrations • Warranty • After Sales Services • Monitoring of the companies operating in the state • Regular training of farmers • Agronomic support to farmers • Make available loans and insurance to farmers

The above diagram clearly states the advantages of having the Special Purpose Vehicle (SPV) for Micro Irrigation. There will be dedicated and trained staff to deal with the farmers' queries and to work on the MI scheme full time. The funds which do not come on time or are not properly managed will be taken care of by the SPV. Often the farmers complain of not getting information on time or the complication of the Govt. processes. This will be dealt with once the SPV is there. The SPV will help people with the paperwork and other

official documentation. Regular demonstrations will be held and so will the work of creating awareness amongst the farmers about MI will be done. The work of the registered companies will be monitored and it will be ensured that warranty and after sales service be provided to the customers. The company will conduct regular training programs not only on MI but also on several other advanced topics of horticulture. In addition the company will have agronomists to guide the farmers for obtaining higher yield. The loan and insurance problems faced by the farmers will also be taken care of by the company by making arrangements which would be convenient to the farmers.

Annexure II: State wise Physical & Financial Targets & Achievements

Table 90: State wise Physical and Financial Target & Achievements during 2005-06

State	2005-06					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	45521	6775	14.88	6129.23	934	15.24
Bihar	-	-	-	-	-	-
Chhattisgarh	-	-	-	-	-	-
Gujarat	16720	5042	30.16	2182.01	701.17	32.13
Haryana	-	-	-	-	-	-
Karnataka	25234	-	-	3584.1	-	-
Maharashtra	41856	-	-	4808.09	-	-
Odisha	-	-	-	-	-	-
Rajasthan	-	-	-	1048.02	-	-
Sikkim	-	-	-	-	-	-
Tamil Nadu	28950	-	-	-	-	-
UP	8910	-	-	1241.74	-	-
Uttarakhand	-	-	-	-	-	-
Grand Total	180223	11817	6.56	23284.15	1635.17	7.02

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 91: State wise Physical and Financial Targets & Achievements during 2006-07

State	2006-07					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	193459	84623	43.74	19519.68	11277	57.77
Bihar	14223	-	-	2482.1	-	-
Chhattisgarh	28748	4600	16	3032.88	256.21	8.45
Gujarat	18247	24338	133.38	3355.9	3930.95	117.14
Haryana	5365	2823	52.62	443.89	231.79	52.22
Karnataka	23737	38850	163.67	2456.75	4451.69	181.2
Maharashtra	65119	108260	166.25	8796.55	13466.37	153.09
Odisha	3314	1222	36.87	454.26	143.19	31.52
Rajasthan	39751	67721	170.36	2833.34	2687.46	94.85
Sikkim	-	-	-	-	-	-
Tamil Nadu	5402	-	-	1200.64	-	-
UP	-	1863.6	-	-	-	-
Uttarakhand	-	-	-	-	-	-
Grand Total	397365	334300.6	84.13	44575.99	36590.33	82.09

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 92: State wise Physical and Financial Targets & Achievements during 2007-08

State	2007-08					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	46385	114846	247.59	5747.76	14559.42	253.31
Bihar	-	229	-	-	26.17	-
Chhattisgarh	10063	20830.74	207.01	783.39	1750.98	223.51
Gujarat	45155	43037.1	95.31	7349.6	4927.41	67.04
Haryana	7215	7784.99	107.9	604.19	508.11	84.09
Karnataka	53517.7	62939	117.6	6864.5	7597.97	110.68
Maharashtra	103672	82224	79.31	13897.34	12792.07	92.05
Odisha	1032	3069.48	297.43	108.4	101.27	93.42
Rajasthan	44707	73735	164.93	2341.14	2908	124.21
Sikkim	-	-	-	-	-	-
Tamil Nadu	12302	7819.57	63.56	2200	1559.91	70.9
UP	-	4659	-	-	562.17	-
Uttarakhand	-	NA	-	-	NA	-
Grand Total	324048.7	421173.9	129.97	39896.32	47293.48	118.54

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 93: State wise Physical and Financial Targets & Achievements during 2008-09

State	2008-09					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	85209	123581	145.03	9727.31	10835.56	111.39
Bihar	-	313	-	-	21.53	-
Chhattisgarh	13633	30573.61	224.26	954.45	2060.25	215.86
Gujarat	33563	53427	159.18	4898.61	7395.85	150.98
Haryana	32404	22301.69	68.82	1207.28	1277.71	105.83
Karnataka	84167	92622.3	110.05	7318.66	5845.08	79.87
Maharashtra	128758	100410	77.98	14748.06	13444.02	91.16
Odisha	3752	2495.53	66.51	337.94	292.78	86.64
Rajasthan	40231	77729	193.21	2382.31	3009.15	126.31
Sikkim	-	-	-	-	-	-
Tamil Nadu	-	11597.35	-	-	2367.21	-
UP	1378	1287.48	93.43	150	235.12	156.75
Uttarakhand	-	-	-	-	-	-
Grand Total	423095	516338	122.04	41724.62	46784.26	112.13

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 94: State wise Physical and Financial Targets & Achievements during 2009-10

State	2009-10					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	114453	138341	120.87	14310.7	17828.7	124.58
Bihar	NA	107.48	-	NA	10.83	-
Chhattisgarh	17636	15771.19	89.43	1251.98	1193.45	95.33
Gujarat	33326	66249.1	198.79	4447.27	5426.48	122.02
Haryana	1576	3257.67	206.70	211.69	385.39	182.05
Karnataka	81311	108205.17	133.08	6381.3	8685.32	136.11
Maharashtra	84673	94507	111.61	10707.08	13226.28	123.53
Odisha	7578	12776	168.59	528.4	871.16	164.87
Rajasthan	85211	95556	112.14	5693.15	6073.35	106.68
Sikkim	-	-	-	-	-	-
Tamil Nadu	-	18008.03	-	-	2558.3	-
UP	-	1974.13	-	-	381.14	-
Uttarakhand	-	-	-	-	-	-
Grand Total	425764	554752.77	130.30	43531.57	56640.40	130.11

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 95: State wise Physical and Financial Targets & Achievements during 2010-11

State	2010-11					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	165500	122758	74.17	24000	24000	100
Bihar	-	13485.04	-	-	825.88	NA
Chhattisgarh	28780	21830.93	75.85	1019	1801	176.74
Gujarat	80338	78294	97.46	12000	12000.02	100
Haryana	4426	9340.2	211.03	1360.81	1402.27	103.05
Karnataka	72700	87447	120.28	9254	8945.25	96.66
Maharashtra	118025.08	118025.08	100	22237	22265.38	100.13
Odisha	9340.92	12013.96	128.62	810	696.82	86.03
Rajasthan	148000	147613	99.74	12000	11620	96.83
Sikkim	-	-	-	-	-	-
Tamil Nadu	35000	26153.16	74.72	6591	7797.18	118.3
UP	5590	3108.632	55.61	812.3	383	47.15
Uttarakhand	-	-	-	-	-	-
Grand Total	667700	640069	95.86	90084.11	91736.8	101.83

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 96: State wise Physical and Financial Targets & Achievements during 2011-12

State	2011-12					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	88951	105063	118.11	28720	28720	100.00
Bihar	1961	23294.28	1187.88	450	2166.83	481.52
Chhattisgarh	17174	18393.63	107.10	3500	3500	100.00
Gujarat	130294	65101.82	49.97	16664	16695.05	100.19
Haryana	6118	5786.08	94.57	1993	1666.61	83.62
Karnataka	63169	58013	91.84	10965	9165	83.58
Maharashtra	271935	115998.94	42.66	24980	24980	100.00
Odisha	11523	11836.59	102.72	823	892.88	108.49
Rajasthan	107072	122183	114.11	13095	12823.9	97.93
Sikkim	-	509.69	-	400	400	100.00
Tamil Nadu	-	27550.54	-	6625	6625	100.00
UP	-	3790.86	-	-	440.88	-
Uttarakhand	-	NA	-	75	-	-
Grand Total	698197	557521.43	79.85	108290	108076.15	99.80

Source: Ministry of Agriculture; Note: T- Target, A- Achievement

Table 97: State wise Physical and Financial Targets & Achievements during 2012-13

State	2012-13 (March' 13)					
	Physical (ha)			Financial (Rs in lakh)		
	T	A	% A	T	A	% A
AP	131685	76065	57.76	28993.32	27020.9	93.20
Bihar	50571	41372	81.81	5200	5340	102.69
Chhattisgarh	19118	14017	73.32	3172	2677.8	84.42
Gujarat	103381	96232	93.08	18200	18201	100.01
Haryana	9277	6538	70.48	3000	2571.05	85.70
Karnataka	107127	88605	82.71	14065	15121.95	107.51
Maharashtra	127751	76620	59.98	15018	15221	101.35
Odisha	17516	19605	111.93	2000	1689.53	84.48
Rajasthan	98400	78535	79.81	11000	10347.08	94.06
Sikkim	392	-	-	200	-	-
Tamil Nadu	37320	26538	71.11	8300	13235	159.46
UP	11245	2143	19.06	595	393	66.05
Uttarakhand	1005	215	21.39	150	70	46.67
Grand Total	714788	526485	73.66	109893.32	111888.31	101.82

Annexure III: Questionnaires

Beneficiary Farmer's Questionnaire

1. General information:

Name of Farmer (किसान का नाम) ----- Age (उम्र) ----- Yrs
 Village (गांव) ----- Block(ब्लॉक)-----
 District(ज़िला)-----State(राज्य) (-----)
 Contact No. (Mob.)----- Landline (with STD code) -----
 E-mail id-----

2. Education status: (शिक्षा की स्थिति)

- 1. Not educated(अशिक्षित) 2. Primary(प्राथमिक) 3. High school (हाईस्कूल)
- 4. Sr. Secondary (वरिष्ठमाध्यमिक) 5. Graduate and above(स्नातक और ऊपर)

3. Gender (लिंग) :- 1. Male(पुरुष) 2. Female (महिला)

4. Categories of farmers(किसान का जाति वर्ग): - 1. Gen.(सामान्य) 2. OBC (अन्य पिछड़ा वर्ग) 3. ST (अनुसूचित जनजाति) 4. SC(अनुसूचित जाति)

5. Land holding (भूमि धारण): 1. Own land (स्वयंकी)..... Acre 2. Leased in (किराए ली)..... Acre 3. Leased out (किराये दी)..... Acre

6. Land holding Category of farmers (Tick (✓))

- 1. Marginal (सीमान्त)(< 2.5 Acre) 2. Small (छोटे) (2.5-5 Acre) 3. Semi medium (अर्धमध्यम) (5-10 Acre) 4. Medium (मध्यम) (10-25 Acre) 5. Large(बड़े) (≥25Acre.)

7. When the MI system was installed? MI उपकरण कब लगाया गया? (DD/MM/YY) ----- Yr

8. How did you get to know about the MI scheme: आपको सूक्ष्म सिंचाई योजना के बारे में जानकारी कैसे हुई?

	Other Farmers	Advertisements/ विज्ञापन				Extension worker	Supplier	Any other (Specify)
		Radio	Newspaper	TV	Pamphlet			
Code	1.	2.	3.	4.	5.	6.	7.	8.

9. Which crops do you grow? (आप कौन सी फसलें पैदा करते हैं?)

S. No	Crops/ फसलें	Name of the crop / फसलकानाम	Spacing (mxm) अंतराल	Area Covered (Acre) फैसला	Area Covered under MI(Acre)	
					Drip	Sprinkler
1.	Horticultural बागवानी					
	a. Fruits/ फल					
	Veg./ सब्जियाँ					
	Flower/फूल					
	Othersअन्य					
2.	Non-Horticultural	a.				
		b.				
Total Area (Acre.)						

10. Plant/crop management techniques used? क्या आपने कोई फसल प्रबंधन की तकनीक इस्तेमाल की है?

a. 1-Yes/ 2-No if yes, then

S.No	Intercropping before MI/ MI के पहले अंतर फसल (Crops)		Intercropping after MI/ MI के बाद अंतर फसल (Crops)	
	Crop	Spacing (mxm)	Crop	Spacing (mxm)
1.				
2.				
3.				

b. Area utilization: (Acre) जमीन का उपयोग:

S. No.	Land	Before NMMI	After NMMI
1.	Agriculture:	a. Horticulture crops	
2.	Permanent waste/ Barren / बंजर एवं अनुपयोगी जमीन		
3.	Total Area (Acre)		

8. Introduction of new crops & spacing followed due to MI? अपनाई गयी नयी फसल और अन्तराल

S. No.	Crop	Spacing (mxm)
1.		
2.		

9. Irrigation Water Details पानी का विवरण:

a. Source/स्रोत:

	Bore well	Canals	Farm Ponds	Water body	Any other
Code	1.	2.	3.	4.

b. Water table:Ft

10. Quality of soil and Irrigation water: मिटटी और सिंचाई के पानी की गुणवत्ता:

Have you got soil & water tested: 1-yes 2-No, if yes then:

S. No.	Soil quality	Response	S. No.	Water quality	Response
i.	pH		i.	pH	
ii.	EC		iii.	EC	

11. Why did you adopt NMMI scheme?आप ने इस योजना को क्यों अपनाया?

Code	Reasons	Code	Reasons
1.	Because of subsidy/अनुदान के कारण	2.	Quality of produce/उत्पाद की गुणवत्ता
3.	Water saving/पानी की बचत	4.	Proper utilization of land/ जमीन का श्रेष्ठ उपयोग
5.	Labor saving/मजदूरी की बचत	6.	Time saving/समय की बचत
7.	Fertilizer saving/उर्वरकों की बचत	8.	Early fruiting/जल्दी फलन
9.	More production/अधिक उत्पादन	10.	Other specify _____

12. Impact of MI

S.No.	Particulars		Units	Before MI	After MI
a.	Irrigated Area/सिंचित क्षेत्र		Acre		
b.	Cost of irrigation/सिंचाई की लागत		Rs/Acre		
c.	Electricity used/बिजलीका उपयोग		Hrs/day		
d.	Fertilizer used/उर्वरकों का उपयोग		Kg/Acre		
e.	Productivity	b. Fruits/ फल	Qts/Acre		
		c. Veg./ सब्जियाँ	Qts/Acre		
		d. Flower/फूल	Qts/Acre		
		e. Othersअन्य	Qts/Acre		
		Non-Horticultural	Qts/Acre		
f.	Income/आय		Rs/Acre		

13. Have you got training of MI system/क्या आपको NMMI योजना का प्रशिक्षण मिला है? 1-

yes 2-No

If Yes, then

i. By whom you got training of MI system:

Agencies	SAUs/ KVKs	State Govt. agencies	Kisan call centers	PFDC	System supplier	Others(Specify)
Code	1	2	3	4	5	6

ii. Training Details: (Duration: (अवधि).....Days)

S. No.	Particulars	1-Yes/ 2-No
1.	Is training material provided/क्या प्रशिक्षण सामग्री दी जाती हैं	

2.	Topic covered in the training/ प्रशिक्षण के मुद्दे	i. Operation of the system/उपकरण की कार्यप्रणाली	
		ii. Maintenance of the system/उपकरण का रखरखाव	
		iii. Package of practices for the crops/फसलों के उगाने की पद्धति	
		iv. Opportunities for Introduction of new crop/ नयी फसलों के परिचय की गुंजाइश	
		v. Other related schemes/कोई अन्य सम्बंधित योजना	
3.	Have you joined any field visit/क्या किसी खेत का मुआइना किया हैं?		
4.	Are you satisfied with the Learning / क्या आपको मिले पर प्रशिक्षण से आप संतुष्ठ हैं		

*SAU= State Agricultural University * PFDC= Precision Farming Development Centre

iii. Promotional activities :

	Awareness description/जागरूकताकावर्णन	1-Yes/ 2-No
a.	Publicity of the MI Scheme in local language इस योजना का प्रचार स्थानीय भाषा में होता हैं	
b.	Whether there is a dedicated website for MI Scheme in the State क्या आप के राज्य में इस योजना को समर्पित कोई वेबसाईट हैं	
c.	Whether online applications are received क्या आप के राज्य में ऑनलाइन अर्जियां ली जाती हैं	
d.	Are you aware about package of practices being adopted for MI क्या आप सूक्ष्म सिंचाई के इस्तेमाल करने की कार्यप्रणाली को समझते हैं	

14. Subsidy Details: अनुदान का विवरण

i.

Financial assistance/आर्थिक सहायता	Govt. (%)	Beneficiary/लाभान्वित(%)	Total system cost (Rs.)/उपकरण की लागत
Drip			
Sprinkler			

ii. Time taken in subsidy disbursement (Days) अनुदानित राशी मिलने में लगा समय (दिनों में):

- i. Application to Sanction - days
- ii. Sanction to Installation - days

15. Finance:

a. Source of beneficiary share of MI: लाभान्वित के हिस्से का स्रोत

1.Own sources	2.Banks Name.....	3.KCC	4.Money lenders	5.Any other
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b. Rate of Interest :(if money borrowed then) ब्याज की दर (उधार लेने की स्थिति में)

Interest rate/ब्याज दर	3-7%	7-10%	10-12%	12-15%.	>15%
Code	1	2	3	4	5

16. Availability of electricity / बिजली की उपलब्धता:Hrs/ day

17. Power of the pump set you are using: पम्प सेट की क्षमता.....HP

18. Type of fertilizer used by the farmer: उपयोग में लिए गए उर्वरकों का प्रकार

- i. 1. Organic 2. Inorganic 3. Both
- ii. 1. Liquid 2. Water soluble 3. Solid

19. Type of Irrigation Filter/s used by the farmers/

किसान द्वारा इस्तेमाल किये जाने वाले सिंचाई फ़िल्टरों के प्रकार:

Type of Filters/ फ़िल्टरों के प्रकार	Code
Hydro-cyclone Filter/हाइड्रो-सायक्लोन फ़िल्टर	1.
Screen filters/स्क्रीन फ़िल्टर	2.
Sand/ Media Filters/सैंड/ मीडिया फ़िल्टर	3.
Disc Filters/डिस्क फ़िल्टर	4.
Any other specifyअन्य (विशेष विवरण) _____	

20. Employment opportunities:(रोजगार के अवसर)

S. No.	Particular	No. of man days before NMMI	No. of man days after NMMI
1.	Pre harvest practices/ कटाई के पहले की प्रक्रिया		
2.	Harvesting/ कटाई		
3.	Post-harvest handling/ कटाई के बाद की प्रक्रिया		

21. Assessment of System Design: प्रणाली का आंकलन

	Particulars	1-Yes/2-No
a.	Whether various system components supplied to you are as per the BIS/ क्या आपको दिए गए उपकरण के सभी हिस्से BISमानकों के अनुरूप हैं	
b.	Whether pump size is proper to the field/ plot size w.r.t crop water requirements./ क्या आपके द्वारा लगाये गए पंप का आकार आप के खेत के आकार और उसमे बोई गयी फसल एवं उपलब्ध पानी के अनुरूप हैं ?	
c.	Does this MI system meet your requirements./ क्या यह MI उपकरण आपकी जरूरत को पूरा करता हैं	
d.	Is this design layout is as per your project proposal/ क्या इस उपकरण का खाका आप के प्रस्ताव के अनुरूप हैं	
e.	Whether after sales service has been received by you from the MI system suppliers/ क्या आपको उपकरण उपलब्ध कराने वाले ने उपकरण बेचने के बाद कोई सेवा प्रदान की हैं	
f.	Whether the MI systems were found to be functional in the field/ क्या MI उपकरण खेत में सुचारू रूप से काम कर रहा हैं	

22. System supplier:

- i. **Brand/Manufacturer of MI equipment used:** उपकरण का निर्माता.....
- ii. **Reasons for buying from them?** उनसे खरीदने का कारण?

	Local Govt. official	Other farmers	company reps	Advertisements
Code	1	2	3	4

- iii. **After sales services:** बिक्री के बाद दी जाने वाली सेवाएं

- i. **Is it provided by the vendor:** विक्रेता द्वारा दी जाती हैं: 1-Yes/2-No, if yes then:

1.timely	2. Late	3. Irregular
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- ii. **Level of satisfaction of the service:** सेवा से संतुष्टी का स्तर

1.Satisfied	2. Not satisfied	3. Indifferent
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- iii. **Warranty:** 1-Yes/2-No, if yes, then: वारंटीय दि हैं तो

	<6 Months	1 Yr	1-2 Yr	2-3 Yr	>3 Yr
Code	1.	2.	3.	4.	5.

23. Difficulty faced by the farmer in NMMI scheme:/NMMI योजनाको अपनाने में उठाई गयी परेशानियाँ

S. No.	Particulars	1-Yes/ 2-No
1.	Procedure related/ प्रक्रिया से सम्बंधित	
2.	Quality issues/ गुणवत्ता से सम्बंधित	
3.	Higher prices charged under scheme of the system then available in market/ उपकरण की बाज़ार भाव से अधिक कीमते	
4.	Delay in system supply (Committed date vs. Actual date)/ उपकरण की आपूर्ति में देरी	
5.	Other charges (Not covered in the scheme/ additional money paid)/ अतिरिक्त भुगतान	
6.	After sale services are not up to the mark/ बेचने के बाद दी गयी सेवाए संतोषजनक नहीं	
7.	Other specify: _____	

24. Would you like to recommend this scheme to others? क्या आप इस योजना को अपनाने की सलाह अन्य को देंगे ? 1-Yes/ 2-No

Share your experiences/अपना अनुभव बताएं:

.....
.....

25. Any other socio economic benefits you would like to mention:

कोई अन्य सामजिक- आर्थिक लाभ?

- i.
ii.

26. Any suggestion for the better implementation of NMMI Scheme?

NMMI योजना को सही तरीके से लागू करने के लिए आप के क्या सुझाव हैं

- i.
ii.
iii.

27. Whether MI System is installed in the entire land holding? Yes / No

28. Any MI demonstration nearby: (Yes/ No)

29. Type of Sprinkle: (1-Portable, 2-semi-permanent, 3-rain gun)

30. Type of Drip: (1-Inline, 2-online)

31. Observations of the MI System at the time of visit: (1-Functional / 2-Not Functional) the investigator

- i. Overall design: **(1-Good, 2-Satisfactory, 3-Bad)**
ii. General condition of the field: **(1-Good condition, 2-Average condition, 3- Bad condition)**
iii. Whether Farmers are using flood irrigation along with MI system: **(1-Yes, 2-No)**
iv. Whether choice of drip/ sprinkler MI system match with the crop requirement: **(1-Yes, 2-No)**

Signature of farmer

किसान का हस्ताक्षर

Investigator's Name

जांचकर्ता का हस्ताक्षर

Date: दिनांक:

Non-beneficiary Farmer's Questionnaire)

1. General information:

Name of Farmer (किसान का नाम) ----- Age (उम्र) ----- Yrs
 Village (गांव) ----- Block(ब्लॉक)-----
 District(जिला)-----State(राज्य)-----
 Contact No. (Mob.)----- Landline (with STD code) -----
 E-mail id-----

2. Education status: (शिक्षा की स्थिति)

1. Not educated(अशिक्षित) 2. Primary(प्राथमिक) 3. High school (हाईस्कूल)
 4. Sr. Secondary (वरिष्ठमाध्यमिक) 5. Graduate and above(स्नातकऔरऊपर)

3. Gender (लिंग) :- 1. Male(पुरुष) 2. Female (महिला)

4. Categories of farmers(किसान का जाति वर्ग) :- 1. Gen.(सामान्य) 2. OBC (अन्य पिछड़ावर्ग)
 3. ST (अनुसूचित जनजाति) 4. SC(अनुसूचित जाति)

5. Land holding (भूमि धारण): 1. Own land (स्वयंकी)..... Acre 2. Leased in (किराए ली)..... Acre 3. Leased out (किराये दी)..... Acre

6. Land holding Category of farmers (Tick (√))

1. Marginal (सीमान्त)(< 2.5 Acre) 2. Small (छोटे) (2.5-5 Acre) 3. Semi medium (अर्धमध्यम -) (5-10 Acre) 4. Medium (मध्यम) (10-25 Acre) 5. Large (बड़े) (≥25Acre.)

7. Are you aware about the NMMI scheme क्या आप NMMI योजना के बारे में जानते हैं ? 1-Yes/ 2-No

If Yes, then how did you get to know about the MI scheme: आप को सूक्ष्म सिंचाई योजना के बारे में जानकारी कैसे हुई?

	Other Farmers	Advertisements/ विज्ञापन				Extension worker	Supplier	Any other (Specify)
		Radio	Newspaper	TV	Pamphlet			
Code	8.	9.	10.	11.	12.	13.	14.	8.

8. Which crops do you grow? (आप कौन सी फसलें पैदा करते हैं?)

S. No	Crops/ फसलें	Name of the crop/ फसल का नाम	Spacing(mxmx)	Area Covered (Ha)
3.	Horticultural बागवानी			
	f. Fruits/ फल			
	g. Veg./ सब्जियाँ			
	h. Flower/फूल			
	i. Others अन्य			
4.	Non-Horticultural	a. b.		
Total Area (Ha.)				

a. Area utilization(Acre) जमीन का उपयोग:

S. No.	Land	Response	
4.	Agriculture:	c. Horticulture crops	
		d. Field crops	
5.	Permanent waste/ Barren/ बंजर एवं अनुपयोगी जमीन		

6.	Total Area (Acre)				
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10. Irrigation Water Detailsपानीका विवरण:

a. Source/स्रोत:

	Bore well	Canals	Farm Ponds	Water body	Any other
Code	5.	6.	7.	8.

b. Water table:Ft

11. Why did you not taken advantage of NMMI scheme?

आपने NMMI योजनाका लाभ क्यों नहीं लिया?

Code	Reasons	Code	Reasons
11.	Less aware of subsidy/ अनुदान के बारे में अनभिज्ञ	12.	Less technical knowledge/ तकनिकी जान नहीं
13.	Lengthy procedure/लम्बी प्रक्रिया	14.	High capital cost involved/अधिक लागत
15.	Not economical/आर्थिक नहीं	16.	Emitters'/Nozzles' frequent clogging टॉंटी का बार बार अवरुद्ध होना
17.	Application yet not cleared/ अभी अर्जी पास नहीं हुयी		
18.	Any other Specify _____		

12. Have you participated in any training program of NMMI /क्या आपको NMMI योजना का प्रशिक्षण मिला है? 1-Yes/ 2-No

If Yes, then

a. By whom you got training of MI system:

Agencies	SAUs/ KVKs	State Govt. agencies	Kisan call centers	PFDC	System supplier	Others(Specify)
Code	1	2	3	4	5	6

b. Training Details: (Duration: (अवधि)Days)

S. No.	Particulars	1-Yes/ 2-No
5.	Is training material provided/क्या प्रशिक्षण सामग्री दी जाती हैं	
6.	Topic covered in the training/ प्रशिक्षण के मुद्दे vi. Operation of the system/उपकरण की कार्य प्रणाली vii. Maintenance of the system/उपकरण का रखरखाव iii. Package of practices for the crops/फसलों के उगाने की पद्धति ix. Opportunities for Introduction of new crop/ नयी फसलों के परिचय की गुंजाइश x. Other related schemes/कोई अन्य सम्बंधित योजना	
7.	Have you joined any field visit/क्या किसी खेत का मुआइना किया हैं?	
8.	Are you satisfied with the Learning / क्या आपको मिले पर प्रशिक्षण से आप संतुष्ट हैं	

*SAU= State Agricultural University * PFDC= Precision Farming Development Centre

c. Promotional activities :

	Awareness description/जागरूकता का वर्णन	1-Yes/ 2-No
e.	Publicity of the MI Scheme in local language इस योजना का प्रचार स्थानीय भाषा में होता है	
f.	Whether there is a dedicated website for MI Scheme in the State	

	क्या आपके राज्य में इस योजना को समर्पित कोई वेबसाईट हैं	
g.	Whether online applications are received क्या आप के राज्य में ऑनलाइन अर्जियां ली जाती हैं	
h.	Are you aware about package of practices being adopted for MI क्या आप सूक्ष्म सिंचाई के इस्तेमाल करने की कार्य प्रणाली को समझते हैं	

13. Availability of electricity / बिजली की उपलब्धता:Hrs/ day

14. Type of fertilizer used by the farmer: उपयोग में लिए गए उर्वरकों का प्रकार

- a.** 1. Organic 2. Inorganic 3. Both
- b.** 1. Liquid 2. Water soluble 3. Solid

15. Difficulty faced by the farmer in NMMI scheme: NMMI योजना को अपनाने में उठाई गयी परेशानियाँ

S. No.	Particulars	1-Yes/ 2-No
8.	Procedure related/ प्रक्रिया से सम्बंधित	
9.	Quality issues/ गुणवत्ता से सम्बंधित	
10.	Higher prices charged under scheme of the system then available in market/ उपकरण की बाजार भाव से अधिक कीमते	
11.	Delay in system supply (Committed date vs. Actual date) / उपकरण की आपूर्ति में देरी	
12.	Other charges (Not covered in the scheme/ additional money paid) / अतिरिक्त भुगतान	
13.	After sale services are not up to the mark/ बेचने के बाद दी गयी सेवाएं संतोषजनक नहीं	
14.	Other specify: _____	

16. Do you like to adopt this scheme in near future? / क्या आप इस योजना को अपनाना चाहेंगे?

1-Yes/ 2-No

Why?

.....

17. Would you like make any suggestion for the better implementation of NMMI Scheme?

NMMI योजना को सही तरीके से लागु करने के लिए आपके क्या सुझाव हैं

- i.
- ii.
- iii.

Signature of farmer

किसानकाहस्ताक्षर

Investigator's Name

जांचकर्ता काहस्ताक्षर

Date: दिनांक:

Annexure IV**Reason of higher cost of drip in Gujarat:**

During the survey in 13 states, 5892 sampled farmers holding 14810.58 hectares of land were interacted. Analysis of data reveals that average unit cost of drip irrigation system ranges between from 54457.36 Rs./ha to 72086.31 Rs./ha. The average cost of drip system installation was found to be highest in Gujarat followed by Chhattisgarh, Tamil Nadu, Maharashtra, Sikkim, U.P. Karnataka, Rajasthan, Andhra Pradesh, Haryana, Bihar and Odisha.

Analysis was carried out to find out reasons for higher average unit cost of drip irrigation system in Gujarat as compared to other States. Following reason are given in support:

- I. The per cent of area coverage under sprinkler irrigation system in Gujarat is 11.69 % and in other states it is 88.30 per cent. The average cost of sprinkler irrigation system is Rs. 18000 /ha against Rs. 55000 Rs./ha of drip irrigation system.
- II. The more per cent of area coverage under drip irrigation system in Gujarat lead to higher average cost.
- III. Figure- 1 shows area coverage under 0-10 m² spacing, it could be seen from the figure that Gujarat is far ahead from other states in term of area coverage in close spacing crops. When area covered under other spaced crops is compared, UP stand at 1st position in term of area coverage under wide space crops and Gujarat cover very least as can be seen from figure1.

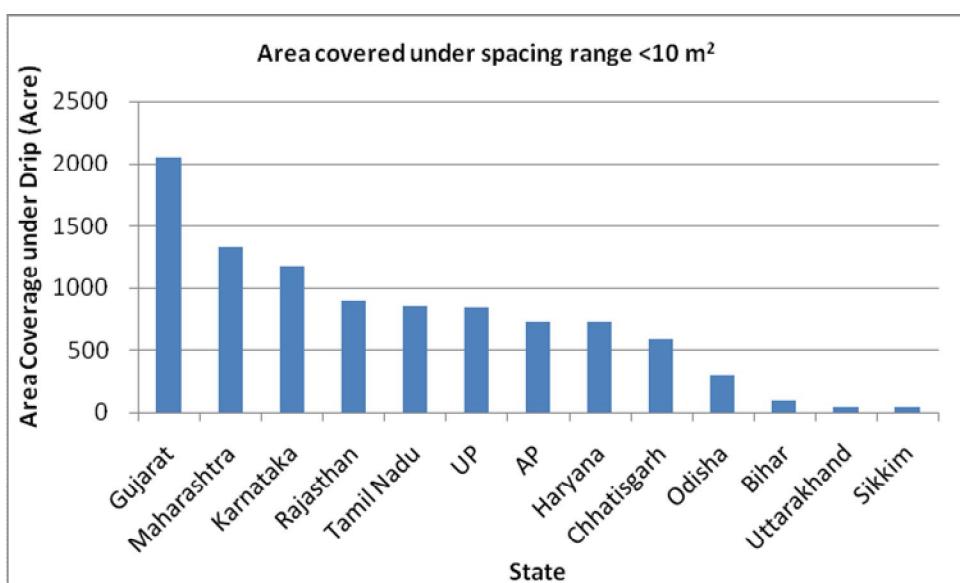


Figure 15: Area coverage under close spacing crops (spacing range <10 m²)

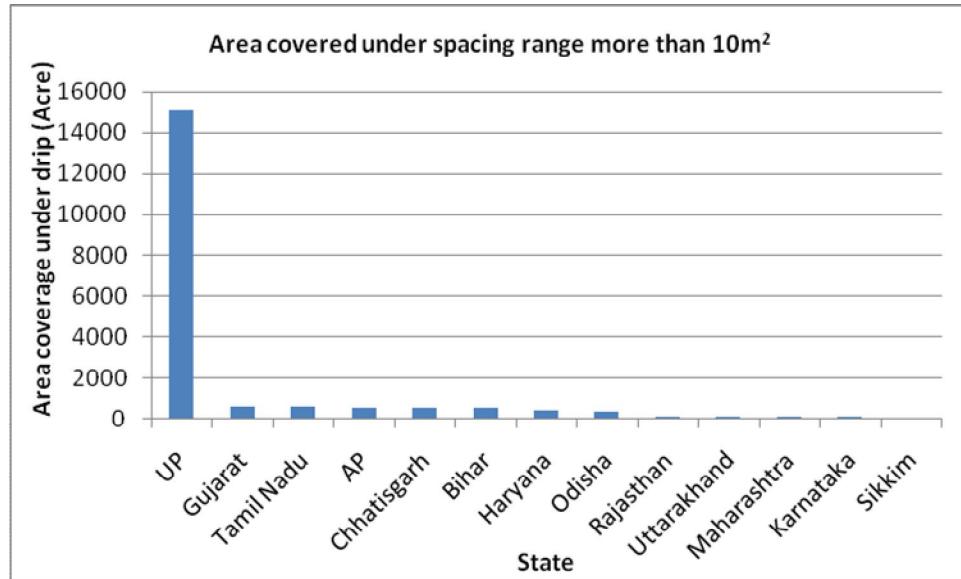


Figure 16: Area coverage under wide spacing crops (spacing range more than 10 m^2)

- IV. When compared average unit cost per ha of drip irrigation system as per NMMI guideline, the average unit cost in closed spacing crops ($0-10\text{ m}^2$) stand at 2.64 times higher than the average unit cost of wide spacing crops (Spacing range more than 10 m^2).

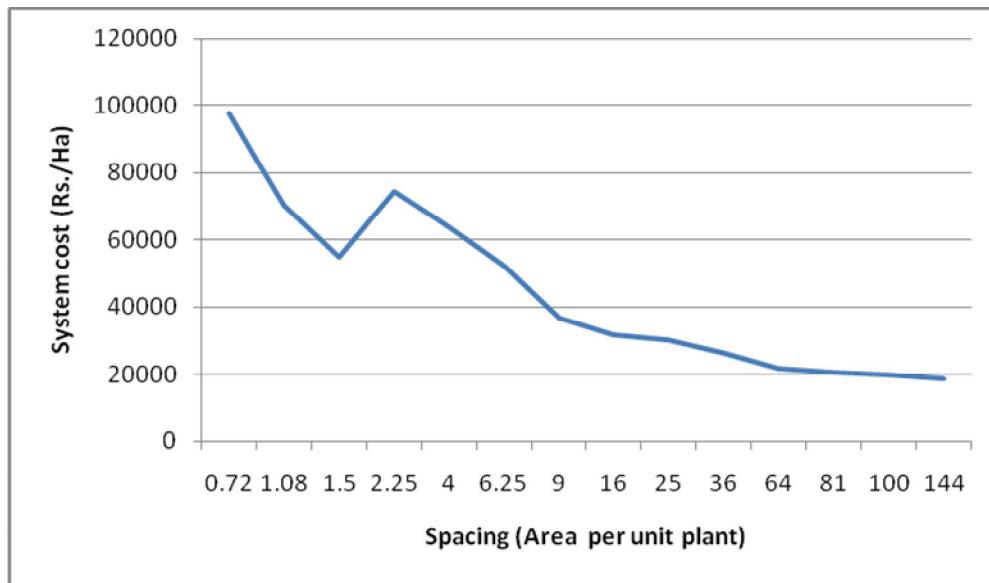


Figure 17: Spacing wise unit cost (Rs./ha) of drip irrigation system as per NMMI guideline

It is also pertinent to mention that financial assistance for installation of drip system in Gujarat is given at actual unit cost rather than as recommended in NMMI guideline which is being adopted in all states other than Gujarat. In Gujarat, the additional amount is given by state exchequer which escalates invoice value resulting in higher average cost.



Taaqat Ek Boond ki



Government of India
Ministry of Agriculture
Department of Agriculture & Cooperation