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The concept of an irrigation "system" refers not only to physical aspects -- irrigation channels, control structures, etc -- but also the management structure which plans, designs, constructs, and operates the physical system. Improving the performance[2] of an irrigation system requires attention to both the physical as well as the managerial components. In recent years, various measures have been attempted to improve irrigation performance through management innovations that place greater responsibility on farmers, while providing an organizational structure whereby farmers' own management capacity can complement the work of the irrigation agency.

This paper discusses two cases of "joint management" between farmers and agencies: The first case is that of Dewahuwa Scheme, where the irrigation system is under the jurisdiction of the Irrigation Department (ID). A Project Manager (PM) from the Irrigation Management Division (IMD) coordinates the management tasks of the ID and other line agencies (e.g., Department of Agriculture, Department of Agrarian Services and the Land Commissioner's Department), and serves as a link between a new cadre of Farmer Representatives (FRs) and project management. The second case is that of the Kalankuttiya Block of Mahaweli System H where the management structure of the of the Resident Project Manager (RPM), Block Manager (BM), and Unit Manager (UM) rests finally upon the shoulders of farmer representatives at the level of the distributary (DC-Reps) and field channels (FC-Reps).

BACKGROUND

Field research in Dewahuwa and Kalankuttiya was started during the 1985 Yala season by staff from the International Irrigation Management Institute (IIMI) [headquartered in Digana Village, near Kandy]. The primary focus of study was to understand the effects of irrigation management on crop diversification from paddy to other food crops (OFCs) such as chilli, green legumes, soybeans, and onions. Two IIMI research assistants, an agricultural engineer and an economist, were assigned to each system to collect data on water flows in the D-channel, F-channel, and allotments, and to monitor agricultural inputs and yields. They were joined by a social science research assistant for Maha 1985/86 whose role was to identify organizational constraints to the more careful management required for irrigating OFCs. Data collection continued during Yala 1986, and again during Yala 1987, when the researchers worked closely with staff from the respective agencies to develop new approaches to water scheduling within the D-Channel, which could be implemented jointly by agency field staff and farmers. This paper is based primarily on data collected during the 1986 Yala from a 100% sample of farmers in two turnouts in Dewahuwa Tract 5, and one turnout of Mahaweli H2, D-4, supplemented by data from an extensive sample of farmers drawn from five tracts in Dewahuwa and five D-channels in Kalankuttiya block. The number of farmers in the intensive samples were 60

and 29, and for the extensive samples, 97 and 100, for Dewahuwa and Kalankuttiya respectively.[3] Data from the 1987 Yala season are also incorporated into this paper, although analysis is still preliminary.

Dewahuwa Tank

Dating to the 3rd Century AD, Dewahuwa tank had been abandoned for centuries when it was reconstructed in the 1950s as a settlement scheme. Farmers were allotted 2 ha parcels of irrigated land plus 1.2 ha "highland" plots near the command area. Subsequent subdivision among family members and/or mortgages and hidden tenancies have increased the total number of cultivators threefold. While most household economies remain primarily agricultural, many of the second and third generations rely on rainfed agriculture outside the scheme, supplemented by off-farm employment.

Physical Structure. The physical layout of the scheme comprises a large tank covering 392 ha feeding a single main canal from which distributary channels take off on one side, to serve an actual command area of ca. 1200 ha (expanded by encroachments from the planned 944 ha). The highland residential area extends along the right side of the canal (see Map 1). Each take-off point from the main channel to a distributary, or from a distributary to a Field Channel, is controlled by a gate which, in theory, is opened or closed only by an Irrigation Department worker. In addition, some allotments are hydrologically independent, receiving water directly from the main canal, or from a distributary.

Organizational Structure. Under the IMD's Integrated Management Structure (INMAS) program, farmer organizations have been instituted in Dewahuwa at the level of the project and the sub-project, but not at the distributary or field-channel levels. Both the project committee and the two committees at the tract level (Tracts 1-7 and Tracts 8-9 which meet together) provide interaction among Farmer Reps, and between the Farmer Reps and project officials, particularly the TA and the Project Manager. The role of the Farmer Rep is recognized both legally, through the Agrarian Services Act, and practically, as evidenced by the level of payment (roughly 75%) of owner farmers to their respective FRs. However, the effectiveness of FRs varies a great deal depending upon their individual leadership abilities and their dedication to their poorly paid positions. A major constraint to the FR's management effectiveness is the high proportion of cultivators who have a temporary relationship with the landowner through a lease, mortgage, or ande agreement. These cultivators tend to feel they do not have a right to seek help from the FR; in the Intensive sample, only 12% of all farmers had received the FR's assistance during the season.

The farmers in one "turnout group" under the guidance of one FR, do not necessarily comprise a hydrological unit; rather, the boundaries of turnout groups are defined as spatial subsections of the total system, which may include part or all of one or more F-channels, as well as direct-issue turnouts from the distributary, or even the main canal. Farmers within a single F-channel have no designated leader other than the FR, who may have obligations in other F-channels as well. As a result, farmers are more or less on their own to distribute water within the turnout. No formal arrange-

ments for water distribution were observed within the turnout. Tail-end farmers often resorted to night irrigation, and sometimes made temporary and informal arrangements with field neighbors for this purpose.

Kalankuttiya Tank in Mahaweli, System H

Prior to construction, much of the 27,000 ha which comprise the irrigated area of System H was jungle, with scattered villages based on irrigated agriculture from village-owned and managed small tanks, and chena plots. The new canal system and associated land development obliterated many of these tanks, and incorporated others into on-line reservoirs of which Kalankuttiya Tank is one. Settler families who had previously owned land within the tank command, as well as families from outside the region were alloted 1 ha parcels of irrigated land and 0.2 ha for house plots and gardens.

Physical Structure. The physical layout of the residential plots and the irrigation canals in System H reveals a highly regular pattern. The Kalankuttiya branch canal which serves the research area feeds 20 DCs (see Map 2), which take water to field channels (FCs), from which water flows through 4-6" concrete pipes into the individual 1 ha plots. Unlike the case in Dewahuwa Tank, there are no fields fed directly from the Main Canal or from the DCs. Each field, and each farmer, is part of a larger irrigated unit defined by the field channel and comprising between 7-15 allotments, most of which (68%) are farmed by the original allotees or close kin.[4]

Organizational Structure. The nominal leader of each FC unit is a "Farmer Rep" selected by the farmers and/or the UM. At the level of the Distributary, (74 allotments in sample distributary) there is a "DC Rep." Both levels of farmer representatives are intended to mobilize labor within their respective units to clean the water channels and enforce water rotations as needed. Neither the DC Rep nor the FC Rep receives any salary, nor has either pattern demonstrated real authority. The actual role of the farmer leaders centers on reporting to the UM about conditions in the field, rather than taking direct management action. One third of the operators sampled did not even know who the Farmer Rep was, and half were not aware of the DC Rep.

Irrigation management at the D-channel level is primarily in the hands of the UM, who is also responsible for many other development activities including agriculture, land matters, marketing, credit and community development. In order to distribute water among the approximately 250 families in his unit, which comprises three separate D-channels, the UM is assisted by a Field Assistant (FA), a salaried employee who reports directly to the UM. At the Block level, an Irrigation Engineer calculates water supplies along the Kalankuttiya branch canal, to feed the 20 distributaries. An engineering assistant supervises the Irrigator (a casual laborer) who actually opens and closes the distributary gates. The Irrigator meets the UM each morning of water issues and either makes adjustments on the spot in response to the UM's needs, or transmits the information to the engineering assistant at the block office.

WATER DISTRIBUTION

In both irrigation schemes, the turnout gate from which water flows from the Distributary to the Field Channel demarcates the management division between the government agency (Irrigation Department, or Mahaweli Authority) and farmers. In general, the agency controls the turnout itself, and the agency employee who makes adjustments to the gate is responding to orders from above, not from farmers. In both Dewahuwa and Kalankuttiya, however, this boundary between the agency and the farmers has begun to shift slightly. During Yala 1987, FRs in Dewahuwa, and DC Reps in Kalankuttiya, took over some of the tasks of adjusting the Field Channel gates. This section describes the water distribution practices observed during Yala 1986, and discusses the changes that took place during Yala 1987.

Dewahuwa

Plans for yala water issues, rotations, and bethma divisions begin at the end of the preceeding maha season, with the pre-kanna meeting. Farmer Reps, but not regular farmers, participate in the Tract Committee and Project Committee meetings that lead up to the pre-kanna meeting. Any farmer can participate in the pre-kanna and kanna meetings. Although the project officials have a definite plan which they take to the farmers at the pre-kanna meeting, there is scope for revision. The yala 1986 water plan which finally emerged reflected some compromises regarding which allotments would be included within the 50% bethma area (e.g., extending the irrigated area further towards the tail than project management had proposed, in order to reduce the distance between tail end farmers and their bethma allotments).

Plans for the start of water issues were not adhered to, because of early rains. The issue date for land preparation was advanced from May 1 to 4 April, which unfortunately coincided with New Year festivities. During the growing season, water rotations were attempted within distributaries, in order to deliver equitable supplies to tailend turnouts, but for various reasons were not implemented successfully. One problem was unclear jurisdiction between the Irrigator (an employee of the Irrigation Department) and the FRs. In general, the Irrigator has greater authority than the FRs, but has no direct control over them. Within F-channels, farmers were on their own, with only sporadic assistance from FRs. In spite of the absence of any formal organization at the F-channel level, farmers were successful in obtaining water either through passive acceptance of what was available to them, or through direct action during the night, particularly in the case of some tail-end farmers. Within the allotment, the cultivators of the owner's portion generally had priority over the bethma partners; again, these arrangements were worked out individually.

During the 1987 Yala, the Project Manager asked FRs to take responsibility for adjusting the turnout gates within their areas. Since only 20% of the area could be included in the bethma area (due to the extremely low tank level), there were many more farmers than normal cultivating within a confined area, and fewer F-channels receiving water (only the head-end tracts). Thus, project management (the PM and the TA) was able to give greater attention to the performance of the FRs in carrying out

their new responsibilities. IIMI research staff assisted in the effort by providing feedback on water deliveries along the F-channels, and also monitored farmer behavior and attitudes. Meetings among the PM, TA, IIMI research assistants, and FRs were held just after the water issues to review the performance of the irrigation system generally, and the role of the FRs in particular. Water rotation schedules were then decided for the next water issue, so the FRs would know when and how much to open their respective turnout gates.

Kalankuttiya

During Yala 1986, the UM instructed the FA on a daily basis (during water issues) which turnouts to open and how much, for each of the F-channels within the three D-channels in the unit. All turnouts along the distributary received water simultaneously for the first day or two of the water issue. Since farmers were supposed to rotate water within the turnouts on a 6-hour basis, the expectation was that as the smaller turnouts (which range in size from 7 to 20 ha) received enough water, they would be closed. In general, adherence to the prescribed 6-hour rotation was the exception rather than the rule, although other types of rotations were adopted in some turnouts. When following a 6 hour rotation, some farmers found it necessary to cut the field channel bund, as they could not get the full flow of water through their pipe outlet.

In the sample distributary, the DC Rep did not make adjustments to the turnout gates, although he had a key. If farmers appealed to the DC Rep for more water to a particular turnout, he would transmit this appeal to the UM, rather than act on his own authority. In actual practice, farmers who felt they needed more water usually appealed directly to the UM, or in some cases, to the FA. Farmers also made informal arrangements among themselves; for example, a woman operator who lived one mile away used to get water from another farmer during the day time due to the difficulties of coming to the field during her assigned rotation at night.

The organization of water distribution during the following Yala season (1987) was marked by several differences. A rotational plan was developed by the block irrigation engineer, in consultation with IIMI staff, by which no more than three, and usually only two turnouts would receive water at any given time. Before each three or four-day water issue, the plan was decided at a meeting of the UM, IE, and IIMI research assistants, who monitored the water flows. The plan was then communicated to the DC rep and the turnout leaders. Later in the season, they were also included in the meetings. With a definite water plan, the DC rep had greater confidence and authority to adjust the gates himself, without asking the UM. In effect, the UM had given his approval in advance, by agreeing to the rotational schedule. The result was that the DC rep and the Field Assistant shared the burden of adjusting turnout gates (each had a key), in accordance with the plan, and in response to farmer requests if these did not deviate significantly from the plan.

IMPLICATIONS FOR MANAGEMENT

In both irrigation systems, although the organizational structure differs, the general prescription for improved water use efficiency within the distributary is the same: equitable water deliveries to the FCs, equitable rotational schedules (taking into account variations in conveyance efficiencies and soil characteristics), and tighter adherence to rotational schedules. If these measures were carried out, the demand for water within the distributary would fall, and supplies could be reduced, or cultivated area could be increased. Ascertaining the amount of water that could be saved is one of the objectives of IIMI's research which must await final analysis of the water data. The general trend, however, is clear: more efficient water use will permit an increase in dry season cultivated area, and a corresponding increase in the production of dry season (and in particular, non-paddy) crops.

An organizational structure to support tighter water control would depend on expanding the role of agency staff, and/or greater involvement by farmers. The experience of the past few seasons, and particularly the 1987 Yala season, at Dewahuwa and Kalankuttiya, suggests that greater involvement by farmers is a feasible solution. Farmers can take on more management responsibility provided there is a management structure that gives them a role to play, as well as technical support and incentives to carry out that role.

In the two systems under study, there are nominal farmer "organizations" in the sense that farmers fill the designated role of Farmer Rep, but there is no involvement of farmers in group management decisions. Even channel cleaning is usually done by farmers individually and not as a group activity. Water is acquired by tail-end farmers not by discussing their problems with head-end farmers, but by blocking the inlets to those farmers' fields during the night, allowing water to reach the tail-end.

Promoting stronger farmer organizations at both the level of the field channel and the distributary would have as the primary objective to ensure the flow of irrigation information among farmers, and the cooperation necessary for equitable, secure water distribution. The formation of farmer groups would require a concerted effort to educate both farmers and the agency staff with whom farmers would now have closer contact, as the experience of Gal Oya (Perera 1986; Merrey and Murray-Rust 1987) has demonstrated. Operational changes, such as clear rotational schedules within the D-channel, and organizational changes at the agency level, such as post-issue meetings of agency staff and farmer reps, are important components of a total management package that give farmers joint responsibility along with the agency, for managing the irrigation system.

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NOTES

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2. "Performance" refers here to how well the irrigation system meets the objectives established for it, which could include crop production, water productivity, social equity, and/or other considerations.

3. The research methodology used varied somewhat in each season (Maha 1985/86, Yala 1986, and Yala 1987). For further details please refer to the reports listed in the References.

4. This figure refers to a sample of 56 operators from three FCs along one Distributary, during Maha season 1985/86. During the Yala season, the proportion of non-owner operators is generally higher.