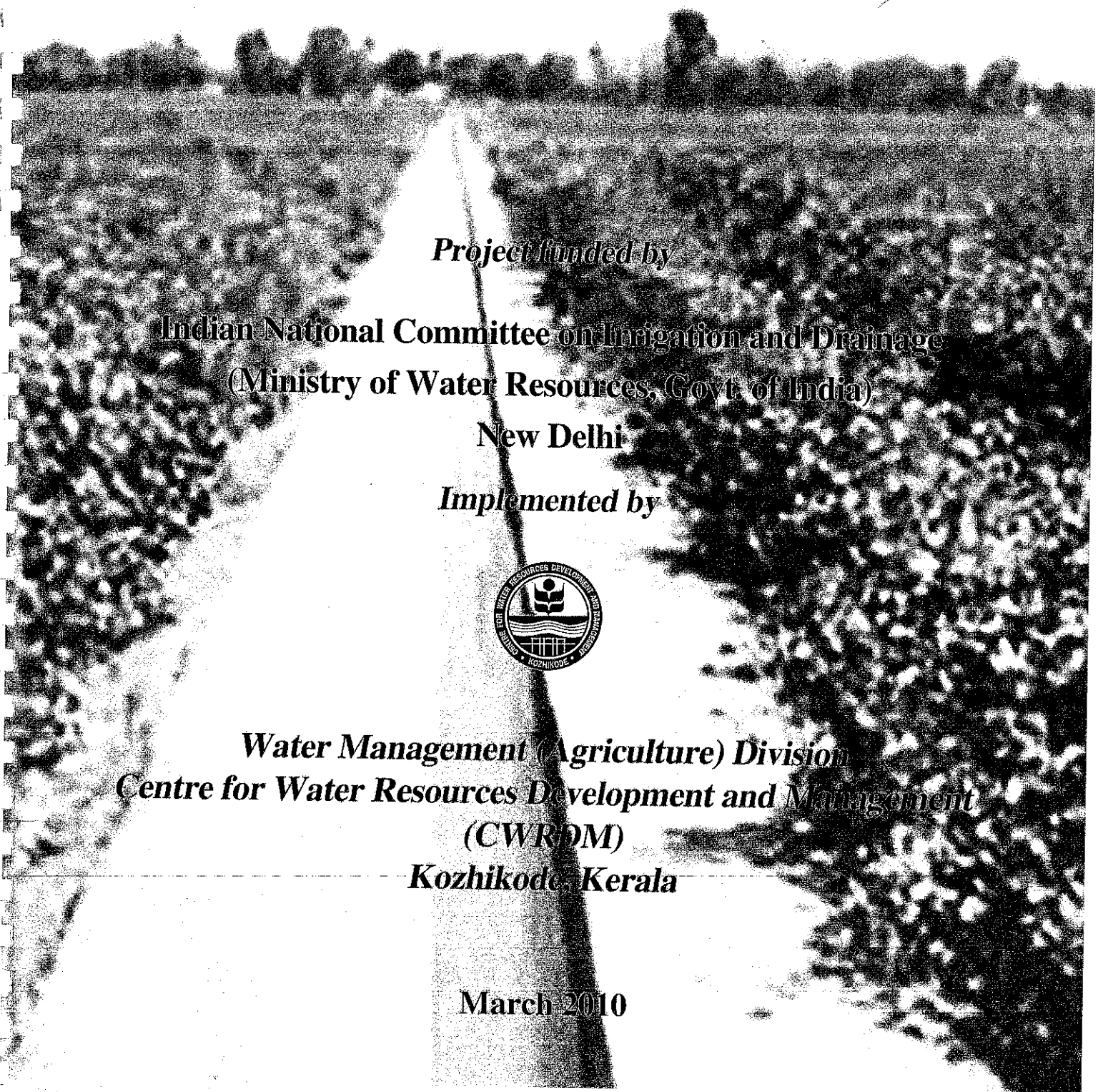
FINAL REPORT

Action Research on On-Farm Water Management for Paddy through Farmers' Participation

K. M. Chacko



Project funded by

Indian National Committee on Irrigation and Drainage
(Ministry of Water Resources, Govt. of India)
New Delhi

Implemented by

Water Management (Agriculture) Division
Centre for Water Resources Development and Management
(CWRDM)
Kozhikode, Kerala

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Project Investigators

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PROJECT DETAILS

1. Implementing Institution : Centre for Water Resources Development and Management (CWRDM), Kunnamangalam, Kozhikode- 673571, Kerala.

2. Title of the Project : Action Research on On-Farm Water Management for Paddy through Farmers' Participation.

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9. Principal Investigator : Dr. K. Madhava Chandran Scientist E_1, Water Management (Agriculture) Division, CWRDM, Kozhikode-673571, Kerala

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* Three months from receipt of Bank Draft

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ii. Smt. V.K. Leena - January 2006 to November 2006
iii. Smt. Sunitha. S - January 2007 to April 2008

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(i) Sandhya Raghunathan, Madhava Chandran, K. and Babu Mathew (2006). A study on On-farm water management for paddy among farmers in the command area of Kuttiyadi irrigation project. *Extended Abstract, XVIII Kerala Science Congress*, Jan. 2006, Thiruvananthapuram, Kerala: 285-287.

(ii) Leena, V. K., Madhava Chandran, K. and Babu Mathew (2007). Water use efficiency of paddy under channel to field irrigation. *Proceedings, XIX Kerala Science Congress*, Jan. 2007, Kannur, Kerala: 418-419.

(iii) Madhava Chandran, K., Babu Mathew and Sundararajan, V (2008). Improving water use efficiency in rice through on-farm water management: A study from Kerala, India. *Journal of Applied Irrigation Science* (International Journal published from Germany in English and German languages). Vol. 43. No. 2. October 2008: 119-127.

1. Introduction

The staple food of the population in Kerala State is rice (paddy). However, the State is not self-sufficient in the production of paddy, and a major part of its requirement is being met by allotment from the Central Government, as well as from neighbouring states. The cultivated area under paddy in Kerala is also reducing day by day due to conversion for other purposes. Hence there exists a wide gap between the requirement and production of rice in the State.

The solution to this lies in improving productivity of rice in the State through adoption of scientific agricultural practices by the farming community. Among the various agricultural inputs required for increasing crop productivity such as seeds, fertilizers, manures, water etc., irrigation water availability during the summer season is the most crucial determinant of productivity of rice. Most of the irrigation projects commissioned in Kerala cater to irrigation of rice. Viswanathan (2002) has reported that there is under utilisation of irrigation potential created to the extent of 35 to 45% in Kerala in most of the completed irrigation schemes, in spite of heavy investments over time. One of the factors for this lower potential utilization is water loss in distribution, especially in the field to field method of irrigation being traditionally practiced by farmers for rice. This brings home the need to adopt proper on-farm water management in the command areas of irrigation projects in the State.

The agriculture sector is coming under pressure to make more efficient use of water. It is being criticised for being the greatest water user, while having the lowest output per unit of water used, among all sectors. Many experiments have shown a positive effect of improved on-farm water management (OFWM) on crop yields. (Wolff and Stein, 2003). According to ICID (2000), on-farm water management (OFWM) can be defined as the planned development, distribution and use of water resources in accordance with pre-determined objectives, while respecting both the quantity and quality of water resources. For this water has to be managed skilfully through certain practices covering various areas, including water application. According to Wolff and Stein (2003), in- appropriate water management is an old problem in OFWM. But this problem now ranks higher on the agenda, as the world is faced with significant increase in population, as food security becomes more of an issue and as land and water resources become scarcer. Over irrigation is a common problem. Traditional management practices of irrigation supply, and conveyance systems often contribute to high water loss. On many farms, the low irrigation efficiency is further accentuated by farmer's traditional irrigation methods and practices. In the past, extensive research in many countries has shown that in irrigated agriculture, OFWM practices require appropriately designed on-farm distribution systems.

Scientific on–farm water management for paddy during the irrigation season in Kerala envisages application of the required quantity of water (based on crop water requirement) at definite intervals so as to maintain the recommended depth of 5 cm. of standing water in the field (State recommendation as per Package of

Practices Recommendations: Crops. KAU, 2002) through channel to field method of irrigation. This requires a network of irrigation channels catering to individual plots in the command areas. At present, improvement in water management at the field level is restricted to a system of concrete field channels of particular length constructed below the outlets under CADA programme, with majority of the farmers still practicing the field to field method of irrigation. Improvement in water use efficiency in the command areas through scientific on-farm water management practices is essential under irrigation projects. Majority of farmers are actually not aware of improved on-farm water management practices such as channel to field irrigation. This is also one of the reasons why they practice field to field irrigation, resulting in wastage of water.

The above discussion indicates the need to carry out a research cum demonstration programme on channel to field method of irrigation, which can improve field water use efficiency, viz, yield per unit quantity of water applied at the farm level. Further, since excess water is the main problem in Kerala during the first crop (Kharif), as well as, up to a certain extent during the second crop season (Rabi), the concrete farm channels can be designed so as to serve the dual purpose of drainage during the above mentioned seasons, in addition to irrigation during the third crop season (Summer).

Under this INCID (MOWR) funded project, research cum demonstration programme on scientific on-farm water management for paddy through channel to field irrigation using concrete field channels (constructed below outlet in the

irrigation canal) has been carried out through farmer participation. The main objective behind formation of farmers' associations under CADA in Kerala was to improve on-farm water management through the farmer participation. Nowadays, there is also a movement towards stronger participation of farmers in agricultural extension and research, since socio-economic and agro–ecological conditions of farmers are complex, diverse and risk-prone, and the conventional approaches based on research station trials, followed by uni-directional technology transfer, are not likely to be very successful. This is where farmer participatory research/extension programme holds promise in enhancing the efficiency of technology development process as well as prospects for technology adoption by farmers.

2. Objectives of the project

i. To study water use efficiency in irrigated rice under channel to field method compared to the traditional practice of field to field method of water distribution

ii. To identify factors which would help to promote adoption, and constraints in adoption of this improved OFWM practice among farmers.

iii. Extension of improved/scientific OFWM practice among farmers through conducting seminar on OFWM practice among farmers.

3. Technical Programme

The project was implemented in the command area of Kuttiyadi irrigation project, Kozhikode district, Kerala State, India. Based on field visits to different parts of the command area, a farmer's paddy (rice) plot of 0.4 ha was identified for conducting the study in the command area of Ichannur sub distributory (of Kakkodi branch canal) under the irrigation project, taking into consideration aspects such as water availability, farmer's interest to associate with the project etc. Knowledge and attitude of the farmer towards improved OFWM practices was analysed through discussions, and the farmer was made aware about various aspects of the proposed project.

Ferro cement farm channels were laid out from the outlet on the nearby irrigation canal to his paddy plot along its border. Channel to field method of water distribution was experimented in the paddy plot during two summer seasons (January to May period of 2006 and 2007). Irrigation to the field was carried out through pipe outlets (Plate 1 and Plate 2) from the Ferro cement channel. Another plot of the same size was selected as control, wherein, the traditional method of irrigation water distribution practiced by farmers in the command area, namely, field to field method, was tried.

Local variety of rice (Arampattu) of 95 days duration was cultivated (as broad cast crop) both in channel to field and field to field plots. Based on observations in farmers' plots in the command area, it was made out that they maintain a standing water depth in the range of 8 to 10 inches in their fields.

Accordingly, based on discussion with the experimental plot owner, it was decided to provide 8 inches depth of irrigation in the control plot. In the channel to field plot and the control plot, irrigation was provided as follows: Up to 15 days after planting of paddy crop, the soil was maintained in a saturated condition, as per the practice adopted by farmers in the command area. In the Ferro cement channel irrigated as well as the control plot, irrigation was started from 16th day after planting, with 1 inch depth of irrigation up to 30th day by irrigating at an interval of 2 days, and 1.5 inches from 31st to 45th day, with 2 days as the irrigation interval. After that, irrigation depth of 4 inches with an interval of 3 days was given in the channel to field plot, while it was 8 inches in the control (field to field) plot at 5 day interval. The irrigation interval was determined, taking in to consideration 20mm/day as the water loss in a paddy field through ETc, seepage and percolation (CWRDM, 1990). The required water levels were maintained in both the plots based on measurements on scales fixed at different points. All other agronomic measures were adopted in both the plots according to the existing practices of the farmer. Data on crop yield and quantity of water used were recorded from the channel to field and field to field plots.

Since non-adoption of scientific OFWM by farmers is primarily due to non-reliability of water and poor condition of canals and control structures, infra structure assessment of the above was carried out, as suggested by Gopal Naik *et al* (2002), in Ichannoor sub distributory. Flow measuring structures (Rectangular weirs) were designed and installed (Plate 3) in the sub

distributory (which delivers water to the study area). Discharge observations by velocity-area method were made at two sections, one in the middle and other in the tail reach to study seepage and variation in discharge.

Data was also collected through interview using questionnaire(APPENDIX I), and discussion with a sample of 100 paddy farmers in the command area on aspects like awareness on scientific irrigation management, reasons for unawareness, preferences for various water distribution methods, reasons for the preference, constraints in adopting channel to field method etc. The constraints were ranked using Garret ranking technique (Palanisami *et al*, 1999). The command areas under Ichannoor and Patterpalam sub distributories and Kannankara and Maruthad field bothies of Kakkodi branch canal of Kuttiadi irrigation project were chosen for the study.

A seminar on On-farm water management for rice was organized. Under this, focused group discussion was conducted with farmers coming under Ichannur, Kozhikundunilam, Muthuvattuthazham, Oottukulam, Aduvarakalthazham (Palam) and Puthiyidathuthazham 'Padashekarams' (malayalam version of rice farming groups) of Kakkodi branch canal. The channel to field irrigation plot was utilized as a demonstration unit for the farmers attending the seminar.

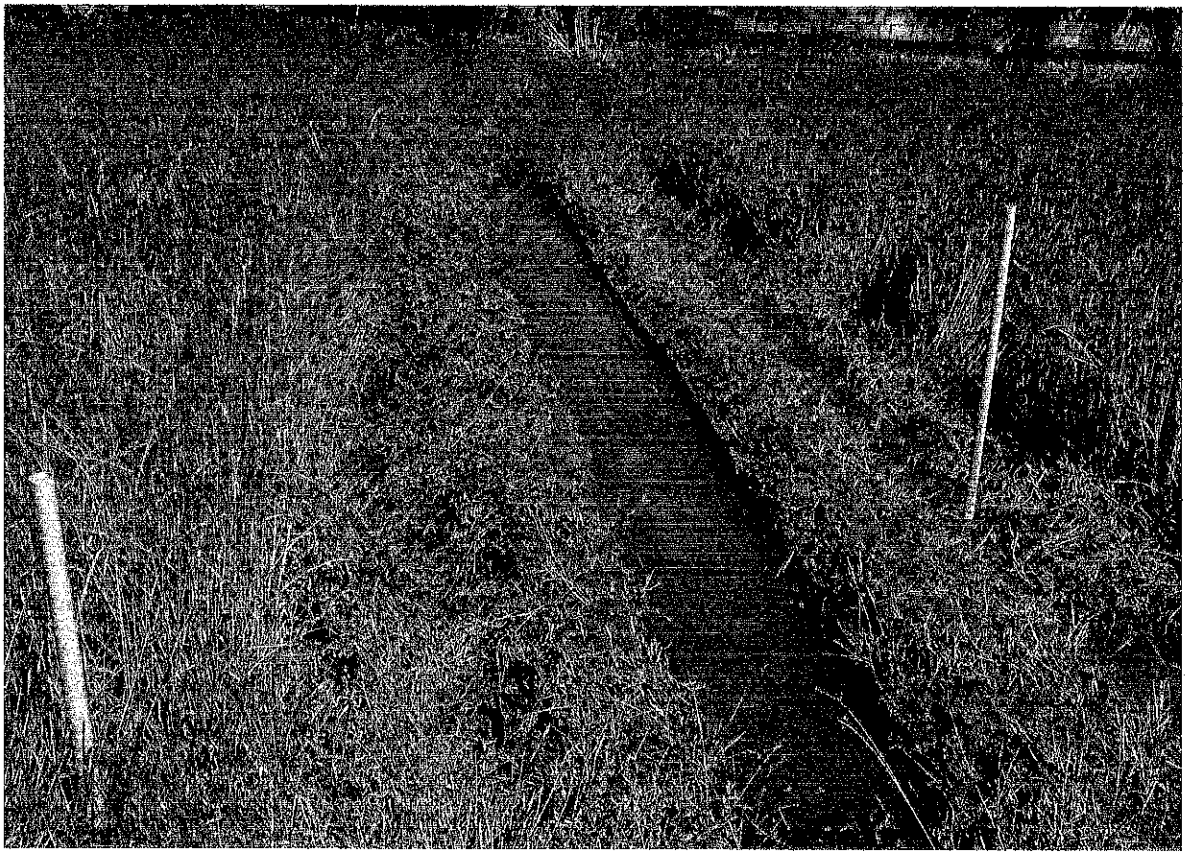

PLATE 1 Ferro cement channel for irrigation

PLATE 2 Pipe outlet to the field from Ferro cement channel

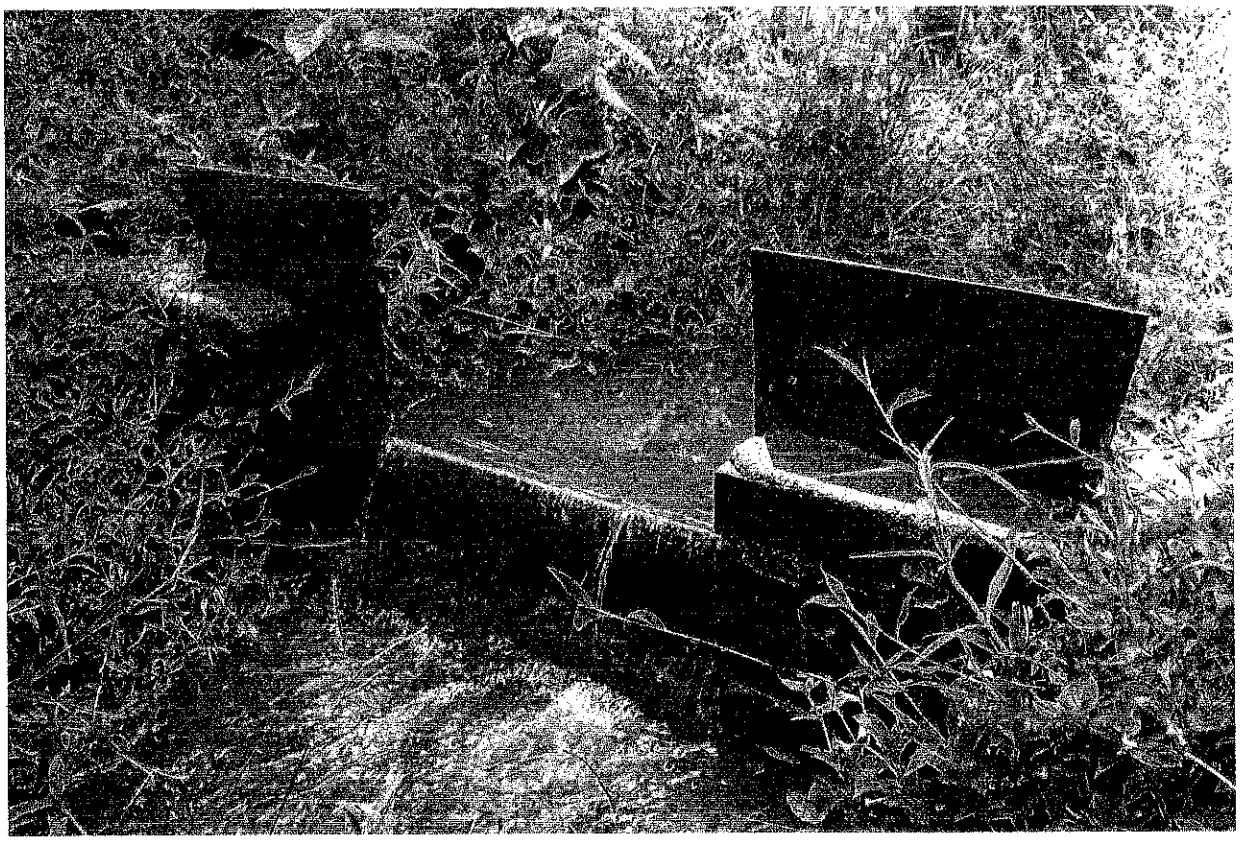

Plate 3 Rectangular weir installed for discharge measurement

4. Results and Discussion

4.1. Awareness on scientific irrigation management

Table 1 gives details regarding awareness of farmers on scientific irrigation management for paddy. It can be observed that majority of the farmers are not aware of scientific irrigation scheduling for paddy, even though many of them are aware of channel to field method of irrigation. A good proportion of them agree that it is a better method (Table 1). However, they cite genuine constraints in adopting it such as cost involved, lack of group action in paddy farming (which is necessary to implement the irrigation method in a comparatively large area in the command), availability of excess water etc.

Only 12.2 % of farmers are aware of scientific irrigation scheduling for paddy, and 38.8% about the quantity of water applied to the crop (Table 1). 34.9 % reported uncertainty in water availability as the most important reason why they are not interested in being aware of scientific water management (Table 2). Table 1 also shows that 73.5% farmers were aware of channel to field method of irrigation.

Table 1. Awareness on scientific irrigation management for paddy

Particulars	Farmers (%) reporting	
	Yes	No
Aware about scientific irrigation scheduling	12.2	87.8
Aware about quantity of irrigation water applied	38.8	61.2
Channel to field is a better method of irrigation	53.1	46.9
Aware about channel-to-field method of irrigation	73.5	26.5

Table 2. Reasons for unawareness on scientific irrigation management

Reason	Farmers (%) reporting
Uncertainty in water availability	34.9
Agriculture is not the main occupation	23.3
Traditional method is more convenient	14.0
Non-co-operation from officials	14.0
No response	14.0
Lack of time	9.3

4.2 Preferences of farmers towards water distribution methods

53.1 % farmers agreed that channel to field is a better method (Table 1). 96.2% of them mention better water management as the reason for preferring it (Table 3). Table 3 also shows 46.2% reporting full utilization of fertilizers through this irrigation method (Table 3). 46.9 % prefer field-to-field method (Table 1). Of them, 47.8% reported convenience in water management as the reason, while, 17.3% were not sure about the benefit of channel to field method (Table 4).

Table 3. Reasons for preferring channel to field method

Reason	Farmers (%) reporting
Better Management of water	96.2
Full Utilization of Fertilizer	46.2
Soil erosion can be prevented	3.8

Table 4. Reasons for preferring field-to-field method

Reason	Farmers (%) reporting
Convenience in water management	47.8
Not sure of the benefit of channel to field method	17.4
Better yield	8.7
Land not level	8.7
Occupies land	4.3
Will deprive water to head end farmers	4.3

4.2.1. Preference ranking for water distribution methods

A few days after the seminar organised for farmers (refer item 5 in this report for details), 50 farmers, who attended were selected using simple random sampling and interviewed using a questionnaire regarding their preferences for various water distribution methods (Refer Interview Schedule shown in this Report). A new approach for analyzing farmers' preferences called "Trade-Off Model" (Gopal Naik and Kalro, 2000) was adopted. This involves the choice a farmer has to make, given a set of alternatives. It requires specification of the trade-off design, consisting of alternatives generated from different levels of two factors. The two factors considered in our study are water distribution methods and availability of subsidy for adopting the methods. The distribution

methods include Ferro cement channel, earthen channel and field to field. Subsidy factor consists of the following levels, namely, 100% subsidy, 75%, 50% and no subsidy.

Farmer's preference was elicited by initially offering all the four water distribution alternatives at the first level of subsidy, namely, 100%, and eliciting preference for the method. This was given rank one. Next, subsidy was made 75% for the distribution method ranked one, keeping the 100% subsidy option for the other two distribution methods. This preference was ranked two. This was repeated until all the cells in the questionnaire were completed.

Analysis of the data collected on preferences reveals that when 100% subsidy is offered, only 62.3% farmers express their first preference for Ferro cement channel, while the remaining 37.7% have first preference for field to field method. When the subsidy is reduced to 75% for Ferro cement channel, maintaining 100% subsidy for the other two methods, only 26.4% farmers express their next (second) preference for Ferro cement channel, while 34% farmers have their second preference for earthen channel, and 1.9% farmers for field to field method.

Hence, the results indicate a significant shift in preferences from Ferro cement channel to earthen channel, when subsidy is reduced for the former method. However, with respect to 37.7% farmers, who give first preference

for the field to field method, data shows that all of them continue their next preferences for the same method under all the other subsidy factors also (i.e.; from 75% to no subsidy). This type of response could probably be because they have been adopting this method for a long time even without any support from the department side. This ultimately indicates that farmers do not necessarily require financial assistance for adopting their traditional method of water distribution.

Table 5 shows the proportion of farmers giving continuous preferences for various water distribution methods. It may be made out that the proportion of farmers preferring Ferro cement channel reduces drastically from 62.3% under 100% subsidy to 26.4% under 75% subsidy, to less than 4% under both 50% and 25% subsidy levels, while none of them prefer this method under no subsidy. However, it can be made out from Table 5 that the rate of reduction in percentage of farmers preferring earthen channel, when subsidy is reduced, is comparatively very less. Even under 25% subsidy, about 25% of the farmers are willing to adopt this method, which is a good indication for a possible change from the traditional method of field to field having low irrigation efficiency. Table 5 further shows that the same proportion of farmers (84.9%) prefers field to field method under all the subsidy levels, and also under no subsidy, indicating their obsession with this time tested traditional practice.

From the above discussion, it may be inferred that, for effecting a significant change over from the traditional, wasteful practice of field to field water distribution for rice to improved OFWM methods like channel to field, it may be required for the irrigation/agriculture department to subsidise the cost of construction/layout of the methods considerably. However, this may not appear to be a very feasible option under the present scenario, where the emphasis of Governments, including that of donor agencies, is to reduce such type of financial assistance in order to instil a sense of "ownership" for farmers in their development activities, and accordingly, make them more sustainable.

Table 5. Continuous preferences of farmers for water distribution methods

Water distribution method	Farmers (%) giving continuous preferences* for a method under				
	100% subsidy	75% subsidy	50% subsidy	25% subsidy	no subsidy
Ferro cement channel	62.3	26.4	3.8	1.9	Nil
Earthen channel	49.1	33.9	24.5	15.1	13.2
Field to field	84.9	84.9	84.9	84.9	84.9

* Preferences reported continuously in succession for each lower level of subsidy; not necessarily starting from first preference alone, but also includes those starting from lower level preferences also

4.3. Infrastructure assessment of sub distributory

The results of infrastructure assessment of Ichannoor sub distributory are shown in Table 6. The table shows that the problems include visible siltation, cracks in canal lining and embankment and unlined portions of the distributory. 37.1 % of the distributory is unlined, causing considerable seepage loss. Of the lined portion, 83.3% is damaged with cracks, which promote leakage and water loss through weed growth. Visible siltation of about 1 cm is observed on the distributory. In all the control structures, gates are missing or in a damaged condition, implying that the distributory and control structures are ill maintained. Hence, water seeps down, causing water logging and without supplying sufficient water to the tail end farmers.

Table 6. Infrastructure assessment of Ichannoor distributory

Particulars	Length (m) of sub distributory	% of total length
Visible siltation	1901.6	100
Cracks in the lining of the distributory	995	83.3
Distributory is not lined	706.3	37.1
Cracks in the embankment	100	5.3

4.4. Constraints in adoption of channel to field method

Though 53.1% of farmers agree that channel to field method is better (Table 1), none of them are practicing it. Hence, the farmers were asked to rank the constraints in its adoption, which were given scores using Garret ranking technique (Palanisami *et al*, 1999)

The most important constraint (Fig. 1) is non-conviction about the method. This may be due to small landholdings and low income from paddy, which could act as a de-motivation for farmers to adopt improved practices. Fig. 1 reveals that the second important constraint is excess water availability, which makes it difficult to adopt channel to field method. Lack of group action in paddy cultivation is the third constraint. Group approach is required to implement channel to field method in a good proportion of the command area. However, the experience of group farming in rice cultivation, implemented by the Agriculture Department in Kerala was not promising.

The cost involved is cited only as the fourth constraint in adoption of channel to field irrigation (Fig.1), implying that if water supply can be controlled and there is group approach in rice farming, cost will not be a problem. Fig. 1 shows some more constraints of farmers such as land occupied by channels, fear of loosing land ownership etc.

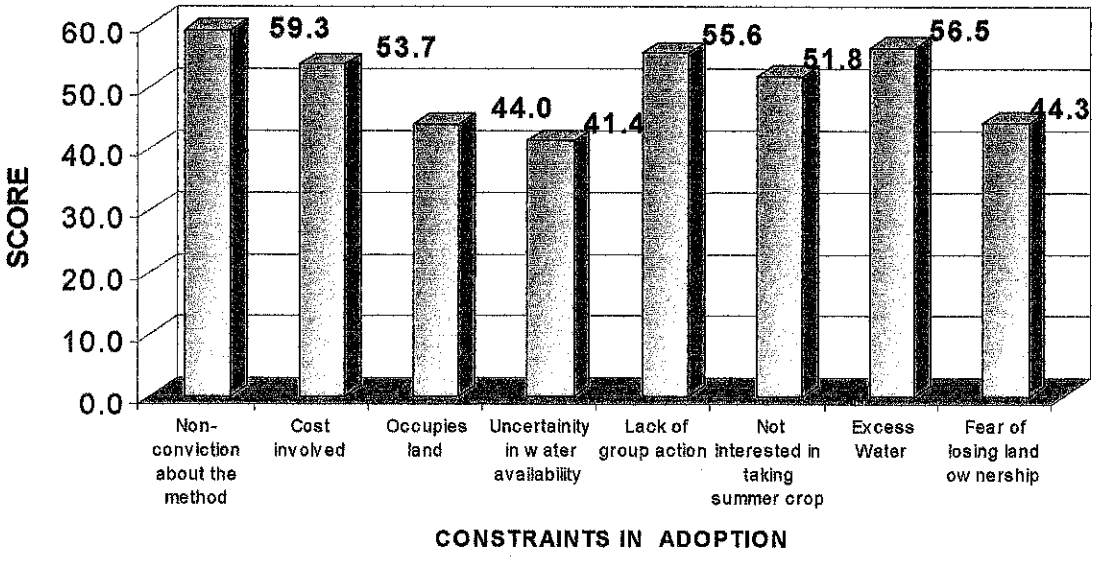

Fig. 1. Constraints in adoption of channel to field method

4.5. Water use efficiency under channel to field method

The quantity of water used in the channel to field plot works out to 1505 mm/ha, while for the field to field irrigation plot it is 1879 mm/ha. Yield was determined through crop cutting in grids of size $4m^2$ (2m x 2m). The moisture content of grains was worked out to quantify the dry weight of grains from the wet weight recorded. The average yield obtained was extrapolated to Kg/ha.

During the first year of the trial, yield obtained under channel to field irrigation is 2087 Kg/ha, while it is 2252 Kg/ha under field to field irrigation. The average yield range of paddy for third (summer) crop of paddy in the command area is reported to be in the range of 1000 to 2750 Kg/ha (CWRDM, 1992).

Water use efficiency worked out in the channel to field irrigation plot comes to 1.4 Kg /mm and that of field to field irrigation is 1.2 Kg/mm (Table 7). It may be inferred from the table that water saving of the order of 3,740 m^3/ha is achieved through adoption of channel to field irrigation in rice, maintaining a yield of about 93% of that obtained under farmer's practice of field to field irrigation.

Table 7. Water use efficiency under water distribution methods

Method	Average yield (Kg/ha)	Qty of water used (mm/ha)	Water saving over field to field method	Water use efficiency (Kg/mm)	% Yield
Channel to field	2087	1505	374 mm/ha (3,740 m^3/ha)	1.4	92.7
Field to field	2252	1879	-	1.2	100

During the second year of the trial, yield of rice obtained under channel to field irrigation is 2500 Kg/ha and 2600 Kg/ha under field to field method (Table 8). Water use efficiency during this irrigation season was worked out and found to be 1.7 Kg /mm in the channel to field irrigation plot, and 1.4 Kg/mm under field to field irrigated plot (Table 8). The previous year's trial

had shown a water use efficiency of 1.4 under channel to field method, and 1.2 under field to field method (Table 7). Higher yield of rice obtained during this year's trial, when compared to the previous year under both the irrigation methods, has contributed to a higher value of water use efficiency under the two irrigation methods during the second year of the trial.

Similar to the first year, a water saving equivalent to 3,740 m^3/ha has been achieved through adoption of channel to field irrigation during this year also, maintaining 96.2% of the yield obtained under farmer's practice of field to field irrigation (Table 8).

Table 8. Water use efficiency under water distribution methods

Method	Average yield (Kg/ha)	Qty of water used (mm/ha)	Water saving over field to field method	Water use efficiency (Kg/mm)	% Yield
Channel to field	2500	1505	374 mm/ha (3,740 m^3/ha)	1.7	96.2
Field to field	2600	1879	-	1.4	100

Based on a study conducted under an irrigation project in Kerala for rice, Joseph (2003) reports that there is no significant yield improvement through adoption of the farmer's practice of field to field irrigation, compared to scientific water management@ 1 to 5 cm standing water applied through

channel to field method. In the latter method, water used is about 60% of that under farmer's practice. Water use efficiency, expressed as Kg ha^{-1} cm^{-1} of water, is 12 under the farmer's practice, and 18 and 21 under scientific on-farm water management during the two years of study. Farmers also reportedly realised that they can use the precious water saved through adoption of the scientific OFWM practice to bring more area under cultivation.

4.6. Hydraulic aspects

During the second year of this research project, in order to study the seepage loss and daily discharge variation, a 300m unlined stretch of Ichannur sub distributory was selected between the middle and tail reaches. Two rectangular weirs of M.S sheet were fabricated and installed at these locations. Discharge observations were made for computing the seepage through this reach by inflow-outflow method. The difference between the inflow at the middle reach and outflow from the tail reach was considered as the seepage. The mean of all observations was taken to work out seepage. The details of the discharge measurements and seepage are shown in Table 9 and Fig. 2. The results show seepage of 0.0115m^3/sec/300m length. This indicates that there is considerable seepage and leakage in this reach, since there is no authorised outlet provided in this stretch of the canal being studied. This indicates the need for lining the distributory with appropriate measures to improve the water conveyance efficiency, which will ensure adequate and timely water availability, a condition necessary for motivating farmers to adopt improved on-farm methods like channel to field irrigation.

Table 9. Seepage through the canal reach (300m)

Date of observation	Discharge at middle reach (m^3/sec)	Discharge at tail reach (m^3/sec)	Seepage (m^3/sec/300m)
18-04-06	0.007	0.004	0.003
21-04-06	0.024	0.016	0.008
09-05-06	0.0209	0.012	0.009
07-05-06	0.032	0.016	0.016
20-05-06	0.051	0.026	0.025
23-05-06	0.016	0.007	0.008
26-05-06	0.018	0.007	0.011

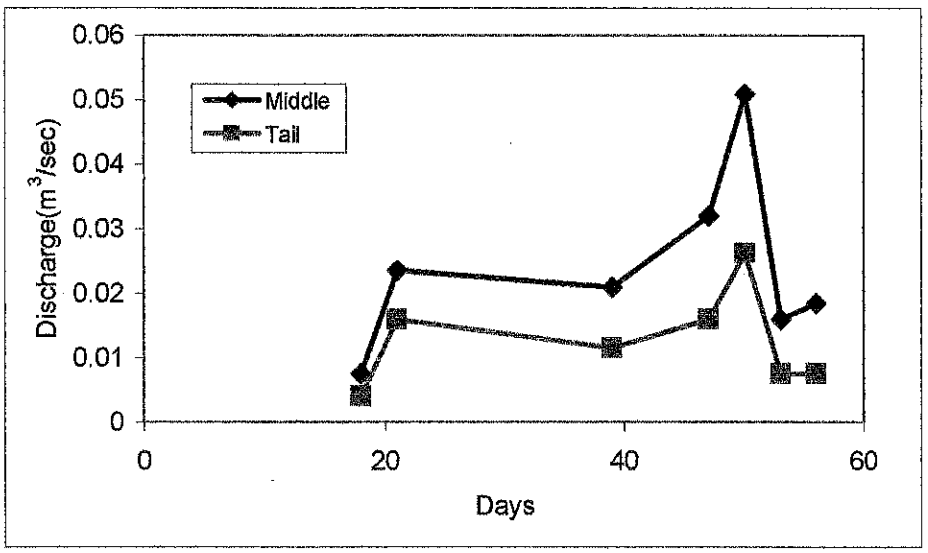

Fig. 2. Discharge variations at middle and tail reaches of sub distributory

To study the seepage loss in the canal, during the third year of the project, discharge measurement was carried out in the head and middle reaches of the Ichannur sub-distributory using velocity-area method. In the head reach and the middle reach, an unlined stretch of 100m length each was selected, where there were no authorised outlets. The discharge measurement in the tail end section could not be taken since water does not reach there due to excessive seepage and leakage in the head and middle sections. Discharge was measured in the entry and exit sections in the head and middle sections. The difference in discharge between these two points provides the seepage loss in the selected area. The average discharge value was calculated from the observations taken, from which the mean seepage was computed.

The average discharge and seepage values are shown in Table 10. Normal value of seepage loss for different soils in Kerala is reported to vary from 0.8 l/sec/1000m^2 to 6.4 l/sec/1000m^2 (KMIP, 1998). It can be seen from Table 10 that the average seepage loss in the distributory is very high, of the order of 86 l/sec/1000m^2 in the head reach, and 72 l/sec/1000m^2 in the middle reach. This can be attributed to seepage from the sides and bottom of the canal, leakage through bore holes drilled by rodents, insects and other creatures, or damage caused by human beings, cattle etc. This indicates the need for lining the distributory with appropriate measures to increase water conveyance efficiency for ensuing adequate and timely water availability to farmers.

The data collected on area utilized vs. potential area created for irrigation in three branch canals under Malampuzha irrigation project in Kerala (one of the biggest projects in Kerala, with a command area of about 20,000 ha) show an average of 59.6% for tail reach, compared to 85.2% in the head and 82% in middle reach of the canals. The conveyance efficiency of lined irrigation canals is found to be in the range of 35 to 64% only, indicating water loss, which ultimately leads to a decrease in the area irrigated at the tail reaches (Varadan *et al*, 1998)

Table 10. Seepage through canal reaches

Canal reach	Average discharge at entry section (l/sec)	Average discharge at exit section (l/sec)	Mean seepage (l/sec)	Average wetted perimeter (m^2)	Mean seepage (l/sec/m^2)	Mean seepage (l/sec/1000 m^2)
Head reach	62.5	47.5	15.0	173.88	0.086	86.0
Middle reach	9.0	2.8	6.2	85.75	0.072	72.0

5. Seminar on On-farm water management in rice cultivation

Many farmers do not have the required technical and economic information on improved OFWM techniques. New and more participatory ways for information dissemination in the field of OFWM is urgently required. A participatory group

extension approach is currently being introduced in Egypt's extension system, which is based on the principle of learning and doing together. This seems to be the only alternative problem solving concept conceivable for introducing a sustainable, advanced form of OFWM (Wolff and Stein, 2003).

In line with the above concept, a seminar was organized for farmers on on-farm water management, with emphasis on channel to field irrigation for rice at the Agriculture Office, Kannankara Panchayath located near the channel to field irrigation trial plot. 60 farmers from Ichannur, Kozhikundunilam, Muthuvattuthazham, Oottukulam, Aduvarakalthazham (Palam) and Puthiyidathuthazham 'Padashekarams' (rice farming groups) of Kakkodi branch canal under the Kuttiadi irrigation project in Kozhikode district, Kerala, participated in the seminar. Officials of the agriculture department also were present. A presentation was made on the channel to field irrigation method and the results obtained from the trial plot, with orientation on water saving achieved through the method. Focused group discussion with farmers and officials on channel to field irrigation was also held as a part of the seminar. This was followed by a visit to the trial plot for exposure on channel to field water distribution method.

The information generated from the discussion shows that farmers, in general, do not have much interest to adopt channel to field irrigation (concrete/ ferrocement or earthen channels) for their rice crop. The main reasons cited for non-adoption of the irrigation method include:

i. Not interested to adopt a new method since they are used to the traditional method of field to field irrigation for rice.

ii. Non-cooperation of farmers to spare land for the field channels.

iii. Cattle will damage earthen channels laid out in the fields.

iv. Channel to field irrigation is feasible only if group farming is undertaken. But, this is not possible because of lack of sufficient labour and also due to the individualistic nature of cultivation by many farmers.

v. Fear of loss of ownership of land where the channels have to be laid out.

vi. Water stagnation in the field through leakage/seepage of canal and poor drainage facilities in the field.

vii. Water scarcity existing in the tail reaches of canal due to water loss from the un-lined head and middle reaches through leakage and seepage.

viii. Non- availability of water at the proper time.

The necessity of lining the irrigation canals to ensure adequate and timely water availability, a pre-condition to make farmers think of practicing improved on-farm water management techniques, is evident from their responses. Similarly, the discussion reveals that adequate drainage facilities, group approach to farming and training for farmers on channel irrigation are some of the other factors, which would probably motivate at least some farmers to practice improved OFWM.

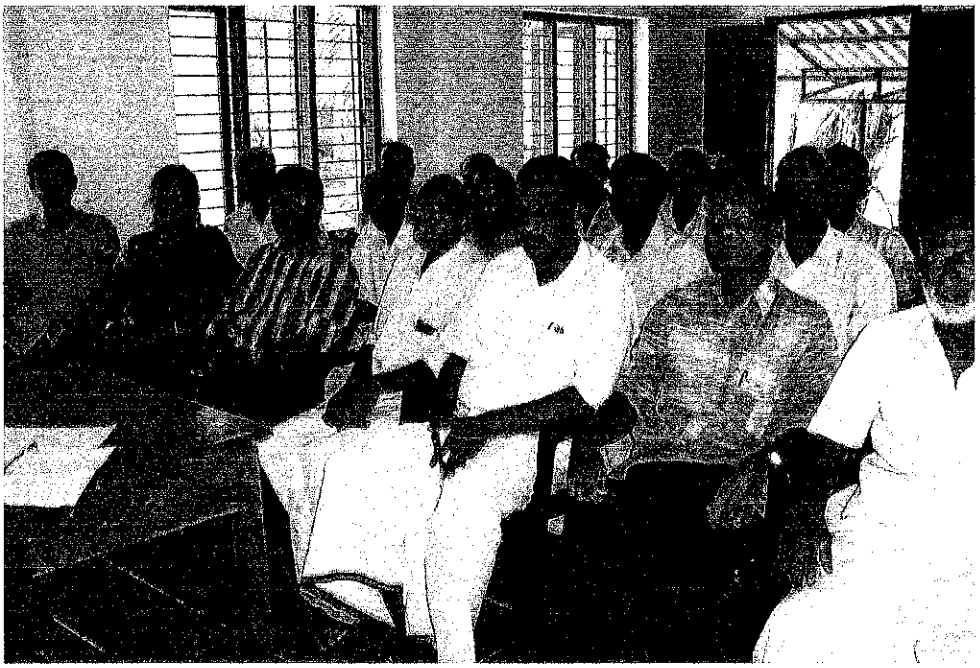

PLATE 4. Seminar on On-farm water management organized for farmers

6. Conclusions and suggestions

The results of the studies carried out under this project reveal that majority of the farmers are not aware of scientific irrigation scheduling for paddy, even though many of them are aware of channel to field method of irrigation. A good proportion of them also agree that it is better than field to field method. However, they cite genuine constraints in adopting it such as cost involved, lack of group action in paddy farming (which will be necessary to implement the irrigation method in a large proportion of the command area), availability of excess water etc. Only 12.2 % of farmers are aware of scientific irrigation scheduling for paddy, and 38.8% about the quantity of water applied to the crop. 34.9 % reported uncertainty in water availability as the most important reason why they are not interested in being aware of scientific water management.

96.2% of the farmers, who express good opinion about channel to field method mention better water management as the reason for it, while 46.2% report full utilization of fertilizers through this irrigation method as the reason for preferring the method. Of the farmers preferring field-to-field method, 7.8% report convenience in water management as the reason, while, 17.3% were not sure about the benefit of channel to field method.

Ranking of constraints in adoption of channel to field method reveals that the most important constraint is non-conviction about the method. This may probably be due to small landholdings and low income from paddy, which act as a de-motivation for farmers to adopt improved practices. The next important constraint reported is excess water availability, which makes it difficult to adopt channel to

field method. Lack of group action in paddy cultivation is the third constraint. The experience of group farming in rice cultivation, implemented by the Agriculture Department in Kerala, was not promising. Group approach is required to implement channel to field method in a good proportion of the command area. Cost involved is cited only as the fourth constraint in adoption of channel to field irrigation, implying that if water supply can be controlled, and there is group approach in rice farming, cost will not be a problem. Some more constraints were mentioned such as land occupied by channels, fear of loosing land ownership etc.

Infrastructure assessment carried out in Ichannur sub distributory, which conveys water to the study area, shows that the problems include visible siltation, cracks in canal lining and embankment and unlined portions of the distributory. 37.1 % of the distributory is unlined, causing considerable seepage loss. Of the lined portion, 83.3% is damaged with cracks, which promote leakage and water loss through weed growth. Visible siltation of about 1 cm is observed on the distributory. In all the control structures, gates are missing or in a damaged condition, implying that the distributory and control structures are ill maintained. Hence, water seeps down, causing water logging and without supplying sufficient water to the tail end farmers. Normal value of seepage loss for different soils in Kerala is reported to vary from 0.8 l/sec/1000m^2 to 6.4 l/sec/1000m^2. However, the average seepage loss in the distributory in the study area is found to be very high, of the order of 86 l/sec/1000m^2 in the head reach, and 72 l/sec/1000m^2 in the middle reach. This indicates the need for lining the canal with appropriate

measures to improve the water conveyance efficiency, which will ensure adequate and timely water availability, a condition necessary for motivating farmers to adopt improved on-farm methods like channel to field irrigation.

In the study on water use efficiency, the quantity of water used under the channel to field trial plot is 1505 mm/ha, while for the field to field irrigation plot, it is 1879 mm/ha. During the first year of the trial, yield obtained under channel to field irrigation is 2087 Kg/ha and 2252 Kg/ha under field to field irrigation, while the water use efficiency under the former method is 1.4 Kg /mm of water applied, and 1.2 Kg/mm under the field to field method. During the second year of the trial, yield of rice obtained is 2500 Kg/ha and 2600 Kg/ha under channel to field and field to field method respectively. Water use efficiency during this irrigation season is found to be 1.7 Kg /mm in the channel to field irrigation plot, and 1.4 Kg/mm under field to field irrigated plot. Similar to the first year of trial, a water saving equivalent to 37,40,000 litres/ha has been achieved through adoption of channel to field irrigation during the second year also, maintaining more than 90% of the yield obtained under farmer's practice of field to field irrigation, in both the years of study.

From the seminar on improved organized on improved On-farm water management for rice, it is observed that farmers, in general, do not have much interest to adopt channel to field irrigation for their rice crop. The main reasons cited for non-adoption of the irrigation method include the following namely, lack of interest since they are used to the traditional method of field to field irrigation,

non-cooperation of farmers to spare land for the field channels, problem of cattle damage to channels laid out in the fields, absence of group farming, mainly due to lack of sufficient labour and the individualistic nature of cultivation by many farmers, fear of loss of ownership of land where the channels have to be laid out, water stagnation in the field through leakage/seepage of canal and poor drainage facilities in the field, water scarcity existing in the tail reaches of canal, non-availability of water at the proper time etc.

Analysis of the data collected on preferences of farmers towards various water distribution methods shows that there is a significant shift in preferences from Ferro cement channel to earthen channel, when subsidy is reduced from 100% for the former method. However, the rate of reduction in number of farmers preferring earthen channel is comparatively very less, when subsidy is reduced. This is a promising indication for possible change from the traditional method of field to field having low irrigation efficiency to this relatively efficient water distribution method. With respect to farmers, who give first preference for field to field method, all of them continue their preferences for the same method under all the lower levels of subsidy, including no subsidy. This indicates that farmers do not necessarily require financial assistance for adopting their traditional method of water distribution. From the above discussion, it may be inferred that, for effecting a significant change over from the traditional, wasteful practice of field to field water distribution for rice to improved OFWM methods like channel to field, it may be required for the irrigation/agriculture department to subsidise the cost of construction/layout of the methods considerably. Even though this may

not appear to be a very feasible option under the present scenario, where the emphasis of Governments, including that of donor agencies, is to reduce such type of financial assistance in order to instil a sense of "ownership" for farmers in their development activities, and accordingly, make them more sustainable, it will be in the good interests of irrigation projects to find out ways and means to finance such improved water management practices in the command areas, if irrigation efficiency has to improve.

Further, in order to make more farmers properly aware, as well as convinced about improved OFWM practices, it will be required to have suitable extension methods like training, seminars/workshops, demonstration plots on the practices etc. in various parts of Kerala state. Group approaches to farming should also be undertaken as action research cum demonstration units by the agriculture/water resourcse departments in different 'Padashekharams' through people's participation, in order to ensure collective adoption of various agricultural practices, including improved OFWM methods by farmers. These units can serve as successful models of not only group farming, but also better water management methods. This appears to be a necessity in the days to come for Kerala state, when the Governments of other states in the country have already started implementing irrigation management transfer to farmers through Participatory Irrigation Management (PIM). Implementation of PIM in the state, with demand based volumetric water supply to farmers, will ultimately require adoption of efficient water distribution methods in the command areas in order to make the programme self sustainable. Also, once it becomes inevitable for the

farmers under PIM programme to adopt water distribution methods like channel to field for efficient, equitable distribution of the measured, volumetric supply of water received from the department, this can also instil a better sense of cooperation among then, which can also help in motivating them to adopt group farming in the long run. PIM programme will then be able to achieve the purpose of economic rice cultivation in Kerala, which, at present, is facing problems due to factors such as high labour cost, labour un-availability, high cost of production, low yield/income, lack of suitable marketing mechanism for farmers etc.

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8. Preference ranking of water distribution methods under various subsidy conditions

Water distribution method	Subsidy available as % of the cost of adopting the method			
	75%	50%	25%	Nil
Earthen channel				
Ferro cement channel				
Field to field				

9. Reasons for giving the first preference to a method

10. Rank the constraints, if any, in adopting channel to field method