IMCD News

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CROP DIVERSIFICATION AND CROPPING-SYSTEM FLEXIBILITY IN RICE-BASED IRRIGATION SYSTEMS

To determine cropping-system flexibility of rice-based irrigation systems, two gravity rice irrigation systems in the Philippines were observed during the 1989 dry season: the Upper Talavera River Irrigation System (UTRIS) and the San Fabian River Irrigation System (SFRIS). Farmers in both these systems have planted nonrice crops in the last 15 years. Engineering measurements, structured interviews and participant observations were combined to generate a comprehensive database while statistical analyses and water control simulations were applied to understand cropping-system flexibility.

The first factor these farmers consider in deciding to diversify is the comparative profitability of rice and alternative crops that can be grown in the command area. They also consider the prevailing soil type of their farms, water availability during land preparation, adequacy of water control structures and farming experience in opting for crop diversification. If they do decide to diversify away from rice, they practice flush irrigation, which is characterized by high water flow rate and short-duration water application as compared with low water flow rate and long-duration water application by nonrice farmers.

To obtain operational flexibility in water application requirements, field irrigation staff exploit the reserve capacity of the irrigation system for rotational irrigation during land preparation for rice.

However, operating rice-based irrigation systems at upper limits of the design requires longer working hours for intensive cross regulation of water in the lateral canals. Therefore, field irrigation staff simplify water scheduling whenever possible and move from adjustable to fixed, proportional water allocation at the primary conveyance system. They also allow farmers to build temporary control structures to attain cropping-system flexibility and better water control.

Designers of irrigation systems should pay particular attention to operating head requirements in the field if they would like to produce irrigation systems with cropping-system flexibility. It is equally important that the designers should also consider variations in farmers' water application behavior.

Field operations staff should control planting windows as a means of harmonizing variations in field water demands and system water supplies. They should aim at head water control, tighter cross regulation to provide flexibility to water flow rate and duration for flush or surge irrigation of nonrice crops.

[Abstract of Ph.D. thesis by Tolentino Bermudez Moya, Ph.D., Cornell University, 1992 on research conducted under the IIMI-IRRI Collaborative Project funded by the Rockefeller Foundation]

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PLANS FOR THE 1993 IMCD RESEARCH NETWORK WORKSHOP

The Research Network will hold its third annual review and coordination workshop from 8 to 11 February 1993 in Dhaka, Bangladesh on the theme "Ensuring Reliable Water Supply for Crop Diversification."

According to the tentative program, country reports from Bangladesh, India, Indonesia, Malaysia, Nepal, the Philippines, Sri Lanka, Thailand and Vietnam will be presented on the opening day of the workshop. The country reports will focus on a) the strategies employed by the member countries and their experiences in ensuring reliable water supply for crop diversification; and b) answers to such questions as what measures have been taken and are being taken, how these are being implemented, what the experiences have been so far, and what steps have been taken to solve the constraints encountered.

A field trip to the Comilla area where various irrigated diversified crops with some intercropping of vegetables are grown is scheduled for the second day.

On the third day, the participants will split into two groups to deliberate on Research and Development, Information Dissemination, and Funding. The workshop will reconvene in the afternoon for small-group reports and discussions to be followed by the workshop wrap-up. After dinner, the IMCD Steering Committee will hold its fourth planning session.

A field trip to other irrigated areas located in Tangail and Mymensingh is scheduled for the fourth day.

Highlights of the 1991 Yogyakarta IMCD Workshop

PROMOTING CROP DIVERSIFICATION IN RICE-BASED SYSTEMS

The 1991 Yogyakarta IMCD workshop was sponsored by the International Irrigation Management Institute (IIMI), the Directorate General of Water Resources Development (DGWRD) of Indonesia and the Faculty of Agricultural Technology (FAT) of the Gadjah Mada University (GMU) in Yogyakarta. It was held at the Fakultas Pasca Sarjana of the Gadjah Mada University. The 35 participants included senior officials, scientists and researchers from the 9-member countries of the network and senior staff of IIMI headed by its Director General. The member countries of the network are Bangladesh, India, Indonesia, Nepal, Malaysia, the Philippines, Sri Lanka, Thailand and Vietnam. The workshop included presentation of country reports and discussions, and a field trip to irrigated crop diversified areas. The third meeting of the Network's Steering Committee was also held during the week-long activity.

Opening Session

Ir. Soenarno, Director of Irrigation I welcomed the participants. On behalf of the Organizing Committee, he thanked all the participants and acknowledged the cooperation of all concerned in organizing the workshop.

Ir. Soenarno said that it has long been recognized among rice producing countries that rice as an agricultural commodity no longer gives sufficient benefits to the farmers. Competition among different uses of water is also intensifying; thus, the need to utilize water more efficiently. Crop diversification has become an important concern. He pointed out, in particular, the timeliness of the workshop because an extraordinary drought had affected most parts of Indonesia for several months, especially the island of Java. This, according to him, should encourage people to promote and intensify efforts toward crop diversification. He expected the workshop to stimulate discussion among scientists, technologists, leaders and policymakers in identifying significant issues and agreeing on mutually beneficial solutions.

In his opening remarks, Dr. Soenarjo Keman, Vice Rector for Academic Affairs of GMU, said that it was an honor for GMU to host and jointly organize the workshop. He expressed his gratitude to IIMI for assisting countries, including Indonesia, to do research on irrigation management for crop diversification. He added that the workshop theme was very relevant to the University's concern with problems faced by the majority of people, especially, those in villages and remote areas.

Dr. Roberto Lenton, Director General of IIMI, expressed his pleasure to be in Indonesia, a country with which IIMI has close links. He thanked the organizers for convening researchers and planners from South and Southeast Asia which was a clear indication of the interest these countries had in the subject.

Dr. Lenton emphasized that crop diversification is not just a question of technology. Other considerations should be looked into; socioeconomics, postharvest processing, technology, management, institutions and the policy environment. He said he was impressed with the progress of the network and acknowledged Dr. Senen Miranda's role in establishing and maintaining it. As proof of the growing interest in the subject, he mentioned that the

International Commission on Irrigation and Drainage (ICID) had requested IIMI and its collaborators to prepare a paper summarizing the results of its collaborative work on crop diversification during the next Afro-Asian meeting of the ICID to be held in Bangkok later this year.

For his part, Dr. Miranda cited GMU's involvement since the start of IIMI's activities in Indonesia. After acknowledging the excellent arrangements made by the host country, he briefed the group on the objectives and expected outputs of the workshop and the guidelines to be followed in addressing them.

Country Presentations

In the country reports, the nine participating countries presented: 1) their experiences on irrigation and irrigation management, irrigated rice-based farming systems and on crop diversification; 2) programs/strategies and problems related to promoting crop diversification; and 3) linkages with national, regional and international agencies and institutions. The following is the gist of the discussions that ensued:

BANGLADESH

With regard to the strategies to improve the research-extension linkage, it was mentioned that several years ago, the extension services did not know what was being done in the research sector. However, under the Agricultural Extension and Research Project, adaptive research is being conducted in farmers' fields and specific practices are recommended only if they are accepted by the farmers. The research-extension linkage is stronger because of the creation of district and regional technical committees consisting of researchers and extensionists, which meet regularly.

The government sector provides support services while the private sector is in charge of the fertilizer supply. Some nongovernmental organizations are also involved in fertilizer marketing.

The profitability of the nonrice crops can be improved by selecting those crops which can compete with rice very well. Price and market support is also provided.

There seems to be no indication that the area grown to nonrice crops is increasing or that diversification is decreasing. There are neither clear policies which facilitate crop diversification nor steps taken to monitor whether strategies to implement it are really working. The need for an improved monitoring process is recognized. In this regard, the information base is modified frequently according to the results of research and extension activities. Participation of farmers' associations is enhanced to facilitate delivery of support services.

To deal with small holdings, government-based farm cooperatives are created. For example, there are water users' groups in gravity irrigation systems.

INDIA

It was mentioned that it is not possible to have two crops of rice per year in India although there are pockets where this could be done. In Nepal, there are areas near rivers in the south where three crops of rice can be grown per year, especially where the climate is subtropical. In India, especially in the northern states, temperatures are sometimes too low to grow rice. Rice varieties which can withstand the cold are yet to be developed. In addition, light incidence is very low in these areas. Rice needs more than 6 hours of sunlight per day.

During the second season, water available in most rivers is not sufficient for rice crops. There may be pockets with enough water but they are not significant in respect of the total irrigable areas. Varietal demand and the price may also have an effect on water availability.

For self-sufficiency, India's requirement of rice is around 20–25 million tons. Rice production is highly subsidized, at around 50–60 percent.

There appears to be no recommended methodology yet to convince small farmers to shift from rice to nonrice crops. Training of farmers and providing them with information on the productivity of crops as well as the introduction of new crops may be helpful.

Again, as regards monitoring, policies should be developed to have a good system. Research may be useful in formulating policies and for evaluating implemented strategies.

An important question that has been raised is whether the government can impose a cropping system on the farmers. Changing a cropping pattern needs a lot of structural adjustments.

INDONESIA

In Indonesia, which is now exporting rice, irrigation service fee rates are based on land type, topography and farmers' ability to pay. Irrigation costs can be reduced mainly through proper management.

In terms of planning for crop diversification in irrigated areas, irrigation is already considered a part of crop diversification. All sectors concerned have to focus on this direction. Agricultural research is oriented toward crop diversification; the government makes relevant policies and provides the appropriate extension activities, and the farmers are given the necessary training.

It has been the government's policy to be self-sufficient in rice first, and then go for other crops. Indonesia became self-sufficient in food in 1985.

The success of any policy depends partly on monitoring, to assess whether the policy objectives are attained or not. For crop diversification, a much deeper meaning is given; other than just looking at nonrice crops, the idea of commercializing crop production is also given emphasis. Crop diversification should be based on commodity, area and income.

MALAYSIA

With better employment and income opportunities in the cities and in industries, farmers are leaving the farms. As a result, Malaysia is facing an acute farm labor shortage.

Mechanization is needed but farm type and cost have to be determined and there is also a need to overcome conservativeness/traditionality. Young people should be attracted to the farm. Agri-business is the key to crop diversification. This is being addressed by forming farmers' groups.

NEPAL

Irrigable area in Nepal was determined by consultants approved by the government who based their appraisal on land use maps and also took into consideration water resources and climatic factors.

The average annual rainfall is about 2,000 mm. The rainy season is from mid-July to mid-August. This is the rice growing period for the rain-fed areas. The average national yield is about 2 t/ha.

PHILIPPINES

The recent Mount Pinatubo eruption has put out of production about 50,000 ha of irrigated land and 30,000 ha of rain-fed land. The effect on total production is minimal and because of a good harvest last year, there are no plans to import rice this year. A more immediate impact is the dislocation of the farm population.

As for the effect of the volcanic eruption on soil fertility, the physical and chemical composition of the lava showed that the material is inert and may not have any immediate benefit in terms of fertility. However, the high humidity and temperature are conducive to active organic activities which can break down the chemicals in 3 to 5 years. Of greater concern is the presence of sulfur which is poisonous to the roots of crops and affects productivity. However, the problem is temporary, as the sulfides will be released to the atmosphere with filling.

Price support is given for rice for helping achieve self-sufficiency. Crop diversification is aimed at increasing crop intensity, especially in areas where water is not enough for rice during the dry season.

Since it is possible to have three crops a year, objectives of crop diversification should include the solving of nutritional imbalances in the local diet. In the Philippines, crop diversification is more commercially oriented. Farmers should move from subsistence to commercial objectives to improve their economic status. For example, in the Ilocos Province, when a tomato-paste factory was set up, the farmers were encouraged to grow tomatoes and the response was good. Nutritional imbalances can be corrected by encouraging garden plots.

Small farm reservoirs are not economically feasible/viable in Bangladesh because the water stored is often not enough to satisfy the requirements during the dry season; in the Philippines, however, they provide a source of additional income in additional crops grown during the dry season. In addition, the reservoirs are being used for fish production.

In regard to solving water management problems for rice and nonrice crops, the Philippine experience has shown that there is no need to change the main irrigation system management to support crop diversification. Most of the adjustments are done on-farm and they can be done by the farmers themselves.

SRI LANKA

The crops alternative to rice are chili, onion, vegetables, banana, sugarcane and pulses. These are chosen because of their high profitability. The usual sources of irrigation water are the minor tanks where there is no need to lift the water. These have small reservoirs and the flow is by gravity.

In the dry zone, run-of-the-river irrigation systems use water which has been diverted from rivers in the central hills of the wet zone through long trans-basin canals. Also, in these areas, drainage water is recycled.

The government has pushed for the formation of farmers' organizations which have specific responsibilities. The farmers are involved in cleaning and general maintenance.

Crop diversification has resulted in increased farm income primarily because there is water even in the dry season.

THAILAND

A distinction is made between temporary and permanent diversification. In areas with permanent diversification, there is no rice. In the temporary-diversification areas, the common crops are sesame, groundnut, onion, tobacco and mungbean. This is true especially in the central area.

Thailand has about 3.5 million ha of irrigated land. The major crop is rice, but about 1 million ha are used for nonrice crops. Rice is grown during the wet season along with several other crops (sesame, watermelon, garlic, tobacco, etc.) which are usually grown in the dry season. There is very intensive land use in the irrigated areas of the central region.

While the export value of agricultural products has doubled, it has declined in terms of percentage of total exports. This reduction is due to the export of finished products instead of raw materials practiced earlier.

Rice production is subsidized through the provision of free water to the farmers. Fertilizer supply is subsidized for rice as well as for other crops. Thai farmers are given many incentives.

VIETNAM

There are about 700,000 ha of cultivable land in the coastal areas. Fresh water comes from reservoirs and rivers and sea water intrusion has no effect because of the flow from the rivers.

The rate of growth of the area planted to nonrice crops is about 12.5 percent per annum, which is a high value. Out of the 5.3 million ha of irrigated land, only 2.2 million ha are used in the wet season while 1.8 million ha are cultivated in the dry season. About 5 million ha are devoted to nonrice crops. All the areas that were destroyed during the war are now being cultivated.

Corn is transplanted after winter rice and is grown using residual moisture. About 400,000 ha are planted to this crop and the yield is about 4 t/ha.

Crop diversification depends on the availability of water. The leaders of cooperatives decide on the time to grow rice. Farmers decide on the first and second crops.

To strengthen the O&M of systems, there are programs which are aimed at improving organizational and irrigation procedures. The investment of the government is based on the production of rice; about 5-8 percent of the total production is invested in irrigation. There is almost 100 percent collection efficiency and 30 percent of the amount collected is used for O&M costs. Even before planting, there is an agreement with the farmers as regards the irrigation fees. Irrigation fees are paid in cash or in kind (rice).

General Discussion

In Sri Lanka, year-round irrigation is practiced in nucleus farms and it is organized by farmers. It enables farmers to respond to market demands at any time. Year-round irrigation is being done in areas alongside main and lined canals at present.

Malaysia is looking for training modules and curricula. These are available in Sri Lanka and can be shared with Malaysia.

Incentives and government intervention are important in promoting crop diversification. The provision of adequate credit, suitable infrastructures, and appropriate markets are possible areas of assistance. The government can also play a significant role in locating appropriate markets and providing the price signals for farmers to respond to. An example is Indonesia where the government is promoting the export of produce. The role of cooperatives may also be strengthened.

Irrigation management has a role in the success of crop diversification, particularly if efficient water delivery is necessary for success. In Thailand, irrigation management is a factor in the promotion of crop diversification.

Small Group Deliberations

The small group deliberations which were held after the presentation and discussion of the country reports focused on research and development, information dissemination and exchange, and funding and organization.

Research and Development Group

With respect to rice culture, three possible situations were identified as existing in the different network-member countries. Like Bangladesh, most countries aim for rice self-sufficiency or near self-sufficiency. In the case of Thailand, production of rice is oriented toward export. Malaysia, on the other hand, has set a target of meeting 65 percent of the requirement from local production and limiting imports to 35 percent.

In discussing the commonalities and/or differences in experiences and strategies for promoting crop diversification in rice-based systems, the group dealt with the objectives of crop diversification lengthily. Along with the objectives, the group identified a) research and development measures which have been successfully employed, b) constraints promotion that could be addressed by research and development, and c) pressing research and development issues, and appropriate research-extension linkages. These are:

Objectives of crop diversification

1) Enhance farmers' incomes
2) Achieve self-sufficiency in food
3) Provide inputs to agro-based industries
4) Optimize use of water for agriculture
5) Generate employment in the countryside and rural areas (except Malaysia)
6) Increase the productivity under irrigated agriculture
7) Attain a balanced diet and nutrition (only for Indian sub-continent)
8) Maximize land use
9) Reduce pressure on O&M of irrigation schemes
10) Enhance import substitution
11) Promote export of nonrice crops
12) Provide sustainability of agriculture

Common strategies to promote diversification

As a strategy to promote diversification, the group emphasized the role of research and development, and policies. The following areas were identified for R&D:

1) Extension services
2) Training and study tours
3) Pilot testing and field-testing
4) Reorientation and improvement of irrigation system O & M
5) Infrastructure support
6) Group or contract farming
7) Market development

The policies relate to:

1) Subsidies (inputs, price, credit)
2) Marketing and infrastructure
3) Zoning and identification of suitable areas for crop diversification
4) Trade (tariff, duties, levies)
5) Crop insurance
6) Irrigation service fee rates

Research and development outputs found useful

1) Market research for demand
2) Planting schedule
3) Optimum cropping pattern
4) On-farm water management
5) Main system management — pilot testing
6) Adoption of experts' advice
7) Use of high yielding varieties (HYVs) of crops
8) Augmentation of water supply

Constraints to promotion that can be addressed by R&D

1) Lack of an adequate database
2) Inadequate system drainage
3) Lack of knowledge on technology relating to production and post-harvest processing
4) Lack of market information
5) Lack of price support policies
6) Lack of information on socio-cultural aspects

Pressing research and development issues

1) Conjunctive use of surface water and groundwater
2) Database
3) System drainage
4) Production technology
5) Pilot testing of management changes and assessment of successful cases
6) Market information

Appropriate research-extension linkage

At the institutional level, the full involvement of the irrigation agency in research and extension activities should be enhanced through some mechanisms. It is believed that any improvement in the existing R&E linkage can benefit crop diversification.

Information Exchange and Dissemination and Funding and Organization Group

The group first discussed the objectives of crop diversification before discussing the commonalities and differences in promoting crop diversification in the different countries. These are:

Objectives

1) Optimal utilization of resources
2) Increase of farm incomes
3) Improved nutrition of farmers' diets
4) Improved soil fertility

Common experiences/observations

1) Irrigation systems primarily designed for rice
2) Serious problem of marketing nonrice crops
3) Lack of a national program on crop diversification except in Thailand, Malaysia and Bangladesh
4) Lack of monitoring and evaluation for crop diversification
5) Labor shortage during peak periods
6) Lack of mechanization

Common strategies in promoting crop diversification

1) Adequate incentives like timely supply of agricultural inputs, fertilizers, seeds, etc.; easy access to credit; and subsidized inputs
2) Market information
3) Effective extension systems
4) Suitable infrastructures, transport and storage facilities
5) Efficient inter-season management
6) Contract farming
7) Stronger coordination among government agencies
8) Crop insurance

Strengths and weaknesses of national programs

In discussing successful extension programs, the different county representatives presented specific examples. Most of the programs mentioned were related to specific commodities like gherkin, sugarcane, rice and tobacco. Others presented experiences on the control of tungro disease, provision of seeds and even crop diversification. It is apparent that these programs became successful because of adequate credit, availability of inputs, availability of funds and government support.

The group identified the lack of specific government plans and an integrated crop diversification program as major weaknesses. In cases where there are programs, these are hampered by weak coordination among the agencies involved. The availability of funds for a crop diversification program in Malaysia and the creation of a coordinating body like NCCD in the Philippines were considered positive steps toward crop diversification.

Research-extension linkages

Pilot projects provide a good testing ground for strengthening the linkage between research and extension. A national coordinating body may also be very helpful.

Role of network to facilitate promotion

1) Circulate information on successful projects among different countries
2) Prepare materials documenting successful policies intended for use by policymakers
3) Circulate research papers on integrated crop diversification through the newsletter

New network ventures

1) Study tour for middle-level managers
2) Cross-visits between neighboring countries
3) Training which makes use of existing facilities of member countries
4) Action program on market information system development

Funding

1) Two-way funding program between IIMI and the network member countries
2) Partial funding of ongoing programs which have irrigation and crop diversification components

General Discussion

The discussion on the group reports highlighted a number of issues. As regards the action program which the network may immediately undertake, the problem on market information was mentioned. What is desired is a market information system which can be used by planners and farmers alike. Some simulation work can be done with existing data to predict prices. The system can also provide a mechanism to inform the farmers. This was identified as a common problem and one which all members can undertake.

IIMI is not a funding agency. So far, it has provided funds to support publications like the newsletter and workshop proceedings, and to coordinate the annual workshops. IIMI, however, can lubricate the process of looking out and sourcing for funds.

The lack of a coordinating mechanism to orchestrate the activities of different government agencies in the member countries was again pointed out as a major weakness. Some member countries are now considering creating a similar body like NCCD in the Philippines.

Charles Abernethy, IIMI's Senior Technical Advisor, mentioned a plan to conduct a study tour of middle-level managers to countries with environments different from those prevailing in the network member countries. The Government of Germany has signified support for such activity for representatives from the ASEAN countries to undertake an observation tour in Egypt and Morocco.

Wrap-up

In summary, Chales Abernethy stated that it is not surprising to observe commonalities in irrigated crop diversification among the participating countries. It is also apparent that there are differences in the strategies that the countries adopt to promote crop diversification in view of the varying situations. In some countries, there is labor shortage. In others like Bangladesh, the landholding is very small. In Sri Lanka, there are the resettlement projects.

The IMCD Network has now reached a stage where member countries can share experiences which can help identify the direction that irrigation management for crop diversification should take. Some questions can be answered by success stories from some countries. There is, however, a need to establish performance indicators or criteria to evaluate crop diversification. The policy objectives must be viewed vis-à-vis the results of related activities. In Thailand, the objectives of enhancing farmers' income and improving the utilization of water have been given attention. There will come a time when irrigation will have to compete with other uses of water.

The farmers themselves are an important component in the irrigated crop diversification system. Most of them still harbor doubts and resist change. They should have a clear understanding of the benefits of diversification. Otherwise, rice production is easier to do, it requires less care/attention and low cash inputs, and it has a stable market. The question of the comparative advantage of cultivating nonrice crops in irrigation systems designed for rice should, therefore, be addressed. The shortage of labor should, likewise, be considered.

The interrelationships among the different components in irrigated crop diversification should be well-understood. These include the irrigation department, farming community and agricultural organizations. Water is delivered by the irrigation agency, support services like credit and other production inputs are given by the agricultural agencies, while the farmers use the inputs and services to produce the crops. The question is to reorient the system so that all three components will work harmoniously. Reorientation could be effected through persuasion and negotiation among the sectors involved. Greater attention should now be given to this reorientation process.

Irrigated crop diversification may be moved either by push or pull forces. At present, it moves because of the push that the government is providing. A shift toward a pulling action may occur with the provision of appropriate incentives. An effective market information system has the potential of triggering the shift. Farmers will go out of rice monoculture if they are convinced that other crops have a market that can give them much higher incomes compared with rice. The change may be more likely to happen with the provision, for instance, of necessary storage and postharvest and market facilities for nonrice crops, including more selective customers.

Field Visits

The last day of the workshop was devoted to field visits to view crop diversification activities in four different irrigated areas in Yogyakarta. These are the *surjan* farming system in Kulon Progo District, farmers' role in irrigation management in the Pijenan Irrigation System in Bantul, a small irrigation scheme included in the turnover program in Ketonggo, and a water users' association in the Tirtoyoso I Opak Irrigation System.

Steering Committee Meeting

The third meeting of the Steering Committee of the Network was held on 12 September 1991 with Ir. Soenarno as Chairman. The committee reviewed the highlights of the second SC meeting held in Cabanatuan City, the Philippines. The committee reviewed the various activities of the Network during the past year and discussed the plans for the fourth progress review and coordination meeting workshop to be held in Bangladesh, the country of the incoming Chairman, Dr. M.A.S. Mandal. Dr. Prakriti Rana of Nepal was elected the next Vice-Chairman.

A STUDY TOUR ON IMCD IN NONRICE-BASED SYSTEMS

A tour was planned to two North African countries, Egypt and Morocco, for a team from Southeast Asia. The purpose of the tour was to assist irrigation management organizations in the rice-based countries of Southeast Asia to understand better, the modes of irrigation management in use in other countries whose irrigation cropping systems are already highly diversified and do not depend primarily on rice.

Members of the study team were asked to contribute chapters to a joint report, analyzing the differences between management arrangements observed during the tour and the Southeast Asian management arrangements. It was hoped that the report would be of sufficient interest and quality to help the Southeast Asian countries to accelerate the process of crop diversification.

As coordinator of the Network on Irrigation Management for Crop Diversification (IMCD), IIMI planned and organized the tour. IIMI staff members accompanied the team.

The team of irrigation managers was drawn from the following four member countries of the IMCD Network: Indonesia, Malaysia, the Philippines and Thailand. All of them were also involved in a joint program conducted by the German Foundation for International Development (DSE) and IIMI, and most of the project costs were borne by that program.

The team consisted of two members from each of the four countries. Each country team consisted of one member with an irrigation engineering background, and the other with an agricultural background.

In order to ensure a harmonious balance of expertise within the whole group, each country was invited to nominate about four possible members for the team. IIMI finalized the selection in consultation with the heads of the national agencies concerned.

The irrigation agencies of Egypt and Morocco had arranged interesting programs of field visits and discussions to give the visiting group opportunities to understand their management methods in detail. The tour took place in October/November 1992.

The team assembled initially at Colombo for two days of discussion and orientation. Here, the assignments for writing the various chapters of the report addressing the following issues were made:

- Processes for water control and water allocation among crops and among farmers
- The role of water users' organizations
- Processes for farmer/agency interaction
- Finance and cost recovery mechanisms
- Factors influencing farmers' crop choices
- The role of post-harvest facilities (such as markets or processing plants) in influencing crop choices
- Seasonal water and crop planning methods, and
- Provision and management of drainage facilities.

The team then proceeded with the tour and spent about 10 days in each country.

At the end of the tour, the team returned to Colombo, where the report was finalized. There will be a review of this report in the next IMCD News issue.

Charles L. Abernethy
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THAILAND'S LAM NAM OON FRIENDSHIP SOCIETY'S IMCD WORK

The founding meeting of the group was held at the Operations Center headquarters of the Lam Nam Oon Irrigation Project at Sakon Nakhon, Northeast Thailand, in August, 1990. Founders included a number of Royal Thai Government officials, private agri-business leaders, farmer-irrigators from the Lam Nam Oon area, and foreign specialists interested in the concepts and practices of Advanced Water Management as developed at Lam Nam Oon.

Those present reviewed ten years of experience of the Royal Irrigation Department, other interested Royal Thai Government agencies, farmer-irrigators of the Lam Nam Oon area, and the private agri-business sector. That experience concerned a Thai search for viable irrigation diversification in dry-season production. Lam Nam Oon is a vital part of that search.

A successful conclusion to that search would benefit millions of Thai farmers now immobilized or whose production efficiency is much reduced during the annual dry seasons. Presently, 36 percent of Thailand's constructed irrigation capacity is potentially useable in each dry season but only 8 percent is in use. All else lies idle for lack of applied concepts and practices in Advanced Water Management.

Starting in 1978, the principal Thai government organization responsible for development at Lam Nam Oon — the Royal Irrigation Department — joined with six other Thai government agencies in an effort to make that irrigation system produce profit-making and sustainable marketed crops during each dry season.

Lam Nam Oon has succeeded in doing this on a modest scale. Farmer-irrigators now obtain B100,000,000 during each dry season. Ten years ago their dry season crop earnings were virtually "0." However, the experience is demonstrating how very many different factors are interdependent in affecting farmer and private agri-business decision making when making investments in Thai dry-season agricultural production. It is also demonstrating how the government must work in order to encourage sound decision making and sustained follow-up in these matters by farmers and the private sector alike.

Several essential factors have emerged from the experience as critical. These have generated concepts and practices of Advanced Water Management which go far beyond engineering delivery and management of irrigation water. They comprise the following for Thai dry-season irrigated high-value and marketable crop production:

- Irrigation engineering and operations from rain to drain which secures water delivery on schedule, with adequate quantities, and according to correct applications.
- Adoption of crops and cropping practices which are socioeconomically as well as agronomically suited to particular irrigation areas.
- Fusion of socioeconomically adopted crops with securely scheduled, reliably priced, private sector agri-business and marketing arrangements.
- Sustaining the environment so that the quality and quantity of water are assured with minimal threat to soil fertility and crop marketability.

After a review of the findings, it was decided to establish a Lam Nam Oon Friendship Society. This Society will explain and assist in the propagation of Advanced Water Management for dry-season irrigation production of valuable and steadily marketable crops throughout Thailand. The Lam Nam Oon model will be further developed as part of this effort.

In its activities, the Society will support efforts by the Royal Irrigation Department, other interested Royal Thai Government agencies, farmer-irrigators, and the private agri-business sector to further develop and test Advanced Water Management concepts and practices. It will, in particular, seek and support the creation of a specialized nongovernmental institute which is organized, funded, and operated to assist these efforts on an expanded and sustained scale within Thailand. Again, in relation to this, the Lam Nam Oon model will be used as a basis for development, testing, and extension elsewhere among selected Thai irrigation systems.

Joining the Society is by invitation only. No fees or contributions are levied. The only obligation for accepting membership is a personal willingness to participate in and/or learn more about the concepts and practices of Advanced Water Management for Thai dry-season irrigated high-value crop production.

Members of the Society are invited to visit the Lam Nam Oon site where overnight stay facilities are available. Staff there, if notified in time, will provide transport from the nearest rail/air center (Udon Thani) and arrange briefings as well as field observation of the concepts and practices of Advanced Water Management under dry season development/ application at Lam Nam Oon.

Arrangements for such visits can be made through the Secretary of the Society: *Mr. Anthony M. Zola at Bangkok, Thailand: Tel. (66-2) 246-1714 and Fax (66-2)246-5785.*

CROP DIVERSIFICATION: AN ALTERNATIVE STRATEGY FOR IMPROVING IRRIGATION WATER MARKET IN BANGLADESH

A two-day workshop on Irrigation Management for Crop Diversification in Bangladesh was held during 5-6 March 1991 at the Bangladesh Agricultural University (BAU), Mymensingh. The workshop discussed the findings of the first phase of a Ford Foundation-funded research project, "Crop Diversification: An Alternative Strategy for Improving the Performance of Irrigation Water Market in Bangladesh." This three-year multidisciplinary research project is directed by Prof. M.R. Biswas, an eminent Irrigation Engineer at BAU. It involves researchers from a number of BAU disciplines such as agronomy, horticulture, soil science, plant protection, irrigation engineering, farm engineering, agricultural economics, sociology, and food technology.

There were eleven presentations based on a broad diagnostic survey conducted in four different agro-ecological regions of the country. The regions are (i) Chandina in Comilla District, which falls under the Old Meghna Estuarine Flood Plain Zone, (ii) Ghatail in Tangail District, which falls under the Old Brahmaputra Flood Plain; (iii) Sadar Upazila of Jhenaidaha District, which falls under the High Ganges River Flood Plain, and (iv) Sadar Upazila of Thakurgaon District, falling under the Old Himalayan Piedmont Plain. The major findings of the workshop presentations are reported below:

The study confirms that nonrice crops share an insignificant proportion of irrigation water (6.59% in Thakurgaon deep tubewells [DTWs], 5% in Jhenaidah DTWs and 19.85% in Chandina DTWs and none in Ghatail). This implies lower irrigation duty and higher irrigation costs of rice irrigation. The degree of irrigated crop diversification under DTWs is in general lower than under shallow tubewells (STWs), implying that as the scale of irrigation technologies diminishes, say DTW to MOSTI, the degree of nonrice irrigation improves because of more flexibility in and control over management of equipment. However, the overall irrigation canal system efficiency (OICSE) is low (less than 70%), and OICSE of

STWs is better than that of DTWs. Irrigation management performance ratio (MPR) increases proportionately with OICSE.

The study also shows that nonrice crops can be irrigated by different designs of furrow methods by using basically the same basins as used for flood irrigation to major cereals such as rice and wheat. Water requirements for T. aman, the major wet-season rice crop, remain largely unmet, which implies that the provision of supplemental irrigation does have a very high potential for improving yields of T. aman.

Nonrice crops do, in general, need finer tillage than rice crops. Nonrice crop production also saves water because land preparation for these crops does not require water. The study revealed that the promotion of nonrice crops in some areas increased demand for farm power, which in effect created a market for power tillers such as in Chandina and Thakurgaon.

In areas with good soils, such as in Chandina where high doses of fertilizers and intensive irrigation were applied, yields of major cereals were very high. The planting of HYV boro can be pushed back up to March in most areas of the country, and a period of 3-3.5 months can be made available for growing nonrice crops with irrigation.

Nonrice crops, especially vegetables, grew well almost in all the locations, and yields of these crops were in most cases higher than national averages but far less than achievable yield levels. It implies that improvement in agronomic and cultural practices such as weeding, mulching, method of irrigation, planting dates, fertilizer application, is likely to improve yields further.

One important finding of this study is that technologies of crop production, especially irrigation technologies for diversified cropping have spread more intensively and rapidly when institutions and infrastructural development took place simultaneously (e.g., spread of HYV technology with the initiation of Comilla cooperative model in Chandina). The opposite took place when technologies were pushed in isolation of appropriate institutional development (e.g., Thakurgaon and Ghatail).

Vegetable production has appeared to be highly profitable in Chandina and Jhenaidah where irrigation was applied to these crops. However, the vegetable-based cropping patterns needed high cash requirements, which are normally beyond the means of farmers, especially small farmers. One encouraging feature observed in Chandina and Jhenidah is that farmers' accumulations of profits from vegetable-based cropping patterns could cover a part of cash requirements for irrigated nonrice crop production. However, the vegetable production needed marketing, processing and storage facilities to increase farmers' returns. To this end, the export market also needs to be explored.

Pulses and oilseeds gave high positive returns and, when irrigated, yields and returns significantly increased and could compete with HYV boro favorably.

Expansion of irrigation to nonrice crops has given rise to an irrigation water market, which has attained a reasonable level of entrepreneurial character, led to economic uses of water for both rice and nonrice crops, and made both water sellers and water buyers aware of costs and returns of irrigation water.

The expanded water market has resulted in higher financial returns to investment in tubewells, especially shallow tubewells as demonstrated by high benefit cost ratios and internal rates of returns. Irrigation water market also induced innovative adjustments in on-farm water management and in water conveyance structures, as observed in Chandina. Water conveyance structures which are mostly kutcha and are normally used for flood irrigation to rice, have been modified and adapted to vegetable production. These are important lessons that can be replicated in other areas of the country.

Chandina, in fact, demonstrated that high population density or low per capita land availability, a more or less common feature in Bangladesh, does not appear to pose a serious obstacle to crop intensification or crop diversification, provided the whole host of institutional back-up services such as marketing, transport, storage, and processing are available at least at the initial stages of technological transformation.

The proceedings of the workshop, which also include eleven individual papers and an expanded summary of the findings and discussion, are almost ready for publication. Any communication in relation to the research project or the proceedings may be made with either Prof. M.R. Biswas, Department of Irrigation Water Management, or Dr. M.A.S. Mandal, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh, Bangladesh.

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BANANA CULTIVATION IN TAMIRAVARUNI SYSTEM IN TAMIL NADU

"Main System Management and Performance — Tamiravaruni System" is the title of a research study under the IIMI-INDIA Collaborative Research Programme. The Tamiravaruni System is one of the five largest irrigation systems in Tamil Nadu and is based on *anicuts* and a system of tanks to balance variation in river flows. Water is conveyed to fields either by means of eleven supply channels or tanks connected with the above supply channels, taking off from existing anicuts to command 34,934 ha. The tail-end areas have bigger tanks compared with other areas.

Rice is the main crop. The cropping pattern followed in the system is rice-rice-pulses. The first crop rice is grown in June-September (KAR), and the second crop rice in October-March (PISHNAM). A third crop of pulses is grown in April-May, using residual soil moisture. Since water has to be released in the river for power generation, industry and domestic purposes, and for Advance Kar in some notified areas in the tail end which are not entitled for Kar Season, the river is allowed to flow continuously throughout the year. These circumstances lead farmers to switch to banana. As part of the research, findings on a study on crop diversification are herein reported.

The study reveals that the area under banana has increased from 6 percent to 32 percent of the total area in the last three decades. About 60 percent of this area lies in the tail-end reaches because of bigger tanks and continuous flow in the river. Other reasons for the increase in the banana area are higher income and steady market, even in other states. The net income from two crops of rice is Rs. 12,000 per ha, compared with Rs. 40,000 per ha for one crop of banana. Moreover, rice is very labor-intensive during transplanting and harvesting operations although requiring only 370 man-days for 8 months for two rice crops per ha. Furthermore, the above demand occurs simultaneously at a time over the entire command resulting in labor shortage. In the case of banana, the seemingly higher labor requirement of 643 man-days for 12 months per hectare is uniformly spread out during the entire season. Thus labor scarcity is not reported for banana cultivation.

Rice-rice-banana is the usual two-year crop rotation followed in the head reaches, whereas in the tail-end areas, where the soil is highly fertile, banana is ratooned for more than 6 times. Farmers adopt the trench method of cultivation to avoid water stagnation during the rainy season. Wind damage to the crop is avoided by planting in June.

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IRRIGATION POLICY IN THE CONTEXT OF CROP DIVERSIFICATION IN INDONESIA

As a consequence of sustained efforts to attain rice self-sufficiency, Indonesia's resources and cultural endowments as well as institutional and technological settings are biased toward rice. The heavy emphasis on rice has led to the dominance of this crop, particularly in irrigated areas. This bias is a significant constraint to the expansion of crop diversification in irrigated areas. Some commodities, however, have shown a significant increase in harvested area. For example, during 1985-89 there was a 31-percent (290,000 hectare [ha]) increase in harvested area for soybean, while for corn the increase in harvested area was 20 percent (470,000 ha).

Irrigation Investment Policies

Irrigation investment strategy in the past was also geared toward supporting sustainable growth and rice self-sufficiency. The long-term strategy of irrigation development is based on two premises. First, the performance of existing irrigation facilities needs to be improved and protected from external disturbances. Second, additional irrigated land resources are needed for income and food security.

Four irrigation programs have been implemented since the outset of the five-year plans, namely rehabilitation of the existing irrigation systems, river and flood control, development of new irrigated land and reclamation of tidal-swamp areas.

The investment share for each program in the Fourth Five-Year Plan (1984–89) was 24, 29, 42, and 5 percent, respectively.

Among these programs, rehabilitation has been considered successful in boosting rice productivity despite the tendency toward increasing marginal cost of investment and shorter rehabilitation cycles. The new irrigation development program is the costliest and tidal-swamp reclamation the cheapest. Productivity of tidal-swamp programs, however, is quite low as most of these systems are still in an early stage of development. Technological and soil-quality factors in tidal-swamp agricultural systems are also related to this low productivity.

Management Policies

A reorientation of management policies has been initiated during the last few years. These include a gradual turnover of the government-managed, small-scale systems of less than 500 ha to the water users' associations, assessment of the sources of funding for operation and maintenance, introduction of irrigation service fees, and institutional strengthening.

Although appropriate policy instruments are still being formulated, these policy objectives are conducive to the promotion of crop diversification if implemented properly. Turning over government systems to local communities will internalize water allocation policy within the irrigation system. This enables local communities to set their own criteria and make their own decisions in choosing an irrigated crop mix suitable to local conditions.

Policy Issues for the Future

The policy to promote crop diversification in irrigated areas requires flexibility on the part of farmers to choose crops suitable to their own decision-making criteria. This flexibility, however, is influenced to a certain extent by the performance of irrigation systems. As most irrigation systems in Java are in an advanced stage of development, it is reasonable to expect farmers in Java to be more responsive in selecting a wider range of crops to be grown. High-value commodities such as onion, garlic, and other horticultural crops are among the crops that might be chosen as components of cropping systems, according to the results of a recent study in East Java. Consequently, a further challenge is to prepare the outer islands to make up for substitute food crop production losses caused by changes in cropping patterns in Java. In other words, irrigation development in the outer islands is needed to create a favorable environment to promote food self-sufficiency and farmers' income simultaneously.

[Abbreviated paper presented at the IFPRI Workshop, 9–11 September 1992, Jakarta, Indonesia]

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UPDATE ON THE MAHAWELI AGRICULTURE AND RURAL DEVELOPMENT (MARD) PROJECT

The USAID-funded Mahaweli Agriculture and Rural Development (MARD) Project, managed by Development Alternatives, Inc. (DAI) for the Mahaweli Authority of Sri Lanka has established with the Seylan Bank, a program of cash-flow-based credit for farmers undertaking diversified cropping for domestic and export markets. While traditionally nonrice cultivation credit in Sri Lanka was given only on the basis of collateralized loans, SEYLAN, with MASL and MARD support has agreed to lend funds for inputs, labor and subsistence to members of farmers' organizations participating in the diversification program if they have contracts with a reliable buyer to purchase their crop.

The dominant buyer is TESS (Pvt.) Limited, a Sri Lankan company which constructed the first cold chain/pack house in Sri Lanka in Mahaweli System "B" with USAID, MASL and MARD support. As farmers have learned to grow high value, export-oriented crops on their irrigated fields, they soon saw the need to cool their produce before shipping them abroad. Consultations among farmers, MASL/MARD professional staff and donor representatives led to the decision to construct the Pack House. This in turn has led many farmers to expand or initiate cultivation of high-value crops.

In many areas of System "B," a main obstacle to the production of crops other than rice on irrigated land is drainage. To help overcome this obstacle, MASL and MARD, in close collaboration with Dr. E.R.N. Gunewardene of the University of Peradeniya, have designed and begun the implementation of trials of subsurface tile drains on poorly drained soils with promising results for diversified agriculture if well-drained. Using locally produced materials, these trials will measure the hydrological, agronomic and economic impacts of subsurface tile drains, including their relative cost of installation and O&M compared to surface drainage ditches.

Finally, the MASL/MARD have arranged with Mahaweli farmers in Systems "B," "C," "G" and "H" to cultivate soybean on irrigated land and furnish 1,000 tons to the Ministry of Health. The Ministry has reduced by this amount its request to import soya. The price offered promises a net return to farmers of more than twice the net return to rice if proper cultivation practices are followed.

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UPDATE ON THE DIVERSIFIED CROPS IRRIGATION ENGINEERING PROJECT (DCIEP)

The DCIEP is being implemented by the National Irrigation Administration (NIA). The Japan International Cooperation Agency (JICA) has already approved a 1-year extension of this 5-year project which was supposed to end on 27 May, 1992.

The main output of the project is an Irrigation Engineering Manual for a Diversified Cropping System (now under final editing). The manual is intended to guide in:

a. the formulation of diversified crop production projects (based on turnout service area);

b. the conduct of investigatory studies on the irrigation of crop-diversified farms; and

c. the preparation of plans for the irrigation of nonrice crop production projects.

The target users are NIA staff and farmers.

The Project has completed the following:

a. Irrigation facility design

b. Hydraulic gate operation

c. Reference evapotranspiration estimation

d. Upland irrigation tests

e. Rice water requirement tests

f. Soil investigation tests

g. Nonrice crop production

The subjects of investigatory studies conducted are:

a. Agricultural condition of crop-diversified areas

b. Water use condition in crop-diversified areas.

c. Farm ditch water losses

d. Terminal irrigation facility performance

e. Surface irrigation parameters

f. Crop water requirements

g. Pedological characteristics of diversified croplands

h. Relationship between soil suction and soil moisture

In terms of training, the project has undertaken the following:

	Course	Duration (days)	Participants (No.)
1.	Seminar-Workshop for Trainers	3	15 Trainers DCIEP staff
2.	Seminar on Crop Diversification	5	993 NIA staff
3.	Seminar on Irrigation Engineering		
	a. Principal level	5	31 NIA staff
	b. Senior level	10	40 NIA staff
	c. Junior level	45	40 NIA staff
4.	Seminar on Nonrice Crop Production	5 5	31 farmers + 29 NIA staff

The projected activities for the one-year follow-up period (May 28, 1992 to May 27, 1993) are as follows:

1. Updating and analyzing previously collected data and information from literature research and field tests.

2. Establishment and operation of a pilot Diversified Crop Production Project (DCPP).

3. Conduct of additional location-specific investigatory studies on diversified crops irrigation engineering.

4. Conduct of group training courses on diversified crops irrigation engineering for NIA staff.

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THREE PHILIPPINE IMCD PUBLICATIONS COMING OUT SOON FROM PCARRD

The Philippines Recommends on Irrigation Management for Diversifying Wetland Rice Areas

The limited water supply available for irrigation during the dry season has left a large portion of the irrigated areas in the country uncultivated. This situation has hampered farmers' productivity. For instance, in 1989, out of a total service area of 621,144 ha covered by the National Irrigation Administration (NIA), only 63 percent was irrigated during the dry season. This figure reflects the need for finding ways to maximize utilization of these areas for increased crop production. Diversifying production to include other crops, particularly those which utilize minimal irrigation, is intended to address this problem.

The publication, Philippines Recommends for Irrigation Management for Diversifying Wetland Rice Areas, offers guidance and recommendations to rice farmers and other concerned sectors in diversifying production in rice-based areas to maximize land utilization and improve their productivity and income. A joint undertaking of PCARRD and IIMI, this publication further hopes to encourage strong support from both the government and the private sector in creating a favorable environment and promoting crop diversification in rice-based areas to overcome water supply limitation without jeopardizing farmers' productivity. The publication is targeted to be off the press by December 1992.

Irrigation Management for Rice-Based Farming Systems in the Philippines

Several countries have nearly attained self-sufficiency in rice and the low world price for this prime commodity has reduced the economic returns from rice production. Within this context, three options could be looked into: (1) increasing the economic yields of rice; (2) increasing the area served by the scarce water resources through more effective and efficient irrigation system management; and (3) introducing high-value crops into the irrigated rice farming system.

As water is the most potent resource in rice production, a growing concern points to a concerted effort toward obtaining higher economic and more equitable social returns from this resource. IRRI and IIMI, two prime institutions with mandates on this concern, have undertaken a collaborative research on Irrigation Management for Rice-based Farming Systems.

During September 10-11, 1990, a national workshop was conducted which provided a means for integrating the results of the different studies under the project. The workshop specifically aimed to: 1) present and discuss the final results and recommendations of the different studies, taking into consideration the identified objectives of the project and its overall goal; 2) consolidate the findings and recommendations of the different studies; and, 3) recommend strategies to put into action these recommendations.

This volume includes the research papers presented during the workshop and highlights the issues and recommendations that were discussed.

Technology! Shallow Groundwater Pump System for Augmenting Irrigation Systems

The limitation of existing irrigation systems in the country to irrigate their intended service areas in the dry season necessitates the application of possible means of increasing water supply for crop production. Augmenting the irrigation systems during the dry season by using a shallow groundwater pump system can be an attractive option, considering that: (1) farmers without adequate irrigation water will not be able to cultivate their areas during the dry season; (2) there are many crops other than rice with market potential that can generate additional income to the farmers; (3) shallow groundwater is generally abundant in the downstream or tail-end areas of the irrigation system which can be tapped to augment irrigation; (4) the water augmentation systems are easy to install and are locally available; and (5) the individual farmer has effective control and use of the shallow groundwater pump system in conjunction with the existing irrigation systems. He can also share the use of the pump system with his neighboring farmers without many socioinstitutional constraints. This publication documents the experiences and utilization of the shallow groundwater pump system by farmers in Central Luzon, particularly in the province of Nueva Ecija. The impact of this technology on increasing farmers' income and the guidelines on the construction and installation of the system were also presented. The publication is a joint undertaking of PCARRD and the Central Luzon State University and is targeted for release by December 1992.

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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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