# Perceived Opinion and Consequences of adoption of Micro-irrigation system in Canal Command Area

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## ABSTRACT

*Micro-irrigation is an advanced method of irrigation aiming at precise application of water and nutrients to the crop at appropriate time in appropriate quantity. The present study was conducted at Lower Bhavani Canal Command Area of Erode District, Tamil Nadu to analyze the strengths, weaknesses, opportunities and threats of microirrigation. Results indicated uniformity in water distribution with equal pressure and less water requirement as major strengths as perceived by extension workers. The farm lands do not have same topography and slope in all the places and this was perceived as a prime weakness in installation of micro-irrigation system. Availability of bank loans with subsidy was the opportunity; Salt encrustation and non availability of spare parts were perceived as threats. The direct consequences of adoption of micro irrigation as reported by farmers include increased yield and thereby increased income. Development of reluctance in use of hybrid varieties of cash crops was the undesirable change. Increased outside contact, increased organizational participation by way of acquiring loans, change in source of credit and getting inputs in time were reported by the respondents as indirect consequences. The results discussed would enable the policy makers to formulate further developmental programmes and creation of infra-structural facilities for the socio-economic development of the farmers in canal command area.*

**Key words:** *Canal command area; Water management; Drip irrigation; Sprinkler irrigation; Fertigation;*

International Water Management Institute (IWMI) report indicates that one-third of the world's population will face absolute water scarcity by the year 2025. Among the worst hit will be the regions in Asia, the Middle-East and Sub-Saharan Africa, home to some of the largest concentrations of rural poverty in the world. Policy makers, researchers, NGOs, and farmers are pursuing various technical, institutional and policy interventions to meet this challenge. Micro-irrigation technologies, commonly in use in water scarce areas of developed countries, constitute one such intervention with the ability to use water more efficiently in irrigated agriculture. These technologies can improve productivity, raise incomes through crop yields and outputs, and enhance food security of households. Numerous studies have established the gains from micro-irrigation adoption and several government and non-government organizations are engaged in actively promoting the technologies. In India, micro-irrigation technologies have been marketed for more than three decades. The main vehicle of government policies to promote micro-irrigation systems are product subsidies in certain cases up to 90 percent. However, there has been a lukewarm response to such initiatives from farmers, especially smallholders. This can be attributed to several causes - lack of access to groundwater, lack of cash, crop specificity of the available micro-irrigation technologies, and lack of know-how, poor product quality and absence of adequate credit facilities (*Narayanamoorthy, 1996*). Studies show that despite active promotion, the appeal of these technologies has remained confined to wealthier farmers who produce commercial crops (*Shah and Keller, 2002*). Despite these constraints, in certain pockets of India, the technology has become a popular choice among farmers. It is notable that, in some of these cases, it has been adopted in the absence of government subsidies. However, IWMI's work shows that, in general, special efforts are required to market cost appropriate technologies to the poor and smallholders. Drip irrigation is often promoted for reasons that do not match with the farmers' main concerns. While the government promotes drip as

long-term investment for water saving and sustainable agriculture, the farmers look for immediate and assured benefits, such as lower cost of cultivation and increased income.

In India, more than 70 per cent of the annual rainfall occurs during the South West monsoon period between June and September. Irrigation especially during winter months enables increased intensity of land use for cultivation. The irrigated agriculture has to expand considerably in order to increase the food production to the required level of about 400 metric tonnes by 2025 (*Venkettkumar, 2001*).

In Tamil Nadu, since water has become a scarce commodity, importance is given for command area development programmes in canal and tank irrigated areas. The available water in Tamil Nadu has been already utilized and the demand is also increasing day by day for all purposes. In most of the rice-based cropping system prevalent in South India, there is a regular practice of releasing water at a definite time and on a fixed date, to enable the utilization of water throughout the cropping season. Rotation or turn system of irrigation was found to be suitable to save water and increase the productivity. Since, more than 90.00% of the available water is used for irrigation, high priority should be given to water management to increase the water use efficiency by adopting the micro-irrigation system *viz.,* drip irrigation, sprinkler irrigation and fertigation. Accordingly, a study has been attempted on micro-irrigation in the canal command area of Erode district.

## METHODOLOGY

Lower Bhavani Command Area of Erode District, Tamil Nadu was purposively selected for this study. In order to make the study more comprehensive, the head, mid and tail reaches of Lower Bhavani Canal Command Area were selected. The river flows through the three Public Works Department Divisions *viz., Sathayamanglam, Erode and Kanagayam* coming under Erode district. Two blocks each at random from the head, mid and tail reaches were selected *viz., Sathayamanglam* and *Nambiyur* in head reach, *Perundurai* and *Modakuruchi* in mid reach and *Kanagayam* and Vellakoil from the tail reach. Three villages were selected at random from each block. Thus, a total of 18 revenue villages were selected which formed the primary locale of the study.

The sample size was 150 farmers who grow paddy, sugarcane, turmeric, banana and groundnut. Fifty farmers each in head, mid and tail reach were considered based on proportionate random sampling method. The Agricultural Officers and Assistant Agricultural Officers working in the sample blocks were purposively selected for the study in order to assess their opinions, suggestions and exhaustive knowledge on the micro-irrigation system

## RESULTS AND DISCUSSION

The extension personnel (Agricultural Officer's and Assistant Agricultural Officer's) who were working in the locale of research were contacted and asked to rank the strengths, weaknesses, opportunities and threats of micro-irrigation system. The details are presented in Table 1

*Strengths:* The respondents were asked to rank the strengths of micro-irrigation system and the responses were quantified in percentages reach-wise and ranks were also given (Table 1). It is observed that micro-irrigation system are useful in economized use of water which was ranked first followed by uniform water distribution, change of cropping pattern, increased area of cultivation and yield increase in crops. Regarding reach-wise, the head-reach respondents indicated uniform distribution of water as the primary strength (100%) followed by economized use of water (90%), increased area of cultivation and change of cropping pattern (50%). Only 30 per cent of respondents indicated yield increase in crops as the last rank. As far as mid-reach is concerned, majority of the respondents expressed economized use of water and uniform distribution of water as primary strengths, followed by change of cropping pattern (60%), yield increase in crops and increased area of cultivation (35%). In tail-reach, economized use of water (100%), increased area of cultivation, uniform distribution of water (85%) and change of cropping pattern (70%) were the major strengthens. Only forty percent of respondents indicated yield increase in crops as last strength. The results are in line with the findings of *Krishanaraj (2004).* The reasons might be that micro irrigation system plays a major role in economization and uniform distribution of water in the water scarcity situation.

*Weaknesses :* It could be observed from Table 1 that initial investment has secured the highest magnitude followed by non-suitability to all areas/ crops/ soil types. The reason might be that micro-irrigation requires high initial cost to purchase various units of the equipment

**Table1. Swot analysis on micro-irrigation system (N=60)***

| S. No. | Details | Extension personnel | | | | | | | | Rank |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Head-reach (n=20) | | Mid-reach (n=20) | | Tail Reach (n=20) | | Total (n=60) | | |
| | | No. | % | No. | % | No. | % | No. | % | |
| *I* | *Strengths* | | | | | | | | | |
| 1. | Economized use of water | 18 | 90.00 | 20 | 100.00 | 20 | 100.00 | 58 | 97.00 | I |
| 2. | Increased area of cultivation | 10 | 50.00 | 7 | 35.00 | 17 | 85.00 | 34 | 57.00 | IV |
| 3. | Uniform water distribution | 20 | 100.00 | 18 | 90.00 | 17 | 85.00 | 55 | 92.00 | II |
| 4. | Change of cropping pattern | 10 | 50.00 | 12 | 60.00 | 14 | 70.00 | 36 | 60.00 | III |
| 5. | Yield increase in crops | 6 | 30.00 | 10 | 50.00 | 8 | 40.00 | 24 | 40.00 | V |
| *II* | *Weaknesses* | | | | | | | | | |
| 1. | Difficulty in intercultural operation | 20 | 50.00 | 3 | 15.00 | 5 | 25.00 | 28 | 46.00 | V |
| 2. | More labour requirement | 18 | 90.00 | 15 | 75.00 | 12 | 60.00 | 45 | 75.00 | III |
| 3. | Difficulties in lay-out and maintenance | 10 | 50.00 | 5 | 25.00 | 3 | 15.00 | 18 | 30.00 | VII |
| 4. | Non-suitability to all areas / crops /soil types | 15 | 75.00 | 17 | 85.00 | 20 | 100.00 | 52 | 87.00 | II |
| 5. | Lack of technical know – how | 10 | 50.00 | 8 | 40.00 | 2 | 10.00 | 20 | 33.00 | VI |
| 6 | Fragmentation of land | 7 | 35.00 | 10 | 50.00 | 13 | 65.00 | 30 | 50.00 | IV |
| 7. | Initial investment | 15 | 75.00 | 20 | 100.00 | 20 | 100.00 | 55 | 92.00 | I |
| *III* | *Opportunities* | | | | | | | | | |
| 1. | Less maintenance cost | 7 | 35.00 | 12 | 60.00 | 9 | 45.00 | 28 | 47.00 | IV |
| 2. | Availability of subsidy | 10 | 50.00 | 14 | 70.00 | 16 | 80.00 | 40 | 67.00 | II |
| 3. | Provision of bank loan | 17 | 85.00 | 20 | 100.00 | 13 | 65.00 | 50 | 83.00 | I |
| 4. | Involvement of private agency | 10 | 50.00 | 6 | 30.00 | 4 | 20.00 | 20 | 33.00 | V |
| 5. | One time investment | 12 | 60.00 | 11 | 55.00 | 7 | 35.00 | 30 | 50.00 | III |
| 6 | Low cost of cultivation | 2 | 10.00 | 3 | 15.00 | 3 | 5.00 | 8 | 13.00 | VI |
| *IV.* | *Threats* | | | | | | | | | |
| 1. | Inadequate availability of spare parts | 7 | 35.00 | 4 | 20.00 | 5 | 25.00 | 16 | 27.00 | IV |
| 2. | Salt encrustation | 5 | 25.00 | 8 | 40.00 | 6 | 35.00 | 19 | 32.00 | III |
| 3. | Damage due to rats and rodents | 6 | 30.00 | 10 | 50.00 | 4 | 20.00 | 20 | 33.00 | II |
| 4. | Pest and disease problem | 5 | 25.00 | 3 | 35.00 | 2 | 10.00 | 10 | 17.00 | V |
| 5. | High investment | 10 | 50.00 | 20 | 100.00 | 20 | 100.00 | 50 | 83.00 | I |

* Multiple responses

and it could not be used in all soils, crops and all areas. Clay soil, cereals, pulses and undulating topography are not suitable to this system. More labour requirement in the installation period was indicated by three fourth (75%) of the respondents followed by fragmentation of land (50%), difficulty in intercultural operations (46%) and lack of technical know-how (33%) as quoted by *Kavitha (1999).*

Regarding reach wise, majority of the respondents in head-reach quoted high labour requirement as the prime weakness followed by non-suitability to all areas / crops / soil types (75%), initial investment (75%), difficulty in intercultural operation (50%), difficulties in layout and maintenance (50%), and fragmentation of land (35%). In mid-reach, majority of the respondents indicated initial investment (100%), non suitability to all areas/crops/soil types (85%), and high labour requirement (75%) followed by fragmentation of land (50%), high labour requirement (40%), difficulty in intercultural operations (25%) and lack of technical know-how (15%) as the identified weaknesses as quoted by *Rajapondi(1983).*

*Opportunities :* Table 1 further reveals that provision of bank loan (83%) was the best opportunity followed by availability of subsidy (67), one time investment, less maintenance cost (47%), involvement of private agency (33%) and low cost of cultivation (3%). In the promotion of micro-irrigation system, banking sector is arranging loan to purchase equipments. The availability of subsidy followed by one time investment indicates that all the private agencies are offering subsidy for purchase of micro-irrigation units and once the system has been installed, this can be used for long time. These results are in line with the results of *Kavitha (2001).*

In reach-wise analysis, provision of bank loan was indicated by majority of the respondents. In head-reach, provision of bank loan (85%), one time investment (60%), availability of subsidy (50%), involvement of private agency (50%), less maintenance cost (35%) and low cost of cultivation) and in the mid and tail reaches, provision of bank loan and availability of subsidy have been expressed by majority of the respondents and is in line with the research findings of *Senthilkumar (1992).*

*Threats :* Table 1 also infers that among the threats, high investment was ranked as the first followed by damage due to rats and rodents (33%), salt encrustation (32%), inadequate availability of spare parts (27%) and pest and disease problem (17%). The reason might be the high cost of equipment, transport cost and installation cost. Further, damage due to rats and rodents and salt encrustation were ranked II and III respectively. Rats and other rodents make holes in the pipes leading to wastage of water and pressure loss. The inadequate availability of spare parts, and pest and disease problem were ranked IV and V as threats. Regarding reach-wise analysis, 50 per cent of head-reach respondents indicated high investment as the main threat followed by inadequate availability of spare parts (35%), damage due to rats and rodents (30%), salt encrustation (25%) and pest and disease problems (25%). In the mid-reach, all the respondents indicated high investment followed by damage due to rats and rodents, salt encrustation, pest and disease problems and inadequate availability of spare part as threats. *Nandhni (1995).*

*Consequences of adoption of micro-irrigation system :* One of the objectives contemplated in this study was to assess the direct and indirect consequences in use of micro-irrigation system by the respondents.

In this section, consequences are classified as economic aspects, farming conditions, personal characteristics and social characteristics. Consequences in yield and income are grouped under direct consequences, whereas all the other consequences are grouped under indirect consequences (*Rogers, 1971*). The details about the direct and indirect consequences are given below.

*Direct consequences :* Under direct consequences, the data with respect to yield and income were collected and subjected to McNemar test *Siegel (1956*). The results are presented in Table 2.

*Yield* **:** Table 2 indicates that 59.33 per cent of the farmers reported increased yield and 25.33 per cent reported decreased yield while same yield was expressed by 15.33 per cent. The yield trend was measured and assessed keeping 2000 as base year. Further, the connected data were subjected to McNemar test. The calculated value of 19.68 was more than the table value indicating significant change in yield due to the adoption of micro irrigation system by the farmers of the canal command area (*Nandal et.al, 1991*).

**Table 2. Consequences in yield and income**

| S.No. | Particulars | No. | % | $\chi^2$ |
|---|---|---|---|---|
| I | *Yield* | | | |
| 1. | Increased yield / acre | 89 | 59.33 | |
| 2 | Decreased yield / acre | 38 | 25.33 | 19.68 ** |
| 3. | Same yield / acre | 23 | 15.33 | |
| | Total | 150 | 100.00 | |
| II | *Income* | | | |
| 1. | Increased income / acre | 85 | 57.00 | |
| 2 | Decreased income / acre | 35 | 23.00 | 20 ** |
| 3. | Same income / acre | 30 | 20.00 | |
| | Total | 150 | 100.00 | |

** Significant at 0.01% level

*Income* : An increase of income was observed among 57 per cent of the respondents while 20 per cent reported same income and decreased income was reported by 23 per cent. The data pertaining to income was also subjected to the McNemar test. The significance of test inferred that there exists a significant change among the farmers. It means that income increased for the canal command area farmers as result of adoption of micro-irrigation system. The reduction in yield might be attributed to inadequate availability of water in canal and less frequent irrigation with long intervals. Because of this, less application of fertilizer also contributed for the reduction of yield. The reduction of income as observed in 23 per cent of the cases might be attributed to the reduction in yield and income as reported by *Hashim (1996).*

*Indirect consequences* : The indirect consequences occurred due to the adoption of micro-irrigation system are discussed below.

*Economic consequences* **:** The data from Table 3 reveals the desirable and undesirables economic consequences. As a consequence of higher income, 33 per cent of the respondents purchased new farm implements. Acquisition of new lands was also observed among 23 per cent of respondents. Due to adoption of micro irrigation system, there was decreased cost of cultivation (34%), reduced labour usage (25%) and easy intercultural operations (21%). Due to increased income, increased savings, digging and deepening new wells were also reported. Further, the increased income was utilized for construction of house (2.60%). Increased

cost of cultivation (26%), difficulty in intercultural operations (25%), increased labour use (13%) and decreased marketable surplus (15%) were reported as the undesirable changes as reported by *Chandrasekhar (1979).*

**Table 3. Economic consequences in Water Management Practices**

| S.No. | Particulars | No. | % |
|---|---|---|---|
| *I* | *Desirable* | | |
| 1. | Decreased cost of cultivation | 51 | 34.00 |
| 2. | Reduced labour use | 37 | 25.00 |
| 3. | Easy in intercultural operation | 32 | 21.00 |
| 4. | Increased saving | 05 | 3.300 |
| 5. | Dry a new well/deepened the existing one | 03 | 2.00 |
| 6. | Purchase of new farm implements | 50 | 33.00 |
| 7. | Acquition of new lands | 35 | 23.00 |
| 8. | Investment in construction of house | 04 | 2.60 |
| 9. | Increased marketable surplus | 10 | 6.6 |
| *II* | *Undesirable* | | |
| 1. | Increased cost of cultivation | 39 | 26.00 |
| 2. | Increased labour use | 20 | 13.00 |
| 3. | Difficulty in intercultural operation | 30 | 25.00 |
| 4. | Deceased marketable surplus | 23 | 15.00 |

*Consequences in farming conditions :* Under the consequences of farming condition pertinent data were collected in two aspects *viz.,* desirable and undesirable changes and the results are given in the Table 4.

**Table 4. Consequences in farming conditions (N = 150)**

| S.No. | Particulars | No. | %* |
|---|---|---|---|
| *I* | *Desirable* | | |
| 1. | Conversion of dry land into irrigated land | 40 | 27.00 |
| 2. | Started using the improved implements for cultivation | 42 | 28.00 |
| 3. | Started raising more cash crops suitable to micro irrigation system | 50 | 33.33 |
| 4. | Raising the less water requirement and drought tolerant crops | 45 | 30.00 |
| *II* | *Undesirable* | | |
| 1. | Developed reluctance in use of hybrid varieties | 30 | 20.00 |

* Multiple responses

Table 4 reveals that desirable and undesirable changes occurred in the farming conditions as a consequence of adoption of water management practices. Conversion of dry land into irrigated land was taken up by 27 per cent of farmers and use of improved implements for cultivation (28%) reported by the respondents. More than one third of the respondents (33.33%) started raising cash crops and thirty percent of the respondents were cultivating drought tolerant crops. Development of reluctance in use of hybrid varieties crops as expressed by 20 percent of respondents is an undesirable consequence. The findings are line with the findings of *Venketapirabu (1998*).

*Consequences in personal characteristics* : The details regarding the consequences in personal characteristics are presented in Table 5.

Table 5 communicates the desirable and undesirable changes in the personal characteristics of canal command area farmers due to adoption of micro-irrigation system on water management.

Consultations regarding problems in farming and for personal issues were reported by 13.33 and 6 per cent of the respondents respectively. It is further seen that 29.33 per cent of the respondents reported recognitions due to high income and high yield, whereas 6.66 per cent reported finding leisure time to attend the other works. Increased exposure to media sources was also reported by 13.33 per cent of respondents. The decision making capacity was increased for 12.66 per cent of respondents as reported.

**Table 5. Consequences in personal characteristics (N = 150)**

| S.No. | Particulars | No. | %* |
|---|---|---|---|
| *I* | *Desirable* | | |
| 1. | Consulted by other farmers on farming purpose | 20 | 13.33 |
| 2. | Consulted by others for personal problems | 9 | 6.00 |
| 3. | Got recognition by others due to high yield, income etc. | 44 | 29.33 |
| 4. | Got more leisure to attend other works | 10 | 6.66 |
| 5. | Increased exposure to media sources | 20 | 13.33 |
| 6. | Improved decision making capacity | 19 | 12.66 |
| *II* | *Undesirable* | | |
| 1. | Increased frequency of cinema going | 13 | 8.66 |
| 2. | Increased habit of taking food in hotels | 15 | 10.00 |

* Multiple responses

The undesirable consequences *viz.,* increased frequency of cinema going (8.66%) and increased habit of taking food in hotels (10%) were also reported due to more exposure on mass media and increased outside contact Opinion leadership in farm problems was sought from panchayat presidents and farmer demonstrators as reported by *Kumar (1980).*

*Consequences in social characteristics* : The details on consequences in social characteristics are presented in Table 6. As seen from Table 6, increased outside contact, increased organizational participation by way of acquiring loans (10%), change in source of credit (13.33%) and getting inputs in time (23.33%) were reported as consequences by the respondents. A meager 2.6 per cent of respondents reported increased litigation in the social characteristics. The canal command area

farmers had leisure time to spend with. They were members in any one of the organization, which might have increased organizational participation leading to outside contact.

**Table 6. Consequences in social characteristics (N=150)**

| S.No. | Particulars | No. | %* |
|---|---|---|---|
| 1. | Increased litigation | 4 | 2.66 |
| 2. | Increased organizational participation by | | |
| | way of a. Acquiring loans | 15 | 10.00 |
| | b.Change in source of credit | 20 | 13.33 |
| | c. Getting inputs in time | 35 | 23.33 |
| 3. | Increased outside contact | 50 | 33.33 |

* Multiple responses

All these accumulated advantages as expressed by the respondents would have paved way for increased yield leading to increased income,

## CONCLUSION

The use of optimum water with uniform distribution had emerged as the major strength associated with micro-irrigation system as identified by the change agency. The uniformity in the distribution with equal pressure, less water and pressure loss could have acted as an important strength in the perception of extension workers. Though the perception of threats and weaknesses were experienced perceptually by the extension workers, it is recommended to change the perception of the extension workers from weaknesses in to strength and threats into opportunities. Because, ultimately it is the perception of change agency system that would decide the course of action and has profound influence on the attitude and mental perception of farmers in canal command area. The direct consequences namely increased yield led to increased income, savings and other consequences. The increased income naturally improved the socio-economic status.

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