

DEVELOPMENT OF MICRO IRRIGATION IN INDIA

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ABSTRACT

India is a large producer of agriculture products. Irrigation resources are limited and the water-use-efficiency as well as agricultural productivity is low.

Micro irrigation (MIS) which is the most efficient method of irrigation, was introduced in 1987. MIS has become popular in India and it has been adopted on 400,000 ha. The integrated approach evolved by Jain Irrigation (JISL) and the support provided by various Government & other agencies are the main factors for the rapid growth of Micro-irrigation in India.

For successful implementation of MIS, numerous technical services such as land Survey, Water & soil analysis, Climatological data, Design, availability of high quality components, installation, extension and training of farmers as well as after sales customer services, etc. are necessary. These vital services, were not available in India. JISL had to set-up the required infrastructure & provide these technical services.

The methodology adopted is discussed in detail in this paper. This methodology can be adopted by other under-developed / developing countries for successful introduction of MIS.

1) **RELEVANCE OF MIS TO INDIAN AGRICULTURE**

- 1.1 India, as we all know, has over 160 million ha. of cultivated land, (second largest in the world). Over 70% of population is dependent on agriculture. Water is the lifeline of agriculture. Productivity is directly affected by the availability of water. Water resources are available in India but are limited and demand on water for industrial, domestic and other uses is increasing day by day. Thus the availability of water for irrigation is becoming a major limiting factor in increasing the agricultural production.
- 1.2 First Green revolution was initiated in India in 1960's. This included creation of large dams and irrigation projects, introduction of hybrid seeds and use of chemical fertilizers. From the net importer of food products, India became self - sufficient in food grains, fruits and vegetables and dairy products.
- 1.3 However, after the 1st green revolution, the agriculture production has stagnated. Moreover since ground and underground water resources were made available to the farmers free of charge, these resources have been exploited mercilessly. This has resulted in water shortages for irrigation.

Further due to the excessive use of chemical fertilizers and water, the soil fertility has been adversely affected.

As per the experts, water would be the single most critical limiting factor for India's economical development and water would be the greatest challenge for the 3rd millennium.

- 1.4 Despite the need for increasing production and per unit productivity and despite the compulsion to use water resources judiciously and optimally, the irrigation method used in India till 1985, was only flood irrigation. Flood irrigation, as we all know, is highly un-efficient (efficiency is only 35 - 55%).
- 1.5 Irrigation experts have started realising that instead of creating additional large dams / irrigation projects which have long gestation periods and are no longer economically viable due to cost escalation and low water-use-efficiency such projects have, it would be better to adopt / develop technologies and take measures so as to improve the water-use-efficiency of the existing water resources.

2) **PROGRESS OF MICRO IRRIGATION**

- 2.1 Drip irrigation or Micro-irrigation (MI) as it is popularly known, was developed and adopted by Israel, USA and Australia in early seventies. Initial growth of MIS in these countries was slow. Today however, MIS has become popular and has been installed on large areas in these countries.
- 2.2 MIS is the most efficient irrigation method. MIS which applies water and other inputs most efficiently & directly near the root-zones of the plants, uniformly and

frequently. Irrigated area can be doubled from the available water resources using MIS. MIS can be installed by small as well as large farmer and is equally beneficial to both.

2.3 MIS consists of main, submain, laterals, drippers, filters and fertilizer tank. MIS can be installed in short time.

2.4 Initially, MIS was introduced for widely spaced fruit trees and has proved very beneficial.

Mango, Oranges, Banana, Papaya, Grapes, Pomegranate, Coconut, Sweetlime, Lemon, Guava, Fig, Custard Apple, Sapota and other fruit orchards have been irrigated by MIS.

MIS has also been tried for sugarcane, cotton, vegetables, melons, arecanut, betelvine, groundnut, mulberry, tea, coffee, spices, agroforestry and other crops and has proved very beneficial and economical for these crops as well.

2.5 Benefits of MIS

Following major benefits have been obtained by the Indian farmers using MIS.

i] Increase in yield & production

In all the cases, on all the crops, use of MIS has resulted in increasing the yield. Yield increases of 30 to 200% have been experienced.

Further MIS enabled doubling of irrigated area from the existing water resource. Increased irrigated area resulted in substantial additional income.

ii] Use of MIS resulted in reduction in fertilizer usage and savings in labour, pesticide, energy & other operational costs.

iii] MIS enabled use of marginal & otherwise un-cultivable lands & saline water and produced good yields.

iv] Optimum conditions for plant growth are maintained by MIS and this resulted in improved quality of the fruits and vegetables.

2.6 MIS has been used for well & canal irrigated crops.

2.7 MIS requires high quality products (hardware) as well as basic and support services. (software)

2.8 From a meagre area of 1500 ha under MIS in 1987, about 400,000 ha area has been brought under MIS by 1999. The growth has been rapid in India.

2.9 There are few constraints in implementation of MIS. Once these constraints are

resolved, the growth of MIS would be even faster.

MIS irrigated area can cross 1 Million ha. by 2005.

2.10 MIS & Sprinkler irrigation together can be used to irrigated most of the crops & offer viable & economical alternative to creation of large irrigation projects.

2.11 Various factors have been responsible for the rapid growth and successful implementation of MIS in India. Government, Banks, Manufacturers, Universities & other agencies have played a major role in the rapid growth of MIS.

3) **DEVELOPMENT OF MIS BY JISL**

3.1 **Jain Irrigation Systems Ltd., (JISL)** entered the MIS market in 1987 and has made pioneering efforts to develop & popularise MIS in India. JISL has been very successful and has become the largest supplier of MIS in India. The company is committed to efficient water management and development of agriculture. It has played a pivotal role and has been the catalyst in bringing MIS and other high tech agro-technologies to the Indian growers.

3.2 **Technical Collaboration**

JISL entered into technical collaboration with M/s. James Hardie Irrigation (JHI), Italy the largest Micro irrigation company in the world. JHI provided full technical support, documentation, designs, drawings and training. Experienced and qualified engineers & scientists were deputed by the collaborators and they worked hand in hand with JISL engineers & agronomists and helped the company establish sound technical base for basic and support services as well as for establishing modern manufacturing facility. JISL engineers and technicians were trained from time to time and sound technical base and approach for implementation of MIS from concept to commissioning was inculcated in them.

3.3 **Integrated approach**

With the technical information and thorough training provided by the collaborators, with the knowledge of Indian farming and after studying the causes for failure of MIS supplied by other manufacturers prior to JISL's entry into this field, JISL evolved an integrated approach for the execution of MIS and this integrated approach has been the single most important factor responsible for large scale adoption and successful implementation of MIS.

Initially the components of MIS were imported from the collaborator. Subsequently most modern manufacturing facility was set-up by the company to undertake manufacturing of the Micro-irrigation products indigenously.

Manufacturing of all the major components was taken-up by the company. Bought-out components such as pressure gauges, tensiometers were sourced by the

company & complete systems were supplied by the company to the farmers.

JISL pioneered this integrated approach for the first time in the country. Initially all of the basic and support services were provided by the company. Later on extensive network of dealers and service agencies was developed and many of these basic services are now provided by these dealers and agencies.

Large financial and human resources have been employed by the company not only for manufacturing Micro-irrigation products (hardware) but also in the development of agronomical practices (software).

JISL manufactured widest range of drippers, filters & other components to suit varied crops, soil, water, climate & topography & provided tailormade solutions.

JISL has enlarged the integrated approach further and is now providing many other high tech inputs such as genetically superior planting material, (tissue-culture plants as well as seed) water soluble fertilizers, green house & shed house equipment, bio-fertilizers, bio-pesticides, etc.

The integrated approach evolved by JISL for MIS included following basic as well as Support Services.

3.4]

Basic Services

Survey and Sampling	Computer Aided System Design	Installation Support
<ul style="list-style-type: none"> * Detailed Engineering Survey * Collection of soil & water samples, * Agro-climatic data * Water source assessment * Crop data * Preparation of drawing from the field sketch considering above drawing. 	<ul style="list-style-type: none"> * Co-relating Agro-Climatic Data * Soil and water analysis * Interpretation of soil, water and agro-climatic data and recommendations * Irrigation, fertigation and chemigation scheduling. * Proper size components & suitable system selection * Hydraulic design & quotation * Assist farmers to obtain Govt. subsidy. * Final layout and Installation 	<ul style="list-style-type: none"> * Supply of each and every component * Transportation to the field * Laying, jointing, testing and commissioning of the system * Training framers, regarding irrigation, fertigation, operation of pumps, valves & ventury/fertiliser tank, maintenance and problem solving procedure/s. * Handing over the complete file to the farmer alongwith maintenance manual.

Thereafter, installation team carried out the installation of the system & trained the farmer regarding operation & maintenance of the system, periodical cleaning of the filtration system, irrigation schedule, chemical treatment & other aspects of Micro-irrigation.

i] **Survey & Soil & water analysis**

Accurate land surveys as well as the agencies to carry out accurate surveys were not available.

Realising the need for accurate land survey required for designing a MIS, company set-up a survey department and carried out land surveys for the farmers interested in installing MIS.

Company's engineers and technicians visited farms / fields and carried out detailed survey. They also collected soil and water samples from the field. The land survey data collected from the field was analysed and accurate drawings were prepared. Water and soil samples collected from the field were analysed in the laboratory set-up by the company.

ii] **Climatological Data**

Climatological data regarding precipitation, temperatures, sunshine, transmission, crop factors, etc. was collected from weatherological laboratories for the previous 25 years. This data was later on computerised and used in designing the MIS. Thus, climatological data for every 100 km radius area became available.

iii] **Hydraulic Design**

After getting land survey details and drawing, crop details water and soil analysis reports and climatological data for the area, design engineers carried out the hydraulic design of the MIS and prepared detailed bill of material, cost report, detailed drawing, irrigation schedule, etc. and a complete proposal was prepared and sent to the farmer.

iv] **Supply of MIS & installation**

JISL's sales engineer visited the farmer and explained the proposal. Once the proposal was accepted by the farmer, JISL supplied all the components required for the system & delivered the material directly to the field in company vehicles.

Support Services

After Sales Services	Extension & Training Services	Research & Development
<ul style="list-style-type: none"> * Agronomic Support 	<ul style="list-style-type: none"> * Publicity through media 	<ul style="list-style-type: none"> * Company owned R & D farms * Customer Demonstration Farms. * Agril University Experimental Demonstration Farms. * Library Research * Preparation of global crop file/s.
<ul style="list-style-type: none"> * Engineering support * Engineer's periodic visits * Supply of spare parts 	<ul style="list-style-type: none"> * Demonstration plots. * Product display & exhibitions * Presentations & Seminars * Farmer's meetings & rallies. * Training of Farmers, Bank & Govt. Extension Officers, Irrigation Engineers, Dealers & our technical and marketing staff. * Publishing literature in regional languages 	<ul style="list-style-type: none"> * Determining cropwise water requirement. * Evaluation of competitive equipment/system efficiency and suitability
<ul style="list-style-type: none"> * Provisions for trained Operators * Performance feed-back by post. 		<ul style="list-style-type: none"> * Collection, compilation of results & recommendations for agronomic practices for higher productivity.

i] After Sales Service

Company had set-up after sales service department which provided services such as periodical inspection, repairs and maintenance & training. Initially these services were provided free of charge. Company ensured that every MIS installed functioned properly and delivered the expected results.

The company's extension & R&D team visited MIS installations periodically to study the problems encountered by the farmers. Numerous problems were encountered in using MIS due to animals, birds, farming practices, etc. Some of these problems were peculiar to the local conditions. R&D team did research and found solutions to overcome these problems.

ii] Extension

Large extension department was set-up by the company. This extension department participated in exhibitions, seminars, farmer-rallies, etc. and took the MIS concept to door steps of farmers in rural areas. This department also prepared various booklets with the co-operation of the farm R&D team giving information regarding various aspects of Micro-irrigation, irrigation scheduling, importance of filtration in Micro-irrigation, blockage of drippers and acid / chemical treatment, application of fertilizers through MIS etc. Crop specific

booklets, success stories / experiences of MIS users etc. were also prepared & made available to farmers, bankers, agriculture departments & others. Different medias like exhibitions, newspapers, periodicals, radio and TV were used extensively to carry out these promotional activities.

iii) **Promotional activities**

Once the decision to manufacture MIS was taken by the company, massive educational campaign through newspapers was started to educate farmers, policy makers, researchers and others regarding irrigation progress made in India, the draw-backs / limitations of the conventional irrigation systems & the urgent need for improving water-use-efficiency & productivity in agriculture. In the second phase of campaign, the concept of highly efficient water management system i/.e. Micro irrigation was introduced & in 3rd phase, the specifics of Micro irrigation i.e. advantages, various stages & their importance in implementation of MIS and the pitfalls of the MIS installed in the past, were introduced. Though these campaigns awareness regarding the need for improving productivity & water-use-efficiency was created.

The company also took-up massive campaign to educate / bring to the notice of policy makers, public opinion makers, government officials & politicians the importance, relevance and the benefits of MIS to Indian farmers and the support needed from them in popularising MIS in India. Number of presentations were made to the Agriculture Ministers, Officers and Researchers regarding benefits of MIS. Their visits to the company's R&D farm and as well as to farmers' fields, were arranged.

iv) **Demonstration farm**

Company has set-up a large farm for demonstration and R&D in 1990. MIS has been installed on as many as 45 different horticultural crops. Many farmers from different parts of the country visit this demonstration cum-R&D farm to see how MIS can be applied for different crops. "Seeing is believing". Farmers saw the benefits of Micro-irrigation on different crops and got convinced and prepared to adopt MIS on their farms.

v) **Product development**

Company also carried out lot of R&D activities both at the factory and field. Redesigning of Filters, Valves, Drippers, etc., to make these suitable for local conditions, was carried out. Original drawings and designs of filters received from James Hardie, were based on large farms and were not suitable for small Indian farms. We had to redesign the filters & manufacture smaller & economical filters suitable for local conditions / requirements. Company also did designing and development of many components, products and accessories used in MIS.

vi] **Field R&D**

Company also carried out extensive field - trials. Lot of R&D work was undertaken to develop irrigation schedules, optimisation of drip design and development of agronomical practices to optimise the benefits of Micro-irrigation and to obtain higher yields at reduced operating costs. The results obtained / the findings were published from time to time and made available to the growers. The R&D work has been very beneficial in achieving higher productivity and optimum use of inputs.

vii] **Collaboration with agriculture universities**

Company donated MIS to Universities and Research Institutions and worked together to study different aspects of Micro-Irrigation and to optimise the performance.

viii] **Demonstration on farmers' fields**

In addition to the demonstration farm established by the company, many Micro-irrigation systems were supplied to farmers in different areas for different crops either free or at subsidised cost.

Close liason and collaborative work was carried out. These farms became good demonstration farms and farmers from near by areas visited these farms and saw the benefits of MIS on given crop. These farms also provided vital information / feedback which helped the company improve design, practices & products. These farmers also became spokesmen and spread the word regarding the benefits of Jain MIS.

4) **OTHER AGENCIES WHICH HAVE CONTRIBUTED TO THE POPULARISATION OF MIS IN INDIA.**

i] **State & Central Govt.**

Realising the importance & relevance of Micro-irrigation & in order to provide incentive to the farmers, Maharashtra State Govt. came forward to provide financial support to the users of MIS and provided subsidy to the extent of 50%.

Govt. also initiated promotional & extension activities through TV & other medias.

The State Govt. played an important role in promoting MIS in Maharashtra. Later on after seeing the success of MIS in Maharashtra, Central Government as well as other State Governments came forward to provide financial support to the Indian growers for MIS.

Governments are realising the importance & usefulness of Micro-irrigation and its Socio-economic relevance for sustainable agriculture. They have further realised that MIS can be adopted on large areas in relatively short period and can double the irrigated area.

The Governments are getting aware of these facts and are taking required measures / steps to popularise MIS and are seriously considering MIS as the viable alternative to creation of additional mega irrigation projects. G.O.I. has made provision of subsidy for MIS in the five year plans.

ii] **Banks & financial institutions**

Investment in MIS is of capital nature and farmers are not in position to invest in MIS. They had to take loans from the banks. JISL made presentations to banks and financial institutions regarding benefits of Micro-irrigation, payback periods and economical viability of MIS for variety of crops.

Banks came forward to provide loans to the farmers without taking any margin money from the farmers. Finance was made available for MIS on priority. Banks have played an important role in promotion of MIS in India.

iii] **NCPA**

A committee was set-up to study the technical and other aspects of using plastic in agriculture and promoting the plasticulture in India. This committee was named **National Committee on Plastics in Agriculture (NCPA)**. NCPA has played an important role in popularisation of MIS in India. NCPA also played a role of recommending steps to be taken and support to be provided by the Govt. NCPA also compiled field data and published booklets. Number of seminars on Micro-irrigation at State as well as National level were arranged by NCPA.

5] **CONCLUSION**

MIS has been successfully introduced to Indian farmers. MIS is the viable alternative to creation of large irrigation projects. It can double the irrigated area using existing water resources.

Necessary support should be provided by all the concerned agencies so as to give thrust and bring minimum 1 Mil. ha. area under MIS by 2005.

The integrated approach developed by JISL and the success story of MIS in India can be adopted by other under-developed and developing countries and these countries will be able to provide large benefits to the farmers and bring about social justice and economical growth of the farmers and the nation.

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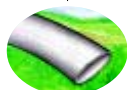
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