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Water Policy Research

HIGHLIGHT

Potential and Challenges in Up-scaling Micro-irrigation in India

Experiences from Nine States

Our studies from nine states indicate that adoption of micro-irrigation (MI) technologies - drip and sprinkler systems - has a positive impact in terms of water saving, yield and income enhancement at farm level. However, the overall impression among the farmers is that MI is capital intensive and suited only to large farmers who have access to capital and technical knowhow. As such, only 12.2 percent of potential drip irrigation area and 7.8 percent of potential sprinkler area is covered in the country with large variations across states. Majority of the MI adopters we sampled in Andhra Pradesh, Karnataka, Orissa and Punjab were small farmers. In contrast, in Maharashtra and Tamil Nadu, majority of MI adopters we found were large farmers. Analysis of the rate of return on MI investment indicated no significant difference in incremental net income attributed to MI across farm categories; however, there were significant differences in incremental net income of MI adopters across States. For accelerating MI adoption in the country, our recommendations include reduction in capital cost of the system, provision of technical support for regular MI operation and maintenance, relaxation of farm size limitation in providing MI subsidies and creation of a single state level agency or a Special Purpose Vehicle (SPV) for speedy implementation of the MI program.

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Potential and Challenges in Up-scaling Micro-irrigation in India Experiences from Nine States[1][2]

Research highlight based on a paper with the same title[3]

Introduction

What little research is available in India on Micro-Irrigation (MI) focuses on its economics and its suitability for different crops at different time periods. Little evidence is available on its adoption pattern and its economic impacts on farm households of different land-holding size categories. Key questions we explored in this research are: who has access to MI and what is the economics of MI for farmers under different land-holding size groups (*viz.,* marginal, small and large farmers). We also explored the kind of interventions that are needed to upscale MI adoption.

Methodology

The study was undertaken during 2010. All the states were covered for the estimation of the potential MI area and the actual spread of the technology. For the farm level analysis of costs and returns among different farm groups, nine states were covered *viz.,* Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Punjab, Rajasthan and Tamil Nadu. Both secondary and primary data were collected in these nine states. The secondary data were collected covering the state level MI sources, cropping pattern, existing area under MI and some details on government subsidy for MI adoption. The primary data was collected from a sample of 150 adopter farm households from each selected state using semi-structured questionnaire which canvassed information on farm size, irrigated area, sources of irrigation water in use, area under MI, crops grown, subsidy availed, crop income and expenditure under crops with and without MI. Farm level constraints for adoption of MI and suggestions for better adoption were also solicited during the field surveys. The sample was post stratified into marginal, small and large farmers. Secondary data was used to estimate the potential for MI in each state based on existing areas grown with crops suitable for drip or sprinkler irrigation. Thereafter, primary data was used to understand the access to and economics of MI under different farm categories as well as to document the suggestions of the farmers for better adoption of MI in the state. Using the farm level data, the following regression equation was fitted to study the influence of various factors on area under MI.

$$Y_i \quad \beta_0 \quad \beta_1 X_i \quad \beta_2 D_{1i} \quad {}_3D_{2i} \quad {}_i$$

Where,

Yi = Area under MI by ith farmer (ha), X = Farm size of ith farmer (ha), D1i and D2i = Dummy variables for ith farmer representing marginal and small farmer category respectively, εi = error term

Analysis of variance without replication was used to test the significance of additional income earned by different categories of farmers under MI across the nine states.

Analysis of the adoption level and economics of MI

MI adoption rates *versus* their potential

The MI potential in each state was estimated using secondary data considering state-wise and source-wise irrigated area, cropped area, and the crop-wise suitability for different micro-irrigation systems (except paddy in canal systems). Further, plantation crops like coffee, tea, rubber, oil palm, etc. which are not covered under National Micro Irrigation Mission (earlier Centrally Sponsored Scheme on Micro Irrigation) subsidy are not considered for potential estimation. Based on these calculations and assuming long term stability in cropping patterns, there is an ultimate potential for bringing around 42 million ha under drip and sprinkler in the country

[1]The study was undertaken as part of the IWMI-Tata Water Policy Program. The authors wish to thank the scientists from the 9 states who did the field survey and provided the cost and returns under micro-irrigation. The authors are also thankful to Dr Kadiri Mohan and Dr Krishna Reddy, ITP staff who provided support in the data analysis and completion of the research paper from the study. Financial support from Sir Ratan Tata Trust, Mumbai is gratefully acknowledged.

[2]This IWMI-Tata Highlight is based on research carried out under the IWMI-Tata Program (ITP), with support from the International Water Management Institute (IWMI), Colombo and Sir Ratan Tata Trust (SRTT), Mumbai. It is not externally peer-reviewed and the views expressed are of the author's alone and not of ITP or either of its funding partners.

[3]These reports are available on request from p.reghu@cgiar.org

(Raman, 2010). Of these, about 30 million ha are suitable for sprinkler irrigation for crops like cereals, pulses and oilseeds in addition to fodder crops. Drip irrigation, which is appropriate for cotton, sugarcane, fruits and vegetables, spices and condiments, and some pulse crops such as red gram, offers an ultimate MI potential of around 12 million ha.

Actual drip irrigated area as percent of the potential in different states varies between zero in Nagaland to a high 49.7 percent in Andhra Pradesh, followed by Maharashtra with 43.2 percent and Tamil Nadu with 24.1 percent. In case of sprinkler irrigation, the actual area equipped as percent of the potential estimated varies from a low 0.01 percent in Bihar to a high 52 percent in Andhra Pradesh. For the country as a whole, the area equipped with MI at 3.9 million ha (1.42 million ha under drip and 2.44 million ha under sprinkler) is only about 9 percent of the potential estimated at 42.2 million ha (Table 1).

Table 1 Potential and actual area under MI in different states (in '000 ha as on 2009)

State	Drip			Sprinkler			Total		
	Potential area	Actual area covered	Actual as percentage of potential	Potential area	Actual area covered	Actual as percentage of potential	Potential Area	Actual area covered	Actual as percentage of potential
Andhra Pradesh	730	363	49.7	387	200.9	51.9	1117	564.0	50.5
Bihar	142	0.2	0.1	1708	0.2	0.0	1850	0.4	0.0
Chhattisgarh	22	3.7	16.6	189	59.3	31.4	211	62.9	29.8
Goa	10	0.8	7.6	1	0.3	33.2	11	1.1	9.9
Gujarat	1599	169.7	10.6	1679	136.3	8.1	3278	305.9	9.3
Haryana	398	7.1	1.8	1992	518.4	26.2	2390	525.5	22.0
Himachal Pradesh	14	0.1	0.8	101	0.6	0.6	115	0.7	0.6
Jharkhand	43	0.1	0.3	114	0.4	0.3	157	0.5	0.3
Karnataka	745	177.3	23.8	697	228.6	32.8	1442	405.9	28.2
Kerala	179	14.1	7.9	35	2.5	7.2	214	16.6	7.8
Madhya Pradesh	1376	20.4	1.5	5015	117.7	2.3	6391	138.1	2.2
Maharashtra	1116	482.3	43.2	1598	214.7	13.4	2714	697.0	25.7
Nagaland	11	0.00	0.0	42	4.0	9.4	53	3.9	7.5
Orissa	157	3.6	2.3	62	23.5	37.8	219	27.1	12.4
Punjab	559	11.7	2.1	2819	10.5	0.4	3378	22.2	0.7
Rajasthan	727	17.0	2.3	4931	706.8	14.3	5658	723.8	12.8
Tamil Nadu	544	131.3	24.1	158	27.2	17.2	702	158.5	22.6
Uttar Pradesh	2207	10.7	0.5	8582	10.6	0.1	10789	21.3	0.2
West Bengal	952	0.2	0.0	280	150.0	53.6	1232	150.2	12.2
Others	128	15.0	11.7	188	30.0	15.9	316	45.00	14.2
Total	11659	1428.5	12.3	30578	2442.4	8.0	42237	3870.8	9.2

Source: Raman 2010; www.indiastat.com for estimating potential for drip, sprinkler and total MI area.

MI and Government subsidy

Since the introduction of MI in India, government agencies have been conscious of high capital investments as a major impediment to adoption of MI technologies especially for marginal and small farmers to adopt. As a result, central and state governments have not only announced a range of MI subsidy schemes but also work with MI manufacturers to keep the unit costs under control. Central government also has launched an ambitious Centrally Sponsored Scheme (CSS) on MI which came into effect during financial year 2005-06. Even before then, states like Andhra Pradesh and Karnataka had MI subsidy schemes of their own. However, the subsidy offered varied from 50 to 100 percent of the capital investment depending upon factors such as the land-holding size class of the applicant farmer. By 2011, it was estimated that an area of around 5.5 million ha was brought under MI in the country. Out of this 2.2 million ha were under drip and 3.3 million ha under sprinkler (NCPAH 2011). Major MI crops covered include field crops such as cotton, maize, groundnut, sugarcane as well as orchard, vegetables and fruit, as well as plantation crops such as tomato, banana, papaya, mango, grapes, lemon, tea, coffee and rubber.

A major problem faced by MI companies as well as farmers is the long time lag between the decision taken on the level of MI subsidy and its actual implementation. For example, the subsidy level for banana crop drip systems in 2010 was fixed at Rs. 65000 per ha; but this was based on cost calculations done in 2008 when material costs were lower. The effective subsidy on offer therefore is less than intended. The problem for MI companies gets aggravated further by the long gap between the delivery of MI systems to farmers and the release of subsidy payments. Such factors play a key role in determining MI adoption rates.

MI adoption by various farm categories

Farm size and area under MI

Table 2 reveals that a majority of our sample farmers adopting MI in the case of Kerala state (52 percent) operate marginal farm-holdings, whereas a majority of MI adopters in Andhra Pradesh (71 percent), Karnataka (66 percent), Orissa (63 percent) and Punjab (55 percent) are small farmers. In Maharashtra and Tamil Nadu, majority (63 and 65 percent respectively) of the MI adopter farmers we sampled turned out to be large farmers. Even after providing the much needed support for promotion of MI, the percentage of area under MI is not remarkable and this has been assessed by farmer category wise in 9 states. Even though financial returns are high, farmers are reluctant to expand MI area due to other constraints like high initial capital cost, lack of technical knowledge in the operation and maintenance of the systems and the type of crops grown.

Table 2 Farm size and area irrigated by MI systems

State	Farmer category	Percentage of sample farmers in holding size categories	Average farm size (ha)	Average area under MI (ha)	Percentage of area under MI
Andhra Pradesh	Marginal	6.00	0.82	0.76	92.68
	Small	70.7	1.7	0.90	52.94
	Large	23.3	14.1	2.96	21.02
Tamil Nadu	Marginal	13.3	0.62	0.48	77.42
	Small	22.0	1.72	1.31	76.16
	Large	64.7	4.67	2.41	51.61
Kerala	Marginal	52.0	0.54	0.15	94.44
	Small	28.0	1.44	1.25	86.80
	Large	20.0	2.38	2.22	93.27
Karnataka	Marginal	6.0	1.89	1.33	70.37
	Small	66.0	5.71	1.82	31.87
	Large	58.0	18.12	6.59	36.37
Maharashtra	Marginal	20.0	1.80	0.90	50.00
	Small	16.7	3.75	2.25	60.00
	Large	63.3	6.60	3.40	51.52

[4]This is likely an overestimation because it represents area covered by all MI systems sold so far; and since many old systems may have been decommissioned, chances are that the actual area under MI today is smaller than this estimate.

Orissa	Marginal	23.3	0.51	0.07	13.72
	Small	62.7	1.74	1.23	70.44
	Large	14.0	15.52	9.56	61.60
Punjab	Marginal	5.3	0.8	0.40	50.00
	Small	55.3	2.7	1.30	48.15
	Large	39.3	8.2	4.30	52.44
Rajasthan	Marginal	14.0	0.43	0.4	93.02
	Small	35.3	1.16	0.95	81.90
	Large	50.7	3.41	2.54	74.49
Gujarat	Marginal	02.0	0.8	0.58	72.50
	Small	20.67	1.75	1.13	64.57
	Large	77.33	3.65	3.0	82.19

Source: Survey data

The experiences of the Gujarat Green Revolution Company (GGRC) in Gujarat indicate that during recent years, an increasing number of small and marginal farmers is adopting the MI (personal communication from Raman, 2010).

Relationship between MI area and farmer categories

The regression results (Table 3) to determine factors affecting MI adoption show that the coefficients of farm size are significant at 1 percent level. This suggests that farm size positively influences the MI adoption rate. The coefficient of dummy variable for small farmers is significant at 10 percent level whereas dummy variable for medium farmers is not significant at all. The average farm size in the 9 states was 0.91 ha, 2.41 ha and 8.51 ha for marginal, small and large farmers respectively. On the average, each farmer could allot about 0.32 ha of every additional ha of land to MI irrespective of the farm size categories.

Farming Costs and returns under micro-irrigation

MI system cost and the farmers' share after subsidy varied across the farm sizes. It is comparatively lower in the larger farms due to economies of scale (Table 4). In Kerala, due to intercropping of the wide spaced perennial crops like rubber, coconut and areca nut, the unit cost of the system is significantly lower than in other states. In all the states, the quantum of actual subsidy as perceived and affirmed by farmers is more than 30 percent of the total cost of the MI system, lower than the subsidy percent announced under government schemes. This may well be one of the reasons for the slower than expected rate of spread of MI technology in different states.

Even though MI benefits can in principle pay for the MI investment, farmers still expect a subsidy for MI because of following reasons: (1) MI technology is capital intensive, with investment varying from Rs. 70000 to Rs. 1.3 lakh[5] per ha depending upon the crops and type of MI systems (drip or sprinkler); and farmers are noticeably reluctant to make this scale of investment readily; (2) farmers' knowledge about the operation and maintenance of the MI systems is limited. MI systems need management as these face various maintenance problems such as clogging of filters and drippers, specific level of water level pressure required for best performance; this lack of familiarity and knowledge about the best way of using the technology makes them risk averse and reluctant to invest; (3) except for widely spaced and commercial crops, MI is not suitable; thus investment decision in MI is often coupled with decisions about changing the entire farming system. Except in groundwater overexploited regions, farmers in other regions do not perceive MI as an immediate need of high priority. Hence, providing incentives in terms of subsidy helps farmers overcome their resistance to adopt MI technology.

Table 3 Relationship between area under MI, farm size and category of farms

Variables	Coefficients	Std. Error	t-stat	p-value
Intercept	1.4249	0.5686	2.5058	0.0197
Farm size (ha)	0.3152	0.0553	5.6963	0.0000
Dummy variable for marginal farmers (D1)	-1.1491	0.6161	-1.8650	0.0750
Dummy variable for small farmers (D2)	-0.8350	0.5629	-1.4834	0.1515

Note: Dependent Variable = Area under MI (ha); R^2 = 0.814, Adj. R^2= 0.7902

[5]One lakh = 0.1 million

Table 4 MI cost and returns across states and farm categories

State	Farmer category	Average total cost of the system (Rs./ha)		Net income (Rs./ha)		IRR (percentage)	
		Drip	Sprinkler	Drip	Sprinkler	Drip	Sprinkler
Andhra Pradesh	M (9)	71380	-	15340	-	16	-
	S (91)	69794	23282	17612	6104	25	27
	L (50)	65373	-	17112	-	27	-
Tamil Nadu	M (20)	81302	-	12842	-	3	-
	S (33)	74509	-	15339	-	14	-
	L (97)	66908	-	26039	-	60	-
Kerala	M (78)	15900	-	5310	-	35	-
	S (42)	18833	-	9217	-	88	-
	L (30)	18462	-	10525	-	128	-
Karnataka	M (9)	57906	-	15699	-	29	-
	S (99)	56950	-	15439	-	29	-
	L (42)	56553	-	15331	-	29	-
Maharashtra	M (25)	42053	-	10026	-	22	-
	S (20)	48085	-	13000	-	29	-
	L (105)	45400	-	24360	-	115	-
Orissa	M (15)	95600	25800	20770	15000	17	138
	S (114)	89750	22330	21515	13977	22	167
	L (21)	73800	22100	16365	14667	18	197
Punjab	M (8)	98456	-	22000	-	18	-
	S (83)	89745	57000	20000	9500	18	5
	L (59)	86563	42000	18000	9500	15	11
Rajasthan	M (25)	-	-	-	-	-	-
	S (50)		19736		6500	-	43
	L (75)		11765		5860	-	98
Gujarat	M (3)	61795		14106		19	-
	S (31)	72482	19300	19683	12617	29	188
	L (116)	73195	10512	19089	10864	27	410

S = Small farmer; M = marginal farmer; L = large farmer; IRR = Internal Rate of Return
Note: Figures in the parenthesis indicate number of farmers under each farm category.
Source: Survey data.

Farmers' Suggestions for more effective promotion of MI systems

Even with proven benefits and applicability of MI systems under different farm categories, adoption rates leave much scope for improvement. This might be due to a variety of constraints identified earlier. This paper further examines the suggestions from farmers and also the policy recommendations at different levels.

Major suggestions include provision of technical support for MI operation after installation, relaxation of farm size limitation in providing MI subsidies, promotion and supply of liquid fertilizers, improved marketing facilities and access to more credit to expand the area under MI. Our survey results also indicate that small farmers from Andhra Pradesh and Punjab and large farmers from Tamil Nadu are in need of more intensive technical support for the adoption and management of MI. Liquid fertilizers are in great demand from farmers in Karnataka. Improving the marketing channels for MI systems and better credit facilities for MI investment are considered important for improving the adoption by farmers in Tamil Nadu and Punjab.

Success of MI in selected states

Among different states, the MI promotion and subsidy scheme is more successfully implemented in states like Andhra Pradesh and Gujarat. One of the major reasons for this is that these two states created SPVs with sole responsibility of promoting and implementing micro-irrigation schemes of state and central governments. In Andhra Pradesh, the SPV is APMIP (Andhra Pradesh Micro Irrigation Project) and in Gujarat, this is GGRC (Gujarat Green Revolution Company Ltd). In other states, MI promotion role is still vested with the departments like agriculture/ horticulture/ soil conservation, for whom implementation of micro irrigation scheme is one of their several responsibilities and therefore does not receive the attention that it requires and deserves.

APMIP was launched in November 2003. Right from the beginning, the project is under the Department of Horticulture, Government of Andhra Pradesh. In each district a separate Project cell is created with Project Director, APD, MI Engineers, MIDCs and other staff. For *mandal* level support, Micro Irrigation Agriculture Officers (MIAOs) who are diploma holders in Agriculture or horticulture are appointed to work with farmers on MI.

GGRC in Gujarat was established in 2005 jointly by Gujarat State Fertilizers and Chemicals (GSFC), Gujarat Narmada Fertilizers Company Ltd (GNFC) and Gujarat Agro Industries Corporation (GAIC) to implement a uniform scheme for promoting Micro Irrigation Systems in the state under the Department of Narmada and Water Resources, Ministry of Irrigation, Government of Gujarat. GGRC was provided a captive budget and full autonomy to pursue its objectives. Transparent implementation of each stage of the scheme - with real-time online monitoring of each farmer's case being followed at GGRC - contributes to a great extent to its success in Gujarat. In addition some of the restrictions in the centrally sponsored scheme in the selection of beneficiaries, area restriction and such other are done away in Gujarat without losing the spirit of the restrictions. As against the restriction on land holding size of under 5 ha per beneficiary in the central scheme, in Gujarat any beneficiary can avail of the MI subsidy for any number of hectares and the subsidy amount over and above the central scheme limit is borne by the state government. Any beneficiary can choose any of the suppliers approved by GGRC based on the their track record of after sales services since the system components costs are fixed and are same for all the companies. A periodical assessment is made of the costs of system components based on petroleum prices. The company also gives priority for awareness and technology training to different stake holders. To top it all, the project monitoring is done at the highest level frequently through a cabinet sub-committee.

In Maharashtra, the MI suppliers are playing a vital and proactive role in the implementation of the scheme. In a nutshell, in each state, an SPV for MI promotion on the lines of APMIP and GGRC needs to be established as the single nodal agency with full autonomy, flexibility and appropriate funding. The whole system needs to be operated with transparent, online monitoring of implementation with a strong focus on continuous training and capacity building for all the stakeholders for better maintenance.

Electricity saving under drip irrigation in Gujarat state

After the inception of the GGRC which is the nodal agency for implementation of all the schemes on micro irrigation in Gujarat, there has been a phenomenal increase in the adoption of micro irrigation in the state. Between 2005-06 and 2010-11, some 1.7 lakh ha have been brought under drip method of irrigation in Gujarat (Table 5). In Gujarat, MI is being used for irrigating more than 40 different crops, some of the major crops being cotton, banana, sugarcane, potato and mango. These five crops together contribute 77 percent of the area under micro irrigation in the state as of March, 2011. It is estimated that between 2005-06 and 2010-11 about 706 lakh kWh of electricity might have been saved, thanks to MI adoption (Raman and Tikadar 2011).

Table 5 Year-wise and crop-wise drip coverage in the state (2005-06 to 2010-11)

Crops	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Potato	291	1233	4878	2215	3849	5376	17841
Banana	1179	1855	2511	2355	2063	1396	11360
Mango	1376	1548	2053	1598	1463	851	8890
Papaya	363	440	697	1468	718	520	4207
Vegetable	570	540	69	21	19	30	1248
Lemon	309	230	382	1088	577	236	2821
Sapota	158	197	236	125	92	52	859
All other horticultural crops	1049	1439	2536	6749	5312	2658	19742
Sub total	5295	7483	13362	15617	14092	11119	66968
Groundnut	50	41	309	2809	2709	1516	7434
Cotton	6003	7412	10518	17148	17279	24619	82980
Sugarcane	1437	3161	1685	1143	1484	1901	10811
Castor	306	193	210	845	621	994	3169
All other crops	47	18	249	46	94	130	584
Sub total	7844	10825	12972	21990	22186	29161	104977
Total	13139	18307	26334	37607	36278	40280	171945

Table 6 Estimated year-wise and crop-wise electricity savings

Crops	Estimated Savings kWh/ha	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total savings (lakh kWh)
Potato	200	0.6	2.5	9.8	4.4	7.7	10.8	35.7
Banana	1660	19.6	30.8	41.7	39.1	34.2	23.2	188.6
Mango	371	5.1	5.7	7.6	5.9	5.4	3.2	33.0
Papaya	200	0.7	0.9	1.4	2.9	1.4	1.0	8.4
Vegetable	200	1.1	1.1	0.1	0.0	0.0	0.1	2.5
Lemon	313	1.0	0.7	1.2	3.4	1.8	0.7	8.8
Sapota	313	0.5	0.6	0.7	0.4	0.3	0.2	2.7
Groundnut	100	0.0	0.0	0.3	2.8	2.7	1.5	7.4
Cotton	258	15.5	19.1	27.1	44.2	44.6	63.5	214.1
Sugarcane	1250	18.0	39.5	21.1	14.3	18.5	23.8	135.1
Castor	200	0.6	0.4	0.4	1.7	1.2	2.0	6.3
Other Horticulture crops	313	3.3	4.5	7.9	21.1	16.6	8.3	61.8
Other crops	200	0.1	0.0	0.5	0.1	0.2	0.3	1.2
Total		66.1	105.9	119.9	140.5	134.8	138.5	705.6

Source: Raman and Tikadar 2011.

Recommendations

In sum, then, our surveys suggest that reducing capital investment in MI systems and improving the technical knowhow of farmers about the operation and maintenance of the technology will help accelerate the adoption of MI. In this context, the following specific points are of interest.

i. **Field Level:** There is scope of reducing the capital cost of MI systems by making minor modifications in farming techniques to suit small and medium farms. Adoption of paired row planting, for example, can be one such modification. Manufacturers, dealers and farmers need to be trained in laying micro-irrigation systems following an efficient crop-specific design. Fixing the emitter spacing keeping in view the soil texture can reduce the system cost significantly; in business-as-usual mode, the dripper spacing adopted is 60 cm and below regardless of the soil type. There is need to design low-cost drip and MI systems to suit the needs of the small and marginal farmers.

ii. **State level:** Reducing the time lag between the announcement of a MI subsidy policy, its actual implementation and subsidy disbursement can accelerate the speed with which suppliers can meet farmers' needs. Suppliers need to be compensated for increase in raw material prices during this time lag to maintain the real subsidy at levels promised in the policy. Periodical review and revision of the unit cost is important as done in Gujarat.

Discussions with the MI companies and officials also indicated that differential subsidy pattern for different crops being followed in different regions is only confusing farmers and implementing agencies. Currently different government agencies follow different subsidy norms and this adds to the confusion. It is important to introduce a uniform subsidy across each state.

Lack of technical support emerged as a key concern at the level of farmers. Capacity building of the implementing team, which in turn can help farmers acquire the minimum technical skills needed to manage the technology effectively, is important. Fertigation, which is the major economic benefit of MI, was not done in most of the sample farms we studied. To enhance crop productivity and income, fertigation should be aggressively promoted among MI adopters. In Tamil Nadu, the introduction of the TNDRIP capacity building program in 2009 covering 100 villages and 1000 farmers resulted in 17 percent yield increase and 23 percent water saving under different crops on fields of farmers covered by the training program compared to untrained drip adopter farmers (ITP, 2011). Training to unemployed village youth and input suppliers to reduce the time lag in MI installation and for improving regular maintenance of the systems is also beneficial. A SPV in each state should be created to manage the implementation of MI program on the lines of GGRC in Gujarat.

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About the IWMI-Tata Program and Water Policy Highlights

The IWMI-Tata Water Policy Program (ITP) was launched in 2000 as a co-equal partnership between the International Water Management Institute (IWMI), Colombo and Sir Ratan Tata Trust (SRTT), Mumbai. The program presents new perspectives and practical solutions derived from the wealth of research done in India on water resource management. Its objective is to help policy makers at the central, state and local levels address their water challenges – in areas such as sustainable groundwater management, water scarcity, and rural poverty – by translating research findings into practical policy recommendations. Through this program, IWMI collaborates with a range of partners across India to identify, analyze and document relevant water-management approaches and current practices. These practices are assessed and synthesized for maximum policy impact in the series on Water Policy Highlights and IWMI-Tata Comments.

Water Policy Highlights are pre-publication discussion papers developed primarily as the basis for discussion during ITP's Annual Partners' Meet. The research underlying these Highlights was funded with support from IWMI, Colombo and SRTT, Mumbai. However, the Highlights are not externally peer-reviewed and the views expressed are of the author/s alone and not of ITP or either of its funding partners.

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