Promoting Implementation of Crop Diversificationin Rice-Based Irrigation Systems in Vietnam

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INTRODUCTION

VIETNAM IS IN the tropical monsoon region. Its land area is 331,000 km^2, of which one third is arable. The annual temperature is 23°C and the annual rainfall ranges from 1,800 to 2,000 mm.

South Vietnam has a higher and a variable temperature. It has more sunshine which is available for agricultural production all year round. North Vietnam's climate is relatively severe. In the winter and spring, from November to April, it is affected by the Northeast cold wind with the temperature averaging below 20°C. Sometimes it goes down below 10°C.

Water resources in Vietnam are abundant but uneven in distribution. Rainfall in the rainy season accounts for 85 percent of the total. Typhoons usually occur from July to November, frequently bringing heavy rains which cause overflowing of rivers and waterlogging.

The country has a dense network of rivers and streams with 25 river systems. About 70-80 percent of the total river runoff is concentrated during the rainy season, causing serious floods. On the contrary, the river runoff is meager in the dry season and the water level is low, resulting in difficulties in irrigation and drought in many areas.

GENERAL AGRICULTURAL DEVELOPMENT

Vietnam is an agricultural country with 80 percent of the population engaged in agricultural production. Rice is the staple food but other crops such as corn, sweet potato, potato, beans, cassava, vegetables and fruits are also widely grown.

The arable land area is 11 million ha, with 7 million ha under cultivation. Three million ha are planted to rice while 4 million ha are in the highlands.

Agricultural production cooperatives (land area ranging from 100 to 300 ha) have been established in the rural areas. Recent reforms in agriculture have considered not only the achievement of self-sufficiency but also commercial production on the basis of market-oriented mechanisms. The right to use lands for agriculture is given to farmers and the peasant household is now becoming an autonomous economic unit in the agricultural economy of the country.

The agricultural land area of the country is not large but the climate allows the growing of more than one crop a year. Thus, emphasis is given to both expansion and vertical development, i.e., expanding new irrigated areas and increasing cropping intensity.

The development of agriculture is considered a priority task in the development of the country's economy. The priority is to meet the demand for food by the growing population.

As a result of policy reforms, agricultural development has progressed especially in the last five years. Annual cropped area increased from 4.8 million ha in 1985 to 5.7 million ha in 1990. Total production of rice increased from 18 million tons to 21.4 million tons. Cropping intensity has more than doubled.

Agriculture, however, is still too dependent on nature. Drought, waterlogging, typhoons, floods and unusual changes of weather remain threats to agricultural production. For example, the spring crop this year suffered heavy losses due to high temperature during the seedling stage and low temperature at the flowering stage.

WATER RESOURCES DEVELOPMENT FOR AGRICULTURE

Over the past years, the development of water resources has been emphasized. One hundred irrigation systems have been constructed. These include 650 large and medium reservoirs, more than 3,500 small reservoirs, 2,500 electric pumping stations with 10,000 pumps and a total power demand of 340 Mw, and over 1,000 sluice gates, with the potential to irrigate an area of 2.2 million ha. The area irrigated by gravity is 840,000 ha, while 800,000 ha are irrigated by pumping, and the rest by minor projects constructed by the farmers themselves. In addition, more than 700,000 ha of coastal land affected by sea water intrusion are now receiving fresh water supplies while 900,000 ha are being drained.

The goals of irrigation development for agriculture are to increase the irrigated area, and the intensity of farming and yields through multiple cropping and crop diversification. To meet these goals, attention has been given to strengthening the operation and maintenance (O&M) of existing systems, assuring a reliable water supply for intensive farming and increasing the production of mainly nonrice food crops in winter.

Annually, the revenue from the 160,000 tons of rice paid as irrigation service fee (130 billion and 12 billion Vietnam Dongs from the Central and Provincial Governments, respectively), have been invested on O&M systems. As a result, the annual irrigated area increased from 4.8 million ha in 1985 to 5.7 million ha in 1990. The nonrice crop area doubled and its production accounted for 12 percent of the total production of the country. Additional nonrice food crops in winter, called winter crops, have been grown, especially in the Red River Delta which is entirely under irrigation. Winter crops occupy 35 percent of the total area on average, the percentage even reaching 40-50 percent in some provinces. Currently, cropping intensity ranges from 2.3 to 2.4.

CROP DIVERSIFICATION IN RICE-BASED IRRIGATION SYSTEMS

Vietnam is a densely populated country with limited arable lands, and many regions remain uncultivated. The development of these areas would require large investments, especially in irrigation development.

Rice is a popular food crop, having great potential for increased production. Thus, rice cultivation represents a major activity in the production system of the country. Irrigated lands can produce 2, or even 3 crops per year.

Since 1980 and especially in the last 5 years, multicropping and crop diversification have played an important role in agricultural development. Table 1 shows the rates of increase in the area cultivated to rice and nonrice crops during the period, 1986-90.

Table 1. Increase in the area cultivated to rice and nonrice crops in Vietnam, 1986-90.

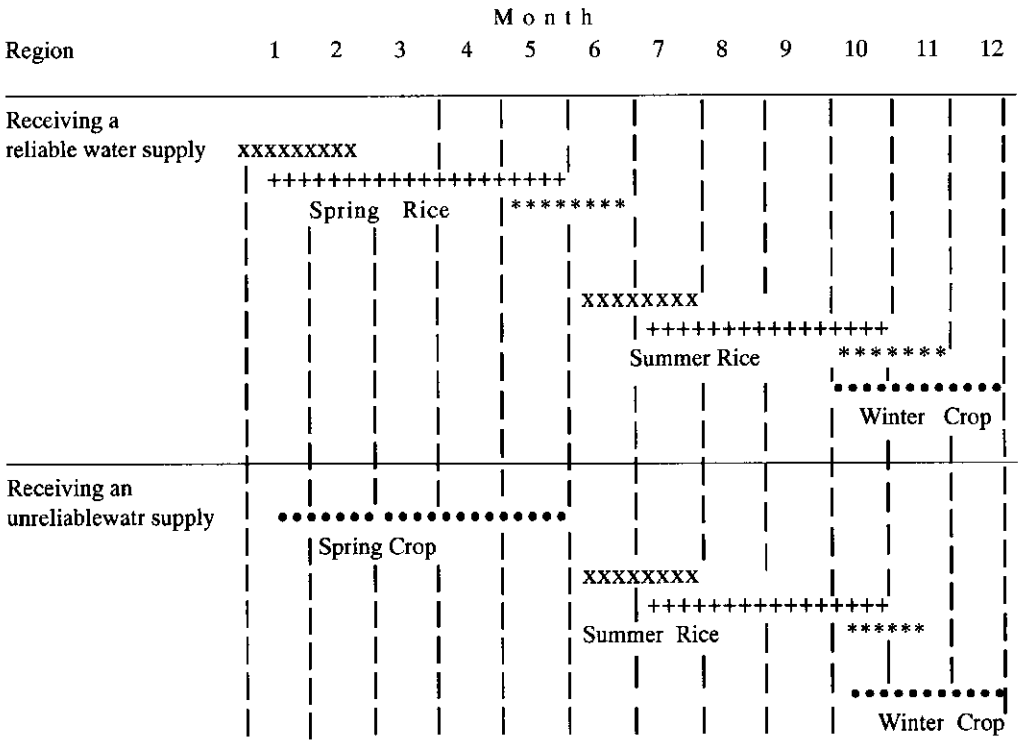
Crop	Percent increase per year	
	Total area	Rice-based irrigation system
Rice	1.25	3.90
Nonrice crops	5.40	12.90

The prevailing cropping pattern in rice-based irrigation systems is rice-rice-nonrice crop (Figure 1). On highlands with an unreliable water supply, the cropping pattern is winter dry crop-spring dry crop-summer rice crop. Major dry crops are corn, sweet potato, potato, ordinary vegetables and high-value vegetables for export such as garlic, chili and water melon.

Since 1980, dry crops, especially nonrice food crops, have played an important role in solving the food problem of the country, and in the development of the economy as a whole.

The food program described in the Five-Year Plan (1986-90) stressed the implementation of intensive farming, multi-cropping and crop diversification in agriculture to achieve food self-sufficiency, and produce agricultural products for export in a short time. Policies and activities of various agencies for promoting crop diversification were in terms of the following: irrigation management, research and extension, and related government policies.

Figure 1. Cropping pattern in a rice-based irrigation system.



Legend :

xxx	Land preparation.
+++	Rice-growing period.
***	Harvesting.
•••	Winter dry crops.

Irrigation Management

Irrigation systems in the country are designed to provide water for rice cultivation. According to field irrigation criteria land preparation, the maximum water consumption is 0.80-1.0 lps/ha while the gross irrigation coefficient is 1.00-1.40 lps/ha.

The irrigation coefficient for rice during the growing state is 0.30-0.40 lps/ha, and 0.30-0.35 lps/ha for nonrice crops (Table 2).

Table 2. Field irrigation coefficient and water requirement of rice and nonrice crops.

Crop	Field irrigation coefficient (lps/ha)	Water requirement (m^3/ha)
Rice		
Land preparation	0.80 - 1.00	1,000 - 2,000
Growth period	0.30 - 0.40	3,500 - 4,000
Nonrice (dry) crops	0.30 - 0.35	2,000 - 2,200

Note: Irrigation technical procedure promulgated by the Ministries of Water Resources and Agriculture.

The cropping season is planned on the basis of climate and the irrigation system's capability to supply water. The water supply (WS) is evaluated based on the amount of water that can be diverted from the water source (Qs), and the gross water demand (Qd). It is essentially the ratio of Qs to Qd.

Usually, during the land preparation period, Qs > Qd, i.e., WS > 1.00. In this case, water is sufficient for crop cultivation. Figure 2 indicates the general relationship between the water supply and the water demand in rice-based irrigation systems.

When the WS can be maintained above 0.80 but below 1.00 and the whole service area in the irrigation system is still planted to rice, rotation irrigation and water saving through proper water management have to be implemented. In cases where WS is expected to be lower than 0.80, some rice lands are planted to nonrice crops. Usually, crop diversification occurs at the highland or tail-end areas of the system. When this situation occurs, the system managers inform the district and agricultural production cooperative leaders and make their suggestions to them. Leaders in areas that will be difficult to irrigate need to be notified to make the cooperative cropping plan possible.

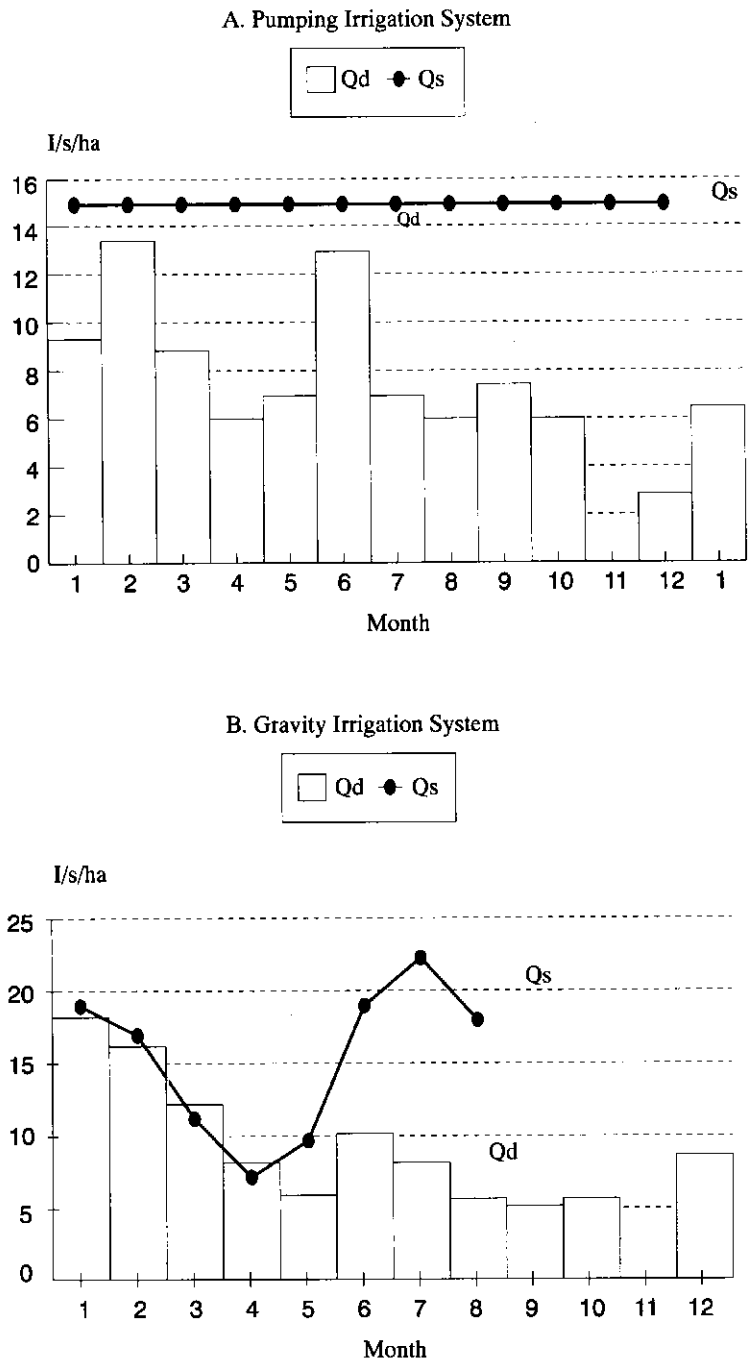
Cooperative leaders and farmers must make cropping decisions. For example, when WS is less than 0.80, an important issue arises as to whether or not system managers have enough knowledge of soil conditions and reliable data to make decisions on the water supply capability of their systems. In most cases, farmers usually grow rice rather than other crops even if irrigation water deliveries cannot be assured. There are two explanations for this: First, they are more familiar with their traditional cultivation habits, and they have inadequate information on technologies for other crops, which could lead to crop failures. Second, there is a lack of incentives to grow crops other than rice.

Besides the two rice crops, food crops and vegetables are widely planted as winter crops in irrigation systems. Winter crops are planted right after the harvests of very early maturing rice and early maturing rice. To make this possible, the system management must consider the following:

1. Assuring a reliable water supply for transplanting summer rice and for crop cultivation according to the cropping pattern of the year.

   A delay of a crop will result in the loss of the next crop, reducing the crop area and yield, or even in the loss of the first harvest when the weather is bad. Adherence to the cropping season plan, therefore, is a very important factor in determining the success or failure of production.

Figure 2. General relationship between water supply and water demand in a sample rice-based irrigation system.



Notes: Qs = Amount of water that can be diverted from the water source.
Qd = Gross water demand.

2. Assuring good operating conditions of the irrigation system.

   Irrigation systems are in operation to provide water for 3 crops in a year. The repair of physical structures and machines, and desilting are scheduled to be carried out within a one-month period, so they must be done within the shortest time possible.

   River water contains a large amount of silt cm- - 1.0-3.0 kg/m^3. During floods, silt is deposited in the intakes of headworks. The amount of silt reaches more than 1 million m^3, including that in the main conveyance and in the field canal network. Desilting is mainly carried out by machines and manual labor when the amount of silt deposited in the intake of a headwork is 500-2,000 m^3.

   Both electric and diesel pumps are used widely for irrigation in Vietnam. As their usage is continuous, the repair of structures and machines must also be carried out regularly and on time.

3. Draining rain water for winter crop cultivation.

   Timely draining of rain water for winter crop cultivation should also be considered. Norms of field drainage for dry crop cultivation were promulgated in 1978 by the Ministries of Water Resources and Agriculture.

Research and Extension

Research institutes such as the Institute for Research in Water Resources, the Institute of Science in Agriculture, the Institute of Food Crops, Corn Research Institute, and central and provincial extension agencies of the Department of Irrigation, the Department of Cultivation and others have been involved in crop diversification. Research being carried out is on major crop varieties and cultivation technology for increasing crop yield with emphasis on:

1. The cropping season and its relation to cropping patterns in order to avoid the influence of unfavorable natural factors such as flood, drought, waterlogging, cold wind and rainfall.
2. Diversification of rice varieties. Rice varieties with different growth durations have been studied and selected. Early-maturing and very-early-maturing rice varieties are needed to make winter crop cultivation possible or to prevent loss of summer rice crop.
3. Technical procedures for the irrigation of rice crop and dry crops. The technologies used in cultivating corn, soybean and potato are examples of other fields of research.

Research stations and experimental fields of various institutes and extension agencies constitute an effective network for research and extension. These research stations are generally located in cooperative fields, and are conducted by agriculture and irrigation technicians and engineers. These serve as avenues for training cooperative leaders in agricultural production, farmers, and agriculture and irrigation workers at the farm level.

Pamphlets and easily understandable guides and manuals on irrigation and crop cultivation techniques have played an important role in improving farmers' knowledge and competence in agriculture.

Government Policies for Promoting Crop Diversification

Some incentives offered for the cultivation of winter crops are:

1. Sufficient supply of fertilizer and seeds.
2. Lower input costs.
3. Adequate electric power for pumping.
4. Free water service. In some provinces, water service is given free to encourage farmers to cultivate winter crops. Irrigation costs are subsidized from the provincial budget although this continues to be a subject of debate.
5. Availability of markets and reasonable market prices for winter crops.
6. Increased investment capital for irrigation management. Priority should be given to the enhancement of desilting and repairing of irrigation facilities.

Constraints to the Implementation of Crop Diversification

The fragmentation of diversified cropped area results in increasing costs of irrigation and difficulties in system management. Taking into account the overall costs of input, it is clear that costs are still high despite some inputs being provided at a low price.

The market for farm products is unstable and the processing industry for agricultural products is still not available. Some locations produced more garlic, chili, water melon, etc., but these were unmarketable, making farmers lose interest in nonrice crop production.

CONCLUSIONS AND RECOMMENDATIONS

Crop diversification in rice-based irrigation systems involves problems with regard to research, technology and cost. Its development depends not only on physical conditions but also on farmers' cultivation habits and government policies. There is a need to study its overall benefits on the basis of various cropping patterns as well as policies supporting the implementation of crop diversification.

There is also a gap between research and extension. In Vietnam, cropping seasons, cropping patterns and infrastructures for restricting adverse natural influences on crops are still objects of research and extension activities. In this regard, the cooperation between international agencies and national institutions, especially between IIMI, FAO and Vietnam under the TCDC spirit, is of great significance. The cooperation can be based on the following:

1. Establishing methodologies for crop diversification in irrigation systems on the basis of market-oriented mechanisms.
2. Evaluating overall benefits of crop diversification as a basis to determine optimal cropping patterns.
3. Assessing optimal irrigation system performance under crop diversification conditions.
4. Upgrading physical conditions of the irrigation system to improve system performance.