IMPACT OF WATER MANAGEMENT ON LAND PREPARATION AND PADDY SOWING IN MAHAWELI SYSTEM H, SRI LANKA

by
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December 1995

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Preface

This investigation was carried out by Mr. A.S. Channabasavanna at the International Irrigation Management Institute (IIMI), Colombo over a period of 3 months from 1 October 1995 to 31 December 1995. During this period, Mr. Basavanna was introduced to field research on water management, conducted a rapid appraisal survey of Mahaweli System H, identified a few researchable issues, conducted a field-study of water distribution problems in a distributary turned over to Farmer Organization while the farmers were preparing the land for paddy sowing; and, analyzed the results to identify the cause, effect and impact of water distribution on land preparation and paddy sowing. The outcome of the study is this report.

Mr. Basavanna was introduced to a number of new methodologies (participant observation, key informant discussion and questionnaire survey) while carrying out this research. Being an Agronomist by profession, he was able to see the importance of field water management research beyond the on-farm boundary particularly at the main system level to provide reliable, adequate and timely supply to farmers so that they can adopt the agronomic packages suggested by the extension agencies. The main message that he got out of this research is the importance of agency (IrrigationDepartment) working closely with farmers to distribute the water equitably between the head and tail end of a distributary and the impact of not distributing water equitably on the farm income and productivity.

We believe that Mr. Basavanna has understood the basics of water management research methodologies as well as the importance of water management research in the context of introducing agronomic practices. With the knowledge he has gained, we are sure that when he goes back to his University, he would be able to build on what he has learned to enrich and expand his own knowledge on water management as well as to contribute through field water management research to improve irrigated agriculture in large irrigation systems in India.

28th December 1995 R. Sakthivadivel Jeff Brewer

Acknowledgements

I wish to express my sincere thanks to staff of IIMI for their cordial, frank and full cooperation throughout the training program. My sincere thanks to Dr. N.G.R. de Silva, Coordinator, Sri Lanka National Program for all the arrangements made during the training program.

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My special thanks to Dr. K. Jinapala, Research Associate, Sri Lanka National Program, IIMI for his valuable comments on the text of this report and his advice.

I owe a very special word of thanks to RPM, DRPMs of Thambuttegama, Block Manager of Nochchiyagama and the staff of Mahaweli Economic Agency for providing all the details, accommodation for stay and transportation facilities.

I also extend my thanks to Mr. A.N. Perera, Agricultural Officer, Irrigation Engineer, Engineering Assistants and the staff members of Nochchiyagama for their cooperation during the study and conveyance provided,

I also thank the Farmer Organization Leader, jalapalakas and farmers of distributary D3/415, Nochchiyagarna for actively participating int he participatory observation and providing essential information.

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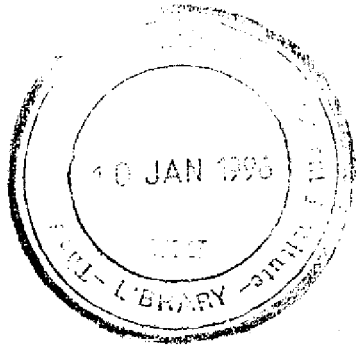

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Contents

CHAPTER 1

Introduction

1.1. Preamble :

Paddy is one of the most important crops of Sri Lanka and is grown in an area of 556,982 ha occupying 27.7 % of the total irrigable area. Paddy cultivation in Mahaweli System H system of Kalawewa during Maha (1991-92) season was 29,294 ha with an average yield of 4.87 ton/ha. against the National average of 3.51 ton/ha. (Annon.1993). Paddy in this area is mostly irrigated by gravity from Kalawewa reservoir which gets its water supply mainly from Mahaweli system, Presently, the water distribution in the system is not meeting the demands of farmers in terms of adequacy, reliability and timeliness. There is considerable potential to increase paddy yield in this system through improved irrigation water management, especially water management.

1.2 A brief description of the system- H :

System H is located in the North- Central province and lies within Kala Oya and Malwathu Oya basins. The total irrigated extent in this area is 42,000 ha of which 28,000 ha is under the Mahaweli system (Hewavisenthi and Silva, 1994).
Mahaweli water supplied to System H is first diverted at Polgolla and then at Bowatenna into the Kala Oya basin .

The water thus diverted is then distributed to main tanks of Kandalama,
Dumbulu Oya and Kalawewa.

The Kalawewa has a capacity of 1223.34 MCM with three off take main canals (RB canal, LB canal, Yoda ela) and three minor canals (Bulaluwewa goda ela, Kalawewa goda ela and Bulan Kulame ela). The Kalawewa RB canal is also known as the Nava Jaya Ganga; it originates at the RB3 outlet sluice and ends at the Pahamuniyagarna tank 50 km away. The RB canal is the principal conveyance system for delivering water to Nochchiyagama, Talawa, Tambuttegama and Eppawala blocks of system H. The canal has a capacity of 32.5 m^3/s.

Nochchiyagama block is located at the tail end of the system H and comprises *3668* ha. of irrigable land (Fig 1.1). Among the distributaries D3/415 has been handed over to farmer organization during Yala of 1995. This distributary was constructed during 1978-79, and takes off from Branch Canal *8*. The length of the D3 /415 canal is 4590 m. with bottom width and height of *1.8* m and 1.0 m at

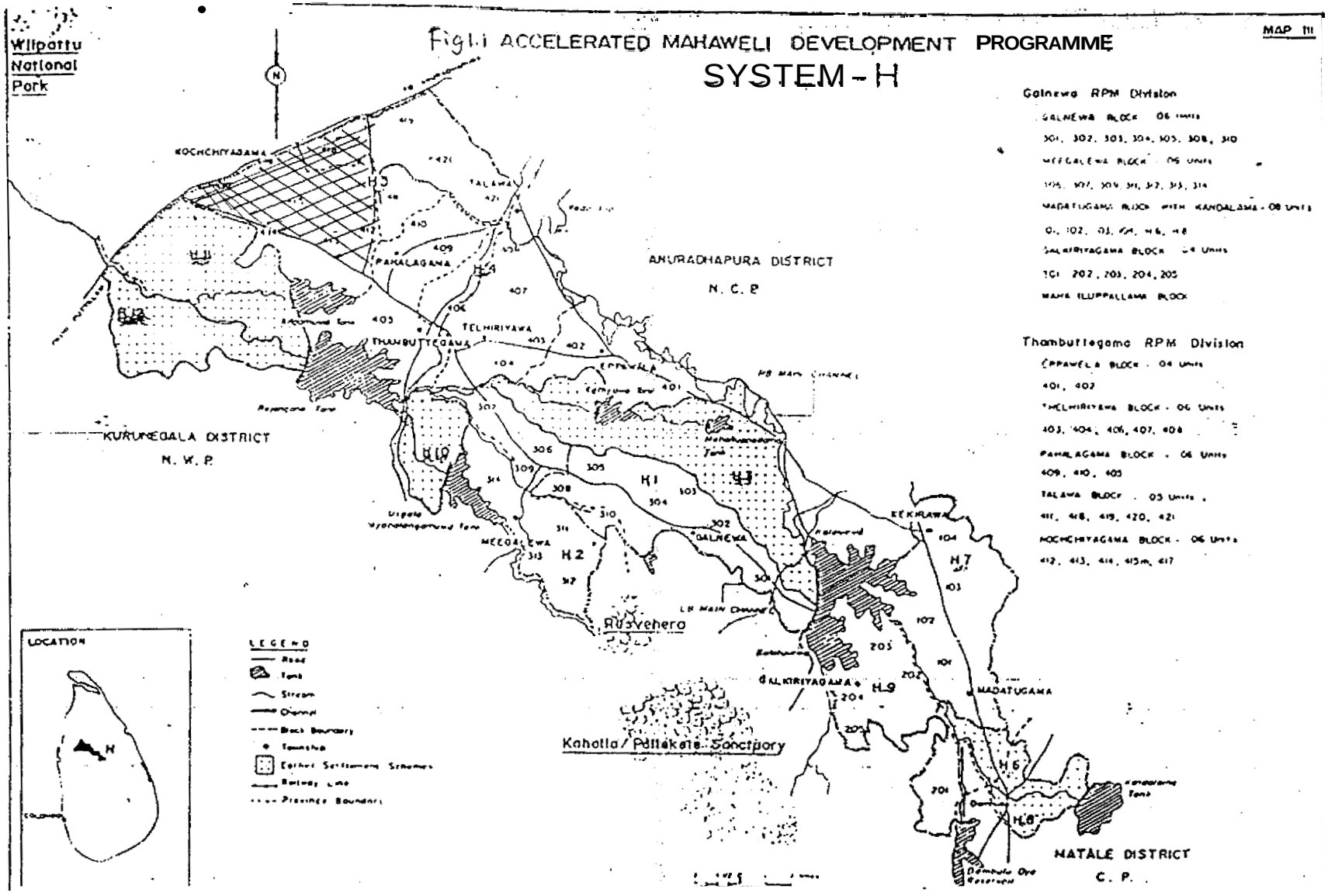
Fig.1 ACCELERATED MAHAWELI DEVELOPMENT PROGRAMME
SYSTEM - H
MAP III
Wilpattu National Park
Galnewa RPM Division
Thambuttegama RPM Division
ANURADHAPURA DISTRICT
N. C. P.
KURUNEGALA DISTRICT
N. W. P.
MATALE DISTRICT
C. P.
Kahalla / Pallekele Sanctuary
Rusvehera
LOCATION
LEGEND

head section and 0.3 m. **and** 0.67 m at the tail end. It irrigates 281 ha of irrigable land through 28 field channels each designed to deliver 1 cusec (28.3 lps). This channel is the one selected for detailed investigation. The command area of this channel consists of Reddish brown soil with good drainage. The seepage and percolation loss of **this distributary** is considered 10 % of the discharge while computing the flow along the distributary.

System H provides irrigation to the total irrigable area during Maha season where farmers cultivate paddy extensively; but during Yala, irrigation is provided to only 50 % of the area. During Yala Bethma system is followed where each farmer is allotted half an hectare to cultivate and tail end farmers have to move to head reach of the system. The farmers asked to cultivate less water consuming crops like onion, chilli, etc. but most of the farmers grow paddy. During 1995 Yala, only 4.2 % and 8.3 % of the farmers took up pure crop of chilli and onion respectively (Table 1.1), while 58.3 % of farmers went for paddy; in yala 1995 most farmers lost their crops due to inadequate water supply.

1.3 Water distribution :

The Project Co-ordinating Committee for System H assists the Resident Project Manager (RPM) in water management issues. The most important function of this Committee is to manage the main sluice operations of the Kalawewa, Dambuluoya and Kandalama tanks. The Committee meets periodically (usually monthly and more **frequently** during periods **of** water shortages) during the irrigation season to review the water issues in relation to the available storage and irrigation demand and to ensure that the available water is distributed equally to the farmers at the main off take levels.

Water issue schedules for each block are prepared by the Block Irrigation Engineer by considering the various aspects like physical system capacity, type of crop grown and the area proposed to be cultivated under each crop. Requirements are submitted to the RPM through Block Manager. The water is issued to each block as per the request made by the block manager and it is the responsibility of the Engineering Assistant (EA) to distribute the water to each distributary. Further, within the distributary the water is shared under the guidance of Farmer Organization leader if that particular distributary has been handed over to the farmer organization. If not, the work is attended by Jalapalaka under the guidance of Engineering Assistant. With in the field channel, farmers distribute the water among themselves.

Presently, water distribution in the system is unstable and unpredictable partly due to unreliable inflow to the Mahaweli reservoirs causing fluctuation **of flow** to the reservoirs and tanks. Farmers at the head reach of the reservoir/tank system usually receive more than sufficient water in time, while at the tail reach water supply is inadequate and unreliable. Some farmers even pump water from their small wells for supplementing canal irrigation.

Table 1.1 **Crops** cultivated **during yala 1995 by the farmers**

Crops	Percent
Paddy alone	58.3
paddy + chlli	4.2
paddy + **onion**	12.5
chilli alone	4.2
Onion alone	**8.3**
No **crops taken**	**12.5**

1.4 Diagnostic analysis :

Before the start of this research, a diagnostic analysis was carried out to identify issue related to water management and to select a site for further investigation. Initially project reports and records containing crops grown, distribution of water from Kalawewa to the tail end distributaries were perused through at MEA, RPM office, Tambuttegama. The matter was further discussed with the Resident Project Manager, DRPMs (Agriculture, General, Irrigation, Land Community Development). These reports and discussions indicated that Nochchiyagama Block at the tail end of the system H is having water management problem and is facing water shortages. This block under Mahaweli system was compared with Rajangana Irrigation System operated by Irrigation Department by visiting the command area of Rajangana and discussing with IE, Rajangana. It was found that Rajangana is a water surplus system having less water management problems. Finally it was decided that Nochchiyagama would be the best place for water distribution studies. Subsequently a survey was conducted by visiting all the distributaries and field channels of Nochchiyagama Block. information on farmer backgrounds, farmer organization activities, distribution of water, soil types and major crops grown was collected. Farmers were interviewed at random at various distributaries regarding their problems in distribution of water, cultivation of crops, availability of inputs, farmer organization activity, co-cperation of farmers in sharing of water, etc. These matters were also discussedwith the concerned officials like Block Manager, Irrigation Engineer, Engineering Assistant, Agricultural Officer, Field Assistants and Unit Manager . Based on these reviews and interviews, the following important water management issues were identified ;

a. Maldistribution of water and tail end farmers facing water shortage.

b. Fewer water controls along the distributary and consequently farmers interference with the working of physical structures due to not getting adequate water.

c. Weak farmer organization with no training of farmers and supervision staff.

d. Poor water holding capacity of soil and no proper land levelling for paddy.

e. Submergence of land causing water logging problem.

Among the distributaries visited D3/415 distributary was finally selected for the study.

1.5 Objective :

The main objective of this investigation is to study the impact of irrigation system management on agronomic practices, particularly on land preparation and sowing of paddy. Also, the study focuses on the role of farmer organization and irrigation staff in the distribution of water and other related aspects which affect agronomic practices.

1.6 Organization of the report :

While this chapter give an introduction to system H of Mahaweli; diagnostic approach adopted to identify water management issues in system H; selection of a distributary for further investigation; and objectives of the study, chapter 2 discusses the methodology adopted and data collected. Chapter 3 analyzes the data and discusses the results. Chapter 4 compares and contrasts the results obtained under this study with those obtained by using a structured questionnaire as a part of this study[1]. The last chapter gives the conclusions and a few recommendations for improving water distribution along distributaries turned over to farmer organizations.

[1] This structured questionnaire study was accounted as a part of this but a separate one on the same distributary by a nation consultant. However, the results of that study are used for comparison in Chapter 4.

CHAPTER 2

Methodology and Data *Collection*

2.1 Data collection from existing records :

The study was primarily initiated by collecting essential data on the system H from the IIMI and other publications available with IIMI at Colombo. The existing literatures were reviewed and a tentative schedule of work was framed for diagnostic analysis of the system H. Further, detailed information on the area irrigated, soil tape, water distribution **pattern**, crops **grown**, cultivation practices, yield levels, activity of farmer Organization were collected from the records maintained at Mahaweli Economic Agency, Thambuttegama and Nochchiyagama.

2.2 Participant Observation :

A sample of 55 farmers with 20 at the head, 17 at the middle and 18 at the tail of the distributary were selected for this study. These farmers **attitude**, behaviour, activities and daily operations relating to **water** issues and distribution were monitored carefully during the land preparation and sowing periods. Problems and questions faced and posed by farmers were discussed with concerned field level officials like Engineering Assistant, farmer organization leader and Jalapalakas. The distribution of water and communication of information among farmers, jalapalaka, farmer organization and agency were carefully observed, and recorded. The participant observation activities such as opening and closing of field channel gates, interfering with the working of field channels and gates, putting obstruction across distributary and cross bunding etc. The day-to-day farmer activities in response to system performance was recorded.

Observations made in the neighbouring distributaries which are not handed over to farmer organization were also recorded to draw conclusions with regard to impact of turnover on system performance.

2.3 Discussion with key informants :

Data collected from observations and records were critically studied and discussed with the resident Project Manager, Deputy Resident Project Managers and Information and Development Unit at Thambuttegama. The matter was then discussed with block manager, Unit manager and concerned agency personnel at Nochchiyagama.

Along with the day-to-day observation of field activities, the problem noticed were discussed with the farmer organization leader, jalapalakas and field agency personnel. A careful record of all

the discussions, observations and activities was made each day during the field work which formed *the* data base for further analysis.

2.4 Water measurements :

During the study, daily data on irrigation water flow at the distributary head was recorded from the scale fixed on the upstream and downstream side of the off-take. Water issue in selected field channels at the head, middle and tail reaches of the distributary were measured by float method as described by Michael (1981).

Daily rainfall recorded at Nochchiyagame meteorological station was obtained and recorded.

2.5 Data collection through questionnaire *survey* :

As a part of this but a separate study by a national consultant was mounted before completing the study to collect data through questionnaire survey. The collected information included area cultivated, problems in water issue, reasons for delay in land preparation, crop and variety chosen, expected yield and cost of cultivation. Data was also collected on what farmers wanted from the agency. What they are supposed to get and actually got. More emphasis was given on the questions relating to farmer organization, its activities, difficulties faced and ways to solve them. Information was also collected on the information flow, constraint faced and co-operation among farmer community. General information was also collected from the neighbouring distributaries which is not handed over to farmer organization. The data collected was used for comparison purposes.

2.6 Data analysis :

Data so collected were tabulated; graphical plots were made wherever necessary and analyzed. Data collected from questionnaire was entered into computer and frequency distribution of the selected variables was obtained. The data so obtained formed the basis for discussion and analysis of the results which are presented in the next chapter.

CHAPTER 3

Results and Discussion

3.1 Introduction :

The study had indicated that the major constraint was that there were unpredictable issues of water in the distributary head and that the water distribution along the distributarywas unequal. The unequal distribution of water was considered due to the number of causes as shown in Fig 3.1. Also, the unequal distribution of water had impact on the agricultural practices and affected the farmers profitability and production. The inter relationship between the causes and impacts due to unequal distribution of water are discussed in the following sections.

3.2 Out come of the study :

3.2.1 Unequal distribution of water :

The water used for land preparation is found to be very much higher than what was planned. It was planned by the Irrigation Engineer to give 12.5 inches of water for land preparation in 4 weeks time. *An* addition of 2.5 inch is also permitted if needed. However, it was observed that both the head and tail reach farmers had used twice the planned amount , whereas farmers at the middle used 2.5 times the planned irrigation water (Table 3.1). Apart from this they have received 19.4 inch of rain water which has not been utilized efficiently. Although the head and tail reach farmers received the same amount of water, it is the way (timeliness) in which they receive water matters. The tail end farmers did not receive water for the first two weeks. Then they received water for the last 4 weeks which was very high during the forth week. More than unequal distribution of water, it is the unreliable distribution which has caused great hardship to farmers of tail end. What was noticed in the distributary is the untimeliness of supply and unpredictable supply to the tail end.

3.3 Causes :

3.3.1 Main system supply not adequate and fluctuating :

The date of release of water and other operations were decided by the Mahaweli Water Management Panel at Colombo. This decision is mainly based on the reservoir storage and the probable expected inflow to the reservoirs. However, the actual date of water issue to different Blocks was fixed in Kanna meeting where farmer organizations play a major role (Table 3.2 and *3.3)*. It was noticed that farmers prefer water issue in their channels after the

Fig. 1.1. A Framework for Analyzing the Causes and Impact of Unequal Distribution of Water Along a Distributary

CAUSES	OUTCOME	IMPACT
Main system supply no adequate and fluctuating	Unequal distribution of water along the distributary	Use of more water for land preparation with extended duration
System incapable of delivering equiable supply		Rainfall not Utilized properly
Soil type not suited; land levelling not done properly		Farmers in the tail end prefer to grow OFCs
Agency support and Training not adequate		Raising coarse varieties of rice extended time of land preparation
Transparent rules and schedules not framed		Farmers following attham practice
Adequate support service not available (tractors, labor charge is high)		Breaking of channels, farmers not disciplined
Weak leadership from Farmer Orga ization		Blaming the turn-over concept for all ills
		Farmers dissatisfaction
		Unequal net income

Table 3.1 : Irrigation water and rainfall used during land preparation (inches of water)

	Head	Middle	Tail
Irrigation water	26.6	33.4	27.7
Rainfall	19.4	19.4	19.4
Total	46.0	52.8	**47.1**

Table 3.2 : Decision taken at Mahaweli Water Management panel meeting, Colombo on 16.06.95

Details	For Long duration Varieties	For Short duration Varieties
Channel cleaning	25.09.95	25.09.95
Release of water	7.10.95	7.10.95
Transplanting	7.11.95	20.11.95
Broadcasting	2.11.95	15.11.95
Last water issue	7.03.96	7.03.96
Harvesting	21.03.96	21.03.96

Table 3.3 : Decision taken in Khanna meeting to issue water in distributary

Distributary No.	Date of water issue
412, 418, 417	10.10.95
413, 414, 415	22.10.95

onset of rainfall which will help in their operations, particularly in bund trimming and smearing of bunds.

The main role of the MEA is to issue water at the head of the distributary according to the farmers need based on the type of operation schedule developed by the farmers and rainfall occurrence. Jalapalaka appointed by the MEA is the only authorized person to operate the distributary gates; he does this job according to the instruction of Engineering Assistant (EA). The D-channel gate is not operated daily by jalapalaka; but the slight variation in discharges was mainly due to fluctuation in the main/branch channel.

Water issues in the study distributary was affected mainly by rainfall and unexpected repair work in Kalawewa which in turn affected land preparation and paddy sowing (Fig. 3.2)

As per the agency calculation, water delivery was to be 20 cusec at the D-channel head for four weeks from the date of first issue. However, the recorded delivery was 20 to 24 cusec (Fig 3.2) extended upto six weeks. Due to heavy rains the water was not issued during the second and third week after release of water and for 4 days from 11.11.95 to 14.11.95 on account of repair work in Kalawewa. The closer of the head gate of the distributary was not discussed and the suggestion of farmer organization was not taken into consideration while closing the .head gate. The unexpected closer had adversely affected land preparation at the tail end.

Farmer organization has no direct role. in operating the disturbutary head gate, but they can put forth the problem in the Unit Co-ordinating Committee meeting held every first week of the month. If the problem is not solved, it will be discussed in the Block Co-ordinating Committee which will be held during the second week of every month. It was noticed that most such water problems will not get solved easily and by the time a decision is taken, it will be too late to implement such decisions.

3.3.2 System incapable of delivering equitable supply :

It is the responsibility of the farmer organization leader to distribute the water within the distributary once the water is issued at the D-channel head by the MEA. As discussed earlier MEA issues 20 cusec of water at D-channel head which has to be distributed through 28 turnouts. The schedule was to issue 5 inches of water to 2/3 of the area for the first 2 weeks; during the next two weeks the remaining 1/3 area gets 5 inches of water while the other (2/3) area gets 2.5 inch of water. An additional 2.5 inches of water is provided if necessary.

In order to execute this schedule, several options can be thought of : i. having a cross regulator at the distributary covering 2/3rd area of the 'distributary to hold and divert the

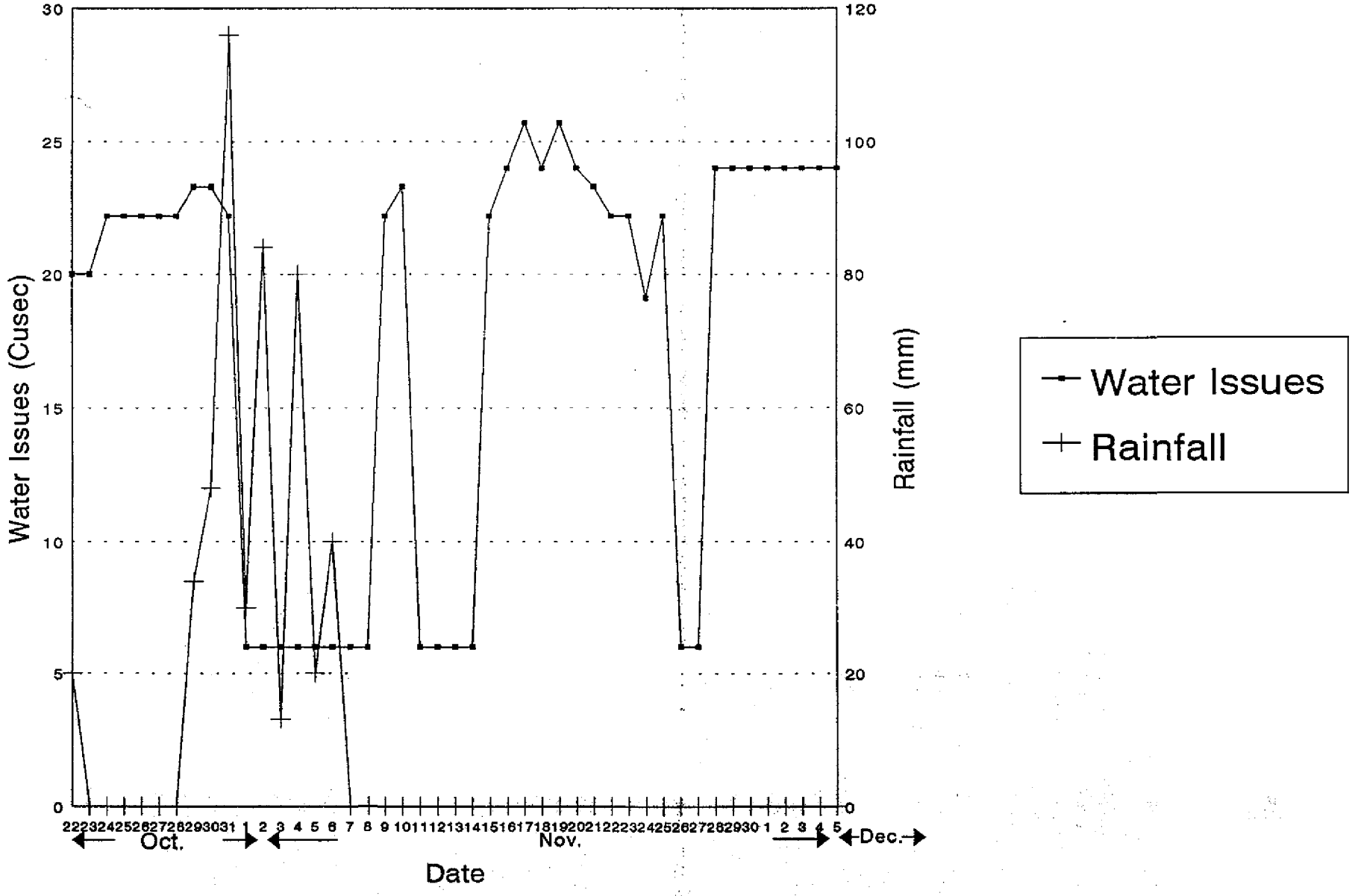

Fig. 3.2 Rainfall and Water Issue at distributary head during land preparation

water along the field channels, ii. the field turnouts must be gated with adjustable gates so that water supply to these turnouts can be adjusted to divert the required quantity depending on the depth of water in the distributary. iii. the distributary canal cross section is designed in such a way that as the discharge decreased along the distributary length, the cross section of the channel is reduced to keep the depth constant; In D3/415 distributary the last option was adopted. However this option would interfere with pushing the whole discharge to the downstream 1/3rd area under Rotational water distribution (RWD) unless if the cross section is made sufficiently large. Since the field turnout gates can not be operated precisely to allow a planned discharge due to design limitations, implementation of an operation schedule as designed by the MEA in this distributary is very difficult to achieve. In other words, the system is not designed to match the operational schedule stipulated by the MEA. This, then is one of the major causes for maldistribution of water between the head and tail reaches of the distributary. One may argue that even if the system is capable of delivering such planned discharge, would the farmers distribute the water according to planned schedule is another management question to be dealt with separately. The mere fact their the system is inadequate to handle the planned flow has exacerbated the unequal distribution of water between the head and tail reaches of the distributary.

It was noticed that no definite pattern of distribution of water was followed by the farmer organization during the land preparation. This is clear from Table 3.4 where the variations in issue of water can be noticed within and between the turnouts. The maldistribution resulted in major differences in water availability from one turnout to another in this distributary. Similar situations were reported by Tabbal and Wickham (1976), Valera and Wickham (1976) and Early et.al. (1978). Generally the tail end portion had serious deficiency of water and the availability is erratic.

In this distributary, it was originally planned to give water from the tail end, but water was given first to the middle reach followed by head reach for the reason that the field channels at the tail section were not cleaned and also due to on-going field channel construction work which could not be completed. It is also true that head end farmers resisted changes, as they believe that they may be affected by this method of rotational water distribution from tail to head (Robert Chamber, 1980). It was observed and recorded that tail end farmers got water 19 days later against 3 days later at the head compared to no delay at the middle section after water release in the distributary.

Table 3.4 : Fluctuation of water issued to the head, middle and tail reaches turnouts

Weeks	Water Issued (Cusec)		
	Head"	Middle'	Tail*
1	4.0	5.0	0.0
2	5.8	3.0	0.0
3	3.6	1.0	2.3
4	5.9	5.7	3.3
5	11.8	8.4	11.1
6	10.9	6.7	6.4
7	6.5	6.2	4.1
Mean	6.9	5.1	3.7
S.D	3.2	2.4	4.0
C.V	0.5	0.5	1.1

* Head reach contains T_{15} and T_{16} turnouts (average taken)
Middle reach contains T_{24} and T_{25} turnouts (average taken)
Tail reach contains T_{33} and T_{34} turnouts (average taken)

3.3.3 Soil type is not suitable; land levelling *not* done properly :

The major soil *type* in this distributary is reddish brown earth which is sandy in nature. Under such soil condition it was very difficult to maintain saturation for long time, store and keep the standing water;this problem of not able to have standing water in the field is one of the main reasons for not preparing the land using rain water since rainfall is not sufficient enough to hold standing water in the field and tractor owners won't come for ploughing. 'Moreover,even distribution of water and water depth in the field is possible only if the land is uniformly levelled; this is more important in the case of paddy field. The topography of land is very undulating with a slope of 2 to 3 % or even more. band within the basin (liyadde) is also not levelled properly which prompts the farmers to use more water to keep the field fully covered with water. This in turn creates increased drainage. The adverse effect of storing unequal depth of water was more sever when this was coupled with receipt of heavy rainfall. During the present season, it was observed that two acres at the middle section were submerged with rain water and water level did not recede even after one week thereby destroying paddy which was just germinating. Levelled land **coupled** with proper drainage will enable a more even distribution of water and prevent soil erosion because of the gentler movement of water (Donald C. Taylor, 1980). A proper land levelling will reduce labour required for distribution of water, and problems of field drainage and flooding may become less.

On argument against land levelling, however, is the cost of undertaking the land levelling, and possible short-term decrease in yield because of disruption of top soils. The soil depletion can be overcome by using legume crops and adding organic manures.

It is suggested that at least land levelling within basin (liyadde)is to be done properly to save water and increase paddy yield.

3.3.4 Agency support and training not adequate :

At present the D3/415 distributary has been handed over to farmer organization for management; subsequent to transfer, no attention is given by the agency to provide necessary technical assistance to operate the distributary. It is essential for the agency to monitor the water distribution operation and help them whenever they are in difficulty.

At present the Farmer Organization is facing problems and could not succeed in distributing the water equitably along the distributary. Most tail end farmers are not satisfied with the water distribution and eagerly waiting for MEA to intervene and set things right.

3.3.5 Transparent rule and water scheduling *not* framed and enforced:

As discussed earlier once the water is issued at the distributary **head** it is the responsibility of the farmer organization leader to distribute the water within the distributary. There are two jalapalakas (one for head to middle and the other for middle to tail end) appointed **by** farmer **organization leader** to operate the turnouts. It **was** noticed that there is no direct link between the jalapalakas, but they **meet** the **farmer** organization leader every day or whenever **necessary** and **act according** to his instructions. No proper schedule was followed during the land preparation period by the farmer **organization** leader. **The** total area under the turnout, stage of land preparation and rainfall occurred were not taken into account for the issue of water. **Jalapalakas** were found **to** operate the turnouts whenever farmers requested for water. This was also a major **reason** for uneven distribution of water.

As per the MEA schedule of operation, during the first two weeks only 2/3 of the area should be given water, then remaining 1/3 area should get water during this next two weeks. Farmer organization leader was not followed this schedule. Instead he opened all the gates simultaneously and later he attempted to distribute water by closing some gates arbitrarily as he desired. This created lot of inconvenience and unpredictable supply to the tail reach farmers.

The other cause for poor operation of the turnouts is due to non-payment of wages by the farmer organization for the work done by the Jalapalakas. Although arrangements were made by the farmer organization to pay 10 kg of paddy **by** each farmer quite a few farmers did not pay to Jalapalakas, **particularly** farmers at the tail reach who are not satisfied with the water supply services.

After the delivery of water to the turnout, **farmers** share that **water** among themselves, after discussing with each other under the leadership of turnout leader. Even though there were no transparent **rules** framed, sharing of water below the turnout was found to be without any conflicts.

3.3.6 Adequate support services not available (tractors, labour charge is high) :

Initially during land preparation period non-availability of water, tractor, labour, finance or combination of these were found to be the main constraints (Table 3.5). Availability of water, **tractor** and combination of water and labour were equally important **at** head section, while middle section farmers did not experience much problem for water as they were the first to **be** issued with water. About 23.4 % of the tail end farmers (of the **total)**

Table 3.5 : **Reported problems** *of* **Availability of inputs for** land **preparation by** farmers.

Farmer's response	Head reach		Middle reach		Tail reach		Total	
	No.	%	NO.	%	No.	%	No.	%
1.Water	5	10.6	2	4.2	11	23.4	18	30.3
2.Tractor	4	8.5	3	6.4	0	0.0	7	14.9
3.Labor	0	0.0	5	10.6	0	0.0	5	10.6
4.Finance	2	4.2	1	2.1	0	0.0	3	6.4
5. 1 + 2	2	4.2	0	0.0	5	10.6	7	14.9
6. 1 + 3	4	8.5	0	0.0	0	0.0	4	8.5
7. 1 + 4	0	0.0	0	0.0	2	6.4	3	6.4

experienced water as the main constraint. Rain water was considered not sufficient to pass tractor rotovator by tractor owners and therefore hiring of tractor was not possible as there was no standing water. There were no bullock power in this distributary to use in this situation. However, most of the constraints were overcome in due course of time except water constraint which remained as the main hurdle for effective land preparation.

It was also noticed that wages for labour were very high which also came in the way of land preparation. Tail end farmers had sufficient time, and therefore followed attham practice, while the head and middle reach farmers are forced to hire labours. Farmers who had finance problem delayed the land preparation.

It is well known fact that getting work done by tractor is more quicker than by bullock power. It was observed that the maintenance of bullock is difficult due to lack of grazing land during yala. Only two farmers at the tail end maintained draught animals with difficulty and used them for land preparation. Only one farmer hired bullocks for ploughing. Rent paid for tractor and bullock pair was the same (Rs.4000/ha for two ploughings); most farmers thought that use of tractor was considered superior and quicker.

It was also observed that when water was abundantly available, as in the head reach area, farmers have sufficient time to complete the land preparation in stipulated time; whereas, farmers in the tail reach did not get water for three weeks and when they did get water, they were able to complete the land preparation operation within four weeks time. On the other hand, most of the farmers in the middle reach who received water first were able to complete the land preparation within four weeks. It was also noticed that the head reach farmers received water for 42 days; middle reach farmers for 32 days; and tail reach farmers for only 15 days. So, one may conclude from the above findings that too much water availability also makes the farmers to become complacent and take it easy in completing the work of land preparation in time.

3.3.7 Weak leadership from farmer organization :

It was found that farmer organization failed to maintain equitable distribution of water and satisfy tail end farmers. During the first two weeks only the head and middle reaches got water but tail end received water from the end of third week, but that too not continuously (Fig 3.3). The maldistribution may be attributed to,

a. Lack of knowledge of farmer organization leader about how to distribute water.

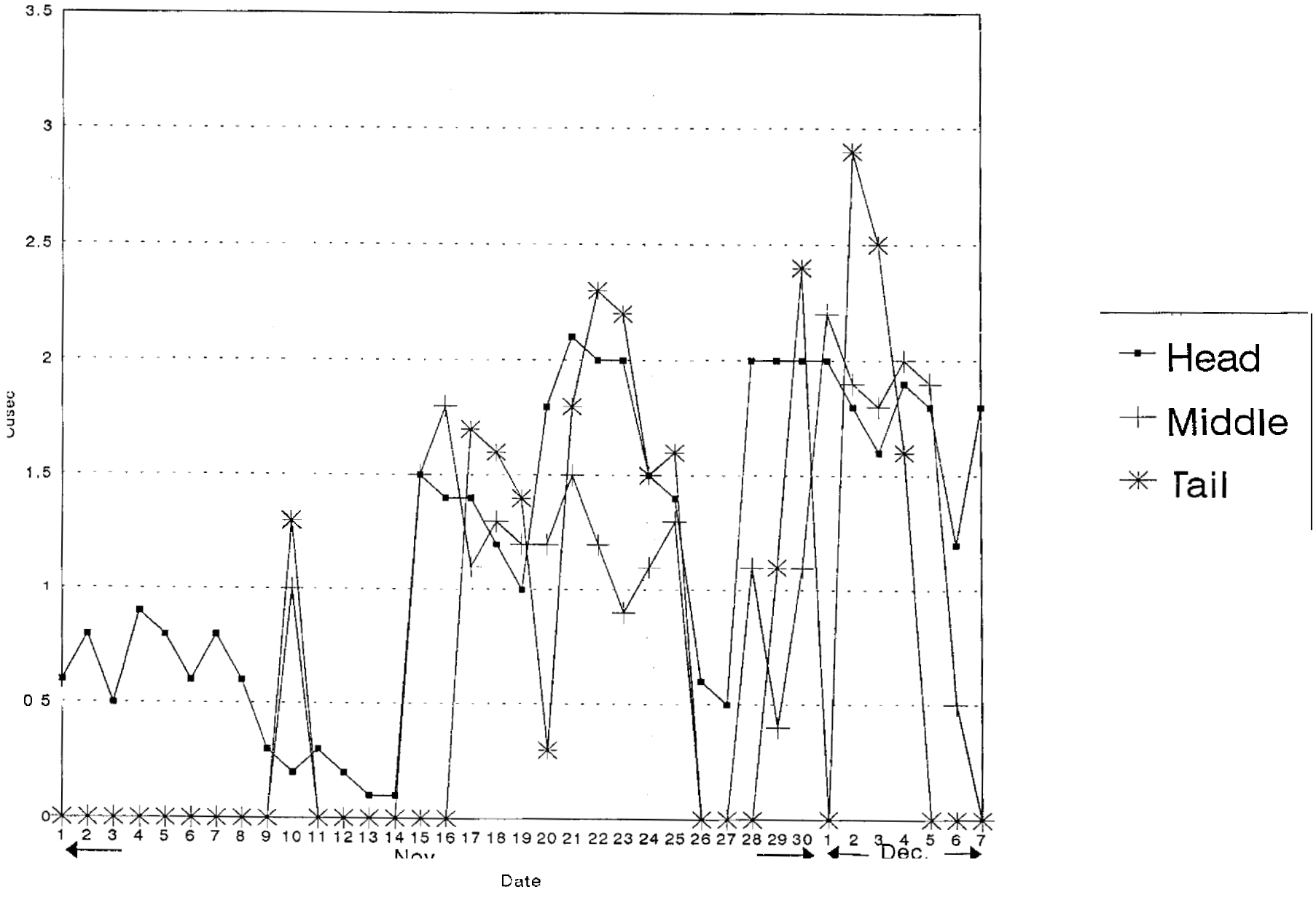

Fig. 3.3 Water Issues in field channel

b. Farmer organization leader was **more** interested **in** executing contract work rather than in distribution of water.

c. No co-operation of head **and** middle end farmers.

d. No guidance from the agency in distributing the water after the distributary was handed over.

3.4 IMPACT :

3.4.1 Use of more water for land preparation with extended duration :

The head and middle reach farmers got water as per **schedule** and even got excess from the date of issue of water, but the tail end **farmer** received water from the third week on wards, that too with uncertainty (Table *3.6)*. Even then with all uncertainty the tail end farmers took just four weeks to complete their land preparation (80 %) while the rest took six weeks. The head and middle reach completed *80* % of the first ploughing by the second week itself, and middle reach farmers completed 80 % of their second ploughing by the third **week,** but head reach farmers prolonged second ploughing for no proper reason. On the other hand, tail end farmers completed 80 % of first and second ploughing by the fifth and sixth weeks respectively. Middle **reach** farmers completed **80** % of sowing paddy by fourth week followed by head (sixth week) and tail end farmers (seventh week) (Table 3.7).

Generally it was noticed that middle and tail reach farmers quite actively participated in land preparation and sowing, but head reach farmers were not so, this may be due to the fact that they were sure to get adequate water continuously and whenever they want.

It was also observed that tail reach farmers received water only for 15 days against 42 and 32 days by the head and middle reach farmers respectively. However, tail reach farmers received higher discharge as compared to others which helped them to complete land preparation in a short time (table 3.8).

3.4.2 **Rainfall** not **utilized** properly :

There was good amount of rainfall during the second week after issue of water (16.2 inch) and the MEA stopped issuing water during this period. This, instead of helping in land preparation, delayed it, and this is more so in the case of tail end farmers;

Table 3.6 : Weekly water issue to Head, Middle and Tail reach farmers

Weeks	Head		Middle		Tail	
	Cusec	inches	Cusec	inches	Cusec	inches
1	4.0	2.5	5.0	5.6	0.0	0.0
2	5.3	3.7	3.0	3.4	0.0	0.0
3	3.6	2.3	1.0	1.1	1.3	1.4
4	5.9	3.7	5.7	6.4	3.3	3.5
5	11.8	7.5	8.4	9.4	11.1	i1.7
6	10.9	6.9	6.7	7.5	6.4	6.8
7	6.5	4.1	6.2	1.1	4.1	4.3
Water used for land preparation		26.6		34.5		27.7

Table 3.7 : **Percentage of farmers completing operations during particular** weeks.

Weeks	Head (%)			Middle (%)			Tail (%)		
	F.P*	S.P**	Sowing	F.P	S.P	Sowing	F.P	S.P	Sowing
1	--	--	--	29	18	12	--	--	--
2	80	--	--	59	5	6	--	--	--
3	20	--	--	12	59	29	67	--	--
4	--	33	7	--	6	23	16	11	11
5	--	40	26	--	6	18	11	44	33
6	--	27	74	--	6	12	6	28	34
7	--	--	--	--	--	--	--	17	22

* First Ploughing
** Second Ploughing

Table 3.8 : **Total** number of **days and quantity of water received at head, middle** arid tail reach **turnouts.**

Reaches	Cusec			**Total** days
	< **1.0**	**1.1 to 1.9**	>2.0	
Head	**16**	25	**1**	42
Middle	**3**	27	**1**	32
Tail	1	**9**	5	15

the tail end farmers made no attempts to harness the rain water for land preparation. This may be due to :

i. Their attention was on upland cultivation.

ii. Soil being sandy in nature, it is difficult to keep standing water on sandy soil without adequate canal water.

iii. There exists a practice called Attham, where farmer families help each other and work together. Therefore, farmers moved to other areas where water was issued earlier and therefore, they could not make use of rain water.

iv. Farmers who had taken up land for lease at the head reach were busy in preparing that land.

v. Hiring of tractor was not possible, because tractor operators expects standing water to pass rotovator.

3.4.3 Farmers in the tail end prefer to grow other field crops :

Water distribution has direct impact on land preparation which intern affects the cultivation practices like varietal selection, application of fertilizers, pesticides and other farming operations. All these practices affect yield and cost of cultivation. Even though all the farmers grow paddy extensively, tail end farmers try to include other field crops such as chillies (22 %) in the red brown earth soils while paddy is grown in lowland areas with LHG soils. Such cultivation of other field crops in the head and middle reaches was not common (Table 3.9).

3.4.4 Raising coarse varieties of rice; extended time of land preparation:

Extended time of land preparation forces the farmers to go for short duration (coarse) paddy varieties. It was noticed that tail reach farmers use more short duration and bold seeded varieties (75%) compared to middle (50 %) and head reaches (25 %) (Table 3.9). Although these varieties produce the same yield as long duration (fine) varieties, yet their low price in the market reduces the net return to the farmers.

Table 3.9 : Crops **taken** and **varieties chosen as influenced** *by* **farmers at** different **reaches**

Details	Head	Middle	Tail
i. Crops taken	90	94	78
a. Paddy			
b. **Paddy + chilli**	**10**	6	22
ii. Varieties			
a. Fine	75	50	25
b. coarse	25	50	75

3.4.5 Farmers following Attham practice :

Labour wages being very high (Rs.125/= per day for women and Rs.150/= per day for men) made many farmers to follow attham in which farmers work together in collective farming operations helping each other. However, this practice is more prominent at the tail reach (83 %) where there was sufficient time for land preparation activities and water received was not regular, In the head and middle reaches where they get early and assured water supplies they engage wage labours to get the work done in time (Table 3.10) .

3.4.6 Breaking of channels; farmers not disciplined :

After taking over by the farmer organization the practice of choking and damaging the structures was found to be not reduced. Out of the 25 turnout gates 3 were slightly damaged so as to take water whenever they want. Farmers have not been disciplined sufficiently to work as a team; considerable effort is needed to motivate them and make them work as a unit. Enforcement of discipline among farmers is also necessary.

3.4.7 Blaming the turnover concept for all the ills :

There was no substantial evidence that conflicts were prevalent within turnout in distributing the water. It was found that they work together helping each other. However, quarrelling among the tail end farmers, the farmer organization leader and the jalapalaka was noticed for non issue of water (Table 3.11). The conflict was taken to the Unit Co-ordinating Committee meeting. The farmers were asking for release of more water to solve their problems.

3.4.8 Farmers dissatisfaction :

The data collected during land preparation phase indicates that farmers appreciate the existence of farmer organization but resent that the farmer organization failed in distributing of water equitabally. Farmers at the tail end indicated that water flow was better when MEA operated the system (Table 3.12). Farmer organization leader also feel that there was some lapse and this is due to not receiving adequate technical help from them the agency.

From the observation it was also felt that sufficient training and assistance of agency is very essential till they become capable of operating the system independently and efficiently.

Table 3.10 : Farmers following Attham practice

Reaches	No. of farmers			% of farmers followed
	Interviewed	Not followed	followed	
Head	20	14	6	30
Middle	17	13	4	23
Tail	18	3	15	63

Table 3.11 : Farmers' reported conflicts over distributary water distribution during land preparation

Farmers Response	Head		Middle		Tail		Total	
	No.	%	No.	%	No	%	No	%
No conflicts	a	26.7	9	30.0	0	0.0	17	56.7
With FO leader	1	3.3	0	0.0	7	23.3	a	26.7
With Jalapalaka	1	3.3	1	3.3	2	6.7	4	13.3
With MEA	0	0.0	0	0.0	1	3.3	1	3.3

Table 3.12 : Farmers response and evaluation of farmer organization management of distributary.

Reach	Farmers (%)		
	Not Satisfied	Slightly Satisfied	Satisfied
Head	14	24	62
Middle	6	29	64
Tail	95	5	0

3.4.9 Unequal net income :

The data in Table 3.13 indicates that farmers at the head reach get higher yield and higher net return followed by the middle and tail reach farmers. The reduction in yield and net return by the tail reach farmers was respectively to a tune of 20 % and 22 % over the head reach farmers. There was not much difference in cost invested for cultivation. The benefits cost ratio indicates that head reach farmers were much benefitted than the tail reach.

Table 3.13 : **Returns to cultivation as expected by farmers at different reaches**

Details	Head	Middle	Tail
Yield (Kg/ha)			
Maximum	8250	7040	6875
Minimum	5500	5500	4400
Average	6816	6050	5479
Gross Return (Rs/ha)	42025	37557	36586
Ccst of cultivation (Rs/ha)	17571	16500	16375
Net Return	24454	21057	18961
Benefit Cost ratio	1.39	1.28	1.16

CHAPTER 4.

A Comparative Analysis of Results by Questionnaire and Participant Observation Methods

4.1 Participant observation verses questionnaire methods :

Information collected by the participant observation method and data collected by questionnaire method were analyzed and the results were compared with each other to ascertain the applicability and utility of these methods. The results obtained by these two methods reveal that both the methods produce comparable results in most of the cases with slight deviation in a very few cases (Annexure-I).

A typical comparable and contrasting results obtained by these two methods are presented below.

4.2 Land preparation and crops grown :

As indicated by the questionnaire method it is true that all farmers could not complete their land preparation within four weeks. it was noticed that 80 % of the farmers could finish land preparation within four weeks, but generally it took five to six weeks by which all the farmers could complete their land preparation. However the reason for delay was different in the head and tail reach areas. Head reach farmers faced with problems like non availability of labour, tractor and excess water, while tail end farmers expressed difficulty in getting water, and hiring tractors.

Similar to participant observation method questionnaire method also indicated that at tail reach more farmers (25 %) cultivated other crops. Data disagrees with the type of crops grown. When data was collected by questionnaire method farmers stated that they have cultivated vegetables instead of chilli. Chilli is the actual crop grown by the farmers.

The questionnaire method indicates that there was no difference in duration of seed paddy selected by the head and tail end farmers, while participant observation method indicates that tail-enders used short duration varieties.

4.3 Farmers organization and water issue :

Questionnaire method also indicates that the farmers though appreciative of the presence of farmer organization, they are dissatisfied with the management of water distribution. It was

clear from the data that most of the tail reach and nearly 50 % of the head reach farmers are not satisfied with water distribution practice adopted by the farmer organization leader. In the participant observation method, the tail reach farmers often expressed that Mahaweli Economic Agency would be the best to operate the water issues but in questionnaire survey they failed to express this idea; it may be due to the fact that they might have forgotten the difficulties they experienced during land preparation. this clearly indicates that there is certain loss of information depending upon when the questionnaire survey is conducted.

4.4 Concluding remarks :

The above comparison indicates that both the methods have their own advantages and disadvantages. Some of these are;

1. The Participant observation method produces time-series data while the questionnaire method provides cross-sectional data.

2. The participant observation method captures the progress as well as the end result (outcome) while farmers recall through questionnaire focuses more on outcome than on process. In many cases, once the problem is solved, the farmers forget the ordeals undergone before that problem is solved and therefore, there is loss of information if the questionnaire is administered at a later date.

3. In the questionnaire method, one must foresee what the process and outcomes would be and those aspects need to be included or else one would miss the important points. In other words, designing and administering a questionnaire to extract correct information is a very important step in the questionnaire method; whereas in the participant observation method, it is important to train process documentor to observe more critically the on-going process and activities without making his presence much visible.

4. Properly designed and administered questionnaire should produce the same result as that of a properly conducted participant observation method. However, participant observation method is laborious, time consuming, costly and requires skilled and trained, participant observer, while questionnaire method requires less stringent skill and training.

CHAPTER 5

Conclusion and Recommendations

The following are the salient conclusions and recommendations arising out of this study:

5.1 Conclusions :

1. Paddy, one of the most important cereal crops of Sri Lanka, is grown in system H where there is considerable potential to save water through improved water management and to improve total production.

2. Water supply in the main system (main and branch canals) was unstable and fluctuating causing variable discharge through off-take head of distributary channels.

3. The operational schedule proposed by the MEA for the distributary canal does not match with the physical system design of the distributary. Therefore, farmers used an ad-hoc method of water distribution resulting in unequal and unreliable distribution between the head and tail-reach farmers.

4. Presently, farmers are using excess water for land preparation. The excess varies anywhere between 100 to 150 percent more than what was planned.

5. Rainfall is not effectively used during the land preparation period.

6. The distributary level water distribution is not effectively carried out by the farmer organization leader.

7. Farmer organization needs technical support from the agency and adequate training for building their capacity to implement the water distribution schedule.

8. Weak leadership of farmer organization, insufficient strengthening of farmer organization and inadequate support from the agency are the main causes for the inefficient water management in the turned over system.

9. Farmers at the head reach were not showing much interest to complete their land preparation in time so as to provide water to the tail-end farmers.

10. Farmers at the tail-end faced severe problem due to uneven distribution of water and non-availability of tractors during land preparation period.

11. Farmers at the tail end prefer to raise short duration varieties to compensate the loss of time incurred due to extended land preparation period.

12. Growing of other field crops like chilli is on the increase in the tail-end compared to head and middle reaches.

13. **The** head reach farmers are found to be benefitted more and *got* higher return than the middle and tail reach farmers. The unreliable water supply along the distributary was considered by the tail-end farmers as the major cause for less net return than the head **and** middle reach farmers.

14 Participant observation methodology was found to be more suitable for detailed analysis of the process and outcomes of irrigation activities while questionnaire method is more suited to *get* the outcome of the irrigation activities.

5.2 Recommendations :

1. The MEA has to develop an operational schedule which will match with the existing physical system design, taking into account the existing state of control and regulating structures and the rainfall occurrences.

2. The farmer organization needs training in implementing the operational plan.

3. The agency has to work with farmer organization in a participatory mode in implementing the operational schedule till the farmers develop sufficient capacity to manage water distribution on their own.

4. Every effort must be made to use rainfall effectively and reduce excess water utilization during the land preparation period.

5. The trend of raising other field crops during both Maha and Yala must be encouraged and sufficient support **needs** to be provided to improve area cultivated with other field crops.

6. The communication gap now existing among the agency, farmers and the farmer organization must be removed and effective interaction needs to be established for the successful functioning of the turned over system.

CHAPTER 6

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ANNEXURE I

Code for water distribution, land preparation and FO performance in distributaries of D3/415, 1995/96 - Maha season - Land preparation and initial crop growth period

			HEAD	TAIL
A. Identification				
01	PLAN	Paddy allotment number		
02	HLAN	High land allotment number		
03	DIST	Name of the distributary		
B. Location				
04	DISTL	Location of paddy allotment in the distributary		
		01 = head		
		02 = tail		
05	FCLOC	Location of paddy allotment in the field channel area		
		01 = head		
		02 = middle		
		03 = tail		
C. Size of land holding				
06	EXTENT	Total extent cultivated with paddy in the distributary in the distributary (acres)		
		01 = 2.49 to 5.00	0	0
		02 = 2.50	6	12
		03 = 2.00 to 2.49	3	0
		04 = 1.00 to 1.99	3	0
		05 = 0.50 to 0.99	0	0
		06 = Less than 0.50	0	0
D Crops				
07	CROPS	Type of crops cultivated in the paddy allotment		
		01 = Faddy	10	9
		02 = Chillies	0	0
		03 = Vegetables	2	2
		04 = Others	0	1
E. First water issue				
08	FDWI	Did you know the first date of water issue for land preparation		
		01 = Yes	9	9
		02 = No	3	3
09	FDWIM	How did you know the first date of water issue for land preparation		
		01 = Khanna meeting	9	9
		02 = Turnout group leader	1	1
		03 = Neighboring farmer	2	2

04 = Jalapalaka	0	0
05 = Technical Assistant	0	0
06 = Others	0	0

F. Land preparation

10 LANDP Were you able to prepare lands i.e. first ploughing, leveling **ete,** during the **first** week of water issues

01 = Yes	4	2
02 = No	8	10

11 LANDL If no, what are the reasons **for** delay in **land** preparation

01 = **Lack** of water initially	0	0
02 = Difficulty in hiring tractor	0	4
03 = Difficulty of hiring buffaloes	0	0
04 = Shortage of labor	3	0
05 = Non availability of credit	1	0
06 = Too much **water**	1	0
07 = Not relevant	2	2

G. Irrigation and Cultivation problems

12 PROBS What were the major irrigation and cultivation problems you faced

01 = Lack **of** water	3	9
02 = Lack of credit	1	0
03 = Non availability of seed **paddy**	0	0
04 = Non availability of **seed** paddy	1	1
05 = Difficulty of hiring tractor/buffaloes		
06 = No **problem**		

H. Water Distribution

13 PROWA If water shortage was your major problem what **is** its nature

01 = Inadequate quantity	2	9
02 = Not available in time	1	1
03 = Too much water	0	0
04 = Others	0	0
05 = Not relevant	9	2

14 WADST How was the distribution of **water** into **your** paddy field

01 = Satisfactory	7	2
02 = Some what satisfactory	0	2
03 = Unsatisfactory	5	8

15 WADSR What do you think as the main reason for **poor** water distribution

01 = **Inadequate** supply to the distributary	3	5

02 = Poor water distribution along the distributary	1	2
03 = Poor water distribution within the FC area	0	0
04 = Illegal water tapping/opening of FC gates illegally	0	2
05 = Damaged structures	0	0
06 = Inadequate DC and FC maintenance	0	1
07 = Other	1	0
08 = Not relevant	0	2

16 WADIS Were there water disputes among farmers during land preparation

01 = Frequently	0	1
02 = Seldom	3	5
03 = No disputes	7	6

I FO Water Distribution Performance

17 MEMB Are you a member of the farmer organization?

01 = Yes	7	8
02 = No	5	4

18 FOSER Did your farmer organization provide the following services during land preparation and after

01 = Supply of credit	1	0
02 = Hiring tractors	0	0
03 = Procurement of seed paddy	0	0
04 = No service	6	8
05 = Not relevant	5	4

19 HANDO Did you know that operational and maintenance responsibilities have been handed over to your FO?

01 = Yes	12	10
02 = No	0	2
03 = Not relevant	0	0

20 WDPR Are you satisfied with the role of water distribution performed by the farmer organization?

01 = Satisfactory	5	1
02 = Somewhat satisfactory	1	5
03 = Unsatisfactory	6	6

21 RNFDP If you *are* not satisfied with water distribution activities of the FO, give main reasons?

01 = Turnout leader is inefficient	0	0
02 = FO/leaders favor rich farmers	0	0
03 = Insufficient quantity received *to* the distributary	0	3

	04 = **Problems** of opening and **closing** FC gates	0	1
	05 = **Poor** water distribution practices of FO leaders	6	4
	06 = **Not** relevant	6	4

2%	COMP	**What do you think is the** best organization to **supervise** water distribution along the ***DC*** **and** FCs?		
		01 = **Mahaweli** Economic **Agency**	3	1
		02 = Farmer Organization	4	**4**
		03 = Do not **know**	5	7

J. Inputs

23	**Seeds**	Duration **of** seed paddy		
		01 = **3** months	1	2
		02 = 3.5 months	6	6
		03 = 4 months	2	2
		04 = 4.5 months	3	2

24	SESOU	From where did *you* **get** your seed paddy?		
		01 = Agrarian Services Department	1	2
		02 = Agriculture Department	3	0
		03 = Farmer Organization	0	**0**
		04 = Unit Manager	1	0
		05 = Cooperative Society	1	**0**
		06 = Own	3	8
		07 = Neighbors	3	2
		08 = Private traders	0	0
		09 = Other	0	0

25	CRED	Did you borrow money for land **preparation**		
		01 = Yes	6	10
		02 = No	6	2

26	CREDS	From **whom** did you borrow?		
		01 = Banks	1	3
		02 = Trader/potential buyer of paddy	4	0
		03 = Relatives	1	1
		04 = Friends	0	1
		05 = Others	0	0
		06 = Not relevant	6	6

27	FOURW	**Do** you own a four wheel tractor?		
		01 = Yes	2	0
		02 = No	10	12

28	TWOW	Do *you* own a **two** wheel tractor?		
		01 = **Yes**	4	1
		02 = **No**	8	**11**

29 **BUFF** **Do you own buffaloes?**

01 = **Yes**	1	5
02 = **No**	11	7

30 **WAPM** **Do** *you* **own** a **water pump?**

01 = **Yes**	1	2
02 = **No**	11	10

31 **YIELM** **What was your** paddy **production during the** 1994/95 maha **season (per acre)?**

32 **YIELY** **What was** your paddy **production during the 1995 Yala season** (per acre)?