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ORGANIZATIONAL ASPECTS OF IMPROVED IRRIGATION MANAGEMENT: KALANKUTTIYA BLOCK, MAHAWELI SYSTEM H, SRI LANKA

by

Ranjanie Moragoda
and
David Groenfeldt

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INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE
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Sri Lanka Field Operations
International Irrigation Management Institute
P.O. Box 2075
Colombo, Sri Lanka

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FOREWORD

This report is one of several IIMI publications addressing the issue of irrigation management to promote diversified cropping during the yala (dry season). As Sri Lanka approaches self-sufficiency in rice production, a target already achieved by some other countries in the region, there is little logic in growing rice using land and water resources which could support higher value non-rice crops which use less water. Thus, one of the incentives in improving irrigation management is to find ways of stretching water further during the dry season, when rice is relatively more expensive to grow than during the wet season (maha), and when other crops which can be grown only during the dry season (when there is less danger of water-logging) offer the farmer and the country a comparative advantage,

IIMI's research interest in the Mahaweli-H system in general, and the Kalankuttiya Block in particular was prompted by the existing widespread adoption of non-rice crops during the yala season. By studying a case of diversified cropping "success" IIMI hoped to better understand the irrigation management factors underlying that success, and if possible, to improve on them. After three seasons of research (yala 1985, maha 1985/86, and yala 1986) to document existing practices a decision was taken, in consultation with the Mahaweli Economic Agency, to attempt an operational intervention during the 1987 yala aimed at improving the efficient use of water in the system. This report presents one important component of the 1987 experiment: the organizational aspects of the new rotational plan which was introduced.

The basic management principle underlying the yala 1987 operational research was information feedback to farmers and Mahaweli officers, and between farmers and officers. The information included measurements of water flow and duration, deviations from the intended pattern, and the attitudes and reactions of fanners and farmer representatives.

The fora introduced to allow feedback and discussion of this information on irrigation-management performance were post-issue meetings which, towards the end of the season, involved farmer leaders, the Unit Manager, the Irrigation Engineer, and IIMI Research Assistants. The purpose of the meetings was both to discuss the previous issue and plan the next issue. The innovation of regular meetings at the unit level while a minor step in itself has significant implications for the ways in which irrigation is managed, in particular, the management participation of farmers.

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The research reported in this paper is part of a larger effort involving a number of IIMI staff, as well as staff of the Mahaweli Economic Agency of the Mahaweli Authority of Sri Lanka. Grateful acknowledgement is made to the other IIMI staff working on the project: H.M. Hemakumara, Senen Miranda, C.R. Panabokke, Ed Martin, and D.W. Bandara. Many thanks for their support and assistance are also due to the Resident Project Manager, Mr. P. Jayawickrema, the Kalankuttiya Block Manager, Mr. W.M. Silva, the Irrigation Engineer, Mr. L. Jayasuriya, the Unit Managers, Mr. Dissanayake (Unit 3) and Mr. Jayathilaka (Unit 2), the D/channel representative, Mr. Heembanda, and the farmer leaders, as well as all the farmers of the study area who shared their experience and insights to make this study possible. Doug Merrey, Head Sri Lanka Field Operations, provided useful editing comments and guided the publication of this paper. The authors alone are responsible for the contents.

INTRODUCTION

This report documents part of an operational experiment in Kalankuttiya Block of Mahaweli System H during the 1987 yala (dry season). The experiment or "action research" was conducted by the International Irrigation Management Institute (IIMI) in cooperation with the Mahaweli Economic Agency of the Mahaweli Authority of Sri Lanka. The experiment was the outgrowth of studies which focused on constraints to non-rice crops during the dry season. Careful monitoring of irrigation and cropping patterns in selected areas of the system, conducted from yala 1985, had documented three important constraints to diversified crops: 1) inadequate water control at the secondary and tertiary levels of the system, 2) lack of organization for water sharing from the secondary level downward, and 3) poor communication between farmers and agency staff regarding water delivery schedules (Panabokke 1989).

Rationale and Objectives

The research carried out during the 1987 yala was an action study designed to influence and monitor a new pattern of water rotations which agency staff and farm leaders jointly decided prior to each issue. The objective of introducing a new rotational plan was to pilot-test possible improvements in irrigation management that could ensure a more equal distribution pattern among field-channel (FC) turnouts, and to accommodate farmers' views.

The more specific objective of this report is to present the organizational aspects of the new rotational plan. Documentation of water use and the physical performance of the system will be presented in a later report outlining the experiment as a whole. The present report builds upon an earlier report on the 1986 yala season, describing the organizational arrangements for water distribution in Kalankuttiya Block (Moragoda and Groenfeldt 1989). Ekanayake and Groenfeldt (1989) provide a comparable analysis of yala 1987 in a nearby irrigation system.

Background

Mahaweli System H is one part of Sri Lanka's largest irrigated settlement scheme which comprises five administratively separate systems, all fed by waters of the Mahaweli River, and supplemented by local streams. System H is the oldest of the five systems completed seven years ago. Its total irrigated area is 27,000 hectares (ha). Each original tenant was allotted a landholding of 1-ha irrigated land and 0.2-ha house plot.

The physical layout of the residential plots and the irrigation canals in System H is highly regular. The Kalankuttiya branch canal which serves the research area feeds 20 distributaries (see Map 2). The distributaries take water to field channels, from which water flows through 4-6 inch (10-15 cm) concrete pipes into the individual 1-ha plots. There are no fields fed directly from the main canal or from the distributaries. Each field, and each farmer, is part of a larger irrigated unit defined by the field channel and comprises between 7 to 15 allotments, most of which are farmed by the original allottee or a close relative.

The organizational setup for the management of the Mahaweli area is based on three levels: project level, block-level, and unit level. The unit level which is administered by a Unit Manager entails direct dealings with farmers. The Unit Manager is responsible for many development activities including water management, agriculture, land matters, marketing, credit, and community development. In order to serve 250 families in each unit the Unit Manager is assisted directly by a casual laborer and a Krushi Viyapthi Sevaka (agricultural extension agent; KVS) and he consults the Irrigation Engineer and Engineering Assistants in the block office on technical matters in the unit and on water distribution.

ing adequate water for the distributary the Unit Manager is assisted by an rri a casual laborer who works under the Engineering Assistant —) at the block office; this Irrigator is responsible for opening and closing the main sluice and the distributary gates. Farmers' participation in irrigation management begins at the distributary level. The distributary channel representative and turnout leaders play a role, along with the Unit Manager, in operating water rotations and in cleaning and maintaining the field channels.

Research Methodology

The overall research methodology during the 1987 yala included the following steps: 1) collecting specific data from a sample of farmers, their fields, and the channels serving them; 2) identifying problems of water distribution at the secondary and tertiary levels; 3) formulating a new rotational plan to overcome these problems; 4) monitoring water use and the actions of farmers, farmer representatives, and agency staff; and 5) analyzing the results. This report focuses on steps 1), 2), and 4); it does not present an analysis of water flows or water use.

Because the 1987 yala was an unusually water-scarce season, only 45 percent of the command area was slated for irrigation on a bethma[1] basis. The normal practice in Kalankuttiya block is to practice a 50 percent bethma during alternate yala seasons, but the 50 percent figure was deemed too high for the limited water available this year.

[1] Under bethma, the portions of the command area that are irrigated are divided equally among all farmers in the system, for that season only.

Sample selection. The sample was limited to farmers in the distributaries D/4 and D/2 of irrigation block 305 (Kalankuttiya). Following the bethma selection process, when the irrigated portions of each distributary were finalized the research sample was drawn on a systematic basis. Every third allotment was selected, and within each allotment (which typically included 1-4 farmers) one farmer was selected randomly. As a result a total of 61 farmers were included in the sample. They answered a short (3-page) questionnaire on household number, occupation, and land- holding,

SEASONAL PLAN FOR IRRIGATION MANAGEMENT

At the close of the 1986/87 maha season water supplies were low and dry weather conditions prevailed. Planners within the Mahaweli Authority forecast that the total water availability within system H for the coming yala season would be sufficient to cultivate only 45 percent of the total cultivable area with non-rice crops (OFCs).[2] It was also anticipated that water diversions from Polgolla (on the Mahaweli River, near Kandy) would be interrupted after August due to repairs. In response to these projections, a 45 percent bethma cultivation was scheduled for the entire extent of the Galnewa Resident Project Manager's (RPM) Division in System H. In normal years roughly half this area receives full water supplies during the yala season with the other half receiving a 50 percent supply; this process alternates from year to year.

The irrigation plan was to issue water by 20 April to the left bank of the Kalawewa reservoir (which includes Kalankuttiya Block) and to permit cultivation of only OFCs, and not rice, for the entire (45 percent) bethma extent. The planned cropping pattern was 80 percent chili, 10 percent pulses, 5 percent onion, and 5 percent other vegetables.

Kalankuttiya Block-Level Plan

A separate kanna meeting[3] attended by about 50 farmers was held for units 305 and 306 in Kalankuttiya Block on 26 March. The first water issue was planned for 20 April with rotations of 3 days of water per 6-day period for each distributary during the land preparation phase. The rotation would be extended to once in 10 days after the completion of land preparation. At the field-channel level turnout leaders were expected to organize rotations with the help of unit-level officers. Each allotment was to receive water for 6 hours per rotation. The irrigated area of each plot was estimated to be 0.81 ha (two acres) which is equivalent to a 40 percent bethma, 5 percent less than what the project-level plan called for.

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[2] The acronym, "OFC" which stand for "Other Food Crop" is used in this report as it is part of the accepted vocabulary in Sri Lankan agriculture. The crops typically denoted by the term include chili, green gram, black gram, soya, and onion.

[3] A meeting of farmers, project officers, and representatives from other line agencies to decide on various cultivation aspects like cropping calendar, irrigation schedule, etc.

The outcome of the kanna meeting corresponded with the directives of the Mahaweli Authority of Sri Lanka on the water pattern: water would be issued for only 0.4 ha (1 acre) per farmer, and only for OFCs. The expected cropping pattern was 50 percent chili and 50 percent other OFCs. It was also decided to select special onion growing areas in the field channels which could be regularly irrigated, as onion requires frequent irrigation. Onion growers were entitled to extra water issues. On a block level, the target cropping pattern was: chili-848 ha, onion-53 ha, pulses-106 ha, and other vegetables-53 ha. The proposed extent of land was 1027 ha. Ploughing was to be completed before 1 May, and chili transplanting was to be completed before 4 May.

Selection of bethma areas was the responsibility of the Unit Manager and farmer leaders, under the guidance of block-level agricultural officers. The main criterion for selecting bethma areas was the suitability of soil for OFCs. The division of the allotment into two equal portions was to be carried out by farmers themselves. As water was to be issued for only 0.4 ha (1 acre) per allotment, each farmer was expected to fallow the remaining portion (0.1 ha or 0.25 acre) of his bethma area. Most farmers found suitable arrangements with either relatives or friends according to their experience from previous seasons and according to their knowledge of the soil type and availability of water.

Bethma

Farmers were expected to finish cleaning their portions of field channels before 15 April. A fine of Rs 5 per portion would be imposed on those who did not comply. The distributary was to be cleaned on a contract basis.

Farmers' crop decisions. Prior to the kanna meeting, the general expectation of farmers was to begin irrigation after the New Year festival period in April. Most intended to plant OFCs, in particular chili, as it is the most profitable yala crop. However, farmers did not plan to cultivate a large extent of chili because of experience with disease in the previous yala and because of the high investment cost.

A survey of sample farmers (n=61) showed that a total of 48 had decided, prior to the water issues, to cultivate chili. Of these, a few farmers had made the decision to cultivate chili at the close of the previous yala season and had retained seeds for this purpose; 31 farmers made their decision to cultivate chili at the time of the kanna meeting after it was clear that chili seeds were available. Other farmers made the decision to grow chili between the time of the kanna meeting (March 26) and the first water issue (20 April).

The other crops which farmers intended to cultivate included green gram, cowpea, and black gram, all of which can be used as subsistence crops and as cash crops. Some farmers decided to grow onion because they received high profits from this crop during the previous yala. In general, farmers showed a tendency to avoid vegetable cultivation because they had faced marketing problems the previous year. Those farmers who intended to cultivate rice did so expecting rain. They felt it was better to have a small amount of rice along with other crops in the event of heavy rains which would damage the OFCs.

Bethma Planning Process

Since bethma allotments are proportional to landholdings, the issue of land tenure becomes critical in understanding how bethma functions, Although there is an established allotment holding of 1 ha (2.5 acres) and an established type of landholder, namely the "owner cultivator" or his immediate family, in practice the situation is considerably more complex. Among the 61 sample farmers there were 5 categories in addition to "owner cultivator" as shown in Table 1.

Table 1. Land tenure categories of sample farmers (n=61) in Kalankuttiya Block during yala 1987.

Land tenure type	Percent
Owner*	69
Lessee	16
Mortgagee	5
Partnership	5
Grant	2
Ande[4]	2

* Includes bethma cultivators who are legitimate owner cultivators and tenant cultivators.

Of the 10 lessees 7 were cultivating bethma lands that the rightful bethma partner preferred to rent rather than to cultivate. The category of "grant" in the table above refers to an abandoned allotment in D/2 which the Unit Manager has granted, provisionally, to landless farmers.

Selecting bethma lands. The task of selecting the 45 percent of the total command area which would be irrigated was left to farmer leaders through discussions with the Unit Manager. The main criterion was soil type, with well-drained soils that could support OKs being preferred. Two other criteria of importance to farmers were 1) distance of the turnouts from the settlement area and 2) ease of water conveyance.

In the case of bethma selection for D2/305, a meeting was held on 2 April, one week after the kanna meeting, at the Unit Manager's office. Present at the meeting were the six turnout leaders, the distributary-channel (DC) representative, two additional farmers from each turnout and all three unit-level staff members (the Unit Manager, the KVS, and the Irrigation Laborer). The purpose of the meeting was to select suitable areas for OKs based on the area of each soil type available within each turnout (which was known from previous soil-survey data). Because of the small area of well- drained soils in head-end turnouts (TO 5 and 6) some areas of imperfectly drained soils were also included in the bethma area. Farmers had experience in growing OKs on these soils fromthe previous yala. However, unlike in previous bethma seasons

[4] Share cropping

a decision was taken to include the head-stretch portions of each turnout in the bethma area, which generally meant omitting the tail end of field channels where the soil tended to be poorly drained and unsuitable for cultivation of OFCs.

Fifty eight allotments or portions of allotments were selected in D2/305. Of these, 23 were "half allotments" (i.e., only half the allotment was included in the bethma, and this area was cultivated by the farmer who normally cultivated that allotment). A similar procedure for selecting the bethma area was followed in D4/305; portions of each turnout were included in the bethma area. Of the 47 allotments selected 19 were "half allotments" of 0.4 ha (one acre), and the remaining 28 were divided into two portions: an "owner" portion and a "bethma" portion, each of 0.4 ha (one acre).

Selecting bethma partners, Most farmers made their own arrangements for finding a suitable partner giving preference to relatives and friends. There was a very strong preference for relatives. For example, the Owner of an allotment in T1/D4[5] arranged to have his father as his bethma partner, although his father was an illegal cultivator of reservation land in D3/305. A farmer in T2/D4 arranged to have, as bethma partner, his son-in-law who himself cultivates land in turnout 4 of the same distributary. A number of farmers purchased cultivation rights from their bethma partners in order to cultivate the entire allotment themselves.

Farmers who did not make arrangements on their own had little choice in what land they cultivated. However, appeals could be made to the Unit Manager. For example, the turnout leader of T3/D4 rejected the bethma portion that he had been assigned and as a substitute the Unit Manager allowed him to cultivate 0.4 ha (1 acre) of reservation land along the distributary in Turnout 3. The owner of the poorly drained allotment in T2/D4 was unsuccessful in his appeal for a similar consideration. He requested the right to irrigate reservation land adjoining his allotment which he had already cultivated but his request was refused. Because he had mortgaged his land the Unit Manager considered him to have forfeited his cultivation rights.

In the vast majority of cases (95 percent of sample farmers) the cultivators of the owner portion and bethma portion were able to agree on the plot divisions without any outside help. Many farmers knew the official bethma-division line as measured in 1983 when bethma cultivation began in System H. Other farmers used field boundaries to divide the land. In a few cases there is a permanent boundary between the owner portion and the bethma portion. For example, in one allotment of T5/D4 there is a wide bund dividing the allotment into two portions, one being slightly lower than the other.

Eight of the 61 sample farmers reported that their allotment was divided due to default. The first cultivator had simply taken a portion of land which he considered to be half the allotment and began cultivation. When his partner arrived this division was accepted. On the whole, both bethma farmers and owner farmers were satisfied with the arrangements for dividing the allotments.

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[5] Where the block number is not specified (as in this case) to Block 305 is referred to.

However, some bethma farmers felt that the owner had taken the more advantageous portion of the allotments and in some cases had taken a larger portion as well.

IMPLEMENTING THE PLAN

Cropping Pattern

Because of the late beginning of this yala season, farmers had to reassess their original decision to cultivate chili as the major crop. However, because of the high profitability of chili and the small extent of land each farmer had to cultivate (due to bethma) most farmers decided in favor of chili. Among the 61 sample farmers in D/4 and D/2 chili was the major crop for 51 farmers (84 percent). Of these, only seven farmers cultivated chili exclusively. Tenant farmers were particularly motivated to cultivate chili because they had rented land for that purpose. Of the seven who cultivated chili only, four were tenant farmers.

The choice of a second crop in addition to chili reflected concern over the expected water scarcity during the season. Farmers showed a preference for short-duration, low water-use crops such as cowpea, green gram, and black gram. According to the agricultural extension officers in the area, demand for seeds of these crops increased at the beginning of the season when it was clear that the season would be delayed. A shortage of chili seeds also contributed to the demand for the seeds of other crops. Of the 61 sample farmers only 8 cultivated these short-term crops as their main crop. Of these, 6 farmers cultivated black gram which requires less attention and lower inputs than most other crops. Two of the black gram cultivators cited their expectation of higher profits rather than lower inputs as the deciding factor in their choice of crop.

Only two farmers cultivated green gram as the major crop. Their reasons for selecting green gram were the low inputs for the crop and the ease of harvesting. The 44 sample chili cultivators, who also grew other crops for home consumption and extra income, gave a variety of reasons for their crop selection. In general, farmers made a first-order decision between chili and non-chili crops, and the selection of the specific variety of non-chili crop was of secondary importance, Farmers cited such factors as land availability, lack of chili seeds, availability of non-chili seeds, and late planting season, as reasons for cultivating non-chili crops.

The most important feature of the cropping pattern during the 1987 yala was cultivation of rice. Although there was no provision to cultivate rice, some farmers did not adhere to the kanna-meeting decision and cultivated rice both within the bethma area and in some cases, outside the bethma area. Of the 61 sample farmers 16 cultivated some rice, and of these three cultivated rice as the major crop. Two of these farmers cultivated only rice. The major reason given for cultivating rice was waterlogging in the land assigned to them under the bethma pattern. Other reasons given included low expenditure and low labor inputs.

By the first week of June the area under rice within Kalankuttiya Block had increased to 67 ha and water was released to meet this demand in order to prevent rice farmers from stealing water. Nonetheless, at least one farmer in the Block appealed to the Member of Parliament in his electorate to induce the project management to release more water for rice.

Channel Cleaning

Field-channel cleaning. Field-channel cleaning is the responsibility of farmers and is expected to be done twice each season: prior to the season and around mid-season, However, the general practice was to clean field channels for land preparation only, that is, prior to the season. In the case of D4, farmers hurried to clean their field channels when they could see water in the branch canal. Cleaning was done individually under the supervision of turnout leaders, as was the practice. The quality of cleaning was highly variable; in some cases only the grass was cut but the channel was not cleared, and in other cases nothing useful was done, Because the cleaning was incomplete the Unit Manager (UM) instructed farmers to fulfill their cleaning duties before the seventh water issue. The UM posted notices to this effect and advised turnout leaders and the DC representatives not to open turnouts until the field channel was completely cleaned. However, these instructions were not implemented.

Portions of the field channel serving abandoned plots had not been cleaned by their owners and because of the practice of cleaning one's own channel portion only, other farmers felt no obligation to clean these portions. Therefore, in the case of turnout 2, the channel overflowed during almost every issue.

Distributary cleaning. Until the 1986 yala season, the work of distributary cleaning was given to private entrepreneurs on contract by the Mahaweli Authority. They cleaned several distributaries under one contract often using labor from outside the local communities. A new procedure was instituted in 1986 to give individual cleaning contracts to the DC representatives, with the aim of giving them some financial compensation for their functions and to ensure accountability to the local farmers. The procedure proved unpopular among the DC representatives who complained that the level of compensation was inadequate. In some cases the DC representatives did agree to the terms, but in other cases they passed on the contract to others. At the same time farmers in the D2 distributary of 305 Block, who had already formed a small association of 17 members with the help of the Unit Manager (see Moragoda and Groenfeldt 1989, p. 15), were authorized to accept the canal-cleaning contract for their channel as well as for two other channels. The farmers were eager to sign the contract because, apart from the money they could earn, when outside contractors cleaned their canal the work was incomplete and had to be redone.

The example of the 305/D2 association served as a model for a new initiative at the beginning of the 1987 yala season to encourage the formation of distributary associations in each distributary. However, unlike the D2 case in which all farmers were invited to join, with the payment of a fee, the new organization developed in D4 was open only to the designated turnout leaders and the DC representative with no fee involved. In February, before the start of the season, the Unit Manager called a meeting as instructed by the Block Manager

and established the new D4 organization comprising the five turnout leaders and the DC representative. Under the new procedure, the DC representative automatically becomes the leader of the organization, with a treasurer selected from among the turnout leaders. The new organization took responsibility for cleaning the D/channel, but did not undertake any water-distribution tasks; these continued to be the responsibility of the DC representative as an individual, not as the head of the new organization.

Water Issues: Main System

The water issue originally scheduled for 20 April was postponed due to the low water supplies in the reservoirs and the absence of significant rainfall. Farmers were informed that the first water issue would be postponed to the end of the month, but a few days before the originally scheduled issue date of 20 April, farmers were told to begin land preparation to take advantage of rain showers in the area. Farmers were reluctant to begin land preparation however, because they doubted that water would be actually issued. As a result, only a few farmers began cleaning their bunds and ploughing their fields. By the beginning of May, farmers were hoping for water but did not make direct demands to the management. Finally, those farmers who had prepared their lands appealed for water to begin chili cultivation and they were given a special water issue.

On 4 May, water was released to four distributaries in Kalankuttiya Block: 305/D1, 308/D1, 306/D1, and 309/D1. Another seven distributaries were issued water on the following day. On 6 May, water was diverted from Mulannatuwa Tank into Kalankuttiya Tank and a total of 16 distributaries were issued water between 6 May and 8 May. On 9 May, all 20 distributaries received water simultaneously.

Farmers' water needs were communicated to the block level by the Unit Manager during regularly scheduled block meetings, the first of which was held on 15 April. Although the block-level plan called for 3-day water issues every week during the land preparation, D2/305 received water on a continuous basis for 6 days from 5 to 11 May, on the request of the Unit Manager.

The water-rotation schedule was modified for the second and third issues also, because of rain. The branch canal was closed on 12 May (Wesak Poya holiday), 9 days after the first opening. The second issue at the level of branch canal was on 15 May, but the canal was immediately closed for two days because of rains on 16 and 17 May. The Kalankuttiya main sluice was opened for the third water issue on 20 May and closed on 22 May. The fourth water issue was from 25 to 29 May.

With the beginning of the fifth water issue (29 May to 3 June) water was first issued to a single distributary, (D1/305). The fifth water issue for all other distributaries began on 3 June and continued till 7 June. At the end of this issue, it was discovered that farmers were illegally opening the distributary gate of D3/308, presumably to irrigate rice. At the weekly block-level meeting held on 6 June, during the fifth water issue, it was decided that since the actual area under rice had increased to 67 ha, water would be issued to service this area and prevent illegal distributary openings.

The water rotation at the distributary level was changed to once in 10 days on 22 June, with the exception of D1/305 which continued to receive water every 7 days throughout the yala season in order to cultivate onion. The change in the rotational schedule was prompted at least partly by the higher labor costs of irrigating on Sundays, which is an official holiday. Management decided not to open the channel gates on the scheduled day of June 21, a Sunday and then instituted the 10-day rotation.

Water issue No. 8 began on 29 June and water was again issued to D1 first, followed by the other 19 distributaries on 2 July. However, by the end of the third day of water issue only 12 distributaries had completedtheir irrigations and there was much illegal opening of distributaries. A similar pattern was followed for issue 9 with D1/305 opened on 10 July and the other distributaries on 13 July.

Water issue No. 11 began 12 days after issue No. 10 and the farmers were informed that it would be the last issue of the season. However, 11 days after the end of this issue, a 12th issue was begun. This issue continued till 28 August and was carried out in 3 parts: D1/305 receivedwater first, followed by a three-day closure of the canal while Kalankuttiya Tank was replenished; next, water was issued to the tail-end distributaries; and third, to the head and middle distributaries.

An extra.issue (Issue No. 13) was provided in August in response to farmers' complaints that their distributaries had received insufficient water. The Irrigation Engineer was able to issue a supplementary supply on 27 and 28 August, following the pattern established in Issue 12: D1/305 received water first, then the tail-end distributaries, and finally the head and middle distributaries.

Water issues in D4/305. The first water issue of the season in D4 was on 9 May; however, water was flowing in the branch canal during the week prior to this date and was tapped at various times by farmers eager for water. On 3 May, a bethma farmer from turnout 5 opened the distributary gate in order to irrigate 1/8 *acre* (0.05 ha) of chili. He had previously requested the Unit Manager to issue water for his chili, but the request was refused as it was not practical to issue water for a single farmer. As water was flowing in the branch canal from a leak in the sluice gate, the farmer decided to take action on his own. The gate was closed later that day.

By 7 May, the Unit Manager recommended that water be issued but there was not enough water in Kalankuttiya Tank. Finally on 9 May, a short (3-day) water issue was given for those farmers who needed it, particularly those who had planted chili. Within the 19-day period from 9 May to 28 May four water issues were given to D4, all made at the request of farmers with priority given to fields of young chili and for fields ready for planting. While the timing of rotations within D4 was responsive to farmer demands, the rotations in the branch canal were made on the basis of rainfall. Thus, the Unit Managers made requests for water at the distributary level on the basis of demands from the farmers. As long as water was available in the branch canal the Irrigation Engineer at the block level tried to accommodate the Unit Managers' requests.

The fifth water issue was also made without any formal distribution plan. Following the fourth water issue, the sluice gate was not completely closed and water accumulated in the branch canal and was released to the distributaries as requested by the Unit Managers. Thus, there was no sharp break between issue 4 and issue 5.

Within D4, all five turnouts received water simultaneously during each issue. Within each turnout there was no systematic water distribution. Farmers made informal arrangements among themselves to deliver the water to their fields. The results were a relatively long period for everyone to take water and a generally high water duty. During the first five issues there were several cases of unauthorized openings of the distributary gate, particularly by farmers in the tail-end turnout.

NEW PLAN FOR WATER ROTATION

The difficulty of issuing water to the scattered type of cropping pattern, which the management faced under the existing delivery pattern was identified during discussions between IIMI staff and Mahaweli officers from Kalankuttiya Block. Therefore, a decision was made to experiment with a new water-delivery plan for the D4 distributary which might serve as a model for the other 19 distributaries in Kalankuttiya Block. The major change from the previous delivery pattern was the maintaining of one-cusec (0.0283 m^3/s) flow at each turnout which is more familiar to farmers, Depending upon the number of allotments in the turnout the duration of flow into the turnout would vary. Therefore, the staggered type of water distribution was required. In this way, each turnout would receive the same duty.

The rotational plan for D/4 was developed by the Irrigation Engineer with the assistance of IIMI staff. The plan was discussed and confirmed at the meeting held prior to the sixth water issue which was attended by the Unit Manager, the Irrigation Engineer, and IIMI research assistants. The plan was then communicated to the farmers through the distributary representative and turnout leaders.

According to the plan, D4 was to be supplied with three cusecs (0.0849 m^3/s) for 2.5 days. During the first day, the three head-end turnouts (T1, T2, and T5) would receive water, and on the second day turnouts 2 and 5 would continue with the addition of the middle turnout (T/4). On the third day the tail-end turnout T/3 would be the only turnout receiving water for half a day.

This plan was implemented with the beginning of the sixth water issue. As agreed first-day issues were made only to TOs 1, 2, and 5. IIMI field staff helped to monitor the flow with the assistance of an irrigation laborer. At about 8.20 pm on the first day it was possible to reduce the TO 1 flow and open the TO 4. In To 1 two farmers shared water to overcome the difficulty they had in getting water through smaller pipe outlets. But in TO 2, as usual, one farmer used the entire flow at a time. In the case of TO 5 which has two sub-FCs farmers practiced a different sharing system. In one sub-FC a head-to-tail sharing system with one farmer at a time was implemented, while in the other sub-FC a tail-to-head system with two farmers at a time was practiced. Therefore, in To 5 three farmers were irrigating at the same time. This practice was difficult to change as farmers were reluctant to deviate from it. On the second day of the issue some farmers from the TO 3 upset the schedule by taking water irrespective of their turn. This resulted in decreasing the flaw to other FCs which continued till the closing of TOs 2 and 5. On the third day at about 10.00 am the Irrigation Engineer visited D4 to observe the results of the new rotation system. After discussions with To leaders and farmers he realized that all the farmers could complete irrigating by about midnight 12.00 pm., and therefore gave

instructions to close the DC at midnight. By 11.30 pm the irrigation laborer closed the distributary gate.

However, two farmers from TO 4 (allotment Nos. 558 and 548) complained about incomplete irrigation and on the following morning the distributary canal was kept open for 2.25 hours with a flow of 40 liters/s (0.04 m^3/s).

At the end of this issue, it was observed that 305 D4 had used 68 mm of water, while the five TO areas had received between 28 and 59 mm. The TO leaders, except the leader of TO 3, and the DC representative were satisfied after this issue because they faced less problems in distributing water. The leader of the TO 3, however complained that he had not received the normal flow of water since other TOs had been taking water on the third day of the issue which should have been reserved for TO 3.

Following the discussions held with the IIMI senior scientists and the Irrigation Engineer, a rotational schedule, as for D4, was prepared for all the distributaries in the Kalankuttiya Block before the seventh issue.

The new rotational schedule was to be implemented at the time of the seventh water issue (22 July). However, the distributary remained opened for four days instead of the intended three, with all five turnouts flowing during days 2-4, resulting in lower flow to each turnout. In *some* cases, the farmers reopened a turnout after it had been officially closed (e.g., turnout 1). At the end of the fourth day of water issues, farmers had still not completed their irrigation, but the Irrigator finally closed the distributary. Farmers pointed out that their fields required more water because of the extended rotation cycle.

Prior to the 8th water issue, the amount of water delivered to each turnout during the 6th and the 7th issues were analyzed and it was observed that there was yet an oversupply. Agreement was therefore reached to reduce the flow in the DC to 2.0 cusecs (0.0566 m^3/s) on a trial basis. By increasing the duration of the rotation the number of turnouts opened at any one time could be reduced to two. On the eighth water issue, T1 and T2 were supplied water on day one; on the second day, turnout 1 was closed and turnout 5 opened, while turnout 2 continued to receive water as scheduled. However, farmers of turnout 1 reopened the turnout gate and continued to take water until the afternoon of day 2. On the third day, the rest of the turnouts (3 and 4) were opened. To meet the demand of the three turnouts, the Unit Manager instructed the Irrigator to increase the flow into the distributary and the duration of the flow was increased to a total of five days.

A significant action taken by the Unit Manager was to ask turnout leaders to record the starting and closing time of irrigation for each allotment within the turnout. The purpose was to gain an understanding of farmers' behavior in order to plan a more effective rotational schedule. Unfortunately, the farmer leaders neglected this assignment by the middle of the water issue. Following the eighth water issue, it became clear to the UM that a three-day water issue would not be sufficient unless the flow to the distributary were increased.

Beginning with the ninth issue, the Irrigation Engineer issued three cusecs (0.0849 m^3/s) to the distributary and the old rotational plan by which three

turnouts would take water a time was adopted. Thus, on the first day, the three head-end turnouts (T1, T2, and T5) took water. On the second day, T1 was closed, and T4 was opened, while T2 and T5 continued to be open. However, on the third day, these three turnouts continued taking water as they had not completed their irrigation. The tail-end turnout (T3) had to wait until the fourth day to irrigate, and continued irrigating into the fifth day. Thus the ninth water issue lasted nearly two days longer than planned.

During the ninth issue, it was observed that significant quantities of water flowedunutilizedinto the drainage channels, Distribution was difficult as each farmer tried to take as much water as possible, because they were uncertain as to when the next issue would take place. The ninth issue had followed an eleven-day "off" after the eighth issue.

The tenth issue started ten days after the ninth issue. A new rotational schedule was adopted by which the tail-end turnout (Turnout 3) received water on the first day with all other turnouts, except turnout 1, closed, The UM agreed to this at the request of the T3 Farmer Leader. When T1 finished irrigating, T4 was opened, and when T3 had finished irrigating, T5 and T2 were opened. By the end of the third day of the issue, the UM closed the distributary gate as scheduled in spite of numerous complaints by farmers who had not completed their irrigation. As a result, the distributary gate was opened illegally by the farmers.

The eleventh water issue began twelve days after the tenth issue, and followed the pattern of rotation. This time, all head-end turnouts were kept closed until water had reached the tail-end (T3) as it takes a long time for water to reach the tail, when the head-end turnouts are opened. This water issue lasted four days, and was repeated for one hour on the fifth day to give water to one farmer in turnout 2 who had not finished his irrigation.

The twelfth water issue began thirteen days after the eleventh issue. The same rotational pattern was followed on the first day with T1 and T3 receiving water. However, T2 was opened on the night of the first day, and on the second day all turnouts except T4 were opened simultaneously. In the afternoon, T3 was closed and T4 opened. Again, three days of issue was not sufficient and the water issue continued until the branch canal itself was closed on 24 August. When'thebranch was reopened after two days T4 again received water until all farmers had completed their irrigation. Thus, the twelfth water issue had a total duration of 6 days.

The thirteenth and last issue began twelve days after the twelfth issue. Again, the same rotational pattern was followed with T1 and T3 taking water on the first day. Turnout 2 was opened on the evening of the first day. By the morning of the second day, 4 turnouts were receiving water. During the 3rd, 4th, and 5th days of this issue 3 turnouts received water simultaneously.

Water Distribution Within Turnouts

During the first five water issues there was no rotational plan for the turnouts within D4 and all turnouts took water simultaneously. Priority among the farmers was given to those planting chili since water was considered to be most critical for them. At the same time, because of rainfall during this period the demand among other farmers for irrigation water decreased. In general, the supply of water was more than adequate to meet the demand and at times surplus water flowed into the drainage channels. If the supply was not adequate the distributary gate would be opened illegally at night; this happened once during the first and sixth issues.

By the fifth water issue, farmers' demand for irrigation water exceeded supply. The result was that two or three farmers were attempting to share an inadequate flow for their chili plots. Meanwhile, rice farmers in the tail end (Turnout 3) were in the stage of land preparation and needed more water. They opened the regulators in the distributary to allow water to flow to their turnout. The result was a lowering of water level in the channel and greater difficulty for upstream farmers to irrigate.

The unsystematic sharing of water resulted in long water-issue periods, with farmers still not able to irrigate their fields. From the sixth issue onwards, when rotations were implemented among the turnouts in D/4, rotations were also implemented within each turnout. In the head-end turnout (T1) two farmers took water simultaneously to overcome the constraint of small (4- inch) pipe outlets. In turnout 2, each farmer took the entire flow in turns, as they had done in previous seasons.

Within turnout 5, where there is a bifurcated field channel, each sub-channel used a different distribution pattern. One sub-channel followed a tail-end to head-end rotational sequence, with two farmers taking water simultaneously; the other sub-channel practiced a head-end to tail-end sequence with each fanner taking water individually. Thus, in turnout 5, three farmers were receiving water at the same time.

In turnout 4, where there are similar sub-channels, one sub-channel was blocked in order to give the full flow to the other and vice-versa. There was no systematic distribution arrangement in turnout 4, but only one farmer took water at a time as arranged informally with his neighbors. In the tail-end turnout (T3) there was also no formal distribution pattern; rather, farmers made their own arrangement, sometimes taking water individually, and sometimes two farmers taking water at the same time.

A water conflict over rotational times occurred during the eighth water issue when, on the evening of the third day, three allotments (542, 547, and 540) within turnout 5 were receiving water simultaneously. This situation arose in part because of the number of farmers cultivating and irrigating a single allotment.

Towards the end of the season the majority of fanners took water for longer periods than their scheduled time. One farmer in turnout 2 took water for 15 hours to irrigate his 2-acre (0.81 ha) chili crop. Another farmer in the same

turnout irrigated his 1.5-acre (0.61 ha) chili crop for 10 hours, while a third farmer irrigated a one-acre (0.4 ha) chili crop for 8.5 hours. In turnout 5, the two farmers (bethma and owner) of one allotment irrigated for a total of 19 hours for 2 acres (0.81 ha) of chili and 0.5 acre (0.2 ha) of rice (11.00 p.m. 23 August to 10.50 a.m. 24 August). A farmer in turnout 4 irrigated 1 acre of chili for 12 hours.

During the last scheduled issue (No, 12), farmers took excess water in order to satisfy their own perceptions, rather than the needs of the crop. Some farmers took extra water outside of their turns; for example, rice farmers in turnout 4 made a hole through the concrete lined channel to take water continuously whenever water was flowing in the turnout. Another technique was to store water in chili plots using very high bunds and using this water to irrigate other fields adjacent to the chili plots. One farmer in Turnout 2 used a PVC tube, being utilized by IIMI for water-table measurements, to make an illegal outlet through the bund of the field channel to irrigate his rice fields at night. A farmer in turnout 1 used the technique of field to field irrigation to irrigate all his plots at once. One farmer who was encroaching in turnout 2 made a practice of irrigating at night when there was less competition for water.

Farmers routinely opened and/or adjusted turnout gates. One farmer who had been given a key by the DC representative to close the turnout gate did so as scheduled, but later reopened it. During the last issue, a relative of the DC representative who was bringing the key to him used the key to further open the gate to turnout 2 to increase the flow. One dispute in turnout 4 resulted in injury, when one farmer attacked another with a mamotti (hoe) during the last water issue. Because of water scarcity at this time, tempers were especially high.

Meetings between Officers, Farmers, and IIMI *Staff*

Under the new rotational plan, feedback information regarding each water issue was discussed in post-issue meetings at the Unit Manager's office, and incorporated into the plan for the next water issue. IIMI research staff measured water flows at the turnouts and recorded farmer behavior through interviews and observations. The meetings were attended by the block-level irrigation engineer, the Unit Manager, the KVS, and IIMI research staff. Later in the season, the distributary representative and turnout leaders were also invited to these meetings.

In one such meeting, the turnout 3 leader proposed a change in the delivery pattern to prevent excess use of water by farmers in his turnout, He explained the difficulties he faced in satisfying the needs of farmers from this tail-end turnout who had to wait until the third day of issue before they could irrigate. As a result of his proposal, the pattern was changed in agreement with the other farmer leaders and water was sent first to the tail end (TO 3). When the farmer leaders (turnout leaders and the DC representative) began attending the meetings towards the latter part of the season, the discussions were focused more on problem-solving, because the farmer leaders had specific difficulties to report as well as specific suggestions for the next water rotation.

In another meeting, turnout leaders suggested that an open meeting be held within the command area inviting all farmers to participate in the discussion. This suggestion was accepted by the management and an open-air meeting was held in 305 D4. About 25 farmers attended the meeting which demonstrated the feasibility of farmers' participation in management decisions. During the meeting, farmers exhibited a degree of technical knowledge about crop-water requirement of various stages of the growth cycle to the surprise of both the project officers and IIMI research staff. Based on their experience, farmers confidently stated that they preferred cultivation of only OFCs for the dry season. They were confident that they could effectively manage deliveries for OFCs on the well-drained and imperfectly drained soils, and they were able to come up with a reliable and workable calendar for future yala seasons in respect of the first issue in April and subsequent rotations.

Reaction to the Plan

The new plan of water rotations was developed by the Irrigation Engineer in Kalankuttiya Block in consultation with IIMI staff. The plan was accepted at the outset by both farmers and other block officers, but during implementation their full support was not always forthcoming.

Some farmers were concerned that the new plan would set a precedent for future water-distribution patterns giving them less water than they had grown accustomed to. Since they were well aware that their individual water issues were being timed by IIMI field staff, they tried to take as long as possible to establish future precedents in their favor. Some farmers complained that their rotational times were being cut short (in successive water issues) because of errors in measuring the actual time they required to irrigate. However, these same farmers agreed that they had less trouble with water distribution under the patterned rotational system.

The reaction of the officers at the end of the season reflected a similar concern that the new pattern gave farmers less water than the old system. However, one Unit Manager commented that since farmers engage in a variety of cultivation activities, of which irrigation is only one, a rigid water schedule of the type practiced under the new plan cannot work in the long run; farmers need more flexible irrigation timings.

PROBLEMS IN IMPLEMENTING THE NEW PLAN

Under the new rotational plan, the major change from the previous pattern was that a minimum one-cusec (0.0283 m^3/s) flow was delivered to each field channel for varying periods of time depending on the number of allotments within the field channel. Under the old system, flows in the field channels were often less than one cusec (0.0283 m^3/s), but the water was available for longer periods as there was no rotation among field channels. In implementing the new plan both farmers and agency field staff faced a number of new problems.

Physical Problems

Farmers readily accepted the new delivery pattern since it provided them with a full cusec of water. However, *some* farmers had difficulty delivering the water through field-channel outlets which were of insufficient size to accommodate a full cusec. Moreover *some* division boxes along the field channels were too small to accommodate a one-cusec flow, For example, in turnout 1 farmers had to divide the flow upstream from the division box *so* that two allotments were irrigating simultaneously. For one farmer in this section of the field channel (allotment 533) even this measure was inadequate as his 3-inch pipe outlet was unable to accommodate even a half- cusec flow. His solution was to cut the bund of the field channel to form an additional outlet.

At the level of the distributary, the control structures were also a constraint, as they could not be closed completely. Carrying out the new water pattern required that the distributary be completely closed just below the turnouts that were opened. Because of missing gates or improperly constructed gates, however, a temporary seal had to be made using banana leaves and straw to block the water. These materials were easily removed either by tail-end farmers, or in *some* cases by children who bathed in the channel.

The long conveyance distance between the distributary channels and the irrigated fields was a particular problem during this bethma season, because selection of bethma land was made on the basis of soil type, rather than its proximity to an irrigation channel as in previous seasons. Some farmers were cultivating plots far from the irrigation channel. An example was a farmer in turnout 4 who had a bethma plot at the very end of the channel separated from other fields by two abandoned allotments. In order to irrigate his field, he conveyed the water through uncleaned portions of channel (the cleaning of which were the responsibility of his neighbors) resulting in considerable water loss.

In sending water to the tail-end turnout (T3) first, a practice which began with issue 10, up to three hours were required for water to travel the length of the distributary. For example, during the 12th water issue, the distributary

gate was opened at 8.00 a.m. and water reached Turnout 3 at 11.30 a.m. In this case the water was delayed as turnout 1 also received water beginning at 8.45 a.m.

Confounding the physical problems of conveying water along an extended distributary was the human problem of opening and closing turnout gates. Although turnout 3 was intended to receive water first, in practice, the Unit Manger's field assistant opened all the turnouts scheduled for irrigation on a particular day simultaneously in order to save time to go to other distributaries and open gates there. Thus, on the 10th water issue in D4, the distributary gate was opened at 9.05 a.m. and water reached the head-end turnout (T1) at 9.15 a.m. In theory, this turnout gate should have remained closed until the water had travelled all the way down the distributary into the tail-end turnout (T3). However, the field assistant opened both turnouts at the same time, as soon as water had reached T1, thus slowing the water flow to T3 where it reached at 11.15 a.m. Farmers often cited this behavior on the part of the field assistant as a justification for taking extra time in irrigating their allotments.

The size of plots (bunded fields) also contributed to the long time required for irrigation. The normal irrigation practice for chili is to flood the entire plot and then break the bund allowing the water to flow into the next plot downstream. Large plots took a long time to fill as they tended to be quite deep.

Finally, the extension of the rotation cycle because of dry weather also aggravated the problems of implementing the new irrigation pattern. Because of the uncertainty of the next irrigation, farmers stored as much water as possible in each plot before sending it to the next plots slowing the water rotation and consuming extra water.

Behavioral Constraints

Following issue No. 6, the first issue under the new pattern of rotations, both farmers and officers expressed satisfaction with the new pattern. At the same time, however, concern was expressed that the new pattern might be used to establish future policy. For example, one farmer in turnout 5 explained that he had made a deliberate effort to take a long time for his irrigation in order to stake a future claim for a longer duration. A number of farmers pointed out difficulties in irrigating their particular type of soil, the unevenness of their land, and other difficulties which justified their slowness in irrigating their fields.

The next water issue (No. 7) of the new water-delivery pattern required 4 days to complete instead of the intended 3 days. The extra time can be attributed to the slowness of the individual farmers, each attempting to ensure that a favorable precedent would be set. Based on the experience of the seventh issue, the Unit Manager changed the pattern for the eighth issue, giving water to only two turnouts at a time and reducing the flow in the distributary to two cusecs. This pattern required even more time to implement; issue 8 lasted 5 days. For the next issue (issue 9) the Irrigation Engineer decided to return

to the original plan used in the sixth issue. In each of these issues, the total volume of water consumed was gradually increased.

Rice farmers contributed to another set of difficulties in implementing the plan for water distribution. The dominant strategy for irrigating rice was to irrigate indirectly by over-irrigating chili plots just above the rice fields, and then allowing the water to flow into the rice fields, Since rice requires significantly more water than chili, but at a slower rate of flow, the relatively fast rotations that were scheduled could not be adhered to, and the entire water schedule for the particular issue became delayed.

The pattern of water rotations within the turnout broke down when several farmers tried to take water at the same time. The extended intervals between water issues contributed to the eagerness of farmers to apply water to their water-stressed crops. Another factor in not adhering to the water schedule was that the full cusec ($0.0283 m^3/s$) of water available was more than farmers could easily handle, and *many* farmers preferred to divide the flow with at least one other farmer. In some cases, as many as four allotments received water simultaneously in one turnout.

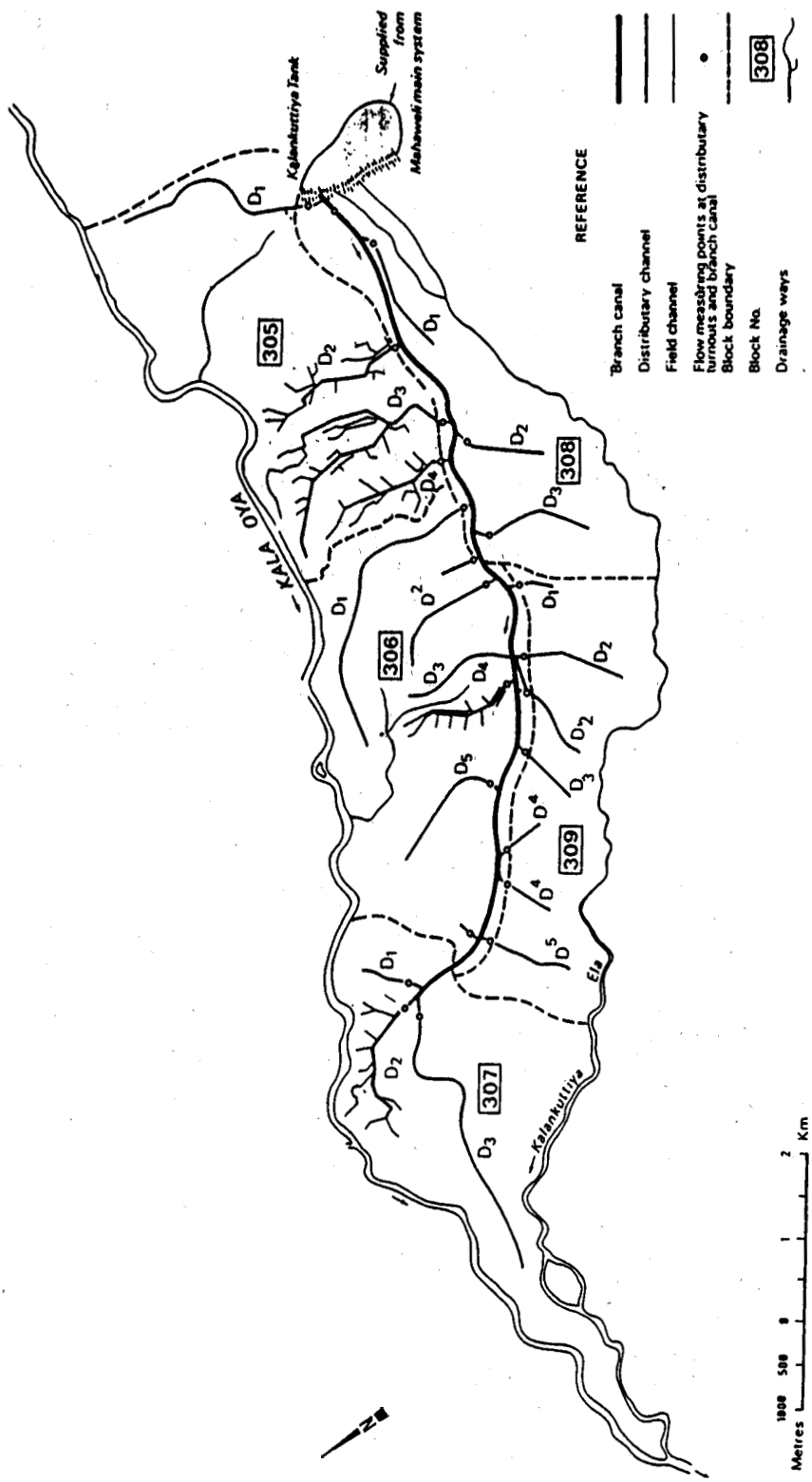
The last four water issues of the season (issues 10, 11, 12, and 13) were particularly problematic because of the uncertainty about the timing of the next issue. Each farmer attempted to capture as much water as possible for his own fields, not knowing when he could expect water again. The result was that the farmers who followed the rules and regulations were deprived of their water rights. The negligence of officers in protecting the rights of these individuals was mirrored in the negligence of farmer leaders in their water-distribution responsibilities.

CONCLUSIONS

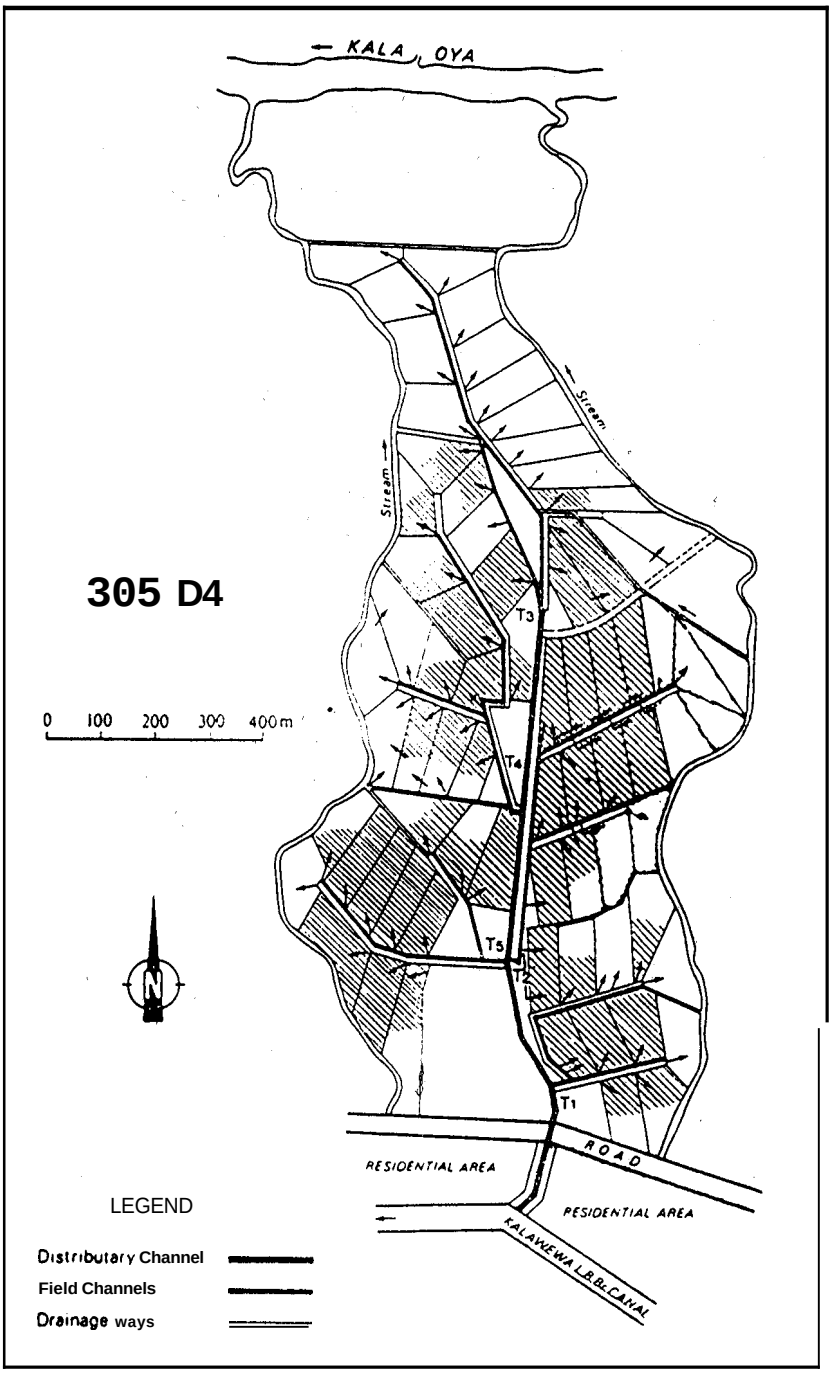
The basic water-management principle underlying the yala 1987 research in Kalankuttiya Block was the practice of rotations within the distributary. The basic management principle employed was information feedback to farmers and project officials, and between farmers and project officials. The information included measurements of water flow and duration, deviations from the intended pattern, and the attitudes of farmers, and farmer leaders.

This report has documented how the rotational plan was carried out, and the management role of farmers and agency staff in implementing the new plan. A recurring problem of group irrigation is that the individual places his own interests above that of the group. For example, individual farmers who took as much water as they could caused delays and disruption in the water-rotation schedule. The type of rotational plan introduced during the 1987 yala requires strong organizational capacity at the farmer level in order to attain maximum effectiveness. To this end, a new approach to farmer organization in Kalankuttiya Block is needed. Farmer training at the group level may be part of the solution, but the implications extend to the realm of Mahaweli Authority policies for recognizing farmer. groups, and for utilizing them in both maintenance contracts and water distribution.

MAP 1 - Kalankuttiya Block of System H.



MAP **2** - **Distributary 4 in Block 305, showing sample** bethma **aea duing** yala **1987.**



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