PD-AAV-890

UNCLASSIFIED

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

PROJECT PAPER

Proposal and Recommendations
For the Review of the
Development Loan Committee

SRI LANKA - Rice Research

AID-DLC/P-2189

UNCLASSIFIED

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

UNCLASSIFIED
AID-DLC/P 2189
June 22, 1976

MEMORANDUM FOR THE DEVELOPMENT LOAN COMMITTEE

SUBJECT: SRI LANKA - Rice Research

Attached for your review is the recommendation for authorization of a loan to the Government of Sri Lanka ("Borrower") of not to exceed Four Million, Two Hundred Thousand Dollars ($4,200,000). The proceeds of this loan will be used to finance the Foreign Exchange costs of technical assistance, training, and commodities to aid in agricultural research of paddy varietal development and identification of improved crop production systems associated with paddy agriculture and the application of these research activities to the farmer.

No meeting has been scheduled for this project. Please note that your views are requested by close of business on Tuesday, June 29, 1976. If you are a voting member a poll sheet has been enclosed for your response.

Development Loan Committee
Office of Development Program Review
and Evaluation

Attachment:
Summary and Recommendations
Project Analysis
Annexes

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE (Check appropriate box) — X Original; Change; Add; Delete

PP

DOCUMENT CODE: 3

2. COUNTRY/ENTITY: Sri Lanka

3. DOCUMENT REVISION NUMBER:

4. Loan Number: 383 T-016

5. BUREAU: a. Symbol: A; b. Code: 2

6. ESTIMATED FY OF PROJECT COMPLETION: FY 81

7. PROJECT TITLE (SHORT (75) letters within brackets): Rice Research

8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION: a. INITIAL (mo. yr.) 6 76; b. FINAL FY 81

9. ESTIMATED TOTAL COST ($000 or equivalent, $1 =)

a. FUNDING SOURCE	FIRST YEAR FY 76 b. FX	c. L/C	d. Total	ALL YEARS e. FX	f. L/C	g. Total
AID APPROPRIATED TOTAL	4200		4200	4200		4200
(Grant)	( )	( )	( )	( )	( )	( )
(Loan)	(4200)	( )	( )	(4200)	( )	(4200)
Other U.S. 1.						
Other U.S. 2.						
HOST GOVERNMENT		350	350		3430	3430
OTHER DONOR(S)				201		201
TOTALS	4200	350	4550	4401	3430	7831

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS ($000)

a. Activity Number (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FY 76 d. Grant	e. Loan	FY 77 f. Grant	g. Loan	FY 78 h. Grant	i. Loan	ALL YEARS j. Grant	k. Loan
	120	080		4200						4200
		071								
		023								
TOTALS				4200						4200
11. ESTIMATED EXPENDITURES						1224		944		4200

12. PROJECT PURPOSE(S) (75 letters within brackets) — Check if different from PID/PRP

Development of a technological base that permits increases in productivity of paddy land thru:

1. increased yields of paddy per unit area, and
2. increased cropping intensity of paddy land.

13. WERE CHANGES MADE IN BLOCKS 12, 13, 14, or 15 OF THE PID FACESHEET? IF YES, ATTACH CHANGED PID FACESHEET

Yes — X No

14. ORIGINATING OFFICE CLEARANCE

Signature:

Title: Fletcher E. Riggs, Chief
ASIA/TR/ARD

Date Signed (mo. day. yr.): 06 08 76

15. Date Received in AID/W or Field Office Designated for Distribution (mo. day. yr.): 06 09 76

AID 1330-1 (7-75)

TABLE OF CONTENTS

	Page No.
Face Sheet - Definitions of Rates, Weights and Terms	
Part I - Project Summary and Recommendations	1
Part II - Project Background and Detailed Description	4
A. Background	4
B. Detailed Description	11
1. Introduction	11
2. Narrative Description	12
a. Regional Research Centers and National Rice Breeding Center	12
b. Rice Research	13
c. Cropping Systems	16
d. Field Experimentation	24
e. Survey of the Resource Capability	25
C. Summary Logical Framework	27
Part III - Project Analysis	36
A. Technical Analysis	36
1. Appropriateness	36
2. Employment Implications	37
3. Environmental Input Statement	37
4. Summary	38

B. Financial Plan/Budget Tables 38

1. Research Divisions Budget 38

2. Summary Cost Estimate and Financial Plan 40

3. Costing of Project Outputs/L.C. provided Inputs 41

4. Costing of Project Outputs/F.X. provided Inputs 41

5. Summary 42

C. Social Analysis 43

1. Overview 43

2. Project linkage to the Congressional Mandate 44

3. Social Concerns of the Government 45

4. Women 46

D. Economic 47

1. Overview 47

2. Analysis 48

Part IV - Implementation Arrangements and Plans 51

A. Administrative Arrangements 51

1. Recipient 51

2. AID 53

a. USAID Staffing 53

b. Waivers 53

1). Vehicles 53

2). IRRI 54

c. Procurement Schedule 56

	Page No.
B. Implementation Plan	57
C. Project Monitoring	63
D. Evaluation Methodologies	63
E. Logistic Support	63
F. Evaluation Arrangements	64
1. Regular	64
2. Exception Reporting	64
G. Conditions, Covenants, and Negotiating Status	65
1. Conditions Precedent to Initial Disbursement	65
2. Covenants	65
3. Terminal Dates	66
4. Status of Negotiations	66

TABLES

No.	Subject	Page No.
1.	Agriculture's Share of the Economy	4
2.	Employment and Gross Cultivated Average by Crop	5
3.	Changes in Agricultural Production	6
4.	Production, Imports, Total Supply and Self-sufficiency in Food Grains	7
5.	Research Division's Current Budget and Budget Projections	38
6.	Summary Cost Estimate and Financial Plan	40
7.	Costing of Project Outputs/L.C. provided Inputs	41
8.	Costing of Project Outputs/F.X. provided Inputs	41
9.	A Summary Estimate of the Internal Economic Rate of Return	50

FIGURES

No.	Subject	Page No.
1.	Annual Production, Yield Per Acre, and Average Area Harvested - All Sri Lanka	8
2.	Climatic Zone, Soil Region, Edaphic Region and Appropriate Area	9
3.	Regional Research Centers	13
4.	Map of Ceylon	14
5.	Major Rice Problem Areas	15
6.	Breeding Objectives for the Different Edaphic Regions	17
7.	Illustrative Flow of Genetic Material Through A GEU Program to Develop Varieties Adapted to Adverse Soils	19
8.	Flow of Genetic Material Through a GEU System	20
9.	Cropping Systems Organizational Configuration	23

ANNEXES

		Page No.
A.	Desired Staffing Pattern by Functional Area	67
B.	Training	71
C.	Commodity Requirements	81
D.	L.C. Costing of Project Outputs/Inputs by Major Functional Area	88
E.	F.X. Costing of Project Outputs/Inputs by Major Functional Area	90
F.	National Rice and Cropping Systems Research Committee	92
G.	Work Groups	93
H.	Job Descriptions for Technical Assistance Specialists	94
I.	Extension	97
J.	Socio-Economic Factors Affecting Cropping Systems in a Selected Dry-Zone Region	103
* K.	1977 Building Program/Research Division	116
* L.	IRRI Training Program	118
M.	611(e) Certification	125
N.	CPI Tracking System	126
* O.	Borrower's Request for Assistance	129
P.	Draft Loan Authorization	130
* Q.	Statutory Criteria Checklist	134
* R.	Beginning of Project Status	152
S.	Log-Frame	169
* T.	PRP Approval Cable	176

* = Annexes not included in this volume.

Definitions of Rates, Weights and Terms

Currency: U.S. Dollar - $1.00 = 12.7 Rupees

Weights:

1 bushel paddy	=	46 pounds paddy
1 million bushels paddy	=	20,575.7 long tons paddy
1 bushel paddy	=	31.28 pounds rice
1 million bushels paddy	=	13,964.28 long tons rice
1 long ton	=	2,240 pounds
Rs 33/bushel paddy	=	Rs .717/lb. paddy = $.052/lb. paddy @ Rs 13.73 = $1

Acronyms:

AI	=	Agricultural Instructor
AID	=	Agency for International Development
APC	=	Agriculture Productivity Committee
ARTI	=	Agrarian Reform and Training Institute
DA	=	Department of Agriculture
EO	=	Experimental Officer
FTD	=	Field Trials Division
FX	=	Foreign Exchange
GEU	=	Genetic Evaluation and Utilization
GSL	=	Government of Sri Lanka
IDRC	=	International Development Research Center
IRAEN	=	International Rice Agro - Economic Network

Acronyms: (con't):

IRRI = International Rice Research Institute

VLW = Village Level Worker

LC = Rupees (Local Currency)

RD = Research Division

RO = Research Officer

UPLB = Univ. Philippines, Los Banos

PART I Project Summary and Recommendations

A. Borrower: The Government of Sri Lanka

B. Implementing Agency: Research Division, Department of Agriculture

C. Loan Amount: $4,200,000 (Four-Million Two Hundred Thousand)

D. Loan Terms: Repayment of principal and payment of interest within 40 years, including a 10-year grace period of repayment of principal, with interest at two percent (2%) per annum during the grace period and three percent (3%) thereafter.

E. Borrowers Contribution: Rs. 47,000,000 (=$3,400,000) @ Rs. 13.73/$1.00)

F. Summary Description of the Project

The project proposed for financing is a multifaceted effort aimed at expanding the technological base of paddy land utilization. Widespread use of indigenously developed improved varieties and IRRI developed varieties has been realized. This $4.2 million loan project is designed to assist the Agricultural Research Division of the Department of Agriculture to further develop and expand its capability to push out the production frontiers of paddy land technology. The project will focus on paddy varietal development and the identification of improved crop production systems associated with paddy agriculture.

The $4.2 million of loan financed foreign exchange provided by the project will be used to finance a contract with the International Rice Research Institute (IRRI) to provide long term technical assistance (15 man years) in the areas of rice breeding, cropping systems, and field testing in farmers' fields; the training of some 30 participants at the MS.and Ph.D. degree level in ten major areas as well as some 48 short-term training positions for a variety of IRRI/sponsored training courses; and about $1.2 million worth of research equipment and vehicles. The Government of Sri Lanka (GSL) will finance salaries of current and additional staff, maintenance of facilities, in-country support of the technical assistance personnel and building of new laboratories and offices. In dollar equivalent the GSL contribution is estimated to be about $3.4 million.

G. Summary Findings

The project is technically, financially, and economically sound and within the capacity of the Department of Agriculture, Research Division, to implement. The achievement of Project Purpose will provide the technical basis necessary to achieve realization of national goals, particularly increased self-sufficiency in rice, and will substantially contribute to employment and welfare goals of the country. The Mission endorses this loan and it meets all statutory criteria.

H. Recommendation

Authorization of a loan in the amount of $4,200,000 on the terms and conditions as stated in the draft Loan Authorization attached in Annex P.

I. Project Development Team

Loan Officer: Jeffrey W. Evans, ASIA/PD
Chairman Agricultural Economist: Charles H. Antholt, ASIA/TR

J. Project Issues

Issues raised in the PRP review were:

(1) "That the research to be undertaken be specifically applicable to the needs of the small farmers, particularly the means by which the economic environment of the small farmer can be addressed in the research activities to be carried out." The project will expand the Research Division's capability to deal with the environment of the small farmer in two ways. First, through training, particularly by long-term training in Agricultural Economics and by short-term training at IRRI's IRAEN program; Secondly, by expanding the Research Division capability to actually contact and work with the small farmer.

(2) "The relationship of achievement of the project purpose to the impact on the GSL agricultural sector goals." Achievement of the project purpose impacts on the sectoral goals first by directly expanding the technical production frontiers of paddy production.

In addition it impacts on the sectoral goals through increasing the factor productivity of resources engaged in paddy farming, particularly land and labor and thus potentially through the income and wages-goods linkages.

(3) "The linkage between research and extension." The expansion of the Research Division's on-farm research will be carried out in cooperation with the regional and village level extension agents. Similarly, formulation of a national coordinated rice and cropping systems research program will be done with active participation of the Extension Department. See Annex I.

(4) "The role of the Ministry of Irrigation and its relationship under the project to the Ministry of Agriculture in carrying out the resource capability survey." The Ministry of Irrigation will play an informal role in its relationship to the Ministry of Agriculture. Relationships are excellent between the Ministries and it has been determined that the cooperation between Ministries has been good in the past and expected to remain so in the future.

(5) "The need for project assistance to carry out the resource survey as well as the ability to implement the resource capability survey." The Land and Water Use Division is currently handicapped by equipment and vehicle constraints. Overcoming these constraints will enable a small but professional staff to carry out the resource capability survey in the wet lands. An earlier identified problem of inadequate areal photography has been disposed of in that there exists recently flown photography of the area to be covered by the resource survey.

(6) "Justification for the implementation of the project through IRRI." IRRI is the world's leader in applied research on paddy and cropping systems associated with paddy production. It is the Department of Agriculture's expressed wish to obtain technical assistance from IRRI, and IRRI has indicated they are willing to cooperate in the implementation of this project. (See Part 4, A2).

(7) Implications for USAID/Colombo staffing. USAID's currently authorized staff does not have the capacity to monitor this project or the FY 76 companion project with the Paddy Marketing Board. These monitoring responsibilities coupled with expected requirements of the project development activities implies, at the minimum, the addition of an agricultural officer to USAID's staff. (See Part 4, A.2).

PART II Project Background and Detailed Description

A. Background

Of Sri Lanka's total population of 13.5 million in 1973, 80% were classified as rural. Farming provided 50% of total employment, and most of the rural non-farm population depended directly on agriculturally related activities for employment. In the same year the agricultural sector provided 33% of the estimated Gross Domestic Product and 78% of all export earnings.

Table I: Agriculture's Share of the Economy

Agriculture's Share of Country Totals (%)

	1963	1973
Rural Population	82	80
Farm Employment	53	50(est.)
GDP	38	33
Export	94	78

Source: GSL Department of Census and Statistics

The IBRD estimates that agricultural output increased at an annual rate of 3.2 percent during the 1960's. Most of the growth was in paddy and other field crops between 1966 and 1971. However, since 1970 there has been no overall growth in agricultural output. (See IBRD reports. No. PA-134 (a) Agricultural Sector Survey - The Republic of Sri Lanka and No. 622a - CE, Recent Economic Developments and Current Prospects for Sri Lanka for additional background data.)

In agricultural sector, paddy is of a major importance in terms of agricultural employment, acreage and value of production. It is estimated that 49 percent of all agricultural employment is related to the production of paddy. In terms of cultivated acreage, 36 percent or 1.4 million acres are used for the production of paddy. Paddy accounted for 24 percent of the total value of agricultural production in 1973.

Table 2: Employment and Gross Cultivated Acreage by Crop

Products	1971 Employment%	1973 Gross Acreage %
Food crops and others		
Paddy	49	36
Other crops	5	14
Sub-total	54	50
Tree crops		
Tea	34	12
Rubber	9	11
Coconut	3	23
Minor crops	N/A	4
Sub-total	56	50

Source: GSL Department of Census and Statistics

Table 3: Changes in Agricultural Production

Products	Indices of value at 1963 Prices 1963	1970	1973	% of total in 1973 prices
Tea	100	97	95	17
Rubber	"	149	143	9
Coconuts	"	110	107	8
Minor tree crops	"	125	227	3
Estate sector sub-total	100	109	113	37
Paddy	"	162	128	24
Other food crops	"	148	161	25
Livestock	"	107	125	6
Fish	"	86	81	4
Forests	"	152	167	4
Non-estate sector sub-total	100	142	136	63
TOTAL AGRICULTURE	"	125	124	100

Source: GSL Department of Census and Statistics

Paddy is important to Sri Lanka in another way in that it is the insufficient production of paddy that has been and continues to be seen by the Government of Sri Lanka (GSL) as a major limitation to economic growth in agriculture and other sectors. Total rice production increased from 602,000 tons in 1960 to a peak in 1970 of 1,084,000 tons and then fell back to 892,000 tons in 1973. Nevertheless, Sri Lanka's increasing population, even though the growth rate has declined from 2.8 percent per annum in 1953 to a recently estimated 1.6 percent, has necessitated the importation of as much as 40 to 45 percent of the country's food grains to meet domestic requirements.

A recent IBRD team estimated that in this current fiscal year some 48 percent of FX expenditures will be used to finance food imports at a time when the balance of payments deficit is expected to be in the order of $245 million. Self-sufficiency in rice production has been, and continues to be, a major policy goal of the Government. Achievement of this goal, however, has remained elusive. Domestic production as a percentage of consumption rose from a little over 50 percent in the early 1960's to about 75 percent in the early 1970's as rice production increased resulting from a 23 percent increase in harvested acreage and a 40 percent increase in yields per acre. Rice imports decreased but wheat/flour imports remained high to meet the increasing need for food. Consequently, the overall self-sufficiency ratio for all grains increased only slightly.

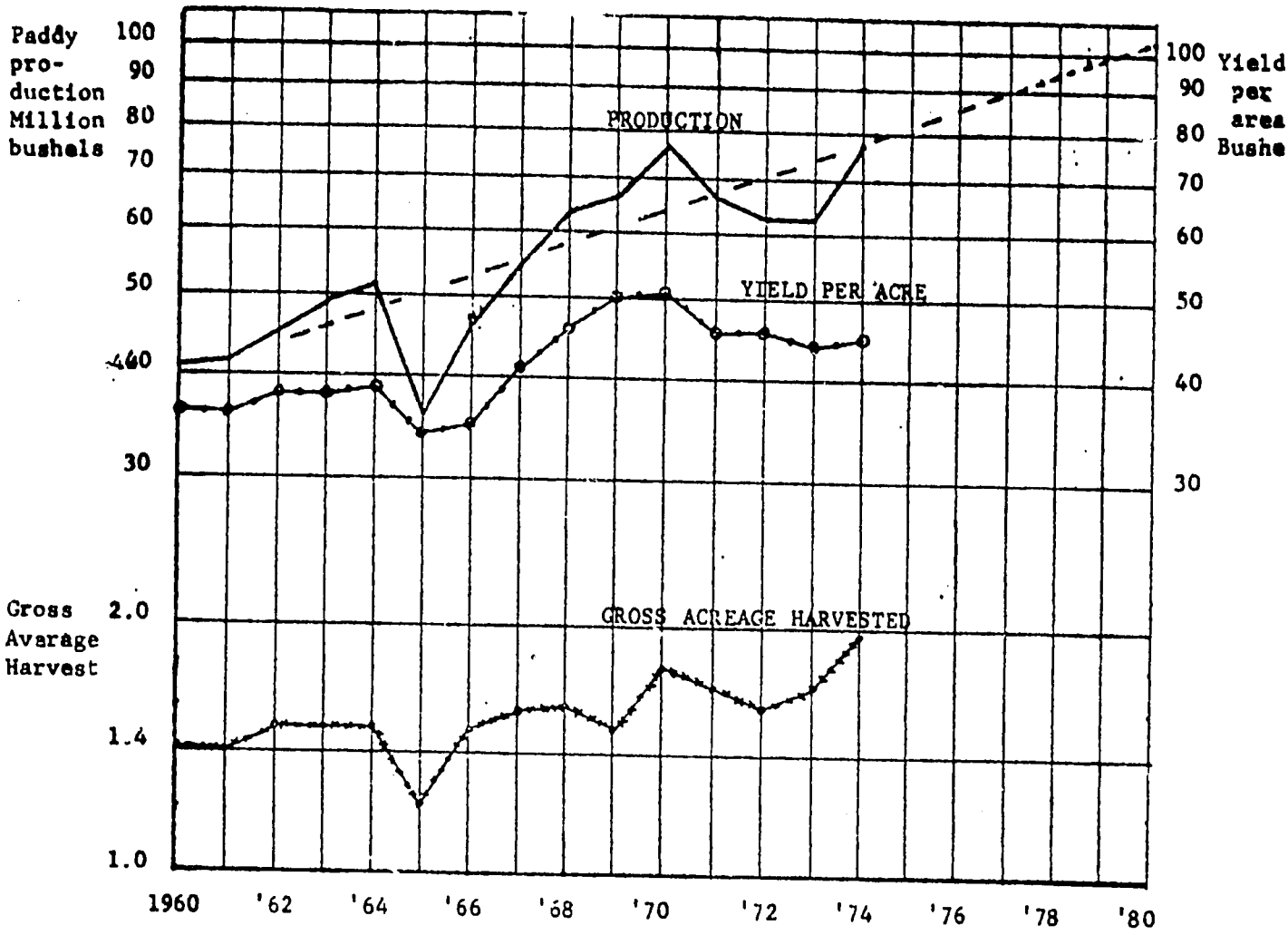
Table 4: Production, Imports, Total Supply and Self-Sufficiency In Food Grains ('000 tons)

		1960	1970	1973	1975 (Estimate)
A.	Rice Production	602	1,098	892	749
B.	Imports Total	677	953	733	975
	1. Rice	532	534	337	460
	2. Wheat (flour)	145	419	396	515
C.	Total supply (A+B)	1,279	2,051	1,625	1,724
D.	Self-sufficiency - %				
	Rice (A/A+B.1)	53	67	72	62
	Rice & Wheat (A/C)	47	54	55	43

Source: IBRD Report No. 1019A-CE - dtd February 1975

Substantial increases in total domestic production of rice and per acre yields have been realized over the last two decades in Sri Lanka. The bulk of these increases has been attributed to the development of HYVs and institutional supports made available to paddy farmers. The full impact of the HYVs and associated technologies was particularly noteworthy during the production period 1966-1970. In 1966 the Department of Census and Statistics estimated national production at about 46 million bushels of paddy with an average yield of 35.6 bushels per acre. By 1970 national production increased to 77.4 million bushels with a national average of 51.3 bushels per acre. (1.7 M.T/ha).

Figure 1, Annual Production, Yield Per Acre, and Average Area Harvested - All Sri Lanka



Since 1970 overall yields have tended to stagnate in general and on the more marginal paddy lands actually decrease. Much of this can be explained by the extremely poor rainfall distribution for the last several years compounded by rather heavy attacks by the brown plant hopper.

Fertilizer use (through 1974) on paddy continued to increase at about 20 percent per year. There is widespread use of the newer high yield ing varieties (available since the late 1960's) with a national average of something like 56 percent of the cultivated acreage planted to these paddy varieties. Some of the Districts in the Dry Zone that have substantial irrigation systems average between 75 and 80 percent of the paddy area planted to the improved varieties.

After a period in the late sixties of nearly seven and a half percent annual increase in yields per acre the flattening out of the growth in yields per acre, as illustrated in figure 1, is of major concern to the Department of Agriculture. The Department feels a major implication of this is that the farmers of Sri Lanka have to a large extent captured the benefits of the new technology embodied in the high yielding varieties. A sort of yield plateau has been reached. Given the nature of the new varieties this is not an unreasonable conclusion. That is, the new varieties do have the ability to respond to fertilizer application and out perform the existing local varieties. However, the new varieties perform the best and are generally limited to areas where there is control of water and high solar radiation. The response by farmers to these varieties in the more favorable areas is evidenced by the Districts of Hambantota, Anuradhapura, Amparai, Trincomalee and Megalle having 70 to 80 percent of the paddy acreage planted to the new varieties. Where these relatively favorable conditions do not exist the new varieties do not perform well and have not been accepted by farmers. In Districts like Kalutara, Jaffna and Galle, only about one fifth of the paddy acreage is planted to the new varieties. (See Annex R).

Climate, soil conditions, and water supply vary widely in the different parts of Sri Lanka resulting in a very wide range of rice growing conditions in the country. In broad terms, ten edaphic rice growing regimes are identified, with each regime posting its own distinctive problems. These ten edaphic regimes are distributed in varying proportion in the three major climatic zones of the country as indicated in figure 2.

Figure 2

Climatic Zone and Soil Region	Edaphic Regime	Approximate Area (Acres)
Dry Zone and Semi-Dry Intermediate Zone Low Land Alfisol Region	1. Major Irrigation	400,000
	2. Minor Irrigation	250,000
	3. Rainfed Manawari	125,000
	4. Rainfed Chena	125,000
Wet Zone & Semi-Wet Intermediate Zone	5. (a) Irrigated-no flood hazard	75,000
	(b) Irrigated-some flood hazard	25,000
Low-land Ultisol Region	6. Rainfed, Stream-fed, Spring-fed	200,000

Contd. (Figure 2)

Climatic Zone and Soil Region	Edaphic Regime	Approximate Extent (Acres)
Wet Zone - III drained Low Land Histosol	7. Swampy, Marshy, Flood Prone	70,000
Wet and Intermediate Zone Midland and	8. Terraced and narrow Sloping valley system	115,000
Upland Ultisol Region	9. Cool to cold elevation on terraced slopes	10,000
Saline-Alkali Soil Regions of Dry Zone	10. Irrigated or semi-irrigated	45,000

While these differences in paddy farming conditions have been recognized, insufficient efforts have been made to develop and improve systems of paddy cultivation suited to the different edaphic regimes. If Sri Lanka is to realize the yield projections envisaged as needed to move towards self-sufficiency, it becomes necessary to adapt to and exploit the natural edaphic characteristics of a particular regime. Given the extreme heterogeneity of paddy land in Sri Lanka, relative to most other Asian Regions, the need for regionalized paddy varietal and associated cropping systems improvement is imperative. Sri Lanka to date has done well in increasing its paddy production through technology indigenously produced and imported from abroad. Sri Lanka is now at a point where it must expand and decentralize its capacity to generate new paddy technology.

In November 1975, the Department of Agriculture requested and obtained assistance from IRRI to outline a course of action to upgrade the Research Division to a point where it would be able to deal effectively on a regional basis with development of edaphic specific varieties and complementary cropping systems. IRRI's preliminary report was accepted by the Government and assistance in meeting the FX requirements was sought from AID. (See Annex O). A PRP was developed and subsequently approved in early April 1976.

The development of the finalized project paper was a result of further collaboration between staffs of IRRI, the Department of Agriculture and AID.

B. Detailed Description

1. Introduction

The project laid out in the following sections is an agricultural research project. Its particular focus is on expanding the technological base underpinning the current use of Sri Lanka's paddy land thru the development of improved rice varieties and improved cropping systems to allow for greater paddy land use intensities. To do this more productive varieties of rice must be developed. particularly varieties more tolerant to adverse conditions, responsive to management, and in some cases earlier maturing. Similarly. companion research must be carried out on cropping systems related to paddy cultivation and the use of paddy land. In some instances this may lead to paddy-paddy cropping patterns. but in situations where a second crop of paddy is not feasible, improved or altered management systems with other crops would be looked at to provide for increased land use intensity.

This project is the combining of GSL and U.S. supplied human and physical resources through agricultural research processes directed at producing technological innovations. Technological innovations that result in higher producing paddy varieties that out-perform currently available varieties in the various ecological environments of Sri Lanka: and technological innovations that identify and develop alternative agronomic management practices for paddy lands so that their use can be intensified. The U.S. project assistance will supply off shore procured inputs to facilitate realization of these objectives in three major categories: 1) technical assistance. 2) training, and 3) commodities. The technical assistance will be three long-term specialists to augment and train GSL scientists in the areas of rice breeding. cropping systems, and field agronomy for a total of 15 man years. In addition there will be consultants to backstop a resource survey activity as well as to support special requirements of the long-term specialists. The job descriptions of the specialists can be seen in Annex H. The training component will focus on equipping Sri Lankan scientists to carry out the required research activities. The training is broken down into two major areas. The first is short-term training which will enable some 48 Sri Lankan scientists to take part in specialized IRRI training programs at Los Banos. Philippines. The second is long-term which provides for 20 M.S. and 10 Ph.D. training positions in 10 agricultural science areas. Again, the bulk

of this training will be at Los Banos in cooperation with the University of the Philippines. See Annex B for a precise breakdown of the training positions and Annex L for a general description of the IPRI administered training activities. Commodities will complement GSL scientists and the project provided technical assistance by making available the necessary additive physical resource base required to carry out station and field research. Annex C gives a detailed breakdown of commodities to be procured.

Complementing the AID supplied inputs will be those supplied thru the Research Division of the Department of Agriculture. These will be primarily some 200 senior, mid. and lower level station and field research scientists, and the facilities of six research stations. In addition, the government will supply all in country support required by the technical assistance team and budgetary support to operate and maintain station and field research activities. Meshing together then, the GSL supplied inputs with the AID supplied resources, the project outputs will be essentially in the form of expanded institutional capacity, a change in institutional approach to required research (See Annexes F and G) and an enhanced program of research activity. For simplicity in the log-frame we broke the outputs down into four major functional areas, "Rice Research," "Cropping systems," "Field Trails," and "Resource Capability Survey," to serve as proxies for the more detailed and measurable outputs that are shown in the output targets section.

2. Narrative Description:

The following is meant to give the reader a broad descriptive picture of the major component activity of the project. This section is also principally broken down by the four major functional or output areas mentioned above.

a. Regional Research Centers and National Rice Breeding Center

In view of the diverse environments of the rice growing regions in the country, the Department of Agriculture will decentralize research with the establishment of five regional research centers. A national rice breeding center is already established in Batalagoda.

Figure 3. Regional Research Centers

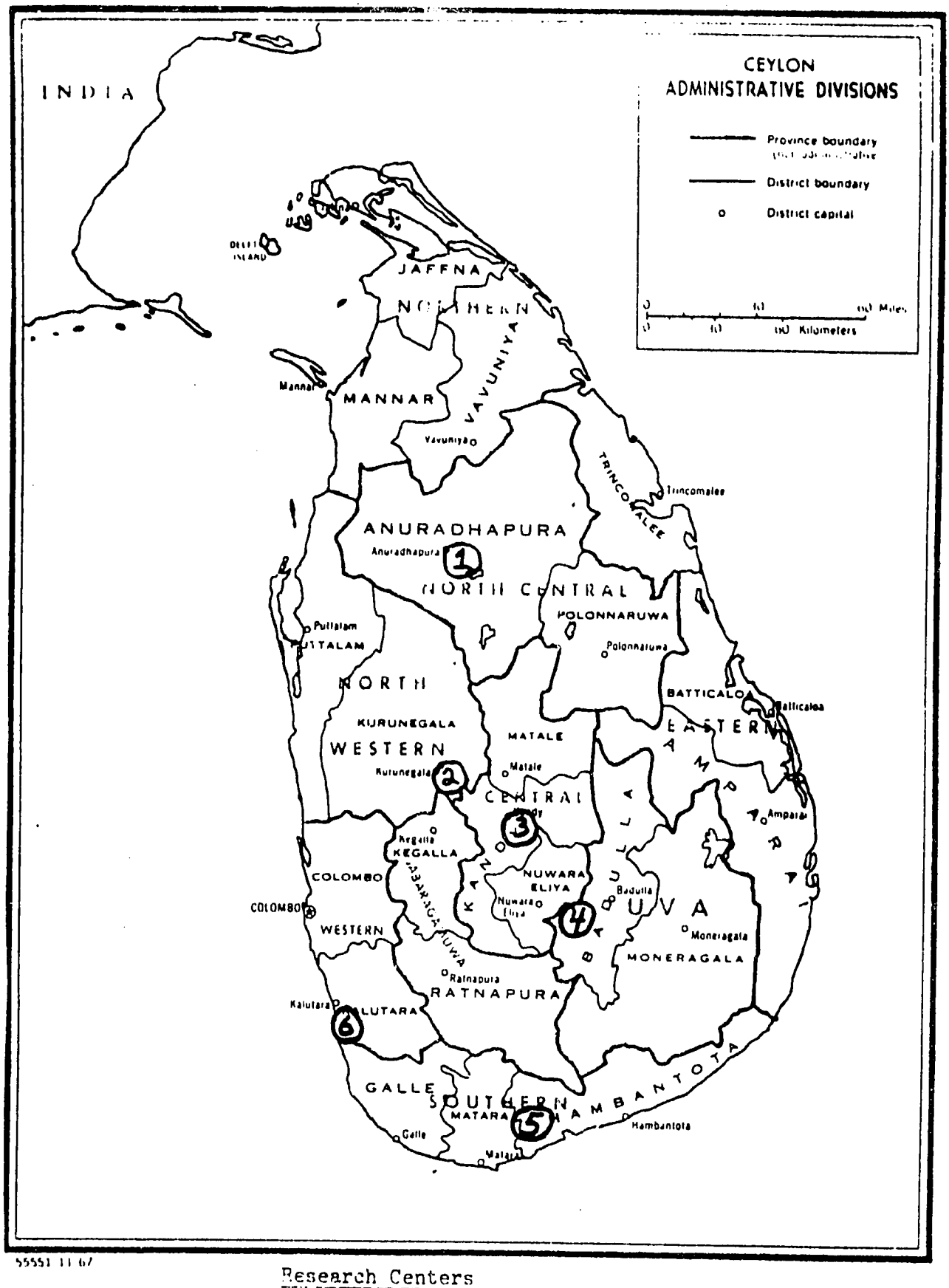
1.	Low country, dry zone Northern and Eastern Regions	Research Station Maha Illuppallama
2.	Low country dry zone Southern Region	Research Station Angunaubolapellessa
3.	Mid country, wet zone	Central Agricultural Research Institute, Gannoruwa
4.	Up country, intermediate zone	Research Station Bandarawela
5.	Low country, wet zone	Research Station Bombuwela

Each regional center will have Research Officers or Experimental Officers and supporting staff such as in the field of rice breeding, entomology, plant pathology, botany (agronomy and physiology), economics, soils, water management and cropping systems (agronomy), (See Annex A). Additional research staff is needed at Bombuwela, Angunaubolapellessa, Bandarawela and Batalagoda to strengthen the research capabilities of the centers (it is also planned that training of "extension workers, farmers, etc." will also be expanded in each new regional center to complement the two training centers already in operation at Maha Illuppallama and Gannoruwa). Annex C gives a breakdown of commodity requirements by station, particularly for Batalagoda while Annex B gives long-term training requirements by station. The map on the following page locates the stations mentioned above.

b. Rice Research

In order to stabilize rice yields, reduce the cost of inputs to farmers and to simplify the seed production program, it is necessary to incorporate as many attributes as possible into rice varieties. This would include resistance to disease, pests, drought and flood tolerance, and response to adverse soil conditions. It would be initially rather difficult to combine an extraordinarily large number of requirements within a single variety. The short term

Figure 4



55551 11 67

Research Centers

1. Maha Illuppallama
*2. Batalagoda
3. Gannoruwa
4. Bandawela
5. Angunaubolapellesa

strategy would therefore be to combine as many of the requirements as possible for each edaphic regime within a single variety.

The more important problem areas which the project will address are:

Figure 5. Major Rice Problem Areas

Rice Pests:	Brown Planthopper Gall midge Stem borer Leaf borer
Rice Diseases:	Blast Bacterial Leaf Blight Sheath Blast
Drought Resistance:	Rainfed and irrigated areas of dry zone Rainfed areas of wet zone
Flood Tolerance:	Swampy and marshy lands of wet zone
Cold Tolerance:	Cold elevation of mid and up country especially during the flowering season in December-January
Problem Soils:	Iron Toxicity Phosphorus deficiency Strong reducing conditions Salinity-alkalinity Probable zinc deficiency

Major emphasis will be in developing adapted varieties for each region. This will require a coordinated interdisciplinary rice breeding program. Sri Lanka can draw heavily on the experience and expertise developed at the International Rice Research Institute (IRRI) in the Genetic Evaluation and Utilization Program (GEU).

The GEU program is an interdisciplinary and problem oriented rice breeding program in which plant breeders team up with problem area scientists such as plant pathologists, entomologists, plant physiologists, soil chemists, agronomists and cereal chemists. The members join efforts in identifying, screening and crossing diverse rices so that disease/insect

resistance, superior agronomic characteristics and other desirable features are incorporated into varieties with the genetic ability to withstand ecologically dictated constraints.

GEU team(s) will be formed at the Central Rice Breeding Station in Batalagoda and possibly at some of the regional rice stations. It is planned that the GEU team supplemented by social scientists will form the core of the "Rice Research Working Group" described in Annex C which will be given the responsibility of planning and implementing a national breeding program.

The national rice breeding center in Batalagoda will coordinate the hybridization, screening and evaluation. Insect and disease resistance and flood tolerance work will also be primarily done at the breeding center, cold tolerance in Bandarawela, drought resistance in Maha Illuppallama, problem soils in Bombuwela.

In addition to breeding, research on crop management such as water management, fertilization, tillage, weed, pest control, production costs and returns, etc., will also be done in each region. In order to prevent duplication, a well coordinated research plan in the area mentioned above will be drawn up by the Rice Research Working Group for implementation in the regional experiment stations.

The breeding objectives of the GSL scientists are defined more precisely in Figure 6 that follows. An illustrative flow of component technology is shown in Figure 7 while the flow of genetic material through a GEU system is illustrated in Figure 8.

c. Cropping Systems

In order to realize the full agricultural potential of the rice growing lands of Sri Lanka, there is a need to improve the present cropping intensity, whether it is based on a succession of rice crops or rice alternating with other crops. In the well drained rice soils of the dry zone and intermediate zone, various kinds of subsidiary crops could alternate with rice. Here rice is best adapted to the wet season, while the subsidiary crops are best adapted to the dry season. Limited developments have already taken place in this direction in the major and minor irrigation projects in the dry zone, while more intensive developments have occurred over longer periods in the semi-dry, mid and upcountry regions.

Figure 6 BREEDING OBJECTIVES FOR THE DIFFERENT EDAPHIC REGIONS

Climatic zone and Soil Region	Edaphic Regime	Acreage (Approx.)	Yield level aimed at Bu/Ac.	Range of Age Class Maha	Range of Age Class Yala	Special considerations	Plant Ideo-type.
1. Dry Zone and semi-dry Intermediate zone lowland Alfisol Region	(a) Major Irrigation (1)	400,000	100 125	3½-4½	3-3½	High pest and disease resistance	Short erect type with very high fertilizer response.
	(b) Minor Irrigation (2)	250,000	75-100	3½	3	Adaptable to semi-irrigation conditions during early growth.	Intermediate type with moderate fertilizer response.
	(c) Rainfed Manawari (3)	125,000	45-50	3-4		Drought tolerant and high root vigour	Early shading habit and low fertilizer response.
	(d) Rainfed Chena (4)	125,000	40-50	3-4		Drought tolerant and high root vigour	Early shading habit and low fertilizer response.
2. Wet Zone and semi-wet Intermediate zone lowland Ultisol Region	(a) Irrigated and no flood hazard (5)	75,000	80-100	4-6	3½-4½	i. High disease and pest resistance ii. Some bronzing	Intermediate type with moderate fertilizer response.
	(a) Irrigated with some flood hazard (5)	25,000	60-80	4-6	4-5	i. Flood tolerance at early stages of growth. ii. Some bronzing	Intermediate type with moderate fertilizer response.

(Continued)

	(b) Rainfed, Stream fed & spring fed (6)	300,000	50-75	4-6	3½-5	i. High disease and pest resistance. ii. Some Bronzing iii. Photo period sensitive for some tracts in Kurunegala Dist	Early shedding and intermediate plant type with moderately low fertilizer response.
3. Wet zone, ill-drained lowland Histosol Region.	Swampy, Marshy, Flood prone (7)	70,000	40-60	4-6 and 3-3½	4½-6½ and 3-4	i. High pest & disease resistance. ii. Flood tolerance at at stages of growth iii. Salinity at tidal elevations iv. Photosensitivity v. Bronzing	Intermediate to traditional plant types with moderately low fertilizer response. Non-lodging medium tall types for low elevations in bog soils.
4. Wet and Intermediate zone, mid-country Ultisol Region	(a) Terraces slopes and narrow valleys, stream & spring fed (8)	115,000	90-125	4-4½	3½-4	Adequate panicle development before flowering in order to ensure proper sink size	Intermediate type with high to moderate fertilizer response.
	(b) Narrow valley, spring fed (9)	15,000	50-60	4-4½	3½-4	Cool tolerance low sterility	High photosynthetic efficiency
5. Saline-Alkaline Soil Region	(a) Irrigated, semi-irrigated, rainfed (10)	45,000	80-100 50-60	3½-4	3	Resistance to salinity and/or alkalinity.	Intermediate type with high fertilizer response.

Figure 7 Illustrative flow of genetic material through a GEU program to develop varieties adapted to adverse soils

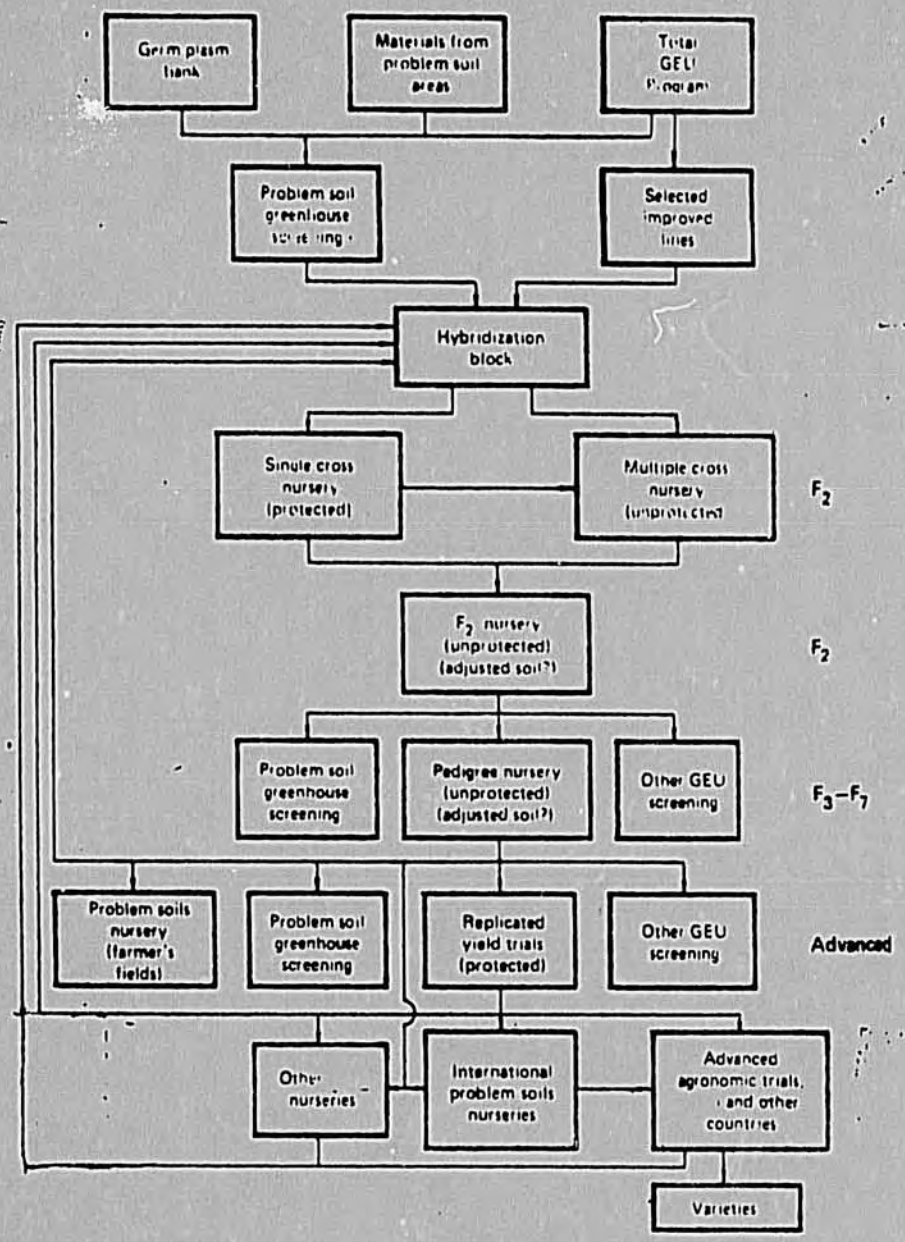
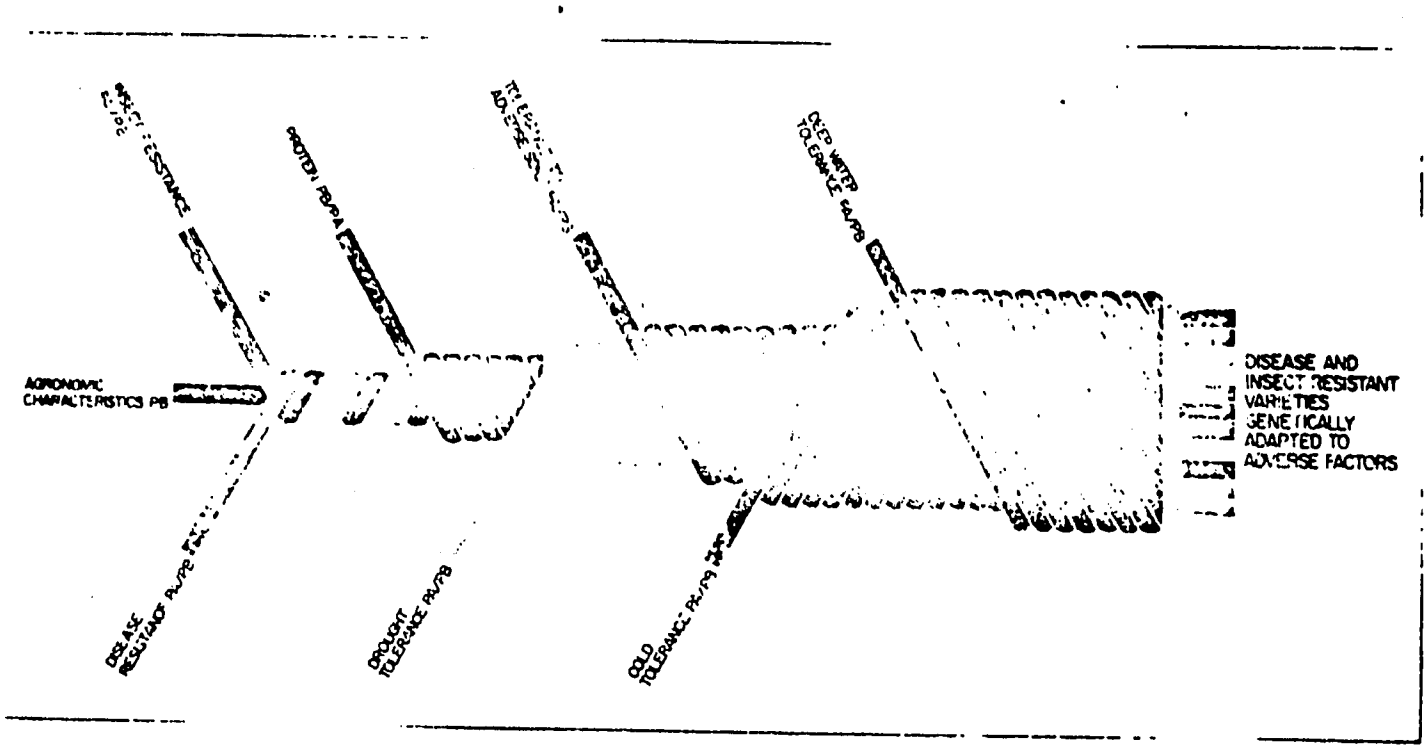


Figure 8

Flow of genetic material through a GEU System with Plant Breeders (PB) and Problems Area Scientists (PA) working together to incorporate various genetic features.



The partially irrigated rice growing lands in the dry zone cover an extent of a little over 350,000 acres. The rain fall and water supply situation is such that the probability of realizing a single irrigated crop per year hardly reaches the 75 percent level. By properly timing the early tillage operation, as well as by resorting to semi-irrigated conditions of rice cultivation, it is hypothesized that the probability of realizing a single rice crop on such land can be raised to 100 percent. In years of good rainfall distribution, it is believed possible to carryover the stored water supplied to mature another 60 to 70 day pulse or a sorghum crop during the short semi-dry season.

The extent of purely rainfed rice growing area in the dry zone is approximately 260,000 acres, while that in the wet zone is approximately 75,000 acres. The hazard of crop failure in the dry zone is high, while in the wet zone the hazard is more moderate. More efficient cropping systems will also enable a better utilization of the agricultural potential on this category of rice growing land.

In the partially irrigated rice growing lands of the wet and intermediate zones, especially in the middle and upper peneplain regions, irrigated rice during the wet season is alternated with vegetables and subsidiary crops during the dry season. The total of such lands is approximately 150,000 acres. Population pressures are very high in this category of land, and the cropping potential of the land could be further intensified by the introduction of shorter and quicker cropping patterns in place of the present traditional patterns.

The focus of cropping systems research will be on developing new cropping packages that allow for increased paddy land use intensities for the different agro ecological regions. Research will be done in different village sites from which results can then be extrapolated to wider rice growing areas. Findings can then be verified by the field testing units in different rice growing areas within each ecological regions.

A major portion of the cropping systems research will be done in farmers' fields. The research approach developed at IRRI which was further refined during a 1975 cropping system workshop sponsored by IRRI can be used with slight modifications to suit the conditions in Sri Lanka.

Cropping systems research is much more interdisciplinary than a single crop research. It will involve not only rice but also the other grain crops and vegetables such as corn, sorghum, cowpeas, soybeans, other pulses, sweet potatoes, cassava, chillie, and other vegetables. This will require a coordinated team effort and will be closely linked with the rice, vegetable, and other grain crops researchers. A cropping system Working Group as described in Annex G will be formed to coordinate the interdisciplinary requirements of this aspect of the project.

Experimental sites will be carefully selected to represent the rice growing areas in each ecological region. Three field sites around one regional center (Maha Illupallama) have already been selected and are being funded by IDRC. This project will fund two more sites at Maha Illupallama, expanded work at the Maha Illupallama regional center and three additional regional centers Angunaubolapellessa, Gannoruwa and Bandarawela) as well as at least five related field sites.

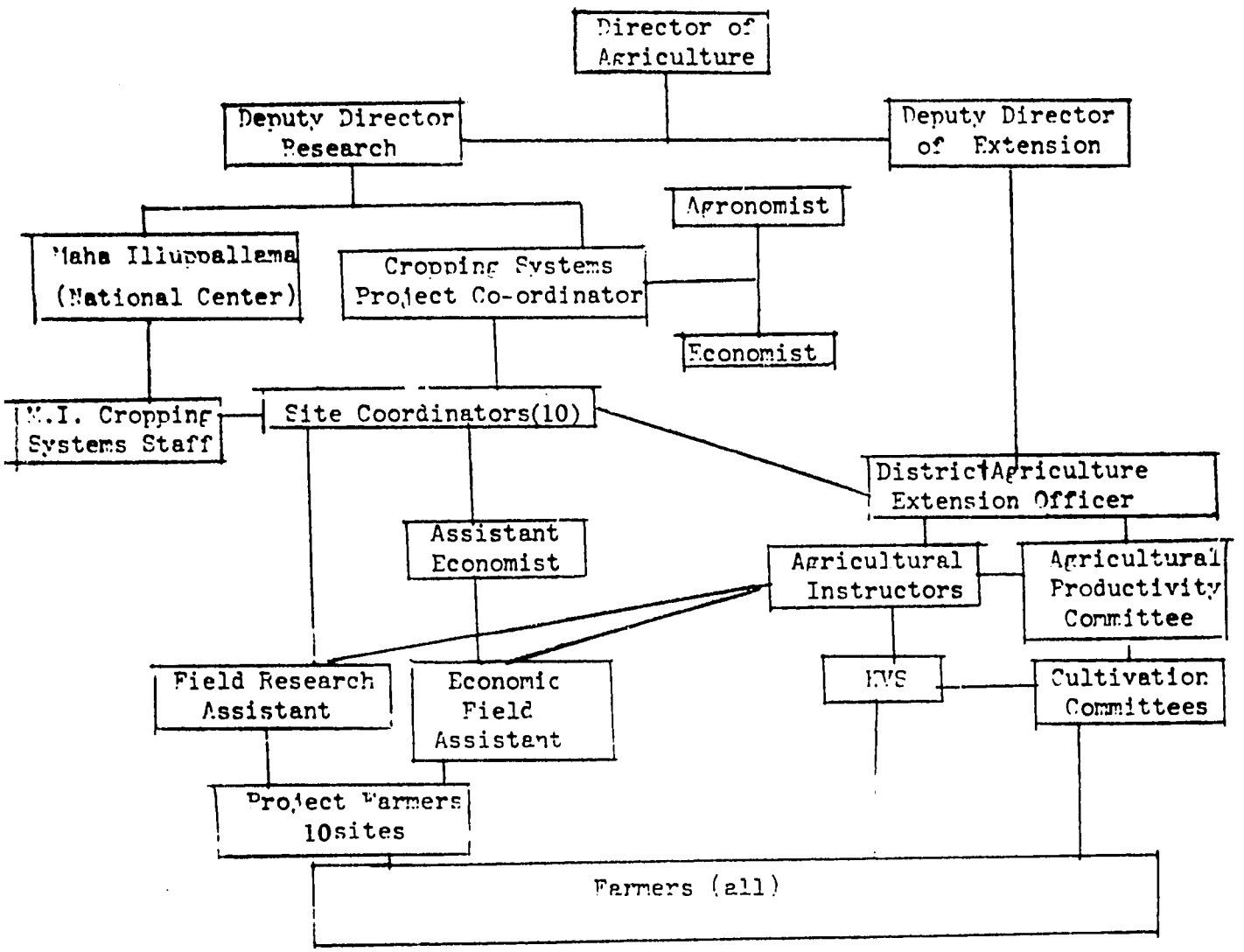
The first phase of any site activity is to study the existing conditions in each site by thorough survey, techniques. Of primary consideration is to obtain data on weather, topography, irrigation, soil type, marketing systems, land tenure, present cropping of agricultural inputs, available farm resources, farm types, etc. to obtain as accurately as possible, the present situation of the rice farmers in that representative area. The first initial site survey is attached as Annex J. The information obtained then serves as a benchmark and guide in designing agronomic research priorities and activities.

The second phase is to design and test improved cropping systems. From the data made available by the initial survey, and research conducted in the experiment stations and from other countries, promising cropping patterns can be designed for testing in farmers' fields under farmer management. In addition to cropping pattern studies varietal tests fertilizer rates, pest and disease control, weed management, and tillage practices are some variables that can be superimposed on farmer-managed fields. In all these studies costs and returns are accounted for to determine a more advantageous cropping system in an economic sense, for the paddy farmers.

The regional centers will backstop the research in farmers' fields. Component technology development and other basic research relating to cropping systems will be done in the regional centers. Most of these studies will be done in Maha Illuppallama which is designated as the national center for cropping systems research.

The research team in each field site will have a minimum of one Research Officer (agronomy), two Experimental Officers or Agricultural Instructors (at least one being an economist) with supporting staff. (See Annex A). The team will reside either at the site or the closest experimental station. The research personnel of the disciplines in the regional research centers will provide the additional expertise and backstop support needed in the experimental sites. Figure 9 that follows diagramatically lays out the institutional configuration of the cropping systems research activities.

Figure 9 Cropping Systems Organizational Configuration



d. Field Experimentation

The regional research stations proposed are expected to identify paddy varieties adapted to the ecological region and develop appropriate management practices for increasing yields. However, the limited and controlled environment in a research station does not afford adequate conditions to fully evaluate the new varieties and management practices before passing them on to the farmers through the extension service. In view of the differences in soils, water availability, variations in climate, economic factors and management level of farmers, often within the same rice tracts, it is essential that the findings and recommendations of research in the regional centers be thoroughly tested before dissemination to farmers.

Simple field testing is necessary to refine the recommendations on fertilizers, cropping patterns, varieties and management practices, etc. This can be done best by involving the farmer himself in conducting the experiment under the supervision of the field research personnel. By this means improved technology can be developed and modified which is more appropriate at the farm level.

Extensive field experimentation in farmers' fields will be conducted in different rice-growing areas within the coverage of each regional center. With the research information from the regional centers, cropping system experimental sites, the agro-ecological data and resource capability survey of the rice areas, simple field trials can be designed and conducted in farmers' fields.

The research oriented field experimentation will pivot on the Field Trials Division (FTD) of the Research Division. This unit has had considerable past experience in field experimentation on rice in farmers' fields. The FTD in Peradeniya will be responsible for overall technical direction, coordination, implementation and reporting of the work done by the Regional and Field Units and also some non-technical administrative aspects.

A FTD unit will be established in each regional center with a regional head in charge of each unit. Each regional unit will be responsible for the field experimentation in areas covered by the center. Each unit will have one research officer and supporting staff. (See Annex A). The other disciplines in the center will provide technical backstopping in other problem areas.

The backbone of the field experimentation is the Field Units which will be administratively attached to the regional centers and will be mobile enough to efficiently conduct research in farmers' fields. Each Field Unit will consist of an Experimental Officer/Agricultural Instructor and three (3) MVSS (village level workers). The Field Units will be located in villages wherever possible in close proximity to the field experimental sites working on cropping systems. The experimental sites will be divided among Field Units with approximately 30 sites for each unit.

The field experiments will be carried out in close cooperation with the extension service in the area. These experimental sites can be used by the extension workers for farmer training. Likewise, the Agricultural Productivity Centers (APC) will be informed and involved.

With the data coming from these trials the extension oriented program of local verification trials, fertilizer and crop management demonstrations can be properly designed and implemented by the Extension Services.

There will be a very close liaison and links at all levels between the Field Trials Division's research oriented experiments in farmers' fields and work done by the extension oriented demonstrations and verification trials.

e. <u>Resource Capability Survey</u>

In the dry and intermediate zones where the soils are predominantly alfisols, there are approximately a million acres of paddy soils. There is considerable information available from the region on the relationship of the soils in the toposequence, production constraints and paddy production potentials. About 500,000 acres of paddy soils occur in the wet and intermediate zones. These soils are predominantly ultisols but with considerable areas of histosols and inceptisols occuring along the south and western coastal region. The paddy-growing soils in this region have elevation ranging from below sea level to 3,000 feet above sea level. Here paddy is grown mostly along broad or narrow valleys and a considerable extent on terraced hill slopes. Paddy farming is much more complicated in this region than in the dry zone.

In order to effectively develop, as well as apply, new rice and cropping systems technologies in these areas, it is necessary to have a well defined understanding of the resource capability and productivity potentials of these areas. The proper

information will aid in design of regional research projects and the field experimentation in farmers' fields within each region, as well as the planning of intensive extension programs.

A survey and supporting studies will be conducted to attain: (1) identification and classification of valley and terraced slope systems; (2) delineate the slope categories in the identified land systems above; and (3) soil survey, characterization and mapping at a medium intensity level.

The identification and description of the valley and terraced slope systems will be done by air-photo interpretation supported by field studies. The slope categories of the individual valleys and land systems will be delineated in the field. Soil mapping units that make up each of the valleys and land systems will be identified and mapped by the usual soil survey methodology. On the basis of the foregoing investigation appropriate cultivation systems will be identified and mapped by the usual soil-survey methodology. The best suited soil-crop-water management system for the more important paddy-land types will be worked out and then will be evaluated by field trials. Similarly, the cropping systems that are best adapted for each situation can be evaluated by the field testing units.

These studies will be conducted by the Land and Water Use Division with the Head of the Division as the national coordinator. Short-term consultants to assist in the design of the studies will be needed. The cropping system specialist will also assist in carrying out some of the research studies.

The Division is currently staffed by a team of one Ph.D. and four M.Sc research officers with majors in agronomy, soils, soil conservation and land classification. Supporting the research officers are four soil surveyors and a cartographer. Supporting the Land and Water Use Division will be the Land Use Division in the Ministry of Irrigation which has a long standing proven informal working relationship with the Ministry of Agriculture people.

The reader is referred to Annex B which briefly describes the government's institutional structure dealing with the agricultural sub-sector, the staffing pattern of the Research Division as it relates to this project, rice and cropping systems research activities currently being carried out, and the current use of new rice technology using maps with district yield and HYP and fertilizer use figures as proxies for "use of technology."

C. Summary Logical Framework

Sector Goals of the GSL:

Agricultural Development that:

1. Increases domestic food production

2. Expands employment opportunities

3. Improves the small farmer's standard of living

Project Purpose:

Development of a technological base that permits increases in the productivity of paddy land thru:

1. Increased yields of paddy per unit area, and

2. increased cropping intensity of paddy land

End of Project Status:

5 Years

1. Varieties developed in the life of the project that in eighty percent of the on-farm trials of the fifth year yield twenty percent more than the best alternative variety in 8 of the 10 major edaphic regions under the same management practices at both low and high levels of inputs.

2. Alternative Cropping Systems developed that:

   a. physically enable a second crop to be grown on paddy land where mono-cropping of paddy is the norm in 8 of the 10 edaphic regions.

   b. in an economic sense, enable increased paddy land use intensity to be both feasible and attractive to 70 percent of all paddy farmers.

10 Years

Successful Agricultural Research is a function of combining many inputs including trained scientists, research equipment, and station and on-farm field trials, but also of time. Success in

development of technology is really measured ultimately by what happens on farmers fields, which is again a function of many things including the "goodness" of the technology, but also of time. Measurement of this project's success or failure because of the time factor is most meaningfully done five years after our self-imposed project life is completed. Measurements of project success at that time would be:

1. 50 percent of all paddy land in each major edaphic region using varieties released in the lifetime of the project yielding at least 20 percent more than other available varieties.

2. Costs of production per bushel of paddy 20 percent less for varieties developed in the project than cost of production per bushel of other paddy varieties.

3. Cropping system developed by the project being utilized on 50 percent of all paddy lands in each major edaphic region.

4. Paddy land use intensity increased to 170 percent thru additional paddy or other crop land use. (Currently paddy land is cropped about 120 percent as a national average).

Means of Verifying End-of-Project Status

1. Records of the Field Trials Division

2. Records of the Cropping Systems Work Group

3. Special Studies focusing on the physical and economic parameters of project developed innovations.

Assumptions (important assumptions that underly achievement of Project Purpose)

1. Genetic breakthroughs will be realized

2. Paddy lands are currently sub-optimally used and improved cropping systems to increase factor productivity in paddy areas can be identified and developed to fit into the various econological areas of the country.

3. The improved capacity of the Research Division thru organizational changes will enhance the output of the Research Division in such a way as to permit the realization of project purpose.

Outputs

I. **Rice Research**

A. Expansion of rice research capacity

B. GEU approach to rice varietal improvement work

C. Co-ordinated rice and cropping systems research program

D. Expanded involvement of farmers in rice and cropping systems research

II. Cropping Systems

A. Expansion of cropping systems research capacity

B. Systems approach to improving the productivity of the paddy farmer

C. Co-ordinated rice and cropping systems research program

D. Expanded involvement of farmers in rice and cropping systems research

E. Cropping systems field trials

III. Field Trials

A. Expansion of the field trials Division's capacity

B. Expanded involvement of farmers in rice and cropping systems research

C. Co-ordinated rice and cropping systems research

D. Field trials on farmers field

IV. Resource Survey

A. Expansion of the land and water use Division's capacity

B. Resource capability survey

Objectively verifiable indicators/targets of output achievement to rice research

I. Rice Research

A. 1. Staff trained and assigned as per Annex A and B

2. Vehicles assigned as per Annex C by late 1977

3. Lab and field research equipment in place as per Annex C by mid 1978

4. Farm equipment assigned as per Annex C by mid 1978

5. Laboratories built as per Annex K by mid 1979

6. Staff Quarters built as per Annex K by mid 1979

B. 1. Interdisciplinary approach to formulation and implementation of rice varietal improvement work

2. Formulation of rice research working group as described in Annex G by late 1977

C. Formulation of the National Rice and Cropping Systems Research Committee that carries out functions as described in Annex G by early 1977

D. 1. Staff assigned to regional operations as envisioned in Annex A by mid 1979

2. Vehicles and equipment available and assigned to the regions as envisioned Annex C by late 1979

3. Relevancy of research experiments/investigations to the particular region

E. To be determined by Yala Season 1977 and each crop season thereafter by the National Rice and Cropping Systems Research Committee and Rice Research Working Group.

II. Cropping Systems

A. 1. Vehicles available as per Annex C by late 1977.

2. Farm equipment available as per Annex C by mid 1978

3. Office/Lab/Field Research equipment in place as per Annex C by mid 1978

4. Trainee returned and assigned as per Annex A and B

B. Formation of cropping systems research working group as described in Annex G by early 1977.

C. Same as I.C. above

D. Cropping systems sites selected, collection of baseline data completed and agronomic research underway at sites in farmers fields by late 1977

E. To be determined by Yala Season 1977 and each crop season thereafter by the National Rice and Cropping Systems Committee and the cropping systems working group.

III. Field Trials

A. 1. Vehicles available as per Annex C by late 1977

2. Office/Lab/Field Research Equipment available as per Annex C by mid 1978

3. Trainees returned and staff assigned as per Annex A and B

B. Field Trials Division effectively carrying out trials in farmers fields in all regions and as called for by the National Rice and Cropping Systems Research Committee and the field trials working group.

C. Same as I.C. above.

D. Same as B. above.

IV. Resource Capability Survey

A. 1. Vehicles available as per Annex C by mid 1977

2. Equipment in place as per Annex C by early 1978

3. Trainees returned as Per Annex B.

B. Resource capability survey of 500,000 acres of paddy land in the South and South Western Coastal Regions completed by the end of the third project year.

INPUTS

I. U. S.

A. Technical Assistance

	Man months
1. Rice Breeder	60
2. Cropping Systems Agreement	60
3. Field Trials Agronomist	60
4. Consultants	26

B. Training

	Positions	
1. Short-term		
a. Rice Production and Applied Research	19	
b. GEU	8	
c. Water management	3	
d. Cropping Systems	8	
e. Resources Survey	2	
f. IRAEN	6	
g. Small Scale machinery	2	
2. Long Term	M.S.	Ph.D.
a. Rice Breeding	2	2
b. Agronomy	8	3
c. Entomology	1	2
d. Plant Pathology		1
e. Soils		1
f. Cereals Chemistry	1	
g. Agricultural Economics	5	1
h. Statistics	1	
i. Soil Survey	1	
j. Soil and Water management	1	

C. Commodities (See Annex C)

II. G.S.L.

A. Staff 12000 man months

B. Facilities

1. Stations 6 Research Stations

a. Existing Buildings

b. Existing Equipment

Implementation Targets

U. S. U. S.	Year 1	2	3	4	5	TOTAL
			($000)			
1. Technical Assistance						
a. Rice Research	67	57	62	69	76	331
b. Cropping Systems	67	57	62	69	76	331
c. Field Trials	67	57	62	69	76	331
d. Consultants	40	40	35	20	20	155
						1148
2. Training						
a. Short term	44	46	39	33	3	165
b. Long term	98	203	178	80	7	566
c. Workshops/seminars	30	30	30	30	30	150
						881
3. Commodities						
a. Vehicles	252	90	5	5	7	359
b. Farm Equipment	67	22	2	2	2	95
c. Lab/Office/Field Research Equipment	259	86	43	22	22	432
d. Supplies	64	64	52	38	38	256
e. Books and publications	11	11	10	9	9	50
						1192
4. Contingency	53	36	29	24	20	162
5. Inflation (8% year)		63	97	122	138	420
6. Contractor Overhead (9.5%)	105	82	66	56	49	358
	1,224	944	772	648	573	4,161

G.S.L.

	Year	77	78	79	80	81	TOTAL
				($000)*			
1.	Salaries	229	254	264	280	330	1357
2.	Travel	33	36	39	40	48	196
3.	Consumables	112	127	134	139	165	677
4.	Maintenance	46	39	41	43	52	221
5.	Essential Services	19	29	31	33	38	150
6.	Equipment	189	44	45	47	54	379
	Buildings	307					307
	Support Services for T.A.	31	24	27	30	31	143
		966	553	581	612	718	3430

* $ equivalent with RS 13.73/$1

4. Summary

The foregoing narrative and log-frame attempts to describe a complex set of institutional arrangements and activities that will be carried under the project. In summary the assemblage of project outputs is hypothesized to provide the necessary basis from which to realize the purpose of the project. However, the outputs, while being necessary, are not in and of themselves sufficient to realize the project purpose. Two important hypotheses underly the statement of the project purpose and they must be recognized. First, that genetic improvements in rice varieties can be made that are significantly better than currently available. Secondly, that there exists improved cropping systems that can be identified and fitted to the various ecological niches found in Sri Lanka to improve the productivity of paddy land utilization.

Achievement of the project purpose is in turn seen as providing a necessary component in the process of realizing the national goals of increased domestic paddy production but it is also viewed as importantly contributing to employment and welfare goals of the nation. The linkage of the project to the goal of increased rice production is direct through greater national production of paddy. The causal relationships between project purpose and the national goals of increased employment and improvement in welfare are more complex and as a result less direct, although not necessarily less important. The linkage to the employment goal is through improved output coefficients which makes it economically possible to increase labor utilization in the production process while non-farm employment is impacted on through income and wages-goods linkages. Welfare improvements are even more complex but again essentially based on increasing the productivity of the factors of production that the small farmer commands, his labor in particular. The reader is referred to Annexes R and S for a partial beginning-of-project status and the complete log-frame.

Part III Project Analysis

A. Technical Analysis

1. Appropriateness:

The technology of weaving together Department of Agriculture staff, GSL existing facilities and facilities to be obtained, training, commodities and outside technical assistance to achieve the project purpose is not a precise one. To identify the individual components in terms of kind, amount and mix, the GSL has looked to IRRI to provide suggestions. Given the nature of the multifaceted problems to be addressed in improving paddy varieties and crop systems on paddy land, IRRI, of the International Centers, has had the most extensive experience in the area of concern. IRRI has provided personnel to assist the GSL and AID further define the problem to be addressed, identify current GSL capacity, and suggest required inputs necessary to lead to the achievement of the project purpose. The proposed project represents the best and most current thinking of IRRI, the AID project development team, and the top most experienced GSL Department of Agriculture employees as to input requirements and their cost.

The training component will, as a matter of principle, be administered so that most, if not all, trainees will receive their training at IRRI and/or the University of the Philippines, Los Banos which is judged to have the most relevant training programs given the needs and environment of Sri Lanka. It is recognized, however, that circumstances may dictate a need to have some training carried out in the U.S. and provision has been made for this if required.

The GSL capability to maintain and operate the research system created by this project is to a large degree addressed by the relative importance given to training (27 percent of the loan). It is this investment in human capital that most assures the continuance of the institutional base being developed by this project. The GSL capacity to maintain the physical equipment provided by AID is somewhat determined by FX availability in Sri Lanka. That in turn is a function of the price and amounts of its major exports as well as its import requirements for food, particularly rice. This project is directed at reducing dependence on imported rice and is expected to have a significant effect in this regard. Little can be said about the other factors impacting on FX availabilities to the GSL. Operation and maintenance not only depends on parts but the ability of the people using them to keep them going. In visiting the various agricultural divisions, stations and so forth, one cannot help but be impressed by the ingenuity of Sri Lankan mechanics in keeping departmental vehicles running even with a severe shortage of parts. Many vehicles can be observed that are over ten years old with odometers that have stopped at a 120,000 miles plus. Similarly, at the stations ancient equipment, including tractors, can be seen still in operation.

2. Employment Implications.

The employment effects of the project are expected to be positive. Clearly increasing cropping intensity, one of the anticipated results of the project, will require more man days of field preparation, planting, weeding, and harvesting than currently required. Part of the varietal improvement program in rice will be looking for varieties of rice that permit a second or third crop of rice where only one or two are taken now. The short duration varietal work on rice will be particularly important in this regard.

Quantification of the employment implications are speculative at best. However, it is the estimation of top GSL agricultural officials that in the first instance if short duration adapted varieties were developed there is a potential for an additional 200,000 acres of second crop paddy. At 70 man days per acre this implies an employment generation impact of something like 58,000 man years. Similarly other less moisture demanding crops have a potential of being planted in paddy land after paddy on about 400,000 acres. These crops while generally less labor intensive also offer substantial employment generation opportunities. If we assume that on the average these other crops might require something like 25-30 man days per acre that represents about 46,000 years of increased employment potential.

3. Environmental Impact Statement.

This project has some important positive watershed and conservation implications, that is, to the extent that improved paddy varieties and productivity of paddy lands can be increased, and to the degree this lessens the pressure to bring marginal areas under cultivation, this project can be of major significance.

A major part of the paddy improvement and cropping systems work will be directed at genetic elimination of negative factors, e.g., varietal resistance to brown leaf hopper, and minimum input approach for paddy land production systems currently being utilized. Environmentally, the implications of these efforts are that insects and diseases will no longer need to be controlled solely by chemicals or that large doses of fertilizer are the most cost-effective way of realizing increased yields of paddy. This is not to say fertilizer use will be ignored but more effective utilization of it will be sought through means as improved placement methods that have proven to support equivalent yields of paddy with one-half of the amount of fertilizer when compared to traditional broadcasting of fertilizer.

4. Summary

The project proposed is the result of the considered attention of some highly qualified individuals and as such represents "best judgements" as to the technical soundness of the project configuration. The necessary financial analysis and planning has been carried out and a reasonably firm cost estimate developed. The project meets FAA Section 611(a) requirements.

B. Financial Plan/Budget Table

The following table gives the budget breakdown for the entire Research Division. The proportion relevant to this project is reflected in Part 2, in the GSL input targets section of the summary log frame.

1. Table 5 - Research Division's Current Budget and Budget Projections

($000)

	1976	*1977	1978	1979	1980	1981
1. Salaries	379	431	483	506	538	643
2. Travel	30	49	53	57	60	71
3. Consumables	95	160	190	200	210	251
4. Maintenance	23	68	60	63	65	79
5. Essential services	20	27	46	48	51	60
6. Equipment	14	471	65	68	71	85
7. Buildings	-	499				
8. Land Development	167	157				
9. Support for Specialists		31	24	27	30	31
	728	1893	921	969	1,025	1,220

*FY '77 reflects roughly $1,070 million requested capital investments like buildings, vehicles, tractors, etc. Similar projections have not been included in subsequent year projections. (See Condition Precedent (d) page 65. Evidence of timely budgeting of funds will be interpreted in implementation letter No.1 as requiring draft budgets for 1978-1981).

The Research Division's Budget projection (which also include those of the Land and Water Use Division) reflects the best judgement of the Director of Agriculture and Deputy Director of Research at a time before they envisioned outside assistance for the Division. The projected budget anticipates a growth rate of a little over 11 percent per annum. As such it may not fully reflect the increased requirements implicit in the implementation of this project. The Department of Agriculture recognizes this and is currently undergoing a reassessment of their budget requirements. The next opportunity to reflect the increased budgetary support required by the project demands in a formal manner will be in the March-April 1977 budget submission exercises . In the meantime the Government has a system of budget supplements which can be submitted at any time throughout the year and the initial increases in budgeting e.g., the support for the technical assistance personnel, can be met through this process without difficulty. The budgeting History of the Department of Agriculture indicates that on previous occasions when increased budgetary resources were required to support a project assisted by an outside donor the Planning Ministry was forthcoming with the needed resources.

Support beyond the formal length of the project is expected, especially for costs that are L.C. in nature and have by the end of the project been incorporated into the "recurrent" budget. However, the continued support that requires FX is more difficult to speculate on in that Sri Lanka does have a serious FX inbalance currently and it is extremely difficult at the moment to get all the FX that might be desired. Not to recognize that this situation could continue beyond the life of the project would be imprudent. The continued support that can best be provided for with FX are likely to be relatively more important for vehicle and tractor spares, and laboratory consumables. As mentioned elsewhere in the paper the Research Division has a respectable track record in "making due" with their tractors and vehicles.

2. Table 6, Summary Cost Estimate and Financial Plan

($000)

Use	AID FX	AID LC	Host Country FX	Host Country LC	Others FX	Others LC	Total
1. TA	1,148						1,148
2. Staff Salaries				1,357			1,357
3. Travel				196			196
4. Consumable Supplies	256			677			933
5. Maintenance				221			221
6. Essential services				150			150
7. Equipment	936			379	201 *		1,516
8. Training	881						881
9. Contingency	162						162
10. Contractor Overhead	358						358
11. Inflation	420						420
12. Specialist Services				143			143
13. Buildings				307			307
	4,161			3430	201		7792

*IRDC/Canada

3. Table 7, Costing of Project Outputs/L.C. provided Inputs*

($000)

Inputs**	Rice Research	Cropping Systems	Field Trials	Resource Survey	Total
1. Salary	587	237	425	108	1357 (40)
2. Travel	83	33	60	20	196 (6)
3. Consumable Supplies	301	122	218	36	677 (20)
4. Maintenance	101	42	72	6	221 (6)
5. Essential Services	69	27	49	5	150 (4)
6. Equipment	195	49	103	32	379 (11)
Specialist Services	49	47	47		143 (4)
Buildings	209	37	32	7	285 (9)
	1594	594	1006	214	3408
	(47)	(17)	(30)	(6)	(100)

* See Annex D
** Percent in ( )

4. Costing of Project Outputs/F.X. provided Inputs*

Table 8

($000)

Inputs**	Rice Research	Cropping Systems	Field Trials	Resource Survey	Total
1. T.A.	381 (34)	371 (32)	356 (31)	40 (3)	1148 (100)
2. Training	391 (45)	295 (33)	151 (17)	44 (5)	881 (100)
3. Commodities	547 (46)	139 (12)	363 (30)	143 (12)	1192 (100)
4. Contingency	66 (41)	41 (25)	43 (27)	12 (7)	162 (100)
5. Inflation	174 (42)	122 (29)	114 (27)	10 (2)	420 (100)
6. Contractor Overhead	147 (41)	92 (26)	97 (27)	22 (6)	358 (100)
	1706 (41)	1060 (25)	1124 (27)	271 (7)	4161 (100)

* See Annex E
**Percent in ( )

5. Summary.

The foregoing tables fairly represent the costing relationships between outputs and the project provided inputs, particularly the FX. Considerable time was spent in estimating the resources required by each major input category by IRRI staff, the GSL Department of Agriculture staff, and the AID project development team members. The FX estimates presented in this paper are deemed reasonable. These estimates when coupled with a 5 percent contingency amount and an inflation factor of 8 percent per annum and are judged to provide a reasonable budget package.

The LC budget estimates are less firm, particularly regarding third through fifth year estimates for consumables, equipment and maintenance. That is, the project development team did not feel it was possible to come to grips with the budgetary implications of increased capacity vis-a-vis these line items. Nevertheless, as mentioned above, the supplemental budget system that is operable, in addition to the regularized annual budget system, is deemed suitable to handle any short term shortfalls that exist between needs and formally budgeted amounts. In the meantime, the projected budget will be thoroughly reviewed and amended as needed, in the next budget cycle in the spring of 1977.

C. Social Analysis:

1. Overview:

According to preliminary data from the 1972 census, 62 percent of all holdings were paddy and other types of food crop and livestock farms. Of these, 48 percent were less than one acre in size with 88 percent less than 5 acres in size. The average size of these farms was about 2.5 acres, farming in total about two million acres of which about 1.4 million acres are estimated to be utilized for paddy production. Two-thirds of the paddy land is cultivated by owners, the remainder by tenants or owners employing hired labor. The area of paddy per cultivator is small, averaging 1.2 acres. Most paddy farmers, however, also farm some additional land in nearby highland areas suitable for upland crops. In the wet zone of the country paddy holdings average .78 acres as compared to an average of 1.48 acres in the dry zone. About half of the wet zone paddy lands are operated by tenants compared with only 22 percent in the dry zone.

The Agrarian Research and Training Institute (ARTI) has studied five paddy producing districts in Sri Lanka. The analysis of the agrarian situation relating to paddy cultivation in these districts is considerable and does reflect to some degree the island as a whole. It was ARTI's finding that the relative importance of paddy as a source of income to paddy cultivators varied from 27 percent in the Colombo district to 85 percent in Hambantota. ARTI analysis suggests that paddy as a source of family income is relatively more important in the dry zone than the wet zone where alternative employment is more generally available. On the other hand, ARTI points out that family receipts from paddy are directly correlated to size of holdings, which places the dry zone in an advantageous position.

The intended beneficiaries of the project, in the first instance, are the cultivators of Sri Lanka's paddy land through increasing the productivity of their farming enterprise. Given the absolute and relative amount of land under the cultivation of the relatively smaller farmer, the project is forced to address the small as well as all farmers if realization of goal level objectives are to be achieved. However, in keeping with Sri Lanka's social objectives, and AID's particular concern with the relatively less advantaged, the development of technological innovations are to be skewed toward the less than five acre farmer. In particular, the Research Division's research activities are expected to focus on innovations that are biased toward this target group and take advantage of their relative abundant factor of production, i.e. labor and management. To some degree the Research Division is already skewing its activities in this manner in that all, albeit limited, field trial activity is focused on the southwest region where regionally the less well off paddy farmers are located. This project provides for additional expansion in this level of effort by decentralizing and upgrading research capability, particularly at Angunukolapellessa, Mandaravela, and Porbuvela. (See the following section). Within individual regions the project also will expand the research capacity to take into account who the paddy cultivators are through the regional cropping site teams and agricultural economists working with the Field Trails Division.

The Department of Agriculture recognizes that the nature of new technology can have an increased risk factor (real or perceived) associated with it which is relatively more important to the smaller farmer. They also recognize that patterns of adapation of new technology (the relatively better off being able to innovate earlier) do not necessarily coincide with equity objectives in the first instance. However, it is also important that an understanding of the small farmers productive environment, and the development of innovations to increase his productivity underly a major option to increase his real earning capacity. It is on this aspect that this project focuses. That is, changing the genetic potential of the rice plant and identifying improved management

systems of paddy land utilization. In the past, the small farmer has adopted the new varieties and management practices, admittedly at a lagged rate, however, over a period of about five years, the use of new varieties and fertilizer, for example, is estimated to be fairly uniform over the various sizes of farms except for the smallest 20 percent of farm units. The project will provide technical basis for the small farmer to improve his livelihood but it cannot assure this in fact will occur.

2. Project Linkage to the Congressional Mandate

This section is intended to highlight or put into perspective what this project can, as well as cannot, do in relationship to the Congressional Mandate and the people we are most concerned about. First, to recapitulate, this project is designed to impact on the productive use of all rice lands; and 88 percent of the cultivators of these lands are farmers with less than 5 acres farming roughly 73 percent of all cultivated paddy land. In addition, the project is also designed to impact on the productive use of labor employed in paddy cultivation. As such, the project focuses on technological innovation thru the processes of agricultural research. Directed technological innovation should result in cost-reducing, output-increasing innovations that increase the returns to land and labor involved in the cultivation of paddy land. That is, it will establish a technical basis for shifting land and labor productivity given the physical and economic environment that Sri Lanka's paddy farmers operate in. This is what the project can do. What the project cannot do is assure that this shifting of technical potentials will directly translate to increasing the absolute as well as relative well being of the paddy farm families. The welfare status of paddy farmers is a function of not only the productivity of their labor and land engaged in paddy cultivation but of marketing structures, land tenure, access to credit and a host of other factors. The linkage of this project then to AID's Congressional Mandate is primarily through the connection between the productivity of the factors the small farmer uses in producing paddy. To the extent increased marketings of paddy occur, the project also should sufficiently impact on food availability, thru relative prices, as well as generation of employment via income and wages-goods linkages and be of relatively more importance to the poor majority.

It is sufficient to only aim at increasing productivity of factors of production in a research project and expect necessarily that welfare and employment objectives will be realized as well. These objectives, as mentioned, cannot only be met by research, but they

can be more closely approached if the research activities move out to the farm environment and parameters put on the research activity take them into account. This project is designed to move in this direction. Some of the specific features of the project are worth noting in this regard. They are:

a. Decentralization: Currently what paddy research capacity exists is primarily in the more favored areas of the country. This project will bring an increased ability to deal with the productive environment of these poorer (physically and income wise) areas of the country. The stations of Angunubolapellesa, Bandarwela and Bombuwele are in these areas.

b. An enhanced relevency of the rice research for all paddy farmers thru training, particularly in agricultural economics, and physically equipping the Research Division to carry out more work on the fields of farmers. The heavy emphasis on motorcycles and vehicles for the Field Trials Division will be particularly important in this regard.

c. A complementary effort to the major orientation on rice via the cropping systems work that looks at the entire farming environment of paddy producers, thereby enabling potentialities to become available which are of relative more importance for the small paddy producer, particularly in regards to the use of his labor. (See Annex J)

3. <u>The Social Concerns of the Government</u>

This project also needs to be viewed in a macro social sensitivity sense. First, the Government has two major social concerns which are to assure a sufficient supply of basic food grains and secondly to improve the general welfare of the nation's people. The Government has reacted to these concerns in the past by allocating considerable resources to projects like the Mahaweli Development Scheme, and programs such as the comprehensive paddy crop insurance program, a widespread and rather effective extension service, large scale efforts at supplying credit to farmers, and so forth. Now, however, the Government sees that resources must be allocated to research which leads to more productive use of available resources, particularly land and labor. The Department of Agriculture is particularly concerned with the leveling off of per unit yields of paddy and had received direction and encouragement from the Planning Commission to allocate more resources to agricultural research to change this trend. The Planning Commission ranks this project high on their scale of priorities and has encouraged the Research Division to look for donor assistance and ask for necessary in-country budgetary increases.

The social consciousness of the Government and its responsiveness to the body politic is better outlined in a paper by F. Roche, "The Demographic Transition in Sri Lanka: Is Development Really a Perequisite?" The paper presents a good review of the Government's concern for welfare and its past policy and program response to this concern. It should be noted that Sri Lanka's Lorenz curve for income receivers shows the Gini co-efficient has moved from .46 in 1953, to .35 in 1973, a phenomenon not commonly observed anywhere. Over the same period of time, Sri Lanka has also put in place a widespread health care service that effectively covers the nation and raised the national literacy rate to 88 percent. In summary, the government has demonstrated its seriousness in dealing with social welfare concerns and ability to put "real" emphasis on these objectives as well. This project will have a straight forward production objective, and is also expected to significantly contribute to national welfare objectives as well.

4. Women:

Realization of purpose or goal level objectives as stated in this project are not anticipated to have a differential impact on women relative to men. That is, we would hope increased rice production and levels of living would be shared equally by both men and women.

Women are involved in the "Western sense" in economic development of Sri Lanka, both as receivers of the increased goods and services but more importantly as out-of-home productively employed people. The GSL has actively encouraged women to take their place in the open economy. Recently legislation moved the percent of government new-hires that must be women from 10 to 25 percent. In the Research Division rougly 10 percent of all ROs are women with as many as 20 and 30 percent at Gannorowa and Maha Illuppullama stations respectively. In early May this year the Research Division reported that out of 46 new hire ROs, 11 were women.

Women will also impact on this project as participants in the On-Farm field trial activities and as residents at the cropping system sites. At these field sites not only the agronomic aspects of rice and paddy land use will be noted but in addition the cooking, storage and general handling qualities will be evaluated from the point of view of women who in most cases are most directly involved with these processes. Similarly field work is traditionally divided among men and women and part of the cropping systems work will have to be addressed to reactions of women to potential changes in their traditional work modes.

D. Economics:

1. Overview:

As typical with a project such as this, little hard economic analysis of the project has been done. The kind of data required for substantive economic analysis and the time required both to generate the data base, as well as to carry out the analysis, are formidable barriers to overcome. The project development team is concerned with the major economic hypothesis underlying this project: that is, anticipated returns to the GSL and ATD resources at the margin do indeed offer the prospect of relatively attractive returns to investments. An economic analysis to estimate the returns from this project follows. It should be noted that it is the judgment, albeit essentially intuitive, of the Department of Agriculture that the project area does offer sufficient and relatively more promising returns to investment than other alternatives uses of resources at this time. The work of Professor Evanson at Yale University and others who are trying to measure internal rates of return to investments in agricultural research versus extension activities, for example, tends to support this.

Similarly, economic implications of the project for the target group in the first instance, the paddy farmer, are not well understood. It is assumed that technology can be developed to increase the factor productivity of paddy farmers and that this in turn will translate directly into improved welfare. It is recognized, however, that the relationship between increased productivity and the ability of the cultivator to capture the benefits of increases in factor productivity is tempered by a number of variables exogenous to the project as well as the farmer himself. Government price policy regarding rice, land tenure arrangements, etc., are among such variables.

Recent Government price policy as it impacts on surplus producers is expected to encourage food production, paddy in particular. The Guaranteed Price Scheme of the Government since 1972 raised the floor price of paddy from Rs. 14 per bushel to Rs. 33 per bushel (in the 73/74 Maha season, cost of production was estimated at Rs. 22.50 per bushel) and has given the Paddy Marketing Board resources to buy at this price. Government price policy has also meant a substantial fertilizer price subsidy although the economic justification is debatable. Nevertheless, the current implication for the paddy producer is a favorable fertilizer/paddy price ratio of about 1:1.

To the nation and national treasury the economics of increased paddy production is at the surface straightforward in that any increase in domestic production reduces the need for FX expenditure for food grains. The degree to which the FX savings can be captured and utilized for economic development is problematical and so one can only conclude at the minimum the potential to utilize FX for developmental purposes would be enhanced.

The whole question of self-sufficiency versus encouraging a more productive export sector and encouraging import substitution is beyond the purview of this project but is recognized as a legitimate question for substantial analysis. It is, however, understandable for a nation to be skeptical about relying on the whims of the international market place for nearly half of its domestic food grain requirements.

2. Analysis. Implicit in considering the economic implications of this project is the assumption that agricultural research on rice and cropping systems is a productive activity. In this section we will try to estimate the likely productivity of the proposed investment. However, conceptualizing and specification of the underlying model is difficult at best and the analysis subject to some critical yet only partially appreciated assumptions. In the following discussion we will outline our estimate of the internal economic return to the project.

Our first major problem was to identify a point from which to measure the expected increases in productivity. We initially decided to disregard any increases in productivity for crops other than rice since the information on non-rice crops is not readily available and our past experience, on which to make future projections, is limited. We, therefore, developed only a baseline for rice and concerned ourselves with projecting benefits arising out of the technological innovations as they pertain to rice.

In projecting our rice baseline we utilized district production figures for the last 14 years. In doing so we projected production figures assuming that without the project the historical growth rates would continue with two modifications. They were: (1) that any districts with historic growth rates above five percent per annum, like Ratnapura with 11.5 percent per annum, would not continue at those rates and were projected to have a growth rate of only five percent; and (2) that districts with growth rates of less than 2 percent would increase their rice production in the future at a per annum growth rate of two percent. Districts like Trincomalee fall into this category.

We made our projections through 1992 on a district basis. Aggregating the district projections, we projected a national average increase in paddy production of 3.9 percent per year. This compares with the base period that had an average annual increase of 4.3 percent. It should be noted that if one were to utilize the production figures dating from 1952 the historic growth rate would be about 5.2 percent per annum.

Our projected production figures then form the base from which we try and identify benefits that could be attributed to this project. If the project is successful and the productivity goals of the project are reached, we would expect the projected growth in paddy production to be increased. The question then is by how much? Again, looking at historical data we note that after the introduction of high yielding varieties the growth in paddy production grew at about 7.5 percent per annum for a period of 5 years. In projecting our expected benefits we assumed that after 6 crop seasons varieties would become available that significantly shift production frontiers. The technological impact on national production would then rise from the projected 3.9 to 4.5 by 1982 and by 1985 reach 6 percent per annum and then drop off to 4 percent by 1992.

The next question to consider in our analysis was how much of the expected increase can be attributed to the new technology. We assumed that 20 percent of the incremental production could be attributed to technology. To attribute the entire incremental production to technology would overstate the return. We then tried to isolate out factors of production also required to realize that increase in production such as fertilizer. Assuming an 8:1 paddy nitrogen ratio we found about 25 percent of the incremental production could be attributed to fertilizer

and arbitrarily assigned 55 percent of the incremental increases to other factors of production, i.e., labor, land, etc.

With the above assumptions we then used standard methodology to arrive at an estimated internal return of 33 percent. Recognizing the limitations of partial analysis and future projections we conclude that the project yields an internal economic return that offers an attractive investment opportunity. Noting the work by Evenson and Boyce in their book Agricultural Research and Extension Programs we find that they cite several studies of reaearch activities by Griliches, Hayami, and others that indicate internal rates of return of 35 to 50 percent are not uncommon. Our estimated internal rate of return could be considered on the low side. However, our estimates have been deliberately conservative. For example, the kind of targets in the rice GEU program should lead to technological shifts in production that would give more than a three percent increase in the rate of growth in production over the baseline projections for similar periods of time. Similarly, we have attributed all of the direct project costs to paddy when some of these costs should be attributed to other activities like cropping systems work while we have not attempted to estimate likely benefits from those activities. In addition, we have not attempted to estimate likely benefits from those activities. We have also been less than generous in attributing benefits to the technological innovations nor have we estimated a salvage value of the technology generated during the project period. We conclude then that our estimated internal rate of return is relatively robust and that it is likely to be under estimated.

How, in an economic sense, does an investment in research compare with other investment opportunities? Again, the constraints imposed by time and data limit alternatives for consideration. If we had sufficient information, we could judge by the estimated internal return the relative ranking of possible projects that are not mutually exclusive. Mutually exclusive projects of course would have to be further analyzed by discounting differences between cash flows.

For comparison, however, we have selected one example. That is, instead of investing project resources in research we invested in urea. Assuming the fertilizer was used on paddy with an 8:1 fertilized output ratio we calculated an internal economic return of over 50 percent. However, it is noted that the districts with relatively high use rates of new varieties are already using high rates of fertilizer (around 40 lbs. of N per acre) and that the marginal response to additional nitrogen might not be as great as 8:1. In addition, the districts with low use rates of the new varieties are likely to get little if any response to additional fertilizer. We conclude that notenough information on fertilizer responses rates at the margin are known island-wide and that while nitrogen fertilizer may offer an attractive investment opportunity it may not be as attractive as the high estimated internal rate of return indicates.

TABLE 9

Agricultural Research/Sri Lanka - A Summary Estimate of the Internal Economic Rate of Return

($ Million)

Year	Gross Costs	Gross Benefits	Incremental Benefits *	D.F. 33%	Present Worth 33%
77	3.1	-	-3.1	.752	-2.3
78	2.6	-	-2.6	.565	-1.5
79	2.6	-	-2.6	.425	-1.1
80	2.6	-	-2.6	.320	- .8
81	2.8	-	-2.8	.240	- .7
82	8.3	10.4	2.1	.181	.4
83	11.5	14.2	2.7	.135	1.4
84	25.6	32.0	6.4	.102	.7
85	39.1	48.9	9.8	.077	.8
86	56.4	70.5	14.1	.058	.9
87	74.3	92.9	18.6	.043	.8
88	87.8	109.7	21.9	.033	.7
89	103.8	129.8	26.0	.025	.7
90	112.2	140.2	28.0	.018	.5
91	116.0	145.0	29.0	.014	.4
92	116.6	145.8	29.2	.010	.3
	765.3	939.4	174.1		**

* Rice valued at $250/M.T., April 1976

** 33% overstates the discount rate needed to bring present worth to exactly zero by 0.15 percent.

Part IV. Implementation Arrangements

A. Administrative Arrangements

1. Recipient

The implementation of the project will be carried out by the Research Division of the Department of Agriculture. The Deputy Director/Research* will be the principal project officer. The sub-units under the Deputy Director/Research that will most directly lead the project activities will be the Working Groups on Rice, Cropping Systems, and Field Trials, as described elsewhere in the paper supported by the staffs of central and regional research stations, and field sites in the Research Division.

The resource capability survey aspect of the project will in part be implemented with supplemental help of the Land Use Division currently in the Ministry of Irrigation. The current Deputy Director of Research has for many years headed the Land Use Division when it was still in the Department of Agriculture as well as after its transfer to the Ministry of Irrigation. Cooperation is excellent between individuals in both Ministries. In addition there is a 15 year history of the Land Use Division, while in the Irrigation Ministry, being most cooperative and supportive of the needs of other Ministries in the Government.

The ability of the Research Division to manage the project will certainly be taxed with the increased, albeit more focused, activity. The Deputy Director of Research recognizes the potential over-extension of his managerial control and is in the process of creating positions for additional administrative assistance. The AID project development team members believe that with anticipated staffing and organizational changes the Research Division is capable of successfully implementing the project.

Increased coordination implied in the development of the component technology involved in a "GEU" or "Cropping Systems" program will be more demanding than the Research Division has had to deal with to date. However, the leadership of the Division as well as the Research Officers are aware of the powerful advantages a coordinated/multidisciplinary approach to problem solving has for Sri Lanka. A manifestation of this awareness is the recognition of the need for improved coordination and the conceptualization already done on the organization and membership on National Rice and Cropping Systems Research Committee and the three major working groups.

With the present management base coupled with expected changes in research approach and staffing the Research Division should be capable of effectively managing the coordination requirements inherent in the project.

*The principal officer of the Research Department.

IRRI has similar projects in Indonesia and Bangladesh and so the needs and requirements vis-a-vis contracting have been well thought out by IRRI and so to some extent it will be easier for the Research Division to make the necessary contractual arrangements. Nevertheless, there may be a possible need for assistance by a contracting officer, including perhaps a visit to Sri Lanka after loan authorization by a staff member of CM/ROD/ASIA.

The administrative environment, while perhaps somewhat cumbersome for the leadership of the Department of Agriculture, is generally positive and should be on the balance a major factor in achievement of project purpose. That is, while the formalized administrative procedures are cumbersome there is a highly developed esprit-de-corps among the leaders and cadre of the Department of Agriculture and the Research Division in particular. Two examples: first, is the general willingness of the research staff to recognize the job to be done and go out to the field and work on the problems. To be sure there are some problems of staff keeping within the bounds of the research stations and not going out to the farm environment, but the AID project development team was impressed by the relative insignificance of this problem as compared to other countries. Coupled with this is the surprising resourcefulness displayed by the research staff in carrying out various tasks under less than ideal situations. A second example might be the quality of work generally displayed by the Agricultural Engineering unit of the Department of Agriculture in carrying out the construction needs of the Department. Again, the AID project development team was particularly impressed by the extra effort put forth by the engineering unit in assuring the quality in the construction of Departmental buildings as compared to the all too common shoddy workmanship that often prevails in government buildings elsewhere. Other units, however, of the Agriculture Department have complained that this characteristic performance by the engineering unit does slow down the rate of building. The above two points are simply illustrative of the administrative environment within which the project will be implemented. In summary, the administrative environment in which the project will be implemented is excellent. The professional concern of the Research Division's leadership expressed throughout the development of the project certainly established a positive basis on which to begin.

The reader is referred to Figure 9 in the Text and Figure 3, Annex P which sketch out the formalized administrative arrangements to link the government researchers to the paddy farmers of Sri Lanka. It should be noted that the bulk of the front-line contact with farmers will be through the Field Trials Division and the Cropping Systems site staff in cooperation with local extension personnel. Annex J illustrates the initial

benchmark survey at the first site selected for cropping systems field work that was done with support from the IPDC. The project implies generally increased work with farmers on their land. We anticipate that the arrangements are adequate to facilitate the needed on-farm work.

2. AID

a. USAID Staffing

In discharging AID responsibilities for the monitoring of the project it is anticipated that about 20 percent of the time of one staff member is required. The USAID project manager should be an experienced agriculturalist preferably with an agricultural economics background in that it is judged AID should be relatively more concerned with the sector implications of the project and their changes over time. However, also of concern to AID will be the development of the Research Division's institutional capacity. It is judged that the monitoring of the technical aspects of the research program will be adequately managed by the Deputy Director of Research with assistance from the IRRI staff members assigned to the project. Therefore, it is also important for the AID staff member assigned as project manager to be generally familiar with agricultural research procedures and methodologies.

The current USAID staff does not have the capacity to carry out the assumed monitoring responsibilities. The exact USAID staffing profile needs to be decided on in the context of not only monitoring this project but the likely future project monitoring and project development work load.

b. Waivers

Two waivers are requested. They are in relationship to vehicles and the non-competive procurement of IRRI to provide technical assistance, and project implementation services for the Government of Sri Lanka.

1). Vehicles:

One of the objectives of the project is to equip the Research Division to expand its regional and on-farm activities. Transportation is a key ingredient in realizing this objective. A waiver for non-U.S. procurement of the following types of vehicles is requested:

a). Motorcycles: The kind of motorcycle required is a trail type bike small enough to handle under primative road conditions. It has been determined that a motorcycle of the 90-100 cc type, waterproofed engine, two range gear box, and with in-country repair and maintenance facilities is required. Approximately 66 motorcycles are estimated to be necessary. The honda trail 90 bike is the type

identified as the most desirable bike meeting the above specifications. The smallest U. S. bike manufactured is the 135 cc and no in-country repair and maintenance capability exists for this U.S. manufactured item.

b). Large Vehicles: The project development team and the GSL estimated the two 3-ton trucks, 15 pickups, 2 Mini-buses or vans, and 4 sedans are required. All vehicles in Sri Lanka require right hand drive. The above vehicles with right hand drive are not available from a U.S. source. (Jeeps also require under the project, are manufactured with right hand drive and will be procured from the U.S.).

2). IRRI:

An exception to AID's competitive procurement procedures permitting the Department of Agriculture to select IRRI for services described below is requested.

The Department of Agriculture has requested that AID approve IRRI as the contractor to assist the Research Division implement the project. The services desired are three in nature. The first are the services of three long term technicians in the area of rice breeding, cropping systems and field trial agronomy, as well as a number of short-term consultants. Second, is to assist with the implementation of the training component of the project. The intent of the project is to have virtually all of both the short and long-term training carried out at IRRI or in cooperation with the adjacent University of Philippines, Los Banos. Third, is to act as the Department of Agriculture's procurement agent both in ordering and the landing of equipment. IRRI has responded to initial requests by the Department of Agriculture to perform these services outlined above favorably.

IRRI was established in 1960 by the Ford and Rockefeller Foundations as a non-profit research organization. It is currently funded by a group of governments, international organizations and private foundations concerned with improving agticulture in developing nations. It is located adjacent to the University of the Philippines at Los Banos, Laguana, 65 kilometers southeast of Manila. IRRI scientists from nine (9) nations work cooperatively with scientists across the rice growing world to jointly develop improved varieties and technology including machinery for the world small scale rice farmers.

IRRI is uniquely qualified to fulfill the project requirements since they have developed an unsurpassed research network designed to serve the developing countries in the field of rice. The major services

provided by IRRI include direct assistance to national research and production programs, sponsorship of uniform international yield, disease and insect trials, pioneering leadership in rice cropping systems, sponsorship of regional workshops, supply of germplasm, advanced lines and varieties, rapid exchange of research data, training and linkage to other developed country institutions. These services are provided through intensive on-campus research programs, both on-campus and in-country training programs, and by placing IRRI personnel at the service of developing countries.

On its on-campus research IRRI seeks to identify the major factors limiting the production and utilization of rice and to formulate research programs that provide solutions (or means of solutions) to these major problems. In its early years IRRI became renowned for its development of high yielding varieties of rice. In more recent years, IRRI has put relatively more emphasis in its international testing programs on developing varieties of rice more suitable to weather conditions in individual countries such as Bangladesh, India, Sri Lanka and Thailand.

A second major on-campus function of IRRI is the training of research staff in the essential skills of effective field experimentation. This training is intensive, short and long-term, practical, and field-oriented. Such training in improved rice production and cropping systems technology is unique to IRRI and is not available at other locations. For long-term or academic training, IRRI collaborates in particular with the University of the Philippines, Los Banos. In these combined programs, the students research is directed to solving actual problems of the students country with his committee members from both the University and IRRI staff.

A third aspect of IRRI's program is the supplying of technical assistance to the developing countries, team visits by IRRI professionals and by providing resident professional personnel. IRRI scientists live and work in the countries at the request of host governments to strengthen and accelerate the national rice improvement programs. IRRI also provides considerable short-term consultancy-like service on request from cooperating countries.

Recommendation: The kind of services IRRI can provide are vital for achieving the project purpose. No other institution can supply the technology and services that IRRI can. The project development team recommends that approval be given for an exception from competitive contracting procedures to permit Sri Lanka to select IRRI on the basis of IRRI's predominant capability to provide services for the Rice Research project to be implemented by the Research Division of the Department of Agriculture.

C. Procurement Schedule

It appears the GSL is prepared to initiate procurement of some items prior to signing of the loan agreement. The project development team recommends that items for the project procured after July 1, 1976 be eligible for AID financing under the loan if they are procured according to AID rules and regulations.

B. Implementation Plan

* - Indicates annual occurring events

KEY: (a) GSL = Government of Sri Lanka
(b) DA = Department of Agriculture
(c) RD = Research Division
(d) IRRI = International Rice Research Institute Team

Action		
	July 1976	
1.	GSL/USAID	Begin negotiation of Loan Agreement
2.	GSL/IRRI	Contract negotiation with IRRI by GSL
3.	RD	Begin process to obtain supplemental budget for technical assistance support
	August 1976	
4.	IRRI	Staff recruitment by IRRI
5.	RD/DA	Supplemental budget for LC support of technical assistance arranged for
5a.	USAID	Review and approve proposed IRRI contract
	September 1976	
6.	GSL/USAID	Sign Loan Agreement
6a.	RD/USAID	Sign IRRI Contract
7.	DA/RD	IRRI team arrives
8.	RD/IRRI	Select and send of two trainees for cropping systems training
	October 1976	
9.	RD/IRRI	Program familiarization by IRRI specialists.
10.	RD/IRRI	Meeting of Working Groups/Selecting Coordinators
11.	DA/RD/IRRI	Initial organization of National Rice Research and Cropping Systems Committee
12.	RD/IRRI	Recruit consultant for Resource Capability Survey
13.	RD/IRRI	Identify and recruit consultants needed to assist in development of National Rice Research Program
14.	RD/IRRI	Prioritize commodity requirements and place initial orders
15.	RD	Implement Maha research activities.
	November 1976	
16.	IRRI	Bring in consultant for Resource Capability Survey
17.	RD/IRRI	Review Project Implementation/Work Plan - update, and forward copy to USAID project manager
18.	GSL	Satisfy conditions precedent to Initial Disbursement

December 1976

19.	RD/IRRI	Program review and formulation of an integrated Rice and Cropping Systems Research Program including activities for working groups.
20.	IRRI	Consultant(s) in to help formulate overall research plans.

January 1977

21.	RD/IRRI	Development of details for regional research programs
22.	RD	Initiate resource capability survey
23.	RD/IRRI	Working Groups initiate initial planning process for Yala season
*24.	Rd/IRRI	Selection of year's trainees
25.	RD/IRRI	All cropping systems sites identified and base line data surveys are initiated
26.	RD	Initiate Resource Capability Survey

February 1977

27.	RD/IRRI	Review commodity needs again and firm up ordering schedule for remaining equipment.
28.	RD/IRRI	Send trainees for GRU training
*29.	RD/IRRI	Field review of Maha research
30.	DA/RD	Local staff requirements
*31.	RD	Begin developing local budget requirements for '78
32.	RD/IRRI	Begin to prepare Yala Research Plans
*33.	RD/IRRI/USAID	Initiate first year annual project review
*34.	RD/IRRI	Review and update project implementation/work plan
*35.	RD/IRRI	Prepare Annual Requirements for Consultancies.

March 1977

36.	RD/IRRI	Send trainees for Rice Production/Applied Research training
*37.	RD/IRRI	Work Group reviews of Maha research results
*38.	RD/IRRI	Finalize research plans for Yala season for Work Groups
*39.	RD/IRRI	National Rice and Cropping Systems Research Committee review of Maha Season

April 1977

*40.	RD	Submit RD budget for following fiscal year
*41.	RD/IRRI	Finalize and implement Yala Season research program

May 1977

*42.	RD/IRRI	Send long-term trainees

July 1977

43. RD/IRRI Order equipment

August 1977

44. RD/IRRI Send long term trainees
45. RD/IRRI Review Yala activity in field
*46. RD/IRRI Initiate research planning for Maha Season
*47. RD/IRRI Review progress of Research Capability Survey

September 1977

48. RD/IRRI Send cropping systems trainees
*49. RD/IRRI Finalzie and initiate Maha Season research program
*50. RD/IRRI Semi Annual Review and up-date of Project Implementing Work Plans.

October 1977

*51. RD/IRRI Working Group meetings to review Yala Season
*52. RD/IRRI National Rice and Cropping System Research Committee meeting to review Yala work

February 1978

53. RD/IRRI Review Status of GSL 1977 Building program

October 1978

54. RD/IRRI Schedule special evaluation review of project by outside evaluators for March 1979.

March 1979

55. RD/IRRI/USAID Carry out special evaluation, project evaluation

April 1979

56. RD/IRRI/USAID Redesign project of necessary

July 1979

57. RD/IRRI Review and evaluate acceptance in 79 Yala season acceptance of project generated and released rice varieties

November 1980

58. RD/IRRI/USAID Schedule major project review for March 1981
59. RD/IRRI Evaluate acceptance of "new" cropping systems by site farmers.

March 1981

60. RD/IRRI/USAID Carry out final evaluation of project

Project Implementation Plan *

CY	76												77												78											
Month:	Jan.	Feb.	March	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
							1													44	48	51				29	37	40	42			46	49	51		
							2													45	49	52				31	38	41					50	52		
							3						21							46	50					32	39									
								4					22													34										
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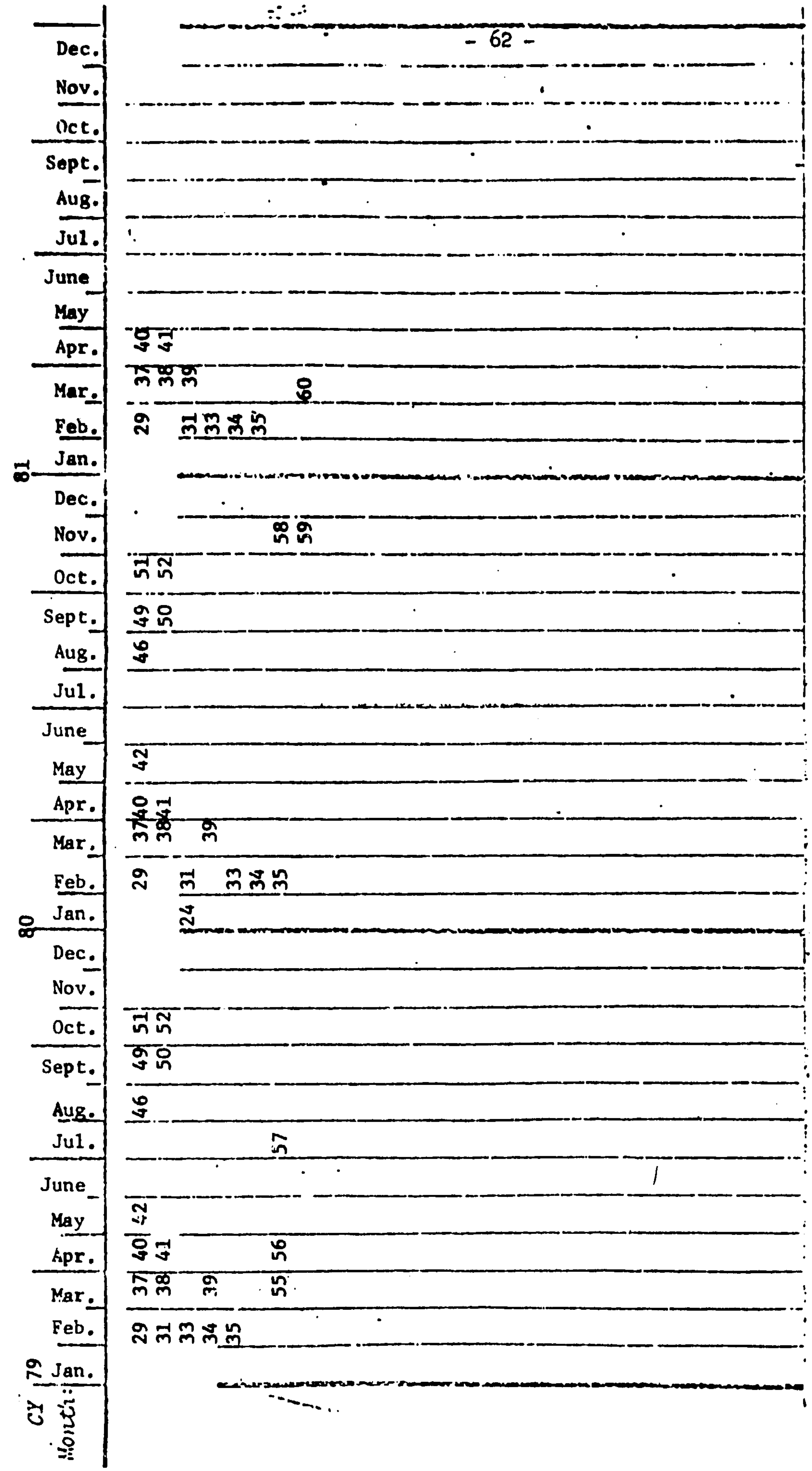
* Numbers correspond to activity identifyed in foregoing narrative of implementation plan.


CY 79
Month:
Jan.
Feb.
29 31 33 34 35
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Jul.
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58 59
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Mar.
37 38 39 60
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40 41
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June
Jul.
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Oct.
Nov.
Dec.

C. Project Monitoring

It will be the responsibility of the Deputy Director/Research to monitor the implementation of the project. At the time of the annual evaluation there will also be an update of actions taken in the project for the previous year. The IRRI team members and the USAID project manager will assist the Deputy Director/Research in this effort and jointly develop a summary report of their findings. During the initial first year of the project the Deputy Director/Research will also on a quarterly basis review with the IRRI team members and the USAID project manager implementation activities. In February 1977, at the first annual evaluation, there will be made a determination as to the need for and frequency of formalized monitoring requirements. In any case, a formal review will be required not less than once in each of the remaining project years at the time of the annual project evaluation.

In keeping with AID's general responsibility to monitor project implementation in addition to the required monitoring and evaluation reports, every effort will be made to advise the USAID project manager from time to time as to general progress of the project and any important difficulties encountered in the carrying out of the project. The USAID project manager will also be advised of, and invited to participate in in-country workshops, seminars, and field trips that are related either directly, or in a more complementary manner, to the project.

D. Evaluation Methodologies:

In discharging the evaluation responsibilities the Deputy Director/Research, his staff, IRRI team members, and the USAID project manager will use the evaluation techniques as laid out in the AID publications Evaluation Guidelines and the AID Evaluation Handbook. The evaluations must meaningfully test the hypotheses of casual relationship between inputs, outputs, purpose and goal level objectives as well as the underlying assumptions about these causal relationships.

E. Logistic Support

The logistic support services required for the long-term technical services will be financed by the GSL budget resources which will be turned over to the IRRI representative for administration. The IRRI representative will be given, on an annual basis, sufficient local currency estimated as necessary for the new year's support services. The IRRI representative shall be expected to expend these funds in a prudent manner and to account for their expenditure in a manner satisfactory to the GSL. Exact details of the budgetary, financial, and accounting procedures will be negotiated during the formulation of the GSL/IRRI contract.

IRRI has been asked, and they have indicated their willingness, to assist the Research Division in handling the ordering of the commodities to be supplied under the loan. IRRI has also agreed to assist in the landing and clearing of commodities as they arrive. This will be carried out by staff assistance hired by the IRRI representative and financed by funds provided for the general technical assistance support services.

F. Evaluation Arrangements

1. Regular

On an annual basis, the GSL and the Research Division in particular, in cooperation with the IRRI team and USAID project manager will review the progress of the project and in particular note the movement toward or achievement of project output targets and end of project indicators. On the basis of this review, the Research Division and IRRI specialists will update the next year's implementation plan and provide for any project design changes as may be appropriate. On completion of the annual program review a summary of the review will be presented orally and in writing to the USAID Representative and other GSL officials as appropriate such as the Secretary of Agriculture and the Director of the Agricultural Department. The exact timing of the annual review should be worked out between the Deputy Director of the Research Division and the IRRI representative during the initial development of the detailed project work plans. It is recommended, however, that the annual plan should be at a time when findings of the review can significantly impact on the annual GSL budget preparation process if implications of the review so require.

2. Exception Reporting:

It will be the responsibility of the USAID Project Manager to in a timely manner inform AID if any of the CPI's in the Project Performance Tracking system will not be met by the date originally anticipated and the resultant implications for the project.

3. Special Evaluation:

A major review of the project should be held in the spring of 1979 before the planting of the Yala Season. At this time, the project will have been through five paddy crop seasons and have been underway for about two and one half years. It is suggested that this review be part of the annual review, but in addition to the persons actually implementing the project, include outside subject matter specialists such as a plant breeder and a cropping systems specialist from IRRI's central staff, a respected member of the international research fraternity, an AID/W official familiar with AID project design and evaluation methodology, a staff member of ARTI, and a respected leader in the professional agricultural community of Sri Lanka. The major focus of the outside participants will be to test the original project hypothesis, the causal relationships between the project inputs and outputs and the achievement of project purpose. The outside participants will submit a report to the GSL and USAID which should clearly detail and outline the major implications of their findings. It is expected that the AID/W team member will, at completion of the review and the presentation of findings, then assist the Research Division and USAID in project documentation changes, such as redesign of certain elements of the project as required.

G. CONDITIONS, COVENANTS, AND NEGOTIATING STATUS

1. Conditions Precedent to Initial Disbursement:

Prior to the first disbursement or to the issuance of the first Letter of Commitment under the Loan, the Government shall, except as A.I.D. may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

a. An opinion of the Attorney General of Sri Lanka or other counsel acceptable to A.I.D. that the Loan Agreement has been duly authorized or ratified by and executed on behalf of the Government of Sri Lanka and that it constitutes a valid and legally binding obligation of the Government;

b. Evidence of the authority of the person or persons who will act as the representative of the Government of Sri Lanka concerning actions to be taken under the Loan and a specimen signature of each such person certified as to its authenticity by either the person rendering the legal opinion under G.I.A. above, or the person who has signed the Loan Agreement for the Government;

c. A signed contract for the technical services to be performed;

d. Evidence of the availability for use by the contractor of local currency sufficient for a minimum of one year's anticipated local cost associated with incountry support of Technical Assistance provided by the Loan, and evidence that the increased staffing required for the project will be sanctioned and required funds budgeted on a timely basis.

e. Evidence of the appointment of a Project Manager with adequate authority to exercise effective responsibility for day-to-day project operations.

2. Covenants:

In addition to the standard loan agreement covenants the loan agreement will provide that:

a. To the extent the normal budget is inadequate, the Borrower agrees to provide additional funding in the recurrent and capital budgets of the Department of Agriculture on a timely basis as well as any additional local cost funding which may be necessary to the project.

b. The Borrower covenants to conduct a performance evaluation on a yearly basis until project completion, together with AID and the IRRI team members and submit a summary of the review in writing to AID. The Borrower undertakes to carry out recommendations made under this evaluation.

c. The borrower covenants to conduct a major review, which may coincide with the yearly review, at the end of about two and one-half years of project activity together with AID, IRRI and outside subject matter specialists deemed appropriate to test the project hypothesis. Recommendations resulting from this review will be carried out by the Borrower.

3. Terminal Dates for Conditions Precedent, Disbursing Authorizations and Disbursements.

a. Conditions prededent to initial disbursement will be met within 120 days of signing of the Loan Agreement.

b. The terminal date for requests for new disbursement authorizations under the loan will be four and a half years from the signing of the Loan Agreement.

c. The terminal date for disbursements under the loan will be five years from the signing of the Loan Agreement.

4. Status of Negotiations.

The above conditions precedent, covenants, and dates have been discussed with and agreed to both by the Department of Agriculture and the External Resources Division of the Government of Sri Lanka. No problems are anticipated in meeting the conditions precedent in the time indicated or in completing the project within the time frame of the Loan.

Annex A

DESIRED STAFFING PATTERN BY FUNCTIONAL AREA

Rice Research

A. Batalagoda

1. RO
   - -National
   - → Coordinator
   - -Rice Breeder 2
   - -Entomologist 1
   - -Pathologist 1
   - -Soil Chemist 1
   - -Agronomist 1
   - -Cereal Chemist 1
2. EO/AI
   - -Rice Breeding 5
   - -Entomology 1
   - -Pathology 1
   - -Soil Chemistry 1
   - -Agronomy 2
   - -Cereal Chemistry 1

B. Gannoruwa

1. RO
   - -Rice Breeder 1
   - -Pathologist 1
   - -Entomologist 1
   - -Statistician 1
   - -Agronomist 1
   - -Chemist 1
   - -Food Technologist 1
   - -Physiologist 1
   - -Soil Chemist 1
2. EO/AI
   - -EO/AI
   - -Rice Breeding 1
   - -Entomology 1
   - -Pathology 1
   - -Statistics 1
   - -Agronomy 2
   - -Chemistry 2
   - -Soils 1
   - -Food Technology 1
   - -Physiology 1

C. Angunubolapellessa

1. RO
   - -Rice Breeder
   - -Agronomy

Cropping Systems

Out reach Sites (2)

1. RO
   - -Agronomist 2
2. EO/AI
   - -Economist 1
   - -Agronomy 3
   - -KVSs 2

Out reach Sites (1)

1. RO
   - -Agronomist 1

Field Trials

National Coordinator

1. RO
   - -Agronomist 1
   - -Statistician 1
   - -Soil Chemist 1
   - -Economist 1
2. EO
   - -Agronomy 1
   - -Statistician 2
   - -Economics 1

Field Units (2)

1. RO
   - -Agronomist 3
   - -KVSs 9

1. RO
   - -Agronomist 1

Rice Research

C. Angunubolapellessa (Cont'd)

2. EO/AI
-Rice Breeding 1
-Agronomy 1
-Entomology 1
-Pathology 1
-Soil Chemistry 1
-Statistics 1

D. Bombuwela

1. RO
-Rice Breeder 1
-Soil Scientist 1
-Agronomist 1

2. EO/AI
-Rice Breeding 1
-Agronomy 1
-Entomology 1
-Pathology 1
-Soils 1

E. Bandarawela

1. RO
-Rice Breeder 1

2. EO/AI
-Entomology 1
-Pathology 1
-Soils 1
-Agronomy 1

Cropping Systems

2. EO
-Economist 1
-

Out Reach Sites 1

1. RO
-Agronomist 2
-KVSs 2

1. RO
-Agronomist 1

2. EO
-Economics 1

Out Reach Sites (1)

1. RO
-Agronomist 1

2. EO/AI
-Agronomy

Field Trials

2. EO/AI
-Agronomy
-Soil Fertility 1

Field Units (4)

1. RO
-Agronomist 4
-KVSs 12

1. RO
-Agronomist 1
-Soil Chemist 1

2. EO/AI
-Soil Chemistry 1
-Agronomy 1

Field Units (4)

1. RO
-Agronomist 4

2. KVSs 12

1. RO
-Agronomist 1

2. EO/AI
-Soil Chemistry 1
-Agronomy 1

Field Units (3)

1. RO
-Agronomy 3

2. KVSs 12

Rice Research

F. MahaIllupallama

1. RO
   - -Rice Breeding 1
   - -Entomologist 1
   - -Pathologist 1
   - -Agronomist 2
   - -Water Management 1
   - -Soil Chemist 1

2. EO/AI
   - -Rice Breeding 2
   - -Entomology 1
   - -Pathology 1
   - -Soils 1
   - -Water Management 1
   - -Economics 1
   - -Agronomy 2

Cropping Systems

National Coordinator

1. RO
   - -Agronomist 1
   - -Economist 1
   - -Entomologist 1
   - -Breeder upland 1
   - -Soil Chemist 1

2. EO/AI
   - -Agronomy 2
   - -Economics 2
   - -Entomology 1
   - -Pathology 1
   - -Soils 1

Out Reach Sites (2)

1. RO
   - -Agronomist 2

2. EO/AI
   - -Agronomy 2
   - -Economics 2
   - -KVSs 4

Field Trials

1. RO
   - -Agronomist 1

2. EO/AI
   - -Soil Fertility 1

Field Units (4

1. RO
   - -Agronomy 4

2. KVSs 12

AGGREGATE STAFF CURRENTLY AVAILABLE AND PROJECTED REQUIREMENTS

		Available	Need
RO Level			
1. Rice Breeders		10	
2. Entomologists		3	1
3. Pathologist		2	1
4. Soil Scientist			1
5. Statistician		1	1
6. Agronomist		8	29
7. Soil Chemist		1	
8. Food Technologist		1	
9. Soil Chemist		4	2
10. Water Management		1	
11. Economists		1	1
12. Cereal Chemist			1
13. Physiologist		1	
	Total	33	37
EO/AI			
1. Rice Breeding		10	2
2. Entomology		3	5
3. Pathology		3	4
4. Soil Chemistry			4
5. Agronomy		14	9
6. Cereal Chemistry			1
7. Statistics		1	1
8. Chemistry		2	
9. Soils		3	2
10. Food Technology		1	
11. Physiology		1	
12. Water Management		1	
13. Economics		3	6
14. Soil Fertility			2
	Total	42	36
KVS			
1.			65

1. Allocation of Long-Term Training by Functional Areas

	M.S.		Ph.D	
A. Rice Research				
1. Rice Breeding	[illegible]		[illegible]	
2. Agronomy	3		1	
3. Entomology			1	
4. Plant Pathology	1		1	
5. Soils			1	
6. Cereal Chemistry	1			
7. Agricultural Economics	1	8		6
B. Cropping Systems				
1. Agricultural Economics	3		1	
2. Agronomy	4		1	
3. Entomology		7	1	3
C. Field Trials				
1. Agronomy	1		1	
2. Statistics	1			
3. Agricultural Economics	1	3		1
D. Land & Water Use Division				
1. Soil Survey	1			
2. Soil & Water Management	1	2		-
		20		10

Long-Term Training No.	M.S.	Ph.D
1. Rice Breeding	2	2
2. Agronomy	8	3
3. Soils		1
4. Entomology		2
5. Cereal Chemistry	1	
6. Plant Pathology	1	1
7. Agricultural Economics	5	1
8. Statistics	1	
9. Soil Survey	1	
10. Soil & Water Management	1	
	20	10

2. Requirements for Long-Term Training

	Rice Research		Cropping Systems		Field Trials	
	M.S.	Ph.D	M.S.	Ph.D	M.S.	Ph.D
A. Batalagoda						
Rice Breeding		1				
Agronomy		1				
Entomology		1				
Pathology		1				
Soils		1				
Cereal Chemistry	1					
B. Gannoruwa						
Agricultural Economics			1		1	
Agronomy			1			1
Statistics					1	
C. Angunubolapellessa						
Rice Breeding	1					
Agronomy	1		1			
Agricultural Economics			1			
D. Bombuwele						
Agronomy	1				1	
Soils						
E. Bandarawela						
Agronomy	1		1			
Rice Breeding	1					
F. M.I.						
Rice Breeding		1				
Plant Path.	1					
Agricultural Economics	1		1	1		
Agronomy			1	1		
Entomology				1		
G. Land & Water Use Division						
Soil Survey	1					
Soil & Water Management	1					
	10	6	7	3	3	1

M.S. 20
Ph.D 10

3. Phasing of Long-Term Training

Year	1	2	3	4	5
1. Rice Breeding					
M.S.	1	2	1		
Ph.D.	1	2	2	1	
2. Agronomy					
M.S.	2	6	5	2	1
Ph.D.		2	3	3	1
3. Soils					
Ph.D.		1	1	1	
4. Entomology					
Ph.D.	1	1	2	1	1
5. Cereal Chemistry					
M.S.	1	1			
6. Plant Pathology					
M.S.			1	1	
Ph.D.		1	1	1	
7. Agricultural Economics					
M.S.	1	3	3	2	1
Ph.D.	1	1	1		
8. Statistics					
M.S.		1	1		
9. Soil Survey					
M.S.	1	1			
10. Soil & Water Management					
M.S.		1	1		
	9	23	22	12	4

4. Selection of Trainees

Year	1	2	3	4	5
1. Rice Breeding					
M.S.	1	1			
Ph.D.	1	1			
2. Agronomy					
M.S.	2	4	1	1	
Ph.D.		2	1		
3. Soils					
M.S.					
Ph.D.		1			
4. Entomology					
M.S.		1			
Ph.D.	1		1		
5. Cereal Chemistry					
M.S.	1				
6. Plant Pathology					
M.S.			1		
Ph.D.		1			
7. Agricultural Economics					
M.S.	1	1	1	1	
Ph.D.	1				
8. Statistics					
M.S.		1			
9. Soil Survey					
M.S.	1				
10. Soil & Water Management					
M.S.		1			
	9	14	5	2	

5. Trainees Return and Available for Project

Project Year	1	2	3	4	5
1. Rice Breeding					
M.S.		1	1		
Ph.D.			1	1	
2. Agronomy					
M.S.		2	4	1	1
Ph.D.				2	1
3. Soils					
M.S.					
Ph.D.				1	
4. Entomology					
M.S.			1		
Ph.D.			1		1
5. Cereal Chemistry					
M.S.		1			
6. Plant Pathology					
M.S.				1	
Ph.D.				1	
7. Agricultural Economics					
M.S.		1	1	1	1
Ph.D.			1		
8. Statistics					
M.S.			1		
9. Soil Survey					
M.S.		1			
10. Soil & Water Management					
M.S.			1		
		6	12	8	4

6. Training costs, Long-term, Rice Research ($000)

Field	Year	1	2	3	4	5	Total
1. Rice Breeding							
	2 M.S.	7	14	7	-	-	28
	2 Ph.D.	9	18	18	9	-	54
2. Agronomy							
	3. M.S.	7	14	14	7	-	42
	1. Ph.D.		9	9	9	-	27
3. Entomology							
	1. Ph.D.	9	9	9	-	-	27
4. Plant Pathology							
	1. M.S.			7	7	-	14
	1. Ph.D.		9	9	9	-	27
5. Soil							
	1. Ph.D.	9	9	9	-	-	27
6. Cereal Chemistry							
	1. M.S.	7	7				14
7. Agricultural Economics							
	1. M.S.			7	7	-	14
	9	48	89	89	48	-	274

7. Training costs, Long-Term, Cropping Systems ($,000)

Field	Year	1	2	3	4	5	Total
1. Agricultural Economics							
	3 M.S.	7	14	7	7	7	42
	1 Ph.D.	9	9	9			27
2. Agronomy							
	4 M.S.	7	21	21	7		56
	1 Ph.D.		9	9	9		27
3. Entomology							
	1 Ph.D.	9	9	9			27
		32	62	35	23	7	179

8. Training, Costs, Long-Term, Field Trials

Field	Year	$(000) 1	2	3	4	5	Total
1. Agronomy							
	1. M.S.	7	7				14
	1. Ph.D.		9	9	9		27
2. Statistics							
	1. M.S.		7	7			14
3. Agricultural Economics							
	1 M.S.		7	7			14
		7	30	23	9		69

9. Training, Costs, Long-Term, Research Capability Survey ($000)

Field	Year	1	2	3	4	5	Total
1. Soil Survey							
	1. M.S.	11	11				22
2. Soil & Water Management							
	1. M.S.		11	11			22
		11	22	11	-	-	44

Analysis of Training Costs ($000)

Training	Cost per Trainee	No.	Total ($000)	%
A. Short-Term				
1. Rice Production & Applied Research	4	19	76	(43)
2. GEU	3	8	24	(14)
3. Water Management	3	3	9	(5)
4. Cropping Systems	4	8	32	(18)
5. Resource Survey	5	2	10	(6)
6. IRAEN	3	6	18	(11)
7. Machinery	3	2	6	(3)
			175	(100)

	Cost/Trainee ($000)		No.			
	M.S.	Ph.D.	M.S.	Ph.D.	Total	(%)
B. Long-Term Training						
1. Rice Breeding	14	27	2	2	82	(14)
2. Agronomy	14	27	8	3	193	(35)
3. Entomology	14	27	1	2	68	(12)
4. Plant Pathology	14	27		1	27	(5)
5. Soils	14	27		1	27	(5)
6. Cereal Chemistry	14	27	1		14	(2)
7. Agricultural Economics	14	27	5	1	97	(17)
8. Statistics	14	27	1		14	(2)
9. Soil Survey	22		1		22	(4)
10. Soil & Water Management	22		1		22	(4)
			20	10	566	100

11. Short-Term Training (Participants)

Year	1	2	3	4	5	Total
1. Rice Production & Applied Research	6	5	4	4		19
2. GEU	2	2	2	2		8
3. Water Management		2	1			3
4. Cropping Systems	2	2	2	2		8
5. Resource Survey	1	1				2
6. IRAEN	2	2	2			6
7. Machinery				1	1	2
	13	14	11	9	1	48

12. Allocation of Short-Term Training to Functional Areas (Participants)

Year	1	2	3	4	5	Total
A. Rice Research						
1. GEU	2	2	2	2		8
2. Water Management		2	1			3
3. IRAEN	1					1
4. Machinery				1	1	2
B. Cropping Systems						
1. Cropping Systems	2	2	2	2		8
2. IRAEN	1	2				3
C. Field Trials						
1. Rice Production & Applied Research	6	5	4	4		19
2. IRAEN			2			2
D. Research Survey						
1. Resource Survey	1	1				2
	13	14	11	9	1	48

13. Costs per Trainee

A. Short-Term

	Cost per Trainee ($000)
1. Rice Production & Applied Research	4
2. GEU	3
3. Water Management	3
4. Cropping Systems	4
5. Resource Survey	5
6. IRAEN	3
7. Machinery	3

B. Long-Term Training

1. Cost per trainee year/Philippines	7,000
2. Cost per trainee year/Western	11,000

14. Trainees Needed Per Year

Short-Term	13	14	11	9	1
Long-Term	9	12	6	3	
	22	26	17	12	1

Commodity Requirements

Rice Research

1. **Batalagoda** (H.Q. for Rice Research)

	No.	($000)	
A. Vehicles			
1. 3 Ton truck	1	12	
2. Pickups	2	10	
3. Mini-bus	2	16	
4. Cars	2	10	
5. Spares		5	53
B. Farm Equipment			
1. 2 Wheel tractors & implements	4	8	
2. 4 Wheel tractors & implements 35 h.p.	2	10	
3. Spares		3	21
C. Laboratory Equipment			
1. Plant Breeding	No.		
a. Moisture testers	2	1	
b. Balances	2	1	
c. Germinator	1	2	
d. Precision balance	2	3	
e. Air Compressor	1	1	
f. Power Sprayers	2	1	
g. Vogel Thresher	1	2	
h. Oven	1	1	
i. Glassware		3	
j. Other		2	17
2. Plant Pathology			
a. Auto claves	2	2	
b. Balances	3	1	
c. Centrifuge and Access	1	2	
d. Willi Mill	1	1	
e. Blenders	2	1	
f. Incubators	2	2	
g. Microscope	2	6	
h. Green House Equipment		4	
i. Glassware		3	
j. Other		2	24
3. Gereal Chemistry (May be located at ARTI rather than Batalagoda)			
a. Huller	2	2	
b. Polisher	1	2	
c. Microkyeldhal	2	1	
d. Balances (precision)	2	4	
e. Cabinets		1	
f. Air Conditioning Unit	1	4	
g. Analyzer apperatus		4	
h. Glassware		3	
i. Other		2	23

4. Entomology

	No.	Total Cost	
a. Green House Equipment		28	
b. Autoclaves	2	2	
c. Incubators	2	2	
d. Microscope	1	2	
e. Ovens	2	3	
f. Glassware		3	
g. Other		3	43

5. Agronomy and Soils

a. Autoclaves	2	2	
b. Balance (percision)	4	3	
c. Centrifugeaand acc.	2	3	
d. Conductivity Bridges and acc.	2	2	
e. Moisture Testers	4	2	
f. Ph. Meters	7	2	
g. Waterstill	1	1	
h. Mufft Furnace	2	1	
i. Kjeldahal apparatus		1	
j. Spectometer	1	1	
k. Ovens		2	
l. Glassware		3	
m. Laboratory Shelves	2	2	
n. Other		2	27

6. Office

a. Typewriters (electric)	4	3	
b. Typewriters (manual)	4	1	
c. Duplicator	1	1	
d. Scanner	1	3	
e. Programable calculator	1	1	
f. Camera and Acc,	1	1	
g. Table Calculator	10	2	
h. Other		3	15

7. General Laboratory and Field Research Equipment/Supplies

Hand Calculators	Tool Kits	
Seed Pans	Coin Envelopes	
Sample Bottles	Thermoeters & Hydographs	
Forceps	Plastic Sealers	
Scissors	Insect Control Equipment	
Trollies	Blenders	
Dollies	Dispersion mixture	
Hot Plates	Intercon	
Vacum Pump	Pocket Calculators	
Buckets	Taper	
Weighing Boats	General Supplies	45
Gloves and Masks		
Dial Gauges		

8. Supplies (Chemical)

1. Laboratory Chemicles	75
2, Field Research Agro-Chemicles	25

Regional Stations (Maha Illuppallama, Angunubolapellessa, Bandaravela, Bombuwele)

	No.	($000)	
A. Vehicles			
1. Pickups	4	20	
2. Jeeps	4	12	
3. Spares		4	36
B. Farm Equipment			
1. 2 Wheel Tractors & Implements	8	15	
2. 4 Wheel Tractors	8	40	
3. Spares		5	60
C. General Research and Office Equipment			
1. Moisture Testers	4	2	
2. Balances	8	6	
3. Germinators	4	2	
4. Field Scales	20	1	
5. Ovens	4	5	
6. Power Sprayes	8	4	
7. Vogel Thresher	4	8	
8. Panicle Thresher	4	8	
9. Typewriters	4	1	
10. Microscopes	4	4	
11. Calculators	20	1	
12. Table Calculators	4	2	
13. Auto Claves	4	4	
14. Plastic sealers	8	1	
15. Glassware		4	
16. Other		5	59
Books and Publications		24	24
			547

Cropping Systems

	No.	Total Cost ($000)	
I. Vehicles			
1. Station Wagons or Pick-ups	4	32	
2. Motor Cycles	10	10	
3. Bicycles	10	1	
4. Jeep	1	6	49
II. Farm Equipment			
1. 4 Wheel Tractor	2	8	
2. 2 Wheel Tractor	4	6	14
III. Field Research/site equipment			
1. Seed Moisture Tester	4	2	
2. Ph Meter	4	1	
3. Survey Equipment		2	
4. Climatological Equipment		4	
5. Field Tools		1	
6. Power Sprayers	6	2	
7. Hand Operated Sprayers	20	2	
8. Other		2	16
IV. Support			
1. Office		5	
2. Dupli. Equipment	1	1	
3. Calculator (Programable)	1	2	
4. Other		6	
5. Spares		5	19
V. Supplies			
1. Agro-Chemicals		10	
2. Glassware		1	
3. General		15	
VI. Books and Publications		15	139

Commodities

Field Trials Division

I. Transport

	per station	Total	Total ($000)	
A. Regional Stations				
1. Motor Scooters	8	40	32	
2. Motor Cycles	1	5	5	
3. Jeeps (4 x 4)	1	5	30	
4. Pick-up	1	5	60	
5. Jeep Trailers	1	5	5	
6. Truck Trailer	1	5	5	
7. Spares			13	150
B. Headquarters (Gannoruwa)				
1. Motor Scooter		10	8	
2. Motor Cycle		1	1	
3. Mini Bus		1	6	
4. Jeep (4 x 4)		1	6	
5. 3-1/2 Ton Truck		1	12	
6. Car		1	5	
7. Spares		1	5	43

II. Equipment	Per Regional Station (5)	H.Q.	Total Cost ($000)	
1. Field Balances (Dial Type)	30	50	5	
2. Pan Type Balances	2	4	2	
3. Platform Balances (2 cwt)	1	3	5	
4. Pan Balances (Dial Type)	1	3	4	
5. Sprayers (hand operated)	20	50	8	
6. Polythene sealers 16"	4	5	5	
7. Polythene sealers 8"	10	10	6	
8. Electric Calculators (Desk)	1	2	5	
9. Electric Calculators (Hand)	2	5	1	
10. Photo Copy		1	2	
11. Dupli Machine		3	2	
12. Motorized Portable Thresher	2	4	7	
13. Hand Dusters	20	50	2	
14. Measuring Tapes	20	50	2	
15. Portable Power Sprayers	2	2	4	
16. Electric Oven (seed & soil Drying)	1	2	5	
17. Seed Germinator	1	2	4	
18. Soil Moisture Tester	1	5	5	
19. Ph Meters	1	3	2	
20. Redox Potential Meters	1	2	3	
21. Redox Potemtoa; ,eter (Lab.)		2	1	
22. Conductivity Bridge	1	2	4	
23. Microscopes	1	1	3	
24. Typewriters (English)	1	1	3	
25. Typewriters (Sinhalese)	1	1	4	
26. Stapling Machines	3	10	1	
27. Top Loading Balance	1	1	4	
28. Seed Cleaners	1	1	5	
29. Seed Sieves (sets)	1	1	1	
30. Camera and Accessories		2	1	
31. Slide Projector		2	4	
32. Panicle Thereshers		2	4	
33. Seed Sampling Divider	1	1	1	
34. Cartography Set		1	3	
35. Office Equipment (Desks, etc)			6	
36. Hand Tools			3	
37. Spares			5	130
38. L.H.M.W. (large)		Doz.		
III. Supplies				
1. Glass Ware			8	
2. Agro and Lab. Chemicals			16	
3. Other			9	33
IV. Books and Publications				7
				363

Commodities

Resource Capability Survey	NO.	Total Cost ($000)	
I. Vehicles			
1. Jeeps	4	24	
2. Car	1	4	28
II. Lab. and Field Equipment		15	
1. Drawomg Equipment		26	
2. Laboratory Equipment		11	
3. Field Equipment		7	59
4. Spares			
III. Supplies			
1. Glassware		7	
2. General		45	52
IV. Books and Publications		4	4
			143

L/C Costing of Project Outputs/Inputs by Major Functional Area

Rice Research L/C

Table 7 ($000)*

Inputs Year/	77	78	79	80	81	Total
1. Salary	100	110	115	121	141	587
2. Travel	15	15	16	17	20	83
3. Consumables	52	57	59	61	72	301
4. Maintenance	21	18	19	20	23	101
5. Essential Services	10	13	14	15	17	69
6. Equipment	110	20	20	21	24	195
Specialist Support	11	8	9	10	11	49
Buildings	209	—	—	—	—	209
	528	241	252	265	308	1594

*($ equivalent with Rs 13.73/$1 U.S.)

Cropping Systems L/C

Cost of Project Outputs/Inputs

Table 8 ($000)*

Project Inputs Year/	77	78	79	80	81	Total
1. Salary	39	44	46	49	59	237
2. Travel	5	6	7	7	8	33
3. Consumables	20	23	24	25	30	122
4. Maintenance	9	7	8	8	10	42
5. Essential Services	3	5	6	6	7	27
6. Equipment	14	8	8	9	10	49
Specialist Support	16	8	9	10	10	47
Buildings	37	—	—	—	—	37
	137	101	108	114	134	594

*($ equivalent with Rs 13.73/$1 U.S.)

Field Trials L/C

Costing of Project Outputs/Inputs

Table 9 ($000)*

Inputs Year/	77	78	79	80	81	Total
1. Salaries	70	79	82	88	106	425
2. Travel	10	11	12	12	15	60
3. Consumables	36	40	43	45	54	218
4. Maintenance	15	13	13	14	17	72
5. Essential Services	5	10	10	11	13	49
6. Equipment	41	14	15	15	18	103
Specialist Services	10	8	9	10	10	47
Buildings	32	—	—	—	—	32
	219	175	184	195	233	1006

*($ equivalent with Rs 13.73/$1 U.S.)

Resources Capability Survey L/C

Cost of Project Outputs/Inputs

Table 10 ($000)*

Inputs Year/	77	78	79	80	81	Total
1. Salaries	20	21	21	22	24	108
2. Travel	3	4	4	4	5	20
3. Consumables	4	7	8	8	9	36
4. Maintenance	1	1	1	1	2	6
5. Essential Services	1	1	1	1	1	5
6. Equipment	24	2	2	2	2	32
7. Buildings	7	—	—	—	—	7
	60	36	37	38	43	214

*($ equivalent with Rs 13.73/$1 U.S.

Annex E

FX Costing of Project Outputs/Inputs by Major Functional Area

Rice Research/FX

Costing of Project Outputs/Inputs

Table 12

($000)

Inputs Year/	1	2	3	4	5	Total
1. Rice Breeder	67	57	62	69	76	331
2. Consultants	10	10	10	10	10	50
3. Training Short-term	9	12	9	9	3	42
Long-term	48	89	89	48	--	274
Work-Shops	15	15	15	15	15	75
4. Commodities	301	126	49	33	38	547
5. Contingency	22	15	12	10	7	66
6. Inflation		26	41	53	54	174
7. Overhead	44	33	27	24	19	147
	516	383	314	271	222	1706

Cropping Systems/FX

Costing Project Outputs/Inputs

Table 13

($000)

Inputs Year/	1	2	3	4	5	Total
1. T.A.	67	57	62	69	76	331
Consultants	10	10	10	5	5	40
2. Training - Short-term	11	14	8	8	-	41
Long-term	32	62	55	23	7	179
Work-Shops	15	15	15	15	15	75
3. Commodities	76	32	13	8	10	139
4. Contingencies	11	10	8	6	6	41
5. Inflation	--	16	28	35	43	122
6. Overhead	21	21	19	16	15	92
	243	237	218	185	177	1060

Field Trials/FX

Costing Project Outputs/Inputs

Table 14 ($000)

Inputs Year/	1	2	3	4	5	Total
1. T.A.	67	57	62	69	76	331
Consultants	5	5	5	5	5	25
2. Training Short-term	24	20	22	16		82
Long-term	7	30	23	9		69
3. Commodities	200	83	33	22	25	363
4. Contingency	15	10	7	6	5	43
5. Inflation		16	25	33	40	114
6. Overhead	30	21	17	15	14	97
	348	242	194	175	165	1124

Resources Capability Survey/FX

Costing Project Outputs/Inputs

Table 15 ($000)

Inputs Year/	1	2	3	4	5	Total
1. T.A.	15	15	10	-	-	40
2. Training Long-term	11	22	11	-	-	44
3. Commodities	78	33	13	9	10	143
4. Contingency	5	3	2	1	1	12
5. Inflation		5	3	1	1	10
6. Overhead	10	2	3	1	1	22
	119	85	42	12	13	271

Annex F

National Rice and Cropping Systems Research Committee (Suggested)

I. Chairman
   Director of Agriculture

II. Vice Chairman

   1. Deputy Director/Research
   2. Deputy Director/Extension
   3. Deputy Director/Training

III. Members

   1. Rice Breeder
   2. Entomologist
   3. Soils
   4. Plant Pathology
   5. Water Management
   6. Economist
   7. Rice Research Coordinator
   8. Cropping Systems Coordinator
   9. Field Trials Coordinator
   10. A.R.T.I.

National Rice Research Committee

A coordination body of the Department of Agriculture to coordinate activities of the different disciplines involved in all aspects of rice research including cropping systems, field trials, resource survey, training and extension. Primary responsibilities are to:

1. Establish research priorities to attain the objectives of increased domestic rice production within the available financial and manpower resources,

2. Develop an integrated rice research program including cropping systems, field trials and resource survey,

3. To serve as an advisory committee to the Department of Agriculture in rice and cropping systems research,

4. Review research progress and as necessary changes over all direction,

5. Prepare policies and guidelines for implementing the national rice and cropping systems program

6. Monitor flow of Research information to paddy farmers.

Annex G

Work Groups

Working groups shall within the policy parameters of the national rice and cropping systems research program carry out:

a. Identification of problems whose solution can be wholly or partially solved through research activities.
b. Preparation of integrated research plans
c. Reviews and evaluates research projects
d. Develops strategies for implementation of research projects

Working Groups: (Possible configuration)

I. Rice Research (Batalagoda, and probably C.A.R.I, staff members)
Working Group Members:

1. Rice Breeder
2. Entomologist
3. Plant Pathologist
4. Soil Chemist
5. Economist
6. Agronomist
7. Plant Physiologist
8. Water Management
9. Training
10. Extension
11. Field Trials
12. ARTI Representative

II. Cropping Systems (MahaIlluppallama)

1. ROs in charge regional outreach sites (10)
2. Economist
3. Plant Pathology
4. Soils
5. Entomologist
6. Rice Breeder (upland)
7. Agronomist
8. Water Management
9. Extension Specialist
10. Training Specialist
11. ARTI Representative

III. Field Experiments

1. ROs in charge of field units (10)
2. Economist
3. Cropping Systems Specialist
4. Extension Specialist
5. Entomologist
6. Agronomist
7. Rice Research Coordinator
8. Training Specialist
9. ARTI Representative

Annex H

Job Description for Technical Assistance Specialists

A. Rice Research

Assist with:

1. Developing the National Rice and Cropping systems research, committee and programs,

2. Organizing a GEU rice improvement team,

3. Developing rice breeding research plans for the center and regional stations,

4. Implementating the rice breeding activities,

5. Organizing workshops and conferences,

6. Organizing an effective and coordinated varietal evaluation program throughout the country,

7. Selection of trainees for international training,

8. Development of National Rice Research Committee and rice working group,

9. In analysis and interpretation of research results for publication,

10. Organizing that Rice Research working group.

Qualifications

1. Rice Breeder with five or more years experience under tropical conditions, Ph.D., or equivalent experience.

Location of Assignment

1. Batalagoda or Kandy.

Annex H

B. Cropping Systems

Assist with:

1. Organizing and activities of the National Rice and Cropping Systems Research Committee and program,

2. Developing cropping systems, research projects at the center, each outreach site, and regional stations,

3. Implementation of the research program,

4. Involving and coordination of the different disciplines engaged in cropping systems research activity,

5. Selection of cropping systems trainees,

6. Analysis and interpretation of experimental results for publication,

7. Design of cropping pattern experiments for the Field Trials Division,

8. Development of the Cropping Systems Working Group,

9. Coordinating with extension research in the outreach sites.

Qualifications

1. Soils or Agronomy Ph.D. or equivalent experience.
2. 6 years experience in tropical agriculture.

Location of Assignment

1. MahaIlluppallama or Kandy.

C. Field Trials Specialist

Assist with:

1. Development of national field trials program,

2. Organization of the field trials division,

3. Developing and implementing research program in the regional sites and in farmer's fields,

4. Coordination and implementation of the research program with extension program and workers,

5. Selection of Trainees for international training,

6. Analysis and interpretation of results for publication,

7. Preparation of recommended practices for extension workers through publications and training,

8. Organizing field trial working group meetings,

9. Organizing field days,

10. Organizing and activities of the National Rice and Cropping Systems, Research Committee and programs,

11. Organizing and activities of the Field Trials Working Group.

Qualifications

1. Soils or Agronomy Ph.D. or equivalent experience.
2. Five years experience in applied research under tropical conditions.

Location of Assignment

Kandy

Extension*

The Department of Agriculture was established in 1912. With the absorption of the field staff of the Ceylon Agricultural Society into the Department in 1921, the unified field extension service working under the Director of Agriculture was established. With the subsequent creation of an Information unit, Young Farmers Program, the Home Economic Program, and general expansion, Sri Lanka has an integrated extension service working with not only adult male farmers but farm women and rural youth as well. There are nearly two thousand divisional and village level extension agents at work in Sri Lanka.

In 1972 Parliament passed the new "Agricultural Productivity Law" which set out authority for the establishment of about 475 Agricultural Productivity Centers each under control of a local Agricultural Productivity Committee (APC).

All of the nation's agricultural land is divided into Agricultural Productivity areas and the central focus within each APC area is the Agricultural Productivity Center (Center). Each Committee is charged with the responsibility for planning and implementing agricultural development programs within its area of authority and provides at the APC Center all the services and facilities required by the farmer. A Rural Bank for credit facilities, agricultural supplies and inputs, marketing, extension, etc. The middle level staff of the Government agencies involved in the above functions are also located at these Centers — for instance the Agricultural Instructors to work closely with the Committees. Such an arrangement actively draws on the other Divisions or line Departments such as Research, Engineering, Animal Husbandry, and Seed Production into a servicing an integrated problem-solving situation.

The Extension organization, readjusted to work within the framework of the island-wide Agricultural Productivity organization, is organized to function at four levels — the National level (Head Office), the District level, the APC level, and the village level (within each APC area).

The island is divided into 22 administrative districts. A Government Agent is overall in charge of each District, and he is responsible for all matters therein.

A. The District Agricultural Extension Office. There are 22 such offices throughout the island, one per District. Each is headed by a senior agriculturalist known as the District Agricultural Officer (D.A.E.O.) who reports immediately to the Deputy Director of Agriculture for Extension (DDC) in Peradeniya and works in very close association with the District's "Government Agent" and all committees, associations, and agencies involved with agricultural production and development. As of October 1973, a "Political Authority", (a Junior Minister or another member of Parliament) is responsible for supervising all developmental programs within a District.

The D.A.E.O. has on his staff a number of Agricultural Instructors (A.I.s) who are located as follows. One group of senior A.I.s of around five to eight is located at the District Office. Each A.I. is trained in a specific area of

*Annex I is base principally on a report prepared by Dr. W. Golden in 1974 for meeting of the CGIAR.

work -- for example, paddy, other field crops, vegetables, plant protection, farm machinery, Young Farmer Clubs, etc., and helps to support another group of A.I.s located at the Agricultural Productivity Centers in each District. There may be ten to twenty-five A.I.s in each District to work at the APC level. Under these A.I.s are the village level workers locally called "Krushikaram Viapthi Sevakas" or K.V.S.s for short (from about 20 to over 100 in some Districts) depending upon the size and agricultural makeup of the District. It is the K.V.S.s who are the key link in communicating new agricultural technology to the farmers. The K.V.S. within his geographic area works with any crop and so is a "generalist". However, since rice is of major importance to the country, considerable effort has been extended in making most K.V.S.s qualified in this crop at least. The K.V.S.s are charged with carrying out farm level demonstrations, organizing farmer training classes and discussion groups, and with identifying and seeking solutions to local farm problems.

B. The Extension Headquarters Staff in Peradeniya is responsible for assisting the Director of Extension in the planning, preparation, and implementation of the various programs, and in backstopping the District staff members and the organization in general. These officers "specialize" with respect to their individual areas of responsibility, e.g., irrigation, agronomy, etc.

1. The Agricultural Information Unit causes production-oriented bulletins on various crops to be published covering varieties, cultural practices, and the economics of production. It also distributes periodically a Newsletter to the extension staff bringing to their attention recent developments in research, extension, or production. Additionally, this unit is active in radio broadcasting and newspaper reporting to stimulate and benefit the public, both rural and urban. Research Officers having specific and timely information frequently participate in the radio programs prepared by the Unit.

2. The Certified Seed Program is equipped with a modern Seed Testing Laboratory and in 1973 processed approximately 30,000 seed samples using internationally accepted procedures. The bulk of the seed intended for certification is produced by the Farms Division on some 65 Government farms, but private seed growers also produce Certified Seed for sale. Certified seeds sold for planting in the Maha 73/74 season included eleven million pounds of paddy and 110,000 pounds of maize, as well as seeds of other crops.

3. The Rural Youth Program has as its primary objective the development of agricultural leadership at the local level. Numerous Young Farmer's Clubs consisting of out-of-school youth from 15-25 years of age have been established over the past several years, but the program in the past has not been completely successful. There are indications that new enthusiasm may be emerging within this program in view of the island-wide food shortage, the recent appearance of a number of improved and high-yielding varieties of several crops, and increases in prices paid to farmers. During the 1973 Yala Season, several Young Farmers' Clubs grew some excellent crops of soybeans, mung beans, and cowpeas and were quite dedicated to their work. Each year the Sri Lanka Extension Service participates in the International Farm Youth Exchange Program (I.F.Y.E.) by sending one or more Ceylonese farm youth abroad and by hosting several from abroad.

4. The Rural Women's Home Economics and Nutrition Program was initiated in 1958 and during the past several years has been strengthened by the assignment of an FAO specialist in the subject who works with the headquarters officer, female K.V.S.s, and village women. With the recent increase in soybean production, the Headquarters staff of the Extension Rural Women's Program has expended considerable time and effort to prepare recipes whidh utilize locally prepared soybeans to improve village diets. They frequently take their kerosene cook stoves to meetings in Colombo or into the village and personally demonstrate the preparation of various soybean dishes. Recipes have been mimeographed in appropriate languages for the audiences concerned and given wide distribution.

5. The Extension Education and Training Program will be described generally in the following paragraphs. Specific training courses relative to rice and multiple cropping will be discussed in greater depth on subsequent pages.

a. A somewhat formal or initial education and training in general agriculture consists of either: (1) a two-year course of study at the School of Agriculture, Kundasale, leading to the award of a certification, or (2) a one-year program of training in practical agriculture at one of several Practical Farm Schools for young men and women expecting to return to their land and engage in farming.

b. "In-Service" training of relatively short duration (one week to two months) is conducted to achieve specific objectives and goals with respect to individual crops (rice, soybeans, sorghum, maize), farming systems (multiple cropping), or subjects (animal husbandry, maintenance of two-wheel tractors, etc.). These programs are frequently presented for government officers already employed in one or another department. The In-Service Training Institute facilities at Gannoruwa and/or Maha Illuppallama are used for these programs.

c. Programs of one or two days duration are presented for farmers or rural women with narrow objectives focused sharply on developing awareness, teaching specific skills or procedures, etc., relative to agricultural production or home science and technology. District Extension Training Centers and In-Service Training Institute facilities are used.

d. Special Programs are conducted on an infrequent basis, such as joint FAO-Sri Lanka Extension Service Workshops, and a 1973 two-month International Multiple Cropping Training Program at Maha Illuppallama (discussed in a later section).

6. Rice Production Training Programs (RPTP). In December 1967 the first three Ceylonese to participate in the IRRI-based RPTP completed their six-month training and returned home. With the assistance of the various District Agricultural Extension Officers in significant rice growing areas, two of the newly trained Rice Production Specialists travelled about the island conducting one-day rice training programs which concentrated on only simple and practical things which farmers readily could do to improve their production. Over a short period of time they met with an estimated 70,000 farmers. These meetings were not intended to teach "how to grow rice" but only to discuss things that peasant farmers could actually do without additional expenditure of cash. This "touring" continued for a period of several months.

Meanwhile, the other two Rice Production Specialists were assigned to the Extension's In-Service Training Institute, Gannoruwa, Peradeniya, where they began "staggered plantings" (planting about 1,000 square meters of rice every thirty days) so they could have a full range of growth stages available in the field when they began their first in-country RPTP. By March 1968 the stage was set, and the first Ceylon-based RPTP patterned after the IRRI model was launched. Since that date there has been a never-ending series of RPTP's to date -- and they continue unabated as of this date. Since March 1968, about 170 RPTPs of varying duration have been conducted at ISTI, Gannoruwa, in which roughly 14,000 individuals participated.

Re-training programs in rice are being conducted annually for extension personnel. Once the basic training program is experienced one or more times, shorter programs are offered which involve only recent developments in rice production.

All Agricultural Officers, Agricultural Instructors, and K.V.S.s working with rice have now undergone the basic course which consists of the opening exam, field work, classroom lectures, and final exam.

RPTP's of one or two weeks duration are routine. Extension officers are the usual trainees. However, groups of Navy personnel, Catholic nuns, farmers, farm youth, agro-business representatives, etc., have also been involved.

The two-month RPTP is conducted every year or 18 months in order to give more in-depth training to selected extension officers who have performed well in the one or two week courses. The individuals selected for the two-month RPTP basically are earmarked to serve as rice production instructors at the District-level Extension Training Centers. The upper 10% of participants in the two-month RPTP may be held back to continue their rice production training as "shadows" of the IRRI-graduates. If they perform satisfactorily and develop "substance" they may actually replace the IRRI graduates so the latter may go on to study for the B.Sc. degree at the University, as described earlier, or to a District Training Center to serve as Rice Production Specialists. Thus, it is possible to have a self-perpetuating RPTP if desired. A sufficient number of IRRI-trained Rice Specialists (33 in all) are available in Sri Lanka to permit this system to function indefinitely.

It is interesting to note that of the 33 graduates of IRRI's RPTP to date, three are studying at the University for their B.Sc. degrees, one is undertaking a M.Sc. degree abroad, one has left the Department of Agriculture to accept a commission in the Sri Lanka Air Force as Agricultural Officer in charge of the Air Force's 1,000 acre farm, and the remaining are actively engaged in agricultural research, extension, teaching or development programs.

7. The Mini-Kit Program. The original Rice Mini-Kit program was born at Los Banos in November 1968 out of sheer necessity when a limited amount of seed of the new rice selection IR 532E576 (later released as IR 20) was made available for distribution throughout the Philippines on an "equitable" basis.

The Rice Mini-Kit Program was introduced into Ceylon during the Maha 1970/71 season when 800 kits were distributed. The Extension Service has continued to package and distribute Mini-Kits every season to thousands of interested farmers throughout the island. On the average, some 4,000 to 5,000 kits go out during Maha seasons and some 2,500 during Yala seasons.

These are furnished free of charge to farmers through normal Extension channels and include the newest and most promising varieties or selections which have demonstrated their superiority in national coordinated Rice Variety Trials conducted by research officers. It should be noted that not all of the entries in a Mini-Kit are necessarily "released" or "recommended" varieties -- some are simply very promising lines which conceivably could become regular varieties if they were found to be acceptable by farmers.

Herein lies one of the very great merits of the Mini-Kit approach. By making available to farmers a small amount of a promising new selection for them to try on their own paddy fields, they are essentially being asked a simple question -- "How do you like this one? Will you grow it a second time now that you have the seed and have observed its performance?" The farmer's response is judged by what he does.

The Mini-Kit has served as an equally potent communication tool for the village level extension officer. Having made the farmer aware of the new rice technology available to him, acceptance by the farmer commits him to the program. The Mini-Kit itself is the action component and requires that the extension office follow-up and explain specific features of the varieties or selections included, at the same time assisting the farmer to resolve any insect, weed, etc., problems which occur. Feed-back information is obtained not in the form of "data" or "interviews", but by virtue of what the farmer actually does with the seeds he harvests from the Mini-Kit.

Since inception of the Extension Rice Mini-Kit program in Maha 70/71 season, roughly 34,000 rice Mini-Kits have been issued to farmers during both the Maha and Yala seasons.

8. The Rice Production Kit Program. Farmers indicated their acceptance of the new variety BG 11-11 when it was first placed in the Mini-Kits distributed in Maha 70/71. As a result, the Production Kit Program was initiated for Maha 71/72 which resulted in the packaging of 100,000 kits containing 16 ounces of BG 11-11 seed along with a set of instructions on how to grow the new variety in order to obtain maximum yields. Recipients paid for the seeds and furnished their own inputs. The kit was intended to plant 1/90 acre, and to produce sufficient seed to permit the farmer to save some of the harvested seed for his own re-planting and perhaps furnish a small amount for his friends and "extended family" circle.

9. Effectiveness of the Extension Service

Just how effective is Sri Lanka's extension service? This is a difficult question to answer. The Government of Sri Lanka notes that with the availability of new high yielding varieties the Extension Service has played a commendable

role in rapidly spreading the new varieties and associated practices to farmers, and national per area yield figures reflect this. In 1966 estimated per acre yields were figured to be 35.6 bushels per acre and by 1970, per acre yields were estimated to be at 51.3 bushels per acre, and roughly 60% of the cultivated paddy was of improved varieties.

That is not to say the Extension Service could not be improved. Dr. William Golden, an IRRI Extension Agronomist, suggested in 1974 that:

(1) There needs to be closer association between research and extension activities particularly in respect to rice production and multiple cropping programs. This implies the establishment of a corps of Extension Subject Matter Specialists who could "bridge the gap" between the two functions. This now appears to be developing slowly.

(2) Specialists, and other extension officers, require a greater degree of mobility in order to reach farmers who already are receptive to agricultural change.

(3) A rapid means of communicating "change" to farmers is needed. Expanded Newsletter coverage to include leading farmers and the agro-business sector is needed, intensified radio broadcasts would help, a deliberate "psychological" campaign involving highly visible posters/billboards and demonstrations will help convey important messages, and public pronouncements at all levels relative to the new agricultural opportunities would serve to bring the message to the public.

(4) Establishment of de-centralized "self-teaching centers" for farmers using synchronized slide-tape presentations on specific agricultural subjects at key locations would transfer the present responsibility of the extension officer to "teach" the farmer to the responsibility of the farmer to "learn" the technology by presenting himself periodically for a short time at the local training center. The efficiency of the local extension staff could be vastly increased by using this technique, as even a clerk could manipulate the equipment for a would-be farmer trainee.

(5) An expanded Extension Staff is required without question if the new agricultural problems oer expanded geographic areas are to be given adequate attention. Additional fields of coverage will also require in-depth coverage ... the social sciences, agricultural engineering, irrigation and drainage, credit and marketing, etc. This means that additional opportunities for professional qualification and development will be required over time, and provisions will need to be made for advanced training.

SOCIO-ECONOMIC FACTORS AFFECTING CROPPING SYSTEMS IN A SELECTED DRY-ZONE REGION

D.E.F. Suraweera*

A Cropping System refers to cropping patterns utilised in a farm or a region, and their interaction with farm resources, other farm enterprises and the socio-economic environment (1). Steps involved in developing a Cropping Systems Research Programme have been observed to fit logically into four phases, namely (a) observation and Description Phase, (b) Design Phase, (c) Test Phase and (d) Extension Phase (1). The initial phase of observation and description is concerned mainly with understanding the existing conditions and constraints in the target area, on such aspects as the presently adopted cropping patterns, resources their utilization and the socio-economic environment. The importance of this phase needs no emphasis since sufficient background knowledge on the above mentioned aspects would be an essential pre-requisite to any objective design and development of a Cropping Systems Programme specifically suited to the area. The purpose of this paper is to analyse the broad features of the socio-economic situation of the target area while reporting on existing resource endowments and cropping patterns and to identify certain socio-economic factors which need to be considered in designing Cropping Systems suited to the area. It incorporates information surfaced from a Baseline Survey carried out in the Project area Walagambahuwa in the latter part of March 1976. Quantitative data has been presented as far as possible, but in instances where such data is still unprocessed or not strictly called for reliance has been placed on qualitative information.

The selected site, the village of Walagambahuwa embodies a three-component system of land use typical of many villages of the dry-zone especially the NCP. The village or settlement has been built over the years around the village tank which occupies a central position and covers an area of 15-18 acres. This traditional system of land use has been aptly described by several writers and hence need not be discussed here in detail (2). The three components in the village system are the irrigable lowland, the homestead and the chena. The Lowland consists of two categories of land, Purana Wela and the Akkara Wela distinguished from each other on the basis of their relative position, and the manner in which each category was originally developed for paddy cultivation. The Purana Wela which covers an extent of approximately 40 acres is the lowest lying paddy land traditionally cultivated from ancient times. It lies in a continuous tract or Yaya with no visible demarcation of individual boundaries.

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The Akkara Wela on the other hand, is the subsequently asweddumized paddy land, of fairly recent development. It covers an area of approximately 42 acres. This tract is situated in a slightly elevated position relative to the Purana Wela, bordering the Purana Wela on practically its whole periphery. Akkara Wela is mainly composed of Crown Land alienated to villgers 3-4 decades ago, to facilitate the expansion of the village.

In addition to the lowland the villagers occupy a highland holding which serves as the homestead where a few permanent tree crops are usually grown. The survey also revealed that practically all the farmers in Walagambahuwa cultivated a chena holding in close proximity to the village. Chena lands are the property of the whole village and every villager has a right to a section of it each year (2). Villagers may also own additional paddy land situated in any one of the neighbouring villages, (the paddy lands being known as "olagam") within the Cultivation Committee area.

Ownership of Land and Tenurial Pattern

The pattern of ownership of land in the village is complicated due to several reasons. 'Owned land' may connote several fine shades of meaning including (a) Land owned by the head of the household, with him, (c) Land owned by several members of the family. Situation is further complicated as many of these so called owners are not the real owners in the legally accepted meaning of the term. Many transfers of land are confined to mere verbal or informal agreements among family members and relatives. For the purposes of the Survey owned land was assumed to mean land legally owned or operated by the respondent of any member of his family who resides with him.

As to be expected, the survey showed that Villager could own, or operate under some other form of tenure, a combination of several categories of land with individual variations, as depicted in Table 1. In the 1975/76 cultivation year, only 20% of the villagers owned or operated all categories of land, namely Purana Wela, Akkara Wela, Homestead, Chena and Olagam. The others operated varying combinations, with 27% operating Purana Wela, Homestead, Chena and Olagam, and 2% operating only chena land. The number of different categories of land the villagers operate will obviously have important implications in terms of apportioning of labour when Cropping Systems are being designed to suit the area.

Purana Wela and Akkara Wela

Nearly 90% of the farmers of Walagambahuwa own or operate a piece of Purana Wela, with an average size of holding of approximately 0.75 acres. An individual holding may consist of a number of widely scattered parcels, with an average of 2.9 parcels per individual holding, (Table 2). There is no doubt this advanced state of parcelization in the Purana Wela would be a structural constraint in evolving an efficient system of farming. Along with the development of a Cropping System it may be necessary to think in terms of trying.out a programme of consolidation of scattered individual holdings taking advantage of the homogeneity of the land. In such a programme care should be taken to maintain the traditional layout of individual holdings in the

The Akkara Wela is owned by a lesser number of farmers in the village - by only 45% of the community. The average holding size is larger than that in Purana Wela, being 2.08 acres probably due to its freedom to expand outwards asweddumizing new land, depending on the capacity of the tank.

Owner-operators constitute the majority in the ownership and tenurial pattern of both Purana Wela and Akkara Wela. 71% of the operators of Purana Wela and 60% of the operators of Akkara Wela are owner-operators. They could operate (if water is available for cultivation 77% and nearly 50% of Purana Wela and Akkara Wela respectively. The relatively lesser number of owner-operators in Akkara Wela would reflect the fact that a good portion of the Akkara Wela is composed of Crown Land leased out to villagers in return for a nominal rent. 30% of the operators of Akkara Wela could make use of 34% of the land under this scheme. (Table 3).

A striking characteristic of the tenurial pattern of both Purana Wela and Akkara Wela is the relatively lesser number of tenant cultivators compared to many areas in the Wet Zone. Tenants constitute only 12% of the total number of operators in the Purana Wela, and in the Akkara Wela this is reduced further to 5%. This demonstrates that the demand for paddy land is very much less compared to the Wet Zone. In fact it has been Chena cultivation that sustained the farmers through 1970s was investigated in fair detail in the Survey.

Chena Cultivation in Walagambahuwa

The farmers in Walagambahuwa cultivated on the average 2.4 acres of chena land during Maha 75-76. Chena land available for cultivation in the vicinity of Walagambahuwa is apparently being restricted progressively as the majority of farmers cultivated land where the previous cultivation had taken place within the last 8 years.

In Maha 75/76 Kurakkan and Chillies have been the more (Tab. 4) extensively cultivated chena crops at Walagambahuwa. Nearly 90% of the chena farmers cultivated them during this season. Cow-pea is rapidly gaining popularity among the chena farmers shown by the fact that nearly 50% cultivated this crop. Sorghum and Meneri were cultivated to a lesser extent being restricted to 21% and 11% of the farmers respectively. Upland paddy was cultivated by only 4% of the chena farmers. In addition these crops, several other crops, Mustard, Green-gram, Black- gram, Wattakka and Tomato were grown in small extents in the majority of chenas. The Tala cultivation was almost exclusively limited to Gingelly.

Of the total extent cultivated Kurakkan occupied the largest extent: 43.6% of the total extent of chena land cultivated in Maha 75/76, while Chillies occupied 39% of the chena area. Chillies were cultivated most frequently as a pure stand. However, within the area planted with Kurakkan farmers planted other crops like Wattakka, Maize, Cucumber, Mekaral etc., once the Kurakkan germinated after the rains.

Time of Cultivation

The sequencing of chena operations and specific time periods of carrying them out are of special interest in designing Cropping Systems suited to the area. These time periods are helpful in gaining insights into the manner in which the farmers have traditionally adopted themselves to a harsh but rythmical climatic pattern.

Jungle clearing and land preparation may commence anytime between late May and early July depending on the nature and density of vegetation, availability of labour and several other factors. The earliest recorded date of commencing jungle clearing in Maha 75/76 was in the last week of May. However, most farmers in Walagambahuwa have to clear only low scrub jungle (Landu-kele) where the previous cultivation has been fairly recent. Therefore, the jungle clearing work and were ready for burning. Sowing or planting the chena land in Maha 75/76 commenced around the latter half of September and extended till the end of November (Chart 1). Though the time of sowing falls into a general pattern there was wide variation in individual cases depending on the extents cultivated, crops grown techniques of planting, availability of labour and outside interests of the cultivator.

However, an attempt is made to fix the time periods of sowing and planting to encompass the majority of cultivators in the village in order to arrive at a general pattern of wider applicability.

Kirakkan on the whole was dry-sown in the final week of September or was sown with the rains in October. Majority of chena cultivators in Walagambahuwa have dry-sown Kirakkan in the latter part of September in Maha 75/76, prior to the onset of the rains.

Two distinct periods of planting Chillies were observed. Row-seeding of chillies commenced in the final week of September and was concluded in the first week of October. Transplanting of chillie seedlings was carried out with the rains from Mid-October till the end of October.

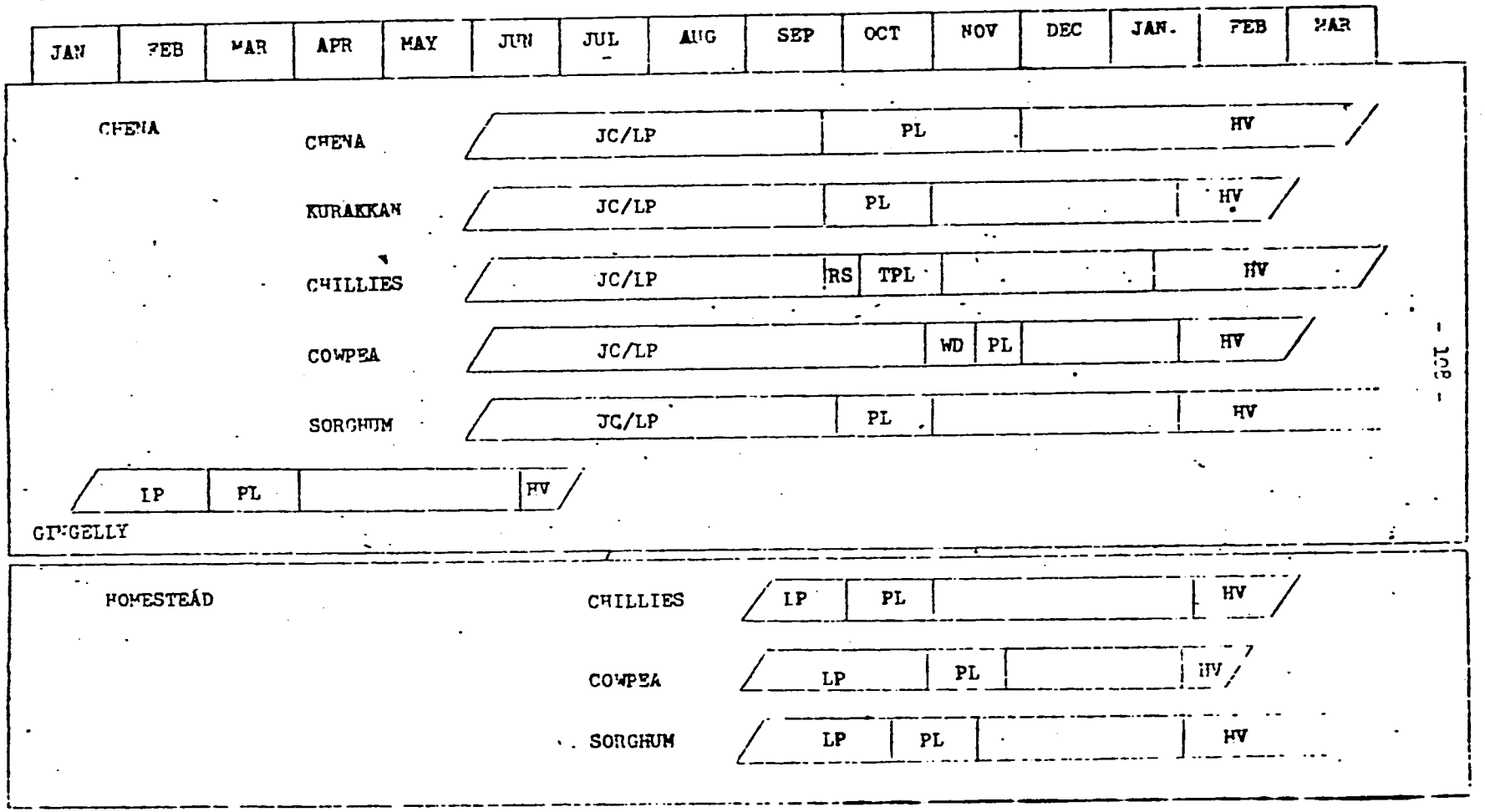
Dry sowing of Kurakkan in late September allowed farmers time to engage in Chillie transplanting once the rains came without any undue loss of time. Kurakkan has the added advantage of being small seeded without being an undue attraction to birds when sown dry.

Transplanting of Chillies was followed by sowing of Cow-pea. By this time the rains had already come and there was a certain amount of weed growth in the fields to be sown. Thus a round of weeding was done in the first half of November and Cow-pea was planted in the latter part of November in Maha 75/76. Sorghum had a fairly long sowing period commencing in the final week of September and extending till the end of October.

(Chart 1 - Next page)

CHART.1

PRESENT CROPPING PATTERNS IN WAIAGAMBAHUWA



In Yala 1975 land preparation for Gingelly commenced around Mid January. However, most cultivators untilized the same fields planted with Kurakkan in the previous season after burning the left over stubble. Sowing of Gingelly in Walagambahuwa extended from the Time of harvesting.

Chena crops were harvested from Mid-January to Mid-March. Harvesting of Kurakkan commenced in the 3rd week of January and by the end of February nearly all farmers had completed harvesting. Chillie harvesting commenced in Mid-January and continued up to Mid March since 3-4 picks were taken on the average. Cow-pea was harvested from the 3rd week of January and ended sometime early in March depending on the varieties grown and life span of each variety. Harvesting of Gingelly planted in Yala 75 extended from Mid-June to early July.

Production and Disposal of Chena Crops

The total production and per-acre yields of the main chena crops are shown in Table 4. The per-acre yields of all main chena crops appear to be very low, (Kirakkan - 6.5 bushels, Chillies - 44 lbs., Sorghum - 7.6 bu., and Cow-pea - 152 lbs.). These data should be treated with caution since farmers tend to under-report their yields and income very often in socio-economic Surveys. However, even conceding there is a certain amount of under-reporting the yields still appear rather low. Several farmers commented that a wet spell during the early stages of the Chilli crop and moisture stress during critical periods in both Kurakkan and Chillies could be at ri buted to the low chena yields.

Only a limited quantity of produce has been sold for cash at the end of 75/76 Maha season. Of the two main products, Kurakkan and Chillies, Kurakkan has been exclusively used for home consumption or kept as seed for the next season, and the amount sold is quite negligible. Chillies, however, were sold for prices ranging from Rs. 12 to Rs.20/lb. The high prices were the direct result of the restricted production of Chillies due to drought conditions that prevailed in the last few seasons in the region. A limited quantity of Cow-pea too has been marketed. The majority of cultivators have transported their produce to Maradankadawela, a town 6 miles away, using the bicycle or CTB bus as the means of transport. A few had sold to traders at the farm itself.

There appears to be no major constraints relating to marketing of produce perhaps due to restricted production. However, with an increase in production associated with a Cropping Systems programme the situation may change and marketing channels may have to be investigated in detail and strengthened.

Recent developments in Chena Cultivation

The survey revealed certain small but significant changes taking place in chena culture, perhaps indicative of a gradual evolution towards a more settled system of farming. The chena cycle is getting shorter with the chena farmer returning to the same land within a shorter interval of time than before, due to the ever-increasing shortage of jungle land for chena. Small but unmistakable changes were observed in Chilli culture, and to a lesser extent in Cow-pea. There has been a heightened awareness among chena farmers of the benefits of improved levels of management in the last few years. For instance, the majority of farmers practised either row-seeding or transplanting of Chillies to facilitate weed control in Maha 75/76. Practically all farmers weeded their Chillies using mammoty and there were a few instances where spraying for pest control was carried out. There was at least one observed instance where fertilizer was applied to Chillies in chena. Weeding of Cow-pea was practised but to a lesser extent than for Chillies. This innovative approach has been primarily taken by farmers due to their increasing dependence on the chena for their livehood with paddy cultivation being on the wane. These changes are bound to bring in their wake problems relating to maintenance of fertility, soil conservation, week control and certain related social problems.

Labour Availability and Use

The average family size in Walagambahuwa according to the findings of the Survey is 6.5 persons per family. The number of persons available in each family for farming on a full or part-time basis varies from 1 to 8 and averages 4.25 per family.

Using the labour utilization data obtained from the Survey, a per-acre labour requirement of crops commonly cultivated in Chena or Homestead was computed and is depicted in Table 5. As seen from the table the total labour requirement of Chillies cultivated under chena conditions is a little over double that required for Kurakkan. For a one-acre chena with crops unspecified the total labour requirement is 82.6 labour days. In all instances jungle clearing and land preparation take up the major portion of the total labour requirement.

Labour requirements for crops grown in the honestead in Maha 75/76 are indicated in Table 5B. Here the total labour requirements for each crop is generally lesser compared to chena crops, due to the shorter period required for land preparation. Here again the number of labour units required for land preparation is the highest compared to other operations except for Chillies where transplanting utilities a greater number of labour units.

Farmers seem to depend mostly on family labour for cultivation. Only about 20% have made use of hired labour for their chena cultivation and this fraction is still less for the homesteads. Exchange labour has been utilized quite frequently especially for land preparation and harvesting. The labour wages commonly paid in Walagambahuwa are as follows: -Rs. 8 per day for adult males, Rs. 6 per day for women and children.

Other Resources

Agricultural implements owned by farmers were mainly confined to simple hand tools such as Mammoties, Sickles, Katties and Axes. A few owned wooden ploughs. Sophisticated equipment in the form of Sprayers, Hand tractors etc., were virtually non-existent in the village, though there was an isolated instance of a farmer owning a water pump. However, nearly 50% of the farmers owned bicycles which were often used as a means of transporting agricultural produce.

Buffaloe population is very small, being limited to about 15-20 buffaloes for the whole village. Number of buffaloes would have dwindled with the decline in paddy cultivation. On the other hand neat cattle population is considerably larger and over 150 animals were recorded in the Survey. However, there has been no systematic development of animal husbandry, and cattle are allowed to graze freely totally unattended to. No instances of farmers rearing poultry, pigs or goats were recorded in the Survey. The potential for animal husbandry in the area should be investigated since it can provide an important source of income during the lean months of the year.

Sources of Income

Currently the farmers in Walagambahuwa receive income from three main sources; Chena, homestead and outside occupations. Of these sources, as seen from Table 6, Chena contributes approximately 41% of the total annual gross income while Homestead contributes about 7%. A major fraction - 52% of the income has been derived from outside occupations.

Nearly 50% of the farmers are engaged in some form of outside occupation. The most common occupation appears to be as labourers engaged in non-agricultural work (provided by the Government), such as repairs to roads and other rural works under the TCEO. Apart from labourers, there are a few carpenters, a bicycle mechanic and a few School Teachers. A major occupation prior to January 1976, has been in "relief work" provided by the Government for repairing tanks, channels, anicuts, roads, etc. Most of the villagers participated in this programme, and were paid in cash in the first few months, (Rs. 2-2.50 for half days work) and in kind (wheat, flour) during the latter months. The relatively

higher fraction of income contributed by off-farm sources last year could be attributed to the above programmes.

The major portion of the total income from chena including both cash income and non-cash income, is contributed by Chillies. Cash income from Kurakkan is negligible though it is an important source of non-cash income. Chillies and Cow-pea provide the bulk of the total annual income from Homestead. The income from tree crops in the homestead has not been considered in this calculation as it was found to be negligible.

As shown in the final analysis in Table 6, the annual gross income of a farm family in Walagambahuwa is Rs. 2.464, giving a monthly gross income of Rs. 205.

Rationale for the Existing Cropping Patterns

Reasons for the farmers general preference for a particular crop or a cropping pattern was broadly investigated in the Survey. As gathered from the somewhat superficial response of the farmers to this question they cultivated Kurakkan since it has been traditionally cultivated as a chena crop and since it is known to be drought resistant. In addition it provides the bulk of the food consumed at home. The reason for selecting Chillies, as expected, was that it gives them a substantial cash income. The other chena crops are grown mainly out of tradition and due to their time-tested compatibility with the dry-zone environment.

Probing a little deeper into the situation it appears that the existing cropping patterns in the area reflect the continued dependance on a traditional cultivation system which was basically sound, but had not kept pace with a changing economy; resource structure and a socio-political environment and also an expanding population. It also reflects the fact that the traditional cultivation system, ideally suited to a certain area in the past has remained somewhat static without any development of a settled arable system of farming to meet the changing needs. It may be due to the fact that a suitable technology had not developed over the years to enable the farmer to venture out into any modifications to his farming system. Causes underlying this situation would be many and complex. Of particular importance is the type of soil in the region. Although soils in the region are naturally fertile they cannot be tilled when the land is dry (3). The non-friable nature of the soil is said to be the most important factor which had operated against the evolution of a settled system of arable farming (3).

Need for Developing Suitable Cropping Systems

From the discussion so far a few salient features relating to the agricultural pattern in Walagambahuwa seem to emerge. As described earlier

the present cropping patterns are of a limited nature, and paddy cultivation has totally declined in the past few years. There is no settled system of highland farming and chena cycles are getting shorter and shorter. This is bound to bring many problems in the foreseable future. Reported chena yields are very low and chena cultivation has sustained the farmers during the last few years mainly due to the high prices paid to Chillies. The contribution was made by animal husbandry is negligible, and does not provide any substantial income to the farmer. There is no guarantee that the drought conditions experienced in the last few years would not prevail further or recur in a few years would not prevail further or recur in a few years time[1/]. There is no immediate prospect of benefitting from the Mahaveli Diversion Project. There is also no guarantee that the Chillie prices would remain high especially with the expansion of cultivation of this crop stimulated by high prices, in other areas of the country with irrigation facilities.

The question which remains in the logical sequence to above is whether the dry zone tank-village typified by Walagambahuwa could continue to survive in its present form. The answer may be the development of a system of land use encompassing the whole village.

The development of suitable Cropping Systems may be considered as the first vital step towards this end and such a venture should be viewed as a matter of unprecendented urgency.

Some considerations in the Design of Cropping Systems

The socio-economic environment in and around Walagambahuwa has already been described for gaining a basic understanding of the area. The next question that arises is the actual design of Cropping Systems making optimum use of resources available at micro-level. This is an area which has received little attention and a suitable methodology has to be evolved for this purpose. The following basic indicators are given to generate discussion on the subject.matter

The main resources that need be considered here are Land Labour Capital and Water. Certain other factors such as a suitable technology, markets, etc., would also play equally important roles. The above factors are often inter-linked and need to be dealt with as a whole.

1/ Relevant in this connection would be the hypothesis that the rainfall pattern of the island over a long period shows regular cyclincal fluctuation patterns - a dry phase alternating with a wet phase, each phase lasting about 20 years (4).

A Cropping System should basically fit the environment, make best use of available resources and be market oriented. These are the pre-conditions for effective planning of Cropping Systems. The crops selected should be primarily suited to the climatic and soil conditions in the area and preferably be compatible with the dry zone tradition. Many varieties satisfying these requirements have already been developed and this aspect would be dealt with later in the Seminar.

a). Land

The availability of land for cultivation in Walagambahuwa has already been discussed. It was seen that Lowland as well as homestead, are grossly under utilized, the lowland by as much as 100%. The question to be critically examined is how this land could be used more intensively. Primary consideration here is that the suggested cropping patterns must be compatible with the levels of other resources particularly water.

b). Water

Availability of water is a major factor determining the existing cropping patterns at Walagambahuwa. The erratic rainfall coupled with the non-adoption of a suitable technology for arable farming had greatly restricted the cropping patterns during the last few years. Though the erratic nature of the rainfall is an accepted fact, whether the best use is made available water is not. In fact, whether the existing cropping patterns make the best use of available water is very much in question. Although detail investigations on this aspect are crucial to the development of Cropping Systems suited for the area, an in-depth study of the situation is not possible from the stand point of a socio-economic survey. Such a study would require examining the rainfall patterns, surface storage, run-off, consumptive use and a host of other factors. These factors would be considered later in the Seminar.

c). Markets

It was already pointed out that at present only a limited amount of produce of Walagambahuwa is marketed and problems related to marketing if any had no occasion to come to the surface. This situation may not remain so if a substantial cultivation of crops is undertaken. Feasible marketing channels should be investigated. The possibility of marketing the produce through the APC which may act as an agent should be considered.

d). Labour

Labour use of chena and homestead crops have already been discussed. Emerging from this discussion is the fact that the present cropping patterns under-utilize the available labour by a very

large margin. This becomes quite apparent when viewed against the fact that the number of persons available for farming averages 4.25 per family.

Capital

Capital by its nature may be considered as somewhat distinct from other resources. It's availability could be influenced to a certain extent by external factors. In designing cropping patterns it would be suitable to consider resources other than capital in the first instance, and then to see if the proposed patterns are compatible with the present or potential level of capital availability. Capital available could be increased to a certain extent, if necessitated by the nature of proposed cropping systems by providing some of the inputs at the unitial stages of the programme or by strengthening the already existing Agricultural Credit Scheme.

Finally, it should be noted that the foregoing indicators relating to design of Cropping Systems by no means cover all aspects of it. In fact the quantitative aspects of design are equally important, and should be given due attention. This would require detail computation of available resources. Calculation of the quantity utilized at present, and thereby obtaining a quantitative estimate of excess un-utilized, to be considered in designing new Cropping Systems.

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References

(1) Proceedings of the Cropping Systems Workshop - IRRI. 1975.

(2) Abeyratne, E.F.L. (1956) - Dry-land Farming in Ceylon Tropical Agriculturist, Vol. 112. 1956.

(3) Panabokke, C. R. (1967) - "Soils and Land Use Patterns in Dry Zone Agriculture". CAAS Symposium on Development of Dry Zone Agriculrure 1967.

(4) Thambyahpillay, G. (1967) - "Climatological Research and Agricultural Development in the Dry Zone.

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ANNEX M

UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
American Embassy, Colombo Sri Lanka

Certification Pursuant to Section 611(e) of the Foreign Assistance Act of 1961, as amended

I, Clark H. Billings, the acting principal officer of the Agency for International Development in Sri Lanka, having taken into account, among other things, the capacity of the Sri Lanka Government and its agencies to properly utilize the commodities being imported under this loan as well as the technical assistance and training to be funded do hereby certify that in my judgment Sri Lanka has both the financial capability and the human resources capability to effectively utilize these inputs.

This judgment is based upon the project analysis as detailed in the Sri Lanka Agricultural Research Project Paper and is subject to the conditions imposed therein.

Clark H. Billings
Clark H. Billings
Acting A.I.D. Representative

May 7, 1976

CPI Tracking System

ANNEX 7

Country:	Project No:	Project Title:	Date:		Approved:
Sri Lanka	383-T-016	Rice Research	June 1976	/X / Original / / Revision #	

CPI DESCRIPTION	Action
1. Loan Agreement signed	GSL/USAID
2. C.P.'s met	GSL
3. GSL arrangements for Specialists for Services completed and necessary Budget resources available to DR for administration	DR
4. IRRI Team members Arrive in Sri Lanka	IRRI
5. Benchmark Studies at all field sites completed	DR/IRRI
6. 70% of Vehicles and equipment in place and operational	DR/IRRI/USAID
7. 70% of project staff increases realized and assigned as per Annex A.	DR
8. 1977 GSL Building Program Completed	DR
9. 60% of Trainees returned and assigned as per Annex B.	DR/IRRI
10. Varieties meeting specifications listed in Figure 6 and acceptable to farmers released for field trial evaluation 6 of 10 edaphic regions.	DR/IRRI

CPI DESCRIPTION	Action
11. Alternative Cropping Systems identified at all six cropping systems sites that are ready for release for field trial evaluation.	DR/IRRI

*A CPI is any point if not realized by projected date will significantly impact on achievement of project purpose.

ANNEX M

CPI Tracking System

Country:	Project No:	Project Title:	Date:		PPT appr.
Sri Lanka	383-T-016	Rice Research	June 76	/ X / Original / / Revision #	

CY	76									77										78									
Month:	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Post Action
rior ctions										1				2			3		4					5 6						8 9						
Financial Plan:*																			1224										944							
Evaluation Plan:**											R			R												R										

*($000)
** R = Regular
S = Special

Country:	Project No:	Project Title:	Date:	/ X / Original / / Revision #	PPT app:
Sri Lanka	383-T-016	Rice Research	June '76		

CY Month: 79 Jan. Feb. Mar. Apr. May June Jul Aug Sept Oct Nov Dec 80 Jan Feb Mar Apr May June Jul Aug Sept Oct Nov Dec 81 Jan Feb Mar Apr May June Jul Aug Sept Oct Nov Dec

0

rior ctions

10

11

Post Actio

Financial Plan: 772 648 573

Evaluation Plan: R5* R R S

*Scheduled for Feb. and March 1979 respectively

ANNEX P

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D C 20523

A.I.D. Loan No. 383-T-016

(Draft)
CAPITAL ASSISTANCE LOAN AUTHORIZATION

Provided from: Food and Nutrition
(Sri Lanka: Agricultural Research)

Pursuant to the authority vested in me as Assistant Administrator, Bureau for Asia, Agency for International Development ("A.I.D."), by the Foreign Assistance Act of 1961, as amended, (the "Act") and the Delegations of Authority issued thereunder, I hereby authorize the establishment of a loan pursuant to Part I, Chapter I, Section 103 and Chapter 2, Title I, the Development Loan Fund, to the Government of Sri Lanka ("Borrower") of not to exceed Four Million, Two Hundred Thousand Dollars ($4,200,000). The proceeds of this loan will be used to finance the Foreign Exchange costs of technical assistance, training, and commodities to aid in agricultural research of paddy varietal development and identification of improved crop production systems associated with paddy agriculture and the application of these research activities to the farmer.

1. Interest Rate and Terms of Repayment

The Borrower shall repay the loan to A.I.D. in United States dollars within forty (40) years after the date of first disbursement under the loan, including a grace period of not to exceed ten (10)

years. The Borrower shall pay to A.I.D. in United States dollars interest from the date of first disbursement at the rate of (a) two percent (2%) per annum during the grace period, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the loan and on any due and unpaid interest accrued thereon.

2. Other Terms and Conditions

A. Unless A.I.D. otherwise agrees in writing,

(a) Goods and services financed under the loan shall have their source and origin in countries included in A.I.D. Geographic Code 941.

(b) The loan agreement shall provide that, prior to the first disbursement of loan proceeds, the Borrower shall submit, or cause to be submitted, the following in form and substance satisfactory to A.I.D.:

(1) A signed contract for technical services to be performed.

(2) Evidence of the availability for use by the contractor of local currency sufficient for a minimum of one year's anticipated local costs associated with the technical assistance contract.

(3) Evidence that the increased staffing required for the project will be sanctioned and required funds budgeted on a timely basis.

(4) Evidence of the appointment of a project manager with adequate authority to exercise effective responsibility for day-to-day project operations.

(c) The loan agreement will contain the following special covenants by the Borrower:

(1) To the extent the normal budget is inadequate, the Borrower agrees to provide additional funding in the recurrent and capital budgets of the Department of Agriculture on a timely basis as well as any additional local cost funding which may be necessary to the project.

(2) The Borrower covenants to conduct a performance evaluation on a yearly basis until project completion, together with A.I.D. and the IRRI team members and submit a summary of the review in writing to A.I.D. The Borrower undertakes to carry out recommendations made under this evaluation.

(3) The Borrower covenants to conduct a major review, which may coincide with the yearly review, at the end of about two and one-half years of project activity together with A.I.D., IRRI and outside subject matter specialists deemed appropriate to test the project hypothesis. Recommendations resulting from this review will be carried out by the Borrower.

B. The loan agreement shall contain such other terms and conditions as A.I.D. may deem advisable.

Assistant Administrator
Bureau for Asia

Date

ANNEX 8

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 76 to FY 81
Total US Funding [illegible] million
Date Prepared: [illegible]

Project Title & Number: Rice Research

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
GSL Sectorial Goals: Agricultural Development that: 1. Increases domestic food production, 2. Expands employment opportunities, and 3. Improves the small farmers standard of living.	1. Percent of total domestice rice production compared to total rice requirements (Base of CY 1973-75) 2. Percent of unemployed as compared to CY 1973-75. 3. Percent of agricultural income received by lower 60 percent of Sri Lanka's farmers.	1. Ministry of Agriculture's records 2. Monthly, annual and staff studies of the Central Bank of Ceylon 3. MARGA studies 4. Studies by APTI 5. Studies by IRRI/USLP IRAEN activities 6. Site specific studies by economists in the Cropping Systems and Field Trial Activities. *Studies referred to above in 3 thru 6 would be specific studies such as in Annex J and others more expanded that would identify and describe the parameters of change in regards to employment and welfare in the rice sub-sector.	1. Concomitant institutional and governmental policy support and co-ordination will be available to support anticipated technical break-throughs. Of particular importance are the assumptions that the level of effort implied in this project will be adequate and that government price policy will not negatively impact on paddy land farmers. 2. Farmers will be able to capture for their own benefit the increases in the productivity of their land and labor. 3. Technological innovations will complement and increase the productivity of Sri Lanka's relatively abundant resource, labor, rather than lead to labor displacement.

ANNEX _____

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number:

Life of Project:
From FY_____ to FY_____
Total US Funding_____
Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Purpose: Development of a technological base that permits increases in the productivity of paddy land thru: 1. Increased yields of paddy per unit area, and 2. increased cropping intensity of paddy land.	1. Varieties developed in the life of the project that in 80 percent of the on-farm trials of the fifth year yield 20 percent more than the best alternative varieties in 8 of the 10 major edaphic regions under the same management practices at both low and high levels of inputs. 2. Alternative Cropping systems developed that: a. physically enable a second crop to be grown on paddy land where mono-cropping of paddy is the norm in 8 of 10 edaphic regions. b. in an economic sense enable increased paddy land use intensity to be both feasible and attractive to 70 percent of all paddy farmers.	1. Records of the Field Trials Division 2. Records of the Cropping Systems Work Group 3. Special Studies focusing on the physical and economic parameters of project developed innovations.	1. Genetic break-throughs will be realized 2. Paddy lands are currently sub-optimally used and improved cropping systems to increase factor productivity in paddy areas can be identified and developed to fit into the various edaphic regions of Sri Lanka. 3. The improve[illegible] capacity of the Research Division thru organizational changes which will enhance the output of the Division in such a way as to permit the realization of the project purpose.

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-246-

125

ANNEX _____

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number:

Life of Project:
From FY_____ to FY_____
Total US Funding_____
Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
OUTPUTS I. Rice Research A. Expansion of rice research capacity B. GFU approach to rice varietal improvement work C. Co-ordinated rice and cropping systems research program D. Decentralization/regionalization of rice improvement work E. Varietal improvement field trials. II. Cropping Systems A. Expansion of cropping systems research capacity B. Systems approach to improving the productivity of the paddy farmer C. Co-ordinated rice and cropping systems research program D. Expanded involvement of farmers in rice and cropping systems research E. Cropping systems field trials. III. Field Trials A. Expansion of the field trials Division's capacity B. Expanded involvement of farmers in rice and cropping systems research C. Co-ordinated rice and cropping systems research D. Field trials on farmers field	I. Rice Research A. 1. Staff trained and assigned as per Annex A and B 2. Vehicles assigned as per Annex C by late 1977 3. Lab and field research equipment in place as per Annex C by mid 1978 4. Farm equipment assigned as per Annex C by mid 1978 5. Laboratories built as per Annex K by mid 1979 6. Staff Quarters built as per Annex K by mid 1979 B. 1. Interdisciplinary approach to formulation and implementation of rice varietal improvement work 2. Formation of rice research working group as described in Annex G by early 1977 C. Formation of the National Rice and Cropping Systems Research Committee that carries out functions as described in Annex F by late 1976. D. 1. Staff assigned to regional operations as envisioned in Annex A by mid 1979 2. Vehicles and equipment available and assigned to the regions as envisioned Annex C by late 1979 3. Relevancy of research experiments/ investigations to the particular region	1. Department of Agriculture Research's annual reports including field research ledgers 2. Annual Reports of IRRI team members 3. USAID records 4. Observational visits to Research Centers, cropping systems sites and trial plots	1. GSL allocates sufficient funds to employ increases in staff numbers 2. Sufficient numbers of qualified personnel can be identified and released for training 3. Existing functional sections within the Department of Agricultural Research can and will be mobilized in an interdisciplinary manner to rice varietal and cropping systems problems 4. Traditional administrative arrangements will not inhibit meaningful decentralization 5. The land use Division personnel currently under the administrative supervision of the Ministry of Irrigation will be available to carry out the Resource capability Survey

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126

ANNEX _____

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY_____ to FY_____
Total US Funding_____
Date Prepared:

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
IV. Resource Survey A. Expansion of the land and water use Division's capacity B. Resource capability survey	E. To be determined by Yala Season 1977 and each crop season thereafter by the National Rice and Cropping Systems Research Committee and Rice Research Working Group. II. Cropping Systems A. 1. Vehicles available as per Annex C by late 1972 2. Farm equipment available as per Annex C by mid 1978 3. Office/Lab/Field Research equipment in place as per Annex C by mid 1978 4. Trainee returned and assigned as per Annex A and B B. Formation of cropping systems research working group as described in Annex G by early 1977 C. Same as I.C. above. D. Cropping systems sites selected collection of baseline data completed and agronomic research underway at sites in farmers fields by late 1977 E. To be determined by Yala Season 1977 and each crop season thereafter by the National Rice and Cropping Systems Committee and the cropping systems working group. III. Field Trials A. 1. Vehicles available as per Annex C by late 1977.		

ANNEX _____

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY_____ to FY_____
Total US Funding_____
Date Prepared:

Project Title & Number:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	2. Office/Lab/Field Research Equipment available as per Annex C by mid 1978 3. Trainees returned and staff assigned as per Annex A and B B. Field Trials Division effectively carrying out trials in farmers fields in all regions and as called for by the National Rice and Cropping Systems Research Committee and the field trials working group. C. Same as I.C. above D. Same as I.B. above IV. Resource Capability Survey A. 1. Vehicles available as per Annex C by mid 1977 2. Equipment in place as per Annex C by early 1977 3. Trainees returned as per Annex B B. Resource capability survey of 500,000 acres of paddy land in the South and South Western Coastal Regions completed by the end of the third project year.		

ANNEX _____

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number:

Life of Project:
From FY _____ to FY _____
Total US Funding _____
Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS

Inputs

I. U.S.

	Man Months
A. Technical Assistance	
1. Rice Breeder	60
2. Cropping Systems Agronomist	60
3. Field Trials Agronomist	60
4. Consultants	26
B. Training	
1. Short-term	Nos.
a. Rice Production and Applied Research	19
b. GEU	8
c. Water management	3
d. Cropping Systems	8
e. Resources Survey	2
f. IRAEN	6
g. Small Scale machinery	2

2. Long-term	M.S.	Ph.D.
a. Rice Breeding	2	2
b. Agronomy	8	3
c. Entomology	1	2
d. Plant Pathology		1
e. Soils		1
f. Cereals Chemistry	1	
g. Agricultural Economics	5	1
h. Statistics	1	
i. Soil Survey	1	
j. Soil and Water management	1	

U.S. (Year)	1	2	3	4	5	TOTAL
		($000)				
1. Technical Assistance						
a. Rice Research	67	57	62	69	76	331
b. Cropping Systems	67	57	62	69	76	331
c. Field Trials	67	57	62	69	76	331
d. Consultants	40	40	35	20	20	155
						1148
2. Training						
a. Short term	44	46	39	33	3	165
b. Long term	98	203	178	80	7	566
c. Workshops/ seminars	30	30	30	30	30	150
						865
3. Commodities						
a. Vehicles	252	90	5	5	7	359
b. Farm Equipment	67	22	2	2	2	95
c. Lab/Office/ Field Research Equipment	259	86	43	22	22	432
d. Supplies	64	64	52	38	38	256
						1192

ANNEX _____

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number:

Life of Project:
From FY_____ to FY_____
Total US Funding_____
Date Prepared:

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATOR	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
II. O.S.L. A. Staff 12000 man months B. Facilities 1. Stations 6 Research Stations a. Existing Buildings b. Existing Equipment			

4. Contingency	53	36	29	24	20	162
5. Inflation (8% year)		63	97	122	138	420
6. Contractor Overhead (9.5%)	105	82	66	56	49	358
	1224	944	772	648	573	4161

O.S.L.* Year	77	78	79	80	81	TOTAL
1. Salaries	229	254	264	280	330	1357
2. Travel	22	36	39	40	48	196
3. Consumables	112	127	134	139	165	667
4. Maintenance	46	39	41	43	52	221
5. Essential Services	19	29	31	33	38	150
6. Equipment	189	44	45	47	54	379
Buildings	307					207
Support Services for T.A.	31	24	27	30	31	143
	966	553	581	612	718	3430

* $ equivalent with RR 13.73/$1