

Promoting Implementation of Crop Diversification in Rice-Based Irrigation Systems in Sri Lanka

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INTRODUCTION

SRI LANKA is a tropical island in the Indian Ocean situated between the latitudes 6°N and 10°N, with a gross land area of about 65,000 km². The main source of income is the agriculture sector, with water and land as the prime physical resources. Over 75 percent of the country's population of 16.5 million, live in the rural areas, with agriculture or agriculture-related activities as their main occupation.

Sri Lanka receives most of its rainfall during the northeast and the southwest monsoons, resulting in two distinct seasons for cultivation, *maha* or the main season from October to February, and *yala* or the dry season from April to June. More precipitation is experienced over the whole island during the northeast monsoon, which usually supplies adequate moisture for the cultivation of crops. The southwest monsoon brings rains mostly to the southwest parts of the island, resulting in soil moisture inadequacy in the other parts during the rest of the year. Based on this phenomenon, the island is roughly divided agroclimatically into dry, wet and intermediate zones.

Rice is the staple diet of the people and is the main crop grown under irrigation. Although Sri Lanka has come very near self-sufficiency in rice, there is still a need to increase rice production to feed the growing population. In turn, increased production demands optimum utilization of the limited land and water resources. To meet this need, the operation of the existing irrigation

schemes at a high level of agricultural production becomes an important objective of the government. Therefore great emphasis is now placed on the following activities:

1. Rehabilitation and improvement of the performance of existing irrigation schemes.
2. Improvement of the management of the irrigation schemes by:
 - a) ensuring farmer participation in the operation and maintenance of the schemes; and
 - b) integrating the services and facilities provided by the various government agencies concerned with the development of irrigated agriculture.

IRRIGATION AND IRRIGATION MANAGEMENT

The total land area under irrigation at present is approximately 520,000 ha, of which 300,000 ha, are managed by the Irrigation Department (ID), 45,000 ha by the Mahaweli Authority of Sri Lanka (MASL), and 175,000 ha by the Department of Agrarian Services (DAS).

The DAS manages minor irrigation schemes with command areas of less than 80 ha. These are small village irrigation schemes renovated or newly constructed by the government and handed over to the farmers for operation and maintenance. It is estimated that there are about 25,000 minor irrigation schemes irrigating about 175,000 ha.

The main feature of the irrigation systems under the Mahaweli Project is the diversion of water from the Mahaweli basin by means of transbasin canals to supplement old irrigation schemes. Twelve old irrigation schemes have benefitted from this diversion.

The planned irrigable area under the current program is approximately 200,000 ha. Approximately 120,000 ha of this area have already been provided with irrigation facilities, with 75,000 ha maintained by the ID and 45,000 ha directly managed by the Mahaweli Authority.

The history of the ID dates back to the year 1900, since when, it has been engaged in the development of irrigation in Sri Lanka. It has constructed a large number of irrigation schemes (reservoirs and run-of-the-river diversions) all over the island.

According to the nature of water sources and supply in the dry zone, five broad categories of irrigable lands are identified.

Category 1: This consists of major irrigation schemes with transbasin diversions from the wet zone. In this area, almost every year during maha and most years during yala, there is an adequate supply of water. Hence, the greatest opportunity for crop diversification exists within this area.

Category 2: This consists of major irrigation schemes with their own catchment areas lying within the dry zone. Only during years of normal rainfall is the full irrigation supply assured for maha, and at least 25-50 percent of the supply for yala. One of the more difficult management problems lies in planning, due to the highly variable availability of irrigation water.

Category 3: These are minor irrigation schemes with moderately stable water supplies. Crop diversification is done during the yala season.

Category 4: These are minor irrigation schemes with unstable water supplies. There is a potential for crop diversification which is yet untapped. Although experiments are successful in cultivating nonrice crops (NRCs) at least in parts of the command area no effective intervention has taken place.

Category 5: This consists of schemes with lift irrigation from open shallow wells or channels. NRCs with high productivity rates are usually grown as the cost of water pumping has to be covered.

The main problem of irrigation management is the lack of awareness of involved officials as well as farmers. Strengthening extension activities will be a good way of addressing this concern.

During the past few years, increasing attention has been given by the authorities to the role of farmers in the management of irrigation schemes. From the position of a passive recipient of resources, they now become active participants. Both the authorities and the farmers have realized the need for this participation.

Farmers' organizations are essential to ensure farmer participation in the activities of a scheme. These organizations will provide an opportunity for dialogue and interaction between the farmers and the officers working with them. This makes a cropping program much easier to implement.

Experiences gained so far have shown the need for farmers' organizations to share in management decisions and responsibilities. Farmers' organizations should be considered not merely as a desirable element but as an essential component of irrigation management. They have to play a major role in crop diversification in irrigation systems.

IRRIGATED RICE-BASED CROP DIVERSIFICATION

Prior to the 1960s, irrigated agriculture in Sri Lanka was synonymous with increasing the area under rice with the sole aim of achieving self-sufficiency in rice production. In the early 1960s, recognizing that water was the limiting factor for food production, the Department of Agriculture started field experimentation and extension work in growing NRCs on irrigable lands during the dry yala season. Initially, crop diversification was accepted with mixed responses at a time when irrigation management was not considered at the policy-planning level. In the late 1970s with the Accelerated Mahaweli Development Project (AMDP), new directions had to be looked at with regard to irrigated agriculture where crop diversification clearly showed comparatively better economic benefits for the individual farmer. The design criteria of the AMDP had been improved, based on the experiences of previous irrigation schemes. Subsequently, the actual operations were adapted for irrigation management for crop diversification through research and extension.

Table 1 shows the potential area for crop diversification in irrigated areas. The potential areas are based on the water availability in tanks and the drainage class of the soils.

Table 1. Potential area for crop diversification (CD) in irrigated areas of Sri Lanka.

Province	Irrigated area (ha)			Potential area for CD (ha)			
	Major	Minor	Total	Major		Minor	
				Maha	Yala	Maha	Yala
Western	2,974	6,992	9,966	145	733	340	1,680
Southern	24,570	11,980	46,550	8,745	11,370	2,990	4,490
Uva	10,824	14,678	25,502	3,245	7,575	4,405	10,275
Sabaragamuwa	1,937	12,095	14,032	580	1,355	3,055	7,320
Central	11,069	21,770	32,839	1,880	5,390	3,340	9,630
Northwestern	21,380	45,826	67,206	6,410	14,300	13,750	31,070
Northcentral	57,964	45,401	1,03,095	18,640	37,720	1,57,775	20,430
Northern and Eastern	1,20,387	29,193	1,49,580	41,190	65,130	10,080	13,200
Total	2,50,335	1,87,935	4,38,770	80,835	1,43,575	53,735	98,095

Source: Data based on DOA 1989-90 Agriculture Implementation Program.

Table 2 shows the cultivated area of nonrice crops by district, during the 1990-91 maha season and the 1990 yala season.

Table 2. Cultivated area (ha) of other field crops under irrigation by district.

District	Maha 1990-91	Yala 1990
Puttalam	2,283	1,627
Kurunegala	177	9,240
Ratnapura	82	308
Kandy	0	95
Matale	117	1,330
Badulla	148	1,701
Monaragala	25	225
Jaffna	4,349	3,384
Killinochi	1,185	970
Vavuniya	6,245	1,132
Mullaitivu	3,796	na
Mannar	1,598	na
Anuradhapura	356	5,104
Polonaruwa	767	3,449
Trincomale	884	na
Batticaloa	2,269	na
Ampara	19	1,118
Hambantota	4,424	1,291
Kalawewa	141	10,270
Walawe	360	219
System B	na	683
Total	29,225	42,146

Note: na = data not available.

PROGRAMS/ACTIVITIES RELATED TO PROMOTING CROP DIVERSIFICATION

Research and Development

Agricultural research in Sri Lanka is presently handled by the Department of Agriculture, Department of Minor Export Crops, Forest Department, Tea Research Institute, Rubber Research Institute, Coconut Research Institute, Sugar Research Institute, Veterinary Research Institute and the Post-Graduate Institute of Agriculture. With these many agencies conducting research and development activities there is no overall body like the Indian Council of Agricultural Research (ICAR), Malaysia Agricultural Research and Development Institute (MARDI) or the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD)

to direct research at the national level. As a result, priorities cannot be determined and interacting areas of research are often neglected. Without such a body, there is very little communication between the government and the individual research organizations. In 1987, however, the Council for Agricultural Research Policy (CARP) was established by an Act of Parliament. It advises the government on all matters pertaining to the planning, coordination and execution of agricultural research handled by the ten organizations stated above.

Most of the research and development works on growing NRCs in rice fields is carried out by the Department of Agriculture. Research problems could be related to agronomy, water requirements at the field level, effective control of soil moisture regimes, on-farm irrigation and drainage systems, selection of crops and varieties, breeding and introduction of new crops, and economic evaluation. These are presented to the researchers at a seasonal forum called the Provincial Technical Working Group (PTWG). Research on the socioeconomic aspects, management problems and system control is handled by various national agencies with support and assistance from the International Irrigation Management Institute (IIMI), which has a special Sri Lanka Field Operations Office.

Pilot-Testing and Demonstration.

Adaptive research into the transfer of new technology or the improvement of an existing technology is jointly carried out by the research and extension divisions of the Department of Agriculture. Adaptive research is conducted in farmers' fields by the extension division.

The Mahaweli Agriculture and Rural Development (MARD) Project aims at carrying out special demonstrations in farmers' fields in System B of the Mahaweli scheme to assist diversified cropping. New technologies, crops and varieties, better seed and planting materials, and improved water management techniques are some of the components of this project. It also aims to raise the income levels of the farmers through increased production and the cultivation of high-value crops.

Training

The training of officers in the DOA is carried out through organized and systematic bi-weekly training programs. These programs are based on cultivation in the field and the work to be done during the two weeks following cultivation.

In addition, officers are trained ahead of the season on subjects requested by the field staff so that they will be competent in advising the farmers. There are special training programs on specific subjects conducted at the In-Service Training Institutes. The Mahaweli Economic Agency also conducts regular and systematic training programs for its staff, mostly in conjunction with the DOA.

Farmer training is conducted in the field by the DOA extension staff on a group-approach basis relating to the day-to-day problems encountered by the farmers. It may be need-based or on a general topic. Village level extension officers are expected to regularly visit their assigned areas.

PROBLEMS IN PROMOTING CROP DIVERSIFICATION PROGRAMS

The constraints involved in crop diversification have been identified in the various physical, agronomic, economic, social and management areas. Moisture inadequacies as well as excesses, soil drainage problems, structural inadequacies to cope with the various irrigation demands, lack of awareness in the farmers of the additional work necessary to make the field suitable for NRCs, limited crop and varietal availability, marketing and storage problems, social values which have a negative effect on NRC promotion and farmer organizational problems are a few of the factors which would affect a crop diversification program.

Information on Crop Diversification Technologies

The transfer of technology on the cultivation of the new NRCs from the researchers to the farmers, and the feedback on its impact are major and important components in the implementation of a crop diversification program. Very frequently, a major setback in the successful cultivation of NRCs in rice-based systems is the lack of precise information needed by the farmers on the use of new technologies. Sometimes, even the government officers are not aware of the need for the precise control of soil moisture for higher yields in NRCs, which could be due to inadequate agronomic data on nonrice crops. This makes it difficult to promote these crops to the farmers.

There are even problems which research has not been able to address. At times, the officers have not been able to provide the farmers with the answers they need.

Socioeconomic Incentives

As is well known, higher prices for the farmers' produce provide the best incentive for them. Commercial farming, however, requires access to more capital. Farmers' organizations or even individual farmers should have access to markets and quality planting materials.

In the nucleus farm/outgrower scheme, one who has a nucleus farm supplements the supply to his factory or direct market with an organized supply from a group of outgrowers generally located close to his operation. In contract farming, a purchaser enters into an agreement with the farmers who will supply him with a particular product. The most risky system is where farmers cultivate to cater to a market that they know exists but are not sure of the details of the price and quality required. It is in this instance that the middleman steps in and fills the void in the marketing system, and in some instances, exploits the farmers.

APPROPRIATE STRATEGIES TO PROMOTE CROP DIVERSIFICATION

Research-Extension Linkage

In the implementation of a crop diversification program, a frequent and regular reciprocal dialogue between research and extension is essential. The cultivation environment of NRCs is different from that of rice and it is inevitable that many field problems will occur in relation to agronomy and socioeconomics. A continuous flow of information from research to extension and to the farmers, and a reverse flow of field issues and problems is a standard approach that is necessary for the implementation of a crop diversification program.

Research and extension linkages are fairly well maintained through the organized structure of the Department of Agriculture which plays an active role in crop production. Information that is needed by other institutions or organizations involved in crop diversification is supplied by the DOA whenever required or requested. Regional Research Centers (RRCs) have been established in all identified major agro-ecological regions in the country to cater to the research services required in these regions.

Extension services were planned and implemented by experienced Assistant Directors of the DOA at the district level, and through a well-organized network of extension officers at the middle and grass-root levels. They are all in a direct line of command for technical and administrative functions. The main purpose is to use the extension program as a tool to boost national agricultural production. A different technical and administrative structure has been adopted by the Mahaweli Economic Agency (MEA), but it also maintains a similar information system. Even in the MEA, most of the research and extension programs are supplemented by the DOA.

With the reorganization of the administrative functions in the provinces and the devolution of central responsibilities to the provincial governments, a modification of the extension procedures has been done. Different provincial governments adopt different systems of extension administration. Shortcomings in the delivery of extension packages and in the provision of other services are reported. The link of farmers with extension at the grass-root level was the *Krushikarma Vyapti Seva Nilandhari* (KSVN). This "link" was replaced by the *Grama Seva Niladhari* (GSN) who has fewer farmers to deal with. The disadvantage with the new arrangement is that the GSN is burdened with the other administrative functions of the farmers. This goes against the extension principle that has been practiced in which the complete attention of the extension workers is given to the farming activities of the farmer.

At present the research-extension linkage is relatively weak due to the unreliability of information coming from the field and the inability of those concerned to evaluate the magnitude of the field problems.

Appropriate Incentives

The incentives available for farmers to implement a crop diversification program are either direct or indirect in nature. The direct incentives are: a) the delivery of inputs in the required quantities at convenient locations and at affordable prices, b) a complete agricultural extension system that

assists farmers to diversify into NRCs successfully and profitably, c) a regular and organized market information system so that farmers can take decisions on what crops to cultivate, and d) distribution of prizes, in cash or in kind, to generate competition among farmers growing NRCS. Although these will encourage the farmers to diversify, to some extent they will act only as initial incentives.

Therefore, if diversified cropping is to be a permanent feature then it is desirable to look at other types of incentives such as favorable prices, better markets, improved processing technologies, better transport systems, etc.

CONCLUSIONS AND RECOMMENDATIONS

Role of National Institutions and Agencies

A number of organizations are involved at present in the implementation of crop diversification programs in Sri Lanka. These are mainly, the DOA, the MEA, and the Irrigation Management Division of the Irrigation Department. Now, the Provincial Councils are also involved through their Ministries of Agriculture. Unfortunately, each of these organizations works independently of the others. A concerted and coordinated program is necessary if the country's diversification program is to be expanded and sustained. All these institutions should agree that an increased contribution to national production and farmer incomes are the objectives in diversifying into NRCs. These two common objectives should make coordination easy.

Grassroot-level organizations have to be strengthened through irrigation management organizations to be able to take greater responsibility in planning and implementing diversification programs. They should also supply accurate information to the management and pass it on to their fellow farmers. This becomes even more important in the absence of suitable extension workers at the farm level.

Role of other Countries and International Agencies

The exchange of information on experiences in crop diversification in different countries is important. The interaction among personnel who actually implement such programs through newsletters, for example, is beneficial. However, it should be understood that all experiences may not be transferrable to any country due to climatic, socioeconomic and other differences.

Through financing crop diversification programs, international agencies can be directly involved in such programs. They may be able to convince the planners at the national level on the importance and benefits of crop diversification. International agencies could convince the planners at the national level on the need for grassroot-level extension, help in funding research activities, and assistance in training of extension staff and policymakers, and in identifying and obtaining better seeds and planting materials.

Finally, the degree of success of a crop diversification program lies in its acceptance by the farmers. International agencies can play an effective role in negotiating with governments to offer

attractive prices and better markets for NRCs. The exchange of information on market needs of different countries is an area where they can play a crucial role so that farmers who grow NRCs concentrate on better quality produce and processed products to earn a better income. This global market intelligence system will enhance the value of the produce even on a regional basis, and thus, enhance the global demand from the region.

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