IMCD News

Newsletter of the Research Network for Irrigation Management for Crop Diversification in Rice-Based Systems

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National Committees to Oversee Activities on Crop Diversification

On 14 December 1990, a memorandum of agreement was entered into by five national agencies of the Philippines to create a National Committee on Crop Diversification (NCCD) to spearhead a coordinated effort in the planning and implementation of a crop diversification program and related programs. Early this year, a committee of concerned personnel working in crop diversification in irrigated rice-based systems was formed in Nepal. A similar committee was formed in Bangladesh this March. With the formation of these committees and the ongoing work in the Farming Systems Institute in Thailand, the consensus reached during the last December Manila workshop of the desirability of having a national committee or some umbrella organization to oversee the activities on crop diversification in rice-based irrigation systems in each country of the Research Network is now being quickly realized.

While it is true that no standard objectives or rules were recommended, the features of the Philippines' NCCD are presented to be considered as a model and modified as needed by those countries that are in the process of or are thinking seriously of forming national committees.

The signatory agencies, namely, the Departments of Agriculture, Agrarian Reform, Science and Technology, the National Economic and Development Authority, and the National Irrigation Administration (NIA) recognized the following realities in the agriculture sector of the Philippines.

* agricultural production in the country is traditionally concentrated on a few main crops with rice dominating the crop sector.
* while there is a need to produce more rice to keep pace with the demand of an increasing population, limited water supply, especially during the dry season, constrains the farmers in fulfilling this need.
* the production of non-rice crops such as onion, garlic, peanut, corn, tobacco, cotton, mungbean, soybean and other vegetables and upland crops, offers opportunities for increasing the productivity and profitability of farmers despite limited water resources.
* crop diversification on producing non-rice crops as an alternative to rice, although not new in the

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country, is not widely practiced in most irrigated areas in the country.

Specifically, the Committee was therefore vested with the following functions:

1. The Committee shall coordinate the formulation, development and implementation of a comprehensive program on crop diversification in the country to include research, development, training and extension.

2. It shall facilitate the provision of necessary technical, financial and other support services for the implementation of the program.

3. It shall formulate and recommend policies promoting crop diversification and zonification.

4. It shall serve as the link between the national program and other related programs within as well as outside the country.

5. It shall perform other functions that may be necessary in the implementation of policies and programs on crop diversification.

The Committee is chaired by the Assistant Secretary of Agriculture for Research, Training and Extension. It is cochaired by the Assistant Administrator for Systems Operations of NIA. Its Vice-Chairman is the Deputy Executive Director for Research and Development of PCARRD. It has nine other members who are mostly Directors of research, planning and extension agencies in agriculture and two farmer leaders who are either presidents of farmers' or irrigators' organizations.

The Committee may invite the participants of other relevant international and local agencies/organizations. It is assisted by a Secretariat composed of representatives from the most concerned agencies. It derives its funding for operation and maintenance from the Department of Agriculture Special Budget.

The NCCD has already met thrice. Even before its formal creation, it met in November 1990 to discuss the preparation for the First IMCD Research Network Workshop held in Manila last December. The Committee actively participated in preparing the country report and in conducting the workshop.

The second meeting in February this year gave an opportunity for each member to get to know the outputs of the December workshop and the other plans of the Network as agreed upon during the Steering Committee meeting. The meeting also initiated the development of a program on irrigated crop diversification. A Technical Working Group (TWG) was created to prepare the program which was to be reviewed during the following meeting of the Committee.

The Committee met for the third time in April to review the initial draft of the program prepared by the TWG.

The next meeting has been scheduled for June 21, 1991 to rereview the proposal.

Plans for the 1991 Annual IMCD Research Network Workshop

With the theme, "Promoting Implementation of Crop Diversification in Rice-Based Systems," the Research Network will hold its second annual review and coordination workshop from 9 to 12 September 1991 in Yogyakarta, Indonesia.

The tentative program will see the workshop opening on the 9th with country reports focusing on the experiences and strategies of the different countries in promoting crop diversification in rice-based irrigation systems. Participants will be asked what measures have been and are being taken, how they are implemented, what have been the experiences so far, and what steps have been taken to alleviate the constraints.

Country reports will include presentations on Bangladesh, India, Indonesia, Malaysia, Nepal, the Philippines, Sri Lanka and Thailand. After coffee break on the 10th morning, a special paper will be presented and then the participants will split into small groups to deliberate on the presentations and discussions that follow bearing on Research and Development, Information and Dissemination, and Funding.

The workshop will reconvene on the 19th for small group reports and discussions. This will be followed by the workshop wrap-up. The afternoon will be devoted to a cultural visit to Borobudur. The following day will be devoted to field visits to view irrigated crop diversification activities in four different irrigation systems in Yogyakarta and also visits to places of cultural interest. After dinner the IMCD Steering Committee will meet to hold its third planning session.

Highlights of the 1990 Manila Workshop

Management Arrangements for Accommodating Non-Rice Crops in Rice-Based Systems

The workshop which was sponsored by the International Irrigation Management Institute (IIMI), the Philippine National Committee on Crop Diversification (NCCD) and the JICA-supported Diversified Crops Irrigation Engineering Project (DCIEP) of NIA, was held at the Diversified Crops Irrigation Engineering Center (DCIEC) at the NIA Building Complex at EDSA from 10 to 14 December 1990. Forty senior irrigation, agriculture and policymaking agency staff, and scientists/researchers representing the eight member countries of the Network participated in it. These countries are Bangladesh, India, Indonesia, Nepal, Malaysia, the Philippines, Sri Lanka and Thailand. Representatives from the JICA-NIA, and IIMI and the members of NCCD also attended the workshop. Secretariat support was provided by the Technical Working Group created for the purpose by NCCD. The workshop included both paper presentation and discussion and a field trip to Central Luzon. The second Steering Committee for the Network was likewise held during the week-long activity.

Opening Session

Administrator Jose B. del Rosario of NIA welcomed the participants. He emphasized the timeliness of the subject of non-rice crops in rice-based systems as the government has embarked on a nationwide agrarian reform program. He said that before a big program on crop diversification could be started it must consider the technologies appropriate for specific irrigation standards and management modes and agricultural production patterns; the locations suitable for certain crops under specific agronomic and climatic conditions and the presence of appropriate physical infrastructures; and the timeliness of implementing the program considering the economic viability and the availability of distinct support services. He also reiterated NIA's offer for DCIEC to become part of the IMCD Research Network in promoting crop diversification in the region.

In his keynote address, Assistant Secretary of Agriculture, Manuel M. Lantin shared some of the activities of the agricultural sector and current efforts on increasing production and farm profits as they relate to the theme of the workshop which is "Management Arrangements for Accommodating Non-Rice Crops in Rice-Based Systems." He said that irrigation and crop diversification are both proven to be indispensable tools to make agriculture in the Philippines a profitable venture. He highlighted some of the more notable programs which included crop diversification as a strategy. These include: The Asian Rice Farming Systems Network (ARFSN); Irrigation Management for Crop Diversification Project; Farming Systems Research and Development Project-Bicol (FSRDP-Bicol); and KABSAKA: the Rain-Fed Farming Systems Project. He likewise emphasized the need for economic infrastructures to cope with second generation problems like marketing and distribution of the increased output.

Country Presentations

In the country reports, the eight participating countries presented their experiences on irrigation management for rice-based cropping as these relate to planning, implementation, monitoring and evaluation at both the system and the farm level. Constraints and opportunities for crop diversification and activities related to research and development, information dissemination and funding were discussed. The direction which these activities are taking was highlighted.

Bangladesh

In Bangladesh, the agroclimatic conditions favor a rice-based farming system. Rice is the staple food and farmers will continue to grow rice to meet consumption demand. However, irrigated rice production is becom-

ing less profitable and growing non-rice crops such as pulses, oilseeds and vegetables with partial or full irrigation in the dry season has become a major strategy to increase farmers' income and improve soil fertility.

The most important factor that influences crop diversification is the economic incentives of farmers in growing non-rice crops. To promote crop diversification, institutional support is needed in terms of credit and price incentives for non-rice crops, back-up services from irrigation-related agencies, and storage, processing and marketing of non-rice crops. More research and development are needed in the field of irrigation water management and varietal development of both rice and non-rice crops.

India

India attained self-sufficiency in rice production during the early 1970s with the introduction of high yielding varieties and the extension of irrigation facilities. This has resulted in declining farmers' income and a need to diversify the cropping system to non-rice crops. These require changes in planning, water allocation, and operation and maintenance of irrigation systems. These changes need consideration of water control, agronomic and irrigation practices, economic risks, inputs, climatic requirements, socioeconomic constraints and institutional strengths. To address the above factors, strategies will have to be identified by undertaking research in terms of policy changes, and implementation of technical solutions to specific constraints. This could be carried out by ICAR institutions, agricultural universities and water and land management institutes in the country.

Indonesia

Irrigation management problems for crop diversification in Indonesia are considered minor, because the existing irrigation systems are developed and operated for diversified crops in rice-field areas. Although the problems are considered minor, they are very complicated and are deeply rooted in technical-socioeconomic interaction between irrigation management practices and the crop diversification farming system.

High opportunities for developing crop diversification and improving irrigation management practices can be gained by conducting a well-planned program and well-structured implementation of research. To accelerate development, program approach in technology transfer is suggested.

Malaysia

In Malaysia, the scale of current crop diversification on rice land is small. At the moment, there is no monitoring and evaluation in the operation of the irrigation system for diversified cropping. No major structural or managerial adjustments have been imposed on the system. Nevertheless, crop diversification has been successfully practiced. Minor adjustments that were enforced and which have potential application elsewhere include: 1) reducing flow to below FSL so that the canal can function as a drain as well; 2) deepening canal to increase storage for pumping and acquiring portable pumps to provide flexibility in water management by farmers; 3) having stable, reliable and predictable water supply to be augmented whenever necessary by farm ponds and tube wells at farm level; and 4) improving on-farm conveyance system by using concrete-lined canals or pipe system, complemented with regulating structures.

Malaysia is now gearing up for crop diversification in rice land. As this proceeds, it is expected to encounter complexities in irrigation management and production. The following strategies are adopted: 1) identification of suitable schemes within the non-granary areas based on water resource, physical condition, marketability, agronomic and socioeconomic criteria; 2) implementing pilot projects for representative schemes; 3) coordinated multi-agency implementation program with strong participation of farmers' associations in an integrated approach; 4) research and development on system design and management, socioeconomic aspects of farmers' organizations and production technology on rice land; and 5) collection of basic data and information to establish a comprehensive database on the non-granaries and rain-fed rice fields.

Nepal

Diversified cropping in the rice-based cropping systems in Nepal is not a new concept. It is probably more than a century-old practice in many parts of the country. This practice is partly due to farmers' diversified need for food grains and other essential farm commodities and partly due to the small and scattered/fragmented landholdings. The government's efforts to maximize cropping intensity and diversify cropping practices are

very much a felt need today. It is urgently needed to protect the environment and to increase the soil fertility by checking erosion and land degradation.

Philippines

In the Philippines, one factor identified which tends to promote the diversified cropping system is the inadequate water supply during the dry season. In the National Irrigation Systems (NISs), only 1 percent is presently devoted to the diversified cropping system out of an estimated potential of about 30 percent. Except those irrigation systems with vegetable production components, non-rice crops are still not considered in the planning of irrigation operations.

The programmed area for irrigation during the dry season has been based on predicted streamflows versus the calculated net operation of water duty.

Encouraging farmers to shift from rice crop cultivation to irrigated non-rice crop cultivation to help alleviate recurring water shortages is not yet extensively done due to know-how deficiency. Suggested research studies on water management for crop diversification deal with the generation and verification of more data on the planning, design and operation of irrigation systems. The characterization of the various factors that tend to hinder or promote crop diversification needs to be addressed.

Sri Lanka

Crop diversification in rice fields in Sri Lanka, especially in the Mahaweli Project areas, has developed because of the following reasons: 1) gradual banning of imports of subsidiary food crop needs; 2) higher economic benefits for farmers through higher net returns and cost-benefit ratios with better product prices of some non-rice crops; 3) water scarcities during the low rainfall season; 4) better extension services and improved communication between farmers and agency officials; 5) shortfall in non-rice crops to meet the growing needs of the population and the resultant price increases due to higher demand; and 6) institutional support for crop diversification mainly through greater interest generated for irrigated crop diversification among policymakers.

Thailand

The diversification of crops in Chao Phraya Project in Thailand during the dry season can be practiced in only a small portion of the project area as farmers are already too familiar with growing rice. Besides, most of the area is low-lying and has poor drainage. Even if the price of rice decreases, the farmers do not want to reduce the area devoted to rice. In attempting to diversify the area, the following should be considered: 1) production zoning to identify the area for diversification; 2) adjustment of the water allocation system to consider irrigation timing and drainage; 3) transfer of crop production and irrigation management technologies; and 4) coordination with other sectors to provide the production inputs and markets for the products.

Special Presentations

In addition to the country papers, two other papers were presented. The synthesis of findings under the IIMI-IRRI Collaborative Project in Bangladesh, Indonesia and the Philippines was discussed by Dr. Miranda. He described the project implementation process which includes the setting of the country specific objectives, the research site selection and implementation procedure and the synthesis itself. The findings and recommendations which were divided into main irrigation system management, farm-level water management, and economics and institutional issues in irrigated rice-based farming systems are found on pages 10 to 12.

In the analysis, four critical issues were highlighted: 1) irrigation service fees; 2) tenurial status; 3) farmers' decision to diversify; and 4) farmers' organizations.

Policies on irrigation service fees should be reviewed in relation to the differences in managing the system for rice versus non-rice. There should be a provision for a mechanism to address the problem of landlord-tenant arrangements, more so in improving land productivity through crop diversification. Although the farmers should be given some degree of flexibility in their decision to diversify, this flexibility should consider not solely his own advantage but also its influence on other farmers and the flexibility of the irrigation system itself. Organizing farmers is not an absolute necessity to have an effective irrigation management which depends on the sociopolitical situation existing in the area where the system is located.

There were still unresolved issues which may be addressed by future research. These could address the following questions: 1) is the design of the irrigation system with flexibility for crop diversification more complex?; 2) how can assessment of both available water supply and water demand be improved to match the requirement of diversified cropping conditions?; 3) should governments get involved directly through such mechanisms as crop plans?; 4) how should the agency and farmers cope with different soils/drainage environments, considering zoning and water requirements?; and 5) for both rice and non-rice production, how should better techniques for improving water use efficiency and productivity be developed?

Dr. Kikuchi, in his paper, emphasized that crop diversification is an inevitable process that the agricultural sector has to take as the economy grows. It is a part of structural transformation of the economy to build flexibility into agriculture. The success of crop diversification hinges critically on the markets. Only with well-functioning markets could its objectives be attained, while being consistent with the long-run need for structural transformation and efficient resource allocation.

In spite of all difficulties, crop diversification will be the direction that many rice-based irrigation systems have to take in the long-run as well as in the short-run, if they are to be a part of the agricultural sector which is bound to diversify as the economy develops. All research efforts in irrigation management for crop diversification should be aimed at the ultimate objective of making rice-based systems as flexible as possible. To build flexibility into the systems is nothing but to provide necessary conditions for diversification.

Small Group Deliberations

The group was divided into three smaller groups after the presentation and discussion of the country reports and the two special papers. More detailed scrutiny was done in terms of research and development, information dissemination and exchange, and funding and organization.

In the context of market demand, transport/storage costs, postharvest processing, subsidies/taxes/ tariffs, and marketing association and considering water sources, water demand, structures, and institutional issues, five research and development areas were identified. They are: 1) drainage requirement for rice and non-rice crops in rice-based systems; 2) techniques of quantifying water demand; 3) on-farm water distribution facilities; 4) development of flexible supplemental water sources; and 5) farmers' support services for diversified cropping in turned over systems.

On information dissemination and exchange, the group recommended that the present annual workshop, the workshop proceedings and the IMCD newsletter should continue. There is need to establish a more responsive mechanism for soliciting contribution materials for the newsletter. In this regard, each member of the Steering Committee shall represent his/her respective country to collect materials as well as to disseminate the information to his/her counterparts. Each member was also requested to initiate a suitable form of a national information network. Special leaflets may be prepared with policymakers as the target.

Training curriculum on IMCD topics should be developed and incorporated into existing training programs such as those conducted by IRRI. IIMI should develop curricula for national and international training programs. Training should be directed particularly to farmers, junior technicians, and officers.

It appears that all eight countries have existing projects on crop diversification with corresponding funding. For future activities, each country may formulate its own research program and IIMI and the Network will help obtain the necessary funds. Joint programs between two or more countries are also suggested.

It was felt that each country should have a national committee or some umbrella organization to oversee the activities on crop diversification. No standard objectives or rules were recommended but the Philippines' NCCD could be taken as a model and modified as necessary.

Field Visits

The last two days of the workshop were devoted to field visits to irrigation systems with diversified cropping in Nueva Ecija and Pangasinan. Specifically, the Upper Talavera River Irrigation System in Nueva Ecija and the San Fabian River Irrigation System in Pangasinan were visited. Watermelon and onion were seen in Nueva Ecija, while cotton and tobacco were seen in Pangasinan. The group had also a chance to visit the DCIEP trial farm in Bulacan.

Steering Committee Meeting

On December 13, the second meeting of the Steering Committee of the Network was held in Cabanatuan City. Ir. Soenarno as Chairman and Dr. M.A.S. Mandal as Vice Chairman were elected afresh, a resolution for the continuing support of the Network was formulated, and the plans for the second progress review and coordination workshop to be held in Indonesia were firmed up. (For the highlights of the meeting see p 3).

Resolution Calls for Continued IIMI Assistance

During 10-14 December 1990, the First Progress Review and Coordination Workshop of the Research Network on Irrigation Management for Crop Diversification in Rice-Based Systems was conducted at Metro Manila where the following resolution (No. 90-01) was passed.

WHEREAS, the workshop, sponsored jointly by IIMI, JICA and NIA, and attended by representatives from eight member countries, IIMI and JICA, provided the forum to identify commonalities, similarities and differences on irrigation management, in the different countries represented, to accommodate diversified crops in rice-based irrigation systems;

WHEREAS, the workshop strengthened the initial action plans formulated for the different concerns of the Network;

WHEREAS, the members of the Steering Committee find the Network essential in promoting crop diversification in the different member countries, particularly in information dissemination of research results and technology breakthroughs;

WHEREAS, the different activities lined-up for 1991 include stronger linkages among the various countries, more active information dissemination, more frequent progress review and coordination workshops, more active and vigorous support to research undertakings and intercountry exchange program;

WHEREAS, it is strongly felt by all members that the continuous support of IIMI, both in terms of technical and financial assistance, is necessary to maintain the Network's initial activities and to pursue the plan for 1991 and future years;

NOW THEREFORE, upon motion of the representative from Sri Lanka duly seconded, it is resolved and it is hereby resolved to request IIMI for its continued technical and financial support/assistance to the Research Network on Irrigation Management for Crop Diversification in Rice-Based Systems;

RESOLVED FURTHER as it is hereby further resolved to provide copies of this resolution to Dr. Roberto Lenton, IIMI Director General, for his information and to request for his personal intercession to obtain favorable consideration on this request;

RESOLVED FINALLY as it is hereby finally resolved to affix the signatures of the members of the Steering Committee of the Research Network and to circulate this Resolution to the different member countries and donor agencies.

Irrigation Management for Upland Crops Grown in Rotation with Rice

The Government of India has invested a large portion of its irrigation investment on rice. About one third of the country's total irrigated command is used for this crop, mostly in South and East India. But because of the high water requirements for rice, this area consumes about two thirds of all water supplied by irrigation systems throughout the country.

Rice will clearly retain an important place in India's irrigation portfolio, but consideration is increasingly being given to irrigation management options for grow-

ing upland crops, in *rabi* (dry season), in parts of the commands of India's systems traditionally planted to rice.

Reasons for Irrigated Upland Crops in Rabi

Because upland crops require much less water than rice, they can be grown in rabi well within the design parameters and water availability of most rice-based irrigation systems. There is no need to concentrate water deliveries to limited areas, and virtually the entire command can be supplied. Equity is served in that all farmers within the command can benefit. Similarly, meeting the water requirements of upland crops in rabi does not lead to the distortions needed to manage the canal system for rice. The canals and associated structures operate in a more stable condition and are subject to less stress.

Certain upland crops are more remunerative than rice to the farmer, provided there exists a satisfactory market for the crop and that farmers can produce it efficiently. Frequently, those assumptions are not met, and initial efforts to produce upland crops are not satisfactory. The attempt to introduce certain crops as alternatives to rice should, thus, be made over a number of years and must involve several cadres, namely, Irrigation Department, Agriculture Department, CADA, etc.

The case of groundnut in Orissa illustrates the process. In the early 1980s, there were few oil extraction plants and little understanding on the farmers' part for producing groundnut. Seeds were purchased from as far away as Maharashtra and frequently arrived late. But by 1990 an indigenous groundnut industry had begun to take shape in the command area of the Mahanadi System. Groundnut yields are frequently over 2 t/ha, and gross farm income exceeds Rs.15,000 per ha, compared with about Rs.9,000 per ha for rice.

Principles of Irrigating Upland Crops in Rice-Based Systems

Although there are good reasons for recommending the production of selected upland crops in rice-based irrigation commands, it is not clear exactly what practices can accomplish this objective. Indeed, the few successful efforts are dwarfed by the large number of failures.

There are certain *preconditions* which can be laid down as requirements to success. These include reasonable marketability of the crop such that it can be produced at profit levels at least equal to those of rice. This in turn assumes agricultural extension advice through the training and visit system or similar projects through which farmers can learn appropriate production techniques. It is also assumed that the effort to produce an upland crop would only be undertaken during rabi when conditions are most favorable.

The author is not aware of specific irrigation management practices that can be said to ensure successful upland crops under such conditions. Each irrigation system and crop is so different from the next that one common set of practices is probably not realistic.

There are, however, a limited number of irrigation management principles which appear to be essential. These are briefly discussed below.

In the management of the main irrigation and distribution system for upland crops, the pattern of irrigation at the outlet should be the mirror image of that for rice: the normal or default condition should be no irrigation; water is supplied only during preplanned, specified and limited periods.

Thus, the irrigation management challenge to Assistant Engineers and lower functionaries is, for the most part, not to maintain a continuous irrigation supply, but rather to withhold it.

This radical change in irrigation management is not easy to achieve because canal systems are designed with the expectation that all outlets draw water whenever supplied. Outlets will thus have to be gated. Distributaries and minors will then be operated to pass only enough water to supply a selected number of outlets; after they have been supplied, the distributary or minor may be shut entirely at the head.

Alternatively, the turn for watering may pass to the successive outlet(s). For on-farm irrigation, farmers need to construct field channels to convey water from the watercourse to their fields. They also need to construct the necessary basins, borders or furrows on the fields. Experience in many locations has shown that farmers are capable of doing this provided some guidance is provided by Command Area Development Authority (CADA) or other appropriate staff. It is not necessary and is probably not advisable for the authorities to construct these channels for the farmers, because they will likely be removed for the *kharif* rice crop.

Appropriate means of drainage are important at the on-farm level. There are three ways to achieve adequate drainage: 1) use those fields with light soils such that the water will quickly infiltrate; 2) use those fields with significant topographic slope such that the water will quickly run off; and 3) make use of a system of ridges and furrows such that the crop is somewhat elevated relative to the water. Combinations of the above may be called for under some conditions. Guidance from CADA and related staff in implementing drainage measures is important.

In the final analysis, however, success in irrigating and producing upland crops will be dependent upon coordination between government officers and the farmers and on the degree of discipline exercised by those officers. It is important, for example, that farmers know and be prepared for each scheduled release of water. They also must know the dates when water will first be provided. It is up to the concerned government officers to formulate the plan, discuss it with farmers, and then carry it out with as much discipline and commitment as possible.

Conclusions

In summary, it can be concluded that:

1. Those irrigation systems in South and East India designed and operated for rice are unable to provide adequate water for rice in rabi. Overall, scarcely 50 percent of the command can be served for rabi rice.

2. New rice varieties and other developments have combined to give greater importance to rabi rice. Farmers invariably prefer rice to other rabi crops which use less water.

3. A shift from irrigated rice to certain upland crops in rabi would serve the following purposes: greater economic returns to farmers and to water; benefit would extend to a greater number of farmers within a command; kharif rice would be benefited; and employment increased.

4. The main reason this shift has not occurred in most systems is because the irrigation management practices for rice area are highly antagonistic to upland crops. New and more appropriate irrigation management practices are needed.

5. In the management of the *main and distribution system,* the primary change must be a shift from continuous irrigation (for rice) to a schedule in which water is provided through the outlet only at specified, preplanned times, and for limited duration, with careful consideration to critical stages of crop growth.

6. In regard to the *on-farm system,* the primary change must be to construct temporary irrigation channels to the fields of upland crops, and to provide for drainage through on-farm ditches, furrows or channels, where needed.

7. Theoretical and/or experimental station research can be a useful starting point, but field studies are critically important to work out the specific practices appropriate to each location.

8. Pilot projects in operating irrigation commands are an excellent way to field-test suitable practices for irrigated upland crops. These pilot projects, if they are to be successful, must include input from Irrigation Department, Agriculture Department and CADA. In addition, training centers, universities and research institutions also have important roles.

9. All efforts to promote upland crops in rice-based commands will fail unless the farmers have confidence that their interests are being taken seriously. This will require dedication, imagination, cooperation and discipline on the part of all irrigation and agriculture officials.

[Abbreviated notes for seminar at the Central Water Commission, 4 December 1990, New Delhi, India.]

Thomas Wickham, Former Director General, IIMI, Sri Lanka, Consultant to Louis Berger Int'l Inc.

IIMI-IRRI Collaborative Project Findings and Recommendations:

A Brief Synthesis

Following a three-stage research process of gaining an understanding of current irrigation management practices for crop diversification in rice-based farming systems, problem identification including suggestions to overcome diagnosed management constraints, and pilot testing of suggested or revised procedures, the November 1990 Colombo intercountry workshop was able to produce a consensus on an integrated set of findings, recommendations and a future course of action. These were categorized into: a) main irrigation system management for rice-based farming systems; b) farm level water management for rice-based farming systems, c) economics and institutional issues in irrigated rice-based farming systems, and, d) critical issues discussed. The following questions were used as a guide in sorting out the findings and recommendations coming out of the Project:

a) What are the factors that influence the options for changes in rice-based farming systems?

b) What are these options and how do the different factors affect them?

c) What are the implications of these changes on irrigation management both at the system level and at the farm level?

d) How could these implications be addressed? What recommendations are already utilizable? Is there a need for further research? What should be done next?

a. Main Irrigation System Management

* Some background issues were considered such as the differences in the type of irrigation systems used as research sites (large gravity direct diversions in the Philippines and Indonesia, and lift and deep tube-well systems in Bangladesh). It was recognized that there were lessons that could be learned from drier environments (Egypt, Morocco, Pakistan, etc.) where diversification is widespread and management issues may be simpler or better understood, and that the main issue is on how the irrigation agency is able to respond to diversification once the external environment is encouraging farmers to do so in terms of water allocation and delivery in the main system. It was agreed that changes be introduced in the planning, implementation, monitoring and evaluation procedures being followed by the irrigation agency.

* On water distribution, reliability of timing may be more important than trying to meet adequacy. Rotational irrigation of some form is almost inevitable because of the risk of overirrigation and the need to maintain the hydraulic head, and because rationing by time is easier than rationing by discharge.

* Irrigation systems properly designed and constructed for implementing irrigation for wet-season rice which can meet the land-soaking and land preparation requirements have enough canal capacity for the intermittent flow of water needed for irrigating non-rice crops, although the need for greater canal-water regulation is apparent.

* It is important that rotation plans be known by all concerned. Irrigation system managers should have different plans for different levels of water deficit. The level of rotation which is the level of the irrigation system where the water delivery rotation is done such as at the main, secondary and tertiary canals or below the tertiary canal level, depending upon the nature and severity of the water shortage, needs further rationalizing to improve reliability and equity. The not-quite-satisfactory weekly rotation being implemented in Indonesia and the Philippines and the 9- to 10-day rotation in the G-K Project in Bangladesh are indications in this regard. It was understood that developing new rotational plans is a gradual process involving negotiation and testing. The selection of alternative rotation plans is a contract between the irrigation agency and the farmers. The activities should be based on suitability for farmers (time of delivery/non-delivery), manageability by agency (staff, number of gates, etc.), and technical feasibility (conveyance capacity, cross-regulation provision).

* There should be an early warning in case of a change in the rotational plan, and this needs a

concerted communication effort of the agency staff and the farmers.

* The information management required should include the monitoring of the dynamic situation at the intake (available river flow and diverted flow to the system), and the overall implementation of the plan. Regular meetings such as after water rotational delivery should be held between the irrigation staff and farmers or their representatives during the implementation of the plan to serve as a means for monitoring the operations of the system. The meetings could provide the needed feedback mechanism to make the schedule more realistic and to settle conflicts in water distribution.

* The involvement of farmers and farmer participation as early as the planning stage (annual seasonal planning) are implied and should be institutionalized to minimize problems during implementation. Active participation of farmers in decision making and in managing the system increases their awareness of the system's capabilities by helping them understand the plan better and the reasons for actions taken.

* The objectives of the plan (whether they are productivity, equity, sustainability, etc.) should be clear to all concerned and translated into clear operational rules.

* Water availability prediction must be good. If water available is less than the demand, rotation between years (i.e., 2-3 years planning cycle, not 1 year) may be more appropriate.

b. *Farm-Level Water Management*

* Although there are several factors influencing the options for changes in rice-based farming systems (e.g., availability of adequate water, and land suitability, climatic condition, availability of management technology, time constraint caused by the presence of rice crop, farmers' preference, resource base, influence of neighboring farmers or extension agents, and land tenurial status) income stability was identified as the major consideration that influenced the farmers to diversify or not.

* In responding to the changes, it is implied that farmers must assume greater responsibility in water sharing to effect the desired changes in water management. Some checking facilities may have to be added to provide the hydraulic head required at certain points to implement the flush basin flooding method for irrigating a number of crops such as onion, tobacco, etc. Additional facilities are needed during the dry season in the form of extra field channels, already temporarily built by farmers, to facilitate the distribution, and application and removal of excess water for non-rice crops. The resulting density of the field channels can be more than thrice those being retained for rice cultivation during the wet season.

* The use of groundwater to supplement canal supplies in the dry season was significant and economically attractive in both the Indonesian and the Philippine sites. The same result is expected in similar groundwater use for rabi (dry) season cropping in the Ganges-Kobadak Irrigation System (GKIS) area in Bangladesh.

* The use of residual soil water is significant in Bangladesh for growing wheat, onion, garlic and legume after the *aman* (wet) season in the GKIS area. While the potential is present in Indonesia and the Philippines, the use of residual soil moisture, especially for mungbean, has not been systematically documented.

* The challenge of managing a high water table resulting from seepage from adjacent unlined canals and surrounding fields was addressed in the Upper Talavera Irrigation System (UTRIS) site in the Philippines by establishing a properly designed interception-cum-drainage channel around and across the average size fields to convert an unsuitable area to effectively produce maize of 7.3 t/ha, compared with 3.3 t/ha in the control area.

* It was found that a cropping pattern of rice - mungbean - maize replacing rice - rice - non-rice has higher productivity than rice - maize - mungbean for systems without adequate irrigation. In Bangladesh, the pattern of green manure - rice - legume is recommended to replace rice-rice pattern.

* Optimal yields for non-rice crops are obtained if soil moisture depletion is not allowed to go beyond 40 percent of the available soil moisture.

c. *Economics and Institutional Issues in Irrigated Rice-Based Farming Systems*

* Different cropping options were identified which the farmers may consider during the dry season. These include leaving the land fallow, planting only non-rice crops, growing combinations of non-rice crops or rice and non-rice crops, and planting dry-season rice crops. These options are influenced by a variety of factors such as crop scheduling/timing, tenurial status, prices of inputs, product (market) prices, land suitability, drainage constraints, farmer experience/attitudes, agency staff skills, labor/farm power, farmers' ability to control water, availability and access to technology, government policies and existence of residual soil moisture.

* The implications of changes on irrigation management as earlier indicated include the need for better coordination among farmers, among agency staff and between farmers and agency staff to increase the reliability of irrigation delivery. Conjunctive use of surface water and groundwater needs to be enhanced and information on drainage should be considered.

* These implications could be addressed through a pilot testing of management changes and an assessment of successful cases. These would involve the agency, farmers and researchers interacting with each other for fine-tuning of management procedures in the internalization process while the participation of the researchers is gradually phased out. The budget implications of the new management changes need to be assessed.

Recommendations for Future Action/ Research

The various papers presented, the reports of the workshop groups, and the discussion throughout the Colombo intercountry workshop pointed to only one direction, that is, the Project may be completed but a lot of things have to be done still. Useful information and technologies have emerged which are expected to enhance irrigation management.

The participants strongly feel that these should be further evaluated through some kind of piloting. It is anticipated that a gradual internalization process is needed to really feel the impact of the recommended innovations.

An action plan is needed to put into reality and operation the findings so far obtained. Stronger and more active participation of the irrigation agency and the farmers is envisioned. Other agencies involved in agriculture (from production to marketing) should likewise be included. The involvement of the research group will become less and less as the recommendations are adopted and institutionalized.

As research is a dynamic process, the Project has likewise provided ideas or areas for further research. In addition to what are indicated in the group outputs, studies on drainage seem to be underplayed. Provision of the basic drainage facilities is necessary, particularly for upland crops. Farmers' motivation to participate in irrigation management should be studied more deeply than the need to form the associations.

Agency-farmer relationship is a necessary part of diversification. This has still a long way to go. This has to be related to reliability of water delivery and variability which cannot be controlled. A measure of reliability is still to be developed. Market forces and postharvest facilities should also be given due consideration.

In implementing these recommendations, the role that IIMI and IRRI have to play is apparent. Collaboration among agencies has shown positive effects and this should be sustained. In fact, it has been suggested that other agencies not earlier involved have to participate, particularly in the piloting activity. Interested fund donors should also be identified.

Senen M. Miranda, Senior Irrigation Specialist, IIMI.

USAID-Funded Crop Diversification Projects in Sri Lanka

USAID/Sri Lanka funds a number of projects which support private sector and agribusiness development. The most important of these are the Mahaweli Agriculture and Rural Development (MARD) Project and the Diversified Agriculture Research Project (DARP).

The MARD Project supports the development of the Mahaweli System B Left Bank, which includes 21,000 ha of irrigated lands. Emphasis is on crop diversification and development of non-rice crops. The project assists farmers to diversify and increase production which can feed agribusinesses and export enterprises. Related to the project is a program whereby the Mahaweli Authority of Sri Lanka leases commercial farm plots of up to 25 hectares to private developers.

Specific assistance includes: technical assistance in production, marketing and processing; foreign firms in locating joint-venture partners; and a commercialization fund which provides small grants for the establishment of new or innovative business activities. The Project has recently assisted a U.S. investor and local partner to obtain a contract for export of 1,000 metric tons of fresh fruit and vegetables to Singapore.

The Agricultural Cooperative Development International (ACDI) is starting a new activity called the Commercial Small Farm Development subproject to develop farmer-owned commercial enterprises. The Project will link small centralized nucleus farms with small farmer outgrowers to produce crops for export or processing. The Project will also help develop commercial tissue culture facilities to expedite importation of commercial planting materials.

The DARP assists the Department of Agriculture to improve research and extension programs for diversified crops (non-rice crops) and with improving seed production for rice, other field crops, and vegetable crops. The research and extension efforts are assisting to increase small farmer production to feed processing industries. The seed program is moving certified seed production from the government to the private sector. To date, 9 farmer groups and 9 private firms have initiated seed production programs and a private seedmen's association with over 20 members has been formed. Opportunities exist for production of field crop seed and vegetable seed for the local market and for assistance to locate local partners for joint ventures to produce vegetable and flower seed for export.

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Diversifying a Rice-Based System by a Modified Operational Plan

Abstract

The productivity of the land in an irrigation command is greatly affected by the land use, cropping system and the effectiveness of water allocation and distribution. The availability of irrigation water and reliability of supply are the key factors in deciding the cropping system. This paper presents a case study in Sathanur Irrigation Command in South India, where a "Rice-Based Irrigation System" is proposed to be converted into an "Irrigated Dry Crop" system by changing the "Operational Plan" of the Irrigation Schedule.

When the Sathanur Dam was constructed during 1956-61, only the Left Bank Canal (SLBC) was excavated localizing an area of 9,472 ha for rice. Subsequently, due to the improved storage position of the reservoir the Right Bank Canal (SRBC) was excavated in 1984 for localizing 8,505 ha of irrigated dry crop. The SLBC and SRBC were scheduled to operate during November and September, respectively, essentially giving priority to SRBC or SLBC. The farmers of SRBC, however, started growing rice instead of irrigated dry crop and thus created a situation of nonavailability of water for SLBC. Under the World Bank aided National Water Management Project, it is proposed to change the operational plan which will radically change a rice-based irrigation system into an irrigated-dry-crop-based system by opening both the canals at the same time and by introducing necessary infrastructure modifications in the irrigation system.

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Major IMCD Conferences in 1991

1. Workshop on Irrigation Management for Crop Diversification, Bangladesh Agricultural University (BAU) Campus, Mymensingh, Bangladesh, 5-6 March 1991.

2. Second Annual Workshop of the IMCD Research Network, Gadjah Mada University, Yogyakarta, Indonesia, 9-12 September 1991.

3. National Workshop on the Irrigation Management for Rice-Based Farming Systems, Bangladesh Agricultural Research Council (BARC) Building, Dhaka, Bangladesh, 6-7 October 1991.

Forthcoming Publications

1. Miranda, S.M., Panabokke, C.R., and IIMI Irrigation Management Crop Diversification Group. (forthcoming). Irrigation management for crop diversification in the North Central Province, Sri Lanka. IIMI, Colombo, Sri Lanka.

2. Miranda, S.M. (Editor). 1991. Proceedings of the first IMCD annual review workshop, held at the DCIEC Building, NIA, Manila, the Philippines. IIMI, Colombo, Sri Lanka.

3. Miranda, S.M. (Editor). 1991. Proceedings of the intercountry workshop on the IIMI-IRRI collaborative project on irrigation management for rice-based farming systems held at Lanka Oberoi Hotel, Colombo. IIMI, Colombo, Sri Lanka.

4. Valera, A. 1991. Irrigation management for diversified cropping in rice-based systems (the Philippines). IIMI, Colombo, Sri Lanka.

5. Vermillion, D. and Murray-Rust, H. 1991. Enhancing the manageability of rotational irrigation in Indonesia. IIMI, Colombo, Sri Lanka.

6. Vermillion, D. 1991. The crop plan and irrigation management in Indonesia. IIMI, Colombo, Sri Lanka.

The IMCD Newsletter is published annually to facilitate information exchange and dissemination on irrigation management for crop diversification in rice-based systems among research network members and others interested in the subject. Contributors are invited to submit concise news about significant research development and related action-oriented activities. Submissions should be limited to two to four double-spaced typewritten pages. Graphics or tables may accompany the articles, and references should be cited. All articles are subject to editing to meet space limitations.

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