PD-AAZ-320

QUARTERLY REPORT

BRRI/IRRI PROJECT

INCLUDING

ANNUAL NARRATIVE REPORT

USAID PROJECT NO. 388-005103
CIDA PROJECT NO. 170/08004

RICE RESEARCH AND TRAINING

PHASE III

OCT - DEC, 1988

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RICE RESEARCH AND TRAINING

PHASE III

OCT - DEC, 1988

January 22, 1989

TO: Mr Steven Rayfield
First Secretary (Development)
Canadian High Commission
Gulshan, Dhaka.

Mr Ray Morton
Agricultural Development Officer
Food & Agriculture Division
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Mr Percy Stanley
Second Secretary (AID)
Australian High Commission
184, Gulshan Avenue
Dhaka.

FROM: Jerry L McIntosh, IRRI Representative, Bangladesh and
Noel P Magor, Farming Systems Specialist, BRRI/IRRI Project.

SUBJECT: BRRI/IRRI Project Quarterly Report, Oct-Dec, 1988.

I. PRINCIPAL ACCOMPLISHMENTS AND ACTIVITIES

A. Funding

In August CIDA officially submitted to ERD a plan of operation (POP) for Phase III of the CIDA funded portion of the BRRI/IRRI Rice Research and Training Project. The POP was developed for a four year period of time. The POP has been approved by the GOB for two years and ERD has subsequently requested that approval be given for the full four years proposed.

We are pleased that final approval is pending so that Project activities may proceed as scheduled. BRRI wishes to request additional funding to cover the $670,903.00 shortfall in funds presently available from the amount originally budgeted. It is hoped that some additional fund may be available from USAID contingency funds.

Annual Narrative Progress Report

Each quarter all project activities are updated for Donor assessment of progress and for project self evaluation. The Quarterly

Reports include records of all research, training and procurement activities during the quarter along with trip reports, research papers, plans of work and collaborative activities that are beyond the scope of the Project but are an inherent part of IRRI's mandate. An Annual Narrative Report is included as Appendix I.

C. Progress of Collaborative Research Initiatives

These projects strengthen research links between BRRI and IRRI, foster scientific collaboration among national research systems and stimulate interests in new ideas and approaches for research.

1. Impact Study of Cropping Systems Research

Phase II of this project has been approved and will begin in January 1989. The research will build on previous research by trying to identify more precisely why farmers have and have not adopted rice cropping systems research technology. From these studies within the context of the whole farm system the project plans to develop and test interventions that can remove constraints.

2. Rice Quality Characteristics in Selected Rice Markets of Asia (Bangladesh).

Analyses of physical, chemical and cooking properties on all samples were completed. Preliminary statistical analysis has been made and the first draft of the report written. Dr Bart Duff, IRRI Project Leader discussed the project activities with Dr Chowdhury during his visit in December.

After final statistical analysis and preparation of a second draft of the report further consultation will be made with Dr Duff

so that the information can be more easily used for in country and cross country comparisons.

3. Botanical Pest Control in Rice Based Farming Systems

Neem products, neemoil (NO), neem cake (NC) and NO+NC were tested under field (BRRI farm and farmers' field) and greenhouse conditions during Boro, Aus and T.Aman seasons 1988. A total of 14 experiments were conducted in the field and greenhouse.

General insect incidence was very low in the field during the seasons and from season to season. In Boro, RB outbreak occurred in the farmers field. NO application greatly reduced RB and LBB infestation. The same trend was observed with NC treated plots. Thrips and whorl maggot population were also lower in the NO and NC treated plots. Crop yields were 10-19% higher in the treated plots.

During Aus season the incidence of GLH, OHLH, DF, LBB, RB was lower in the NO, NC and NO+NC treated plots. Again yields were 3-10% higher in the treated plots in comparison with control plots.

In T.Aman, RB and GH outbreaks occurred on the BRRI farm. NO and NC applications significantly reduced the infestations. This was also true in case of GLH at BRRI farm with NO+NC and in farmers field with NO and NC treated plots, separately. Higher yields (6-12%) were found in the treated plots than the control.

Both BRRI farm and farmers' field were badly infested with CW and LR. Thrips was the major problem at BRRI farm while Tungro was the major problem in farmers' field. CW, Thrips and LR damages

were reduced in the treated plots at BRRI farm and Tungro and LR in the farmers' field.

In the greenhouse, neem oil (20%) was highly toxic to feeding of BPH (20-34%), GLH (12-50%), RH (30-70%), RB(56-92%), GH (74-98%) and LHC (74-98%). Mortality of BPH, GLH, RH, RB, GH and LHC increased with the increase of concentration and time.

Future work

Since the present study showed the high potentiality of neem, study should be continued in the following areas-

(1) Intensification of all on going studies

(2) Impact of NO and NC on natural enemies-parasites, and predators such as spiders in different locations of Bangladesh.

(3) Survey to develop a greater understanding of farmers' pest control practices for selected locations in Bangladesh.

(4) Integration of botanicals (neem) with other control methods.

(5) Effectivity trials of neem in farmers plots.

RH - Rice Hispa
GH - Grass Hopper
RB - Rice Bug
LBB - Lady Bird Beatle
OHLH- Orange Headed Leaf Hopper
DF - Damsel Fly
LHC - Long Horned Cricket
GLH - Green Leaf Hopper
BPH - Brown Plant Hopper
CW - Cut Worm
LR - Leaf Roller

4. Prosperity Through Rice (PTR-II)

The research has continued on schedule. Five members of the Team were able to participate in the PTR-II Review and Study Work Tour in Thailand, 30 Oct- 6 Nov 1988. The Team prepared a comprehensive report. The Aman crop was harvested on schedule.

The Project staff have been busy trying to correct some constraints and/or problems identified in the project areas. As in most projects in Bangladesh there is a feeling that farmers are slow to adopt new technologies and that more time is needed to demonstrate benefits among farmers. Also, farmers have little available cash and any new technology requiring extra cash expenditures will not be adopted as quickly as expected.

The project staff have also observed that earthen canals used for irrigation lose large quantities of water through percolation and overflow. The Project has convinced farmers of the desirability of improving the situation by lining the canals with brick. This work was begun during the quarter.

5. Rainfed Rice Project

Approval has been given by the GOB for implementation of the Project. It is up to BRRI to develop procedures and identify personnel that meet GOB guidelines. This is still a high priority project and hopefully it may be implemented in January, 1989.

6. Differential Impact Study of Modern Rice Technology (DIS)

The data collection of Phase I of the Project has been completed. Phase II data collection has begun.

The preliminary results of Phase I will be reported during the "Workshop and Cross-country Visit" of the Project to be held in Bangladesh and Nepal, 27 March through 7 April, 1989. The workshop will be held in Dhaka and field visits will be made in both countries.

7. Irrigation Water Management Studies

This project is beginning Phase II. The research will continue in the North Bangladesh Tubewell (NBT) and Ganges-Kobadak (G-K) project areas.

Water management and rice production problems have been identified and technologies developed to increase total crop production and farmer income. Phase II research will be directed more toward the management aspects of irrigation systems. For example, in the NBT project area, water is made available for T.Aman and wheat but not for Aus-T.Aman. The BRRI/IRRI Water Management Project has shown the feasibility for T.Aus-T.Aman rice cropping system with either a green manure or a pulse crop during the Rabi season. Through project efforts the NBT Project Engineer has agreed to provide water for this cropping system if 30% of the farmers in a tubewell command area agree. In the G-K the main constraints to T.Aus-T.Aman -Green manure (or pulse crop) crop system are the late and uncertain arrival of the irrigation water throughout the system and inadequate water in the extreme ends of the system. Timely water depends on timely maintenance and repair of the pump and irrigation canals. Many times engineers simply are

not aware of the problems uncertain water supply creates. The first problem can be solved by better communication and rapport among concerned individuals and organizations. The second problem is more difficult. The water level in the Ganges has become lower since the G-K was planned. The pumping capacity has decreased and there is not enough water to supply the whole system simultaneously. Consequently the system is on a 3 day rotation. This should be sufficient to keep the rice paddies saturated but not necessarily flooded. Unfortunately the canals are not kept full of water during the rotation. This means that by the time the canals are full at the extreme ends, the rotation period is about over and the farmers do not get enough water. The canals are drained to reduce unauthorized tapping of the system. The solution to this problem depends on better supervision. Nevertheless, the G-K Project Engineer plans to develop two model areas to demonstrate the more intensive technology. Again close cooperation between researchers and the Irrigation Project is needed to improve irrigation efficiency.

8. Simulation and Systems Analysis for Rice Production

Since Dr Jansen's visit in early October, 1988 the BRRI Team has been trying to modify the model, L1Q.CSM, so as to make it adaptive to Bangladesh conditions. They have completed modifying the model and have almost completed the following tasks:

1. Adaptation test of the model
2. Sensitivity test of the modified model

3. Trial runs with input data (weather) from Joydebpur, Barisal and Rajshahi

4. Final runs for the above stations with weather data for 1982 to 1987 and using the cultivars-Nizersail, BR4, BR11, and BR22.

The team has started preparing a report for the workshop to be held during January 16 to 27, 1989 at IRRI. The final results indicate that the trend in grain yield follows the observed yield patterns but with some deviations from the observed values. Thus the model must be refine in the days to come.

Until now no problem has been encountered with the PC. However, a firm table is needed for the PC so as to avoid possible damage due to shaking of the table during operations. Mr D N R Paul of the Statistics Division has been requested to take up this matter immediately.

9. Joint Research on Evaluation of Phosphorus Sources (IRRI/BAU)

Dr Eaqub of BAU was invited to IRRI to participate in the IRRC in November and present a paper on fertilizer management practices for lowland rice. During the visit Dr Eaqub spent some extra time to inspect the N loss experiments. These experiments are designed to evaluate the different mechanisms for N loss from soil both quantatively and qualitatively. IRRI will provide BAU one experimental applicator for injecting liquid urea into paddy soils. These experiments will be conducted beginning in January 1989. The BAU Soils Department will again have an experiment to evaluate different P-sources for lowland rice during the 1989 Boro season. IRRI Agronomy Department will supply the experimental materials.

10. Collaborative Research on Rice Blast

In October 400 entries of the International Rice Blast Nursery (IRBN) and 24 entries of local cultivars were planted in miniplots for identifying partial resistance to rice blast. The data collected are now being analyzed. A second set of cultivars/lines will be planted for testing in January.

Mrs Niru Nahar received 4 months on-the-job training at IRRI, Jul-Oct, 1988 on rice blast screening techniques. She has been able to make good use of the training.

11. Women in Rice Farming Systems Research

The project proposal has been prepared and approval has been given by the BRRI Director of Research. A questionnaire has been developed for collecting the initial base data. The research will begin in January 1989.

Dr Bart Duff and Ms Thelma Paris, IRRI Economics Department visited BRRI in December after participating in the Women in Agriculture Conference in New Delhi. Visits were made to BARI and BAU as well. There is much interest in this area of research and the base has been developed for collaboration among the various research and educational institutions to carry out effective and applicable research.

12. Rice-fish Farming Systems Research

The BRRI RFS Division has developed a draft proposal for this research. The BRRI Administration stipulates that the research must fit within the overall research program of BRRI. The project

is proposed to be jointly implemented by BRRI and the FRI, Mymensingh. It would be carried out in DWR areas during the flood period. A preliminary survey is planned to more clearly characterize the different rice-fish ecosystems.

13. Conservation and Utilization of DWR Forage

BRRI Administration has agreed to collaborate with the Project as soon as IRRI has received Donor support. This study would be only a small part of the overall DWR research program.

14. Pest Management in DWR

There has been little progress since the last report. The project is funded and BRRI presently has access to these funds supplied by the ADB through IRRI. There is a need to finalize the budget and decide how the project can have sufficient manpower. The assigned project leader is also project leader for the ODA funded DWR project. In spite of these constraints, BRRI expects to initiate research in March-April during the DWR planting season. Recently Dr Derk HilleRisLambers visited BRRI and discussions were held with the various Division Heads and with the BRRI Administration. It was decided to start screening F_2 materials from BRRI and IRRI for Ufra nematode resistance as soon as possible. It may be necessary to remodel one of the BRRI glass houses to accommodate these studies.

15. Rice Wheat Project

There is considerable interest at BRRI to participate in the Project. IRRI and CIMMYT are developing a project proposal in collaboration with relevant National Agricultural Research Systems to submit to donors for consideration. The initial collaborating countries would be Pakistan, India, Nepal and Bangladesh.

BRRI has initiated studies in the Thakurgaon Tubewell Project area to characterize existing farm systems especially where wheat is involved. The CIDA funded wheat project at BARI is actively involved in varietal improvement and crop management studies. Together with BRRI on-going research, Bangladesh scientists should be able to strongly support the international Rice/wheat research effort.

II. PROJECT ADMINISTRATIVE ACTIVITIES

The administrative aspects of the Project seem to move along more smoothly. There are some delays but these can be anticipated and the problems minimized. Progress has been made in disposing of the surplus and unserviceable vehicles. They have been removed by the buyer from the premises of Bungalow # 4.

A. Project vehicles despatched for BRRI Use (Table 1)

Fortunately the use of the vehicles has not been as great and this has given time to repair and service them. The Director of Research has prepared guidelines for BRRI staff use of the vehicles. This is most helpful. As a consequence the BRRI Administration will be more directly involved in seeing that travel is coordinated and relevant.

B. Participant Training and Networking

The degree and short term training proceeded on schedule. But there was a ban on travel for workshops, conferences and monitoring tours from September to early November. The ban was lifted too late to allow BRRI staff to participate in the IRRC held at IRRI in November.

1. Degree Training (Table 2)

Table 2, Section I shows the summary for all BRRI/IRRI research scholars for the year. Two more Ph.D scholar returned in November and December. One more has finished all requirements but still needs to make some revision in his thesis. One more In-country Ph.D Scholar has started his degree program on funds from Phase II. He was selected during Phase II but admission to BAU was

Table 1. Project Vehicles Dispatched for BRRI Use

Sl.No.	Date	Division	Purpose
1.	10 Oct	Agronomy	Visit sulfur deficiency area at Mymensingh
2.	10-12 Oct	Agronomy	Post flood rehabilitation program at Bogra
3.	14-19 Oct	Irrigation	Visit irrigation site at Rangpur
4.	16-22 Oct	Rice Tech.	Collect rice samples from Chittagong & Cox's Bazar
5.	24 Oct	Lapitan & J L McIntosh	Visit BAU,Mymensingh
6.	24 Oct	Breeding	Inspect disease infected fields at Mymensingh
7.	01 Nov	N P Magor	Site visit Sreepur
8.	02 Nov	N P Magor	Visit Regional Stn Comilla
9.	04 Nov	Economics	Visit BAU Mymensingh
10.	9-12 Nov	Genetic Resources	Collection of local varieties, at Faridpur
11.	15-22 Nov	''	Collection of local varieties, at Faridpur
12.	15-26 Nov	ARTD	Transport trainees, Dhaka to Joydebpur BARC Training
13.	16-18 Nov	Divisional Heads	Visit Sonagazi Regional Station
14.	15-21 Nov	Genetic Resources	Collection of Local varieties Rangpur, Dinajpur and Rajshahi
15.	22 Nov	JLM & NPM	Visit to Comilla Regional Station
16.	23-26 Nov	Pl Breeding	Evaluate Breeding Materials in Chittagong
17.	28 Nov-4 Dec	Genetic Resources	Collect rice germplasm from different areas in Bangladesh

Table 1. (cont'd....)

Sl.No.	Date	Division	Purpose
18.	3-17 Dec	ARTD	Transport trainees, Dhaka to Joydebpur BARC Trng
19.	0-13 Dec	Genetic Resources	Collect rice germplasm from different areas in Bangladesh
20.	15 Dec	JLM & S Alam	Meeting with Vice Chancellor at BAU Mymensingh
21.	15-22 Dec	Dancan Vaughan	Collect rice germplasm from Sylhet
22.	19-23 Dec	ARTD	Trainees visit Comilla,Chittagong and Cox's Bazar
23.	24 Dec	Farm Div.	Site visit Narsinghdi
24.	27-30 Dec	Pl Path	Monitor seedling disease and insect pests in Boro seedbeds Jessore

TABLE 2. Status Report, Degree Training Program, 30 Sep, 1988

I. Phase II- Continuation of Degree Programs

A. Ph.D Scholars	Field of Study	Period of Study	Institution	Cost (US $)
Abroad				
1. Farhad Jameel	Ag Education (ARTD)	Feb 84 - Jul 88	Cornell	(82,919)
2. Kamal Rahim	Statistics	Jun 84 - Dec 88	UP/Diliman	(48,950)
3. Abdus Salam	Plant Breeding (Botany)	Nov 84 - Nov 88	UP/Diliman	(41,719)
4. N I Miah	Agronomy (RFS)	Jun 85 - (Jan 89)	UPLB	(45,800)
5. Mahiul Haque	Plant Breeding	Jan 86 - (Jun 89)	UPLB	(48,010)
6. Nur-E-Elahi	Agronomy (RFS)	Sep 86 - (Jan 90)	Cornell	(64,841)
7. Syed Ahmed	Vertebrate Pests	Dec 86 - (Jun 90)	Colorado State Univ.	(63,828)
8. B A A Mustafi	Ag Economics	Jun 87 - (Dec 90)	Univ. Pertanian Malaysia	(45,000)
B. Ph.D Scholars				
In-country				
1. Tulsi Das	Plant Breeding	Apr 86 - (Sep 89)	Dhaka Univ.	(2,909)
2. Gazi Jasimuddin Ahmed PSO, Comilla	Agronomy	Dec 86 - (May 90)	BAU	(3,350)
3. Khairul Alam Billah SSO, BRRI	Ag Education			
4. M A Bakr, PSO, Comilla	Pathology			

Approximate dates and costs in (parenthesis)

TABLE 2.(Cont'd.....)

I. Phase II- Continuation of Degree Programs

C. M.S. Scholars	Field of Study	Period of Study	Institution	Cost (US $)
Abroad				
1. Md Nazmul Hasan	Ag Engineering (Irrig)	Jun 86 - Nov 88	CLSU	(29,644)
2. Monoranjan K Mondol	Ag Engineering (Irrig)	Jun 86 - Dec 88	UPLB	(29,644)
3. Murshedul Alam	Agronomy (RFS)	Jun 87 - (Dec 89)	UPLB	(29,500)
4. N R Sharma	Plant Pathology	Jun 87 - (Dec 89)	CLSU	(29,500)
5.	Research Planning and Management	No nominations 31 Dec 88.		(30,500)

D. M.S. Scholars

In-country

None

Approximate dates and costs in (parenthesis)

only finalized recently. There was no continuing In-country M.S. scholars from Phase II.

Table 2,Section II shows the degree training planned for Phase III and the slots presently filled. Only one slot remains to be filled for Ph.D scholars to be trained abroad. Only one of the M.S. slots has been filled. BRRI, in line with government policy, wishes to convert most of these into Ph.D slots at the rate of three M.S. slots for two Ph.D slots. This will be as originally planned in the Project Proposal.

The identification of candidates for the In-country Ph.D and M.S. slots has proceeded on schedule. Eight slots out of 19 remain to be filled. Now it will take some time for the nominees to be admitted to an appropriate graduate schools in-country.

There is an existing BAU/IRRI MOU that was signed in 1984 to enhance the cooperation between BAU and IRRI for staff development and degree training purposes. The MOU appears to be more of an institutional development arrangement for BAU and consequently was not actively implemented. It is hoped that a new MOU can be developed that recognizes the special relationship between BRRI and IRRI and enhances the role of BAU as an educational institution -particularly for graduate studies.

TABLE 2. (Cont'd.....)

II. Phase III - New Scholarships (as budgeted)

A. Ph.D Scholars	Field of Study	Period of Study	Institution	Cost (US $)
Abroad				
1. Mujibul Islam	Soil Science	Sep 88 - (Feb 92)	Oregon State University	(77,200)
2. Abdur Rashid	Agronomy	Nov 88 - (Apr 92)	CLSU	(46,670)
3. Mukhlesur R Ahmed	Applied Research	Nov 88 - (Apr 92)	CLSU	
4. Hafizuddin Ahmed	Pathology		LSU	
5. Abdus Sattar	Ag Engineering	Nov 88 -(Apr 92)	CSLU	
6.	Physiology	(on hold)		(46,670)

B. M.S. Scholars				
Abroad				
1.	Plant Breeding	No nominations 31 Dec 88		(30,500/slot)
2.	Plant Breeding	,,		
3.	Plant Breeding	,,		
4.	Soil Science	,,		
5.	Entomology	,,		
6.	Pathology	,,		
7. Kashem Khan	Ag Engineering (Irrig)	Nov 88 -(Apr 91)	CLSU	
8.	Ag Engineering (Machinery)	No nominations 31 Dec 88		
9.	Rice Quality	,,		
10.	Statistics	,,		

Approximate dates and costs in (parenthesis)

TABLE 2. (Cont'd.....)

II. Phase III - New Scholarships (as budgeted)

C. Ph.D Scholars	Field of Study	Period of Study	Institution	Cost (US $)
In-country				
1. Md Anwarul Islam PSO, BRRI	Plant Breeding	No nominations 30 Sep 88		(3,490/slot)
2. Md Anwarul Kabir PSO, BRRI	Plant Breeding	,,		
3.	Soil Science	,,		
4.	Soil Science	,,		
5.	Agronomy	,,		
6.	Agronomy	,,		
7. Quazi M A Razzak SSO, BRRI	Entomology	,,		
8.	Entomology	,,		
9. Md Anwar Hossain SSO, BRRI	Pathology	,,		
10. Md Montezer Rahman SSO, BRRI	Pathology	,,		
11.	Farming Systems	,,		
12. Kh Aminul Kabir SSO, BRRI	Rice Quality	,,		
13. Md Shirajul Islam SO, BRRI	Physiology	,,		
14. DNR Paul SSO, BRRI	Statistics	,,		
15.	Economics	,,		

D. M.S. Scholars

In-country		
1. Md Nazrul Islam SO, BRRI	Ag Engineering	(960/slot)
2. M A Rashid SO, BRRI	Ag Engineering	
3.	Ag Engineering	
4. Mono Ranjan Mondol Asst Ed., BRRI	Communications	

Approximate dates and costs in (parenthesis)

2. Short Term Training and Networking 1988

Table 3, Section I shows the short term training schedule and courses completed in 1988. A total of 30 slots were made available to BRRI (and sister organizations) and 18 slots were completed for about 57.5 person months of training. There were no major constraints for the second semester simply because IRRI and donors were willing to give approval for training even though funding details were not final. There were no problems in getting GOB approval even during the time when much official international travel was banned.

Table 3, Section II shows the workshops and meeting to which BRRI staff were invited through the project. In most cases nominations were made by BRRI. In some cases nominations were not made when foreign travel was banned. There were 14 different events to which 39 slots were made available to BRRI (and other institutes) and BRRI/IRRI staff. A total of 26 slots were used. The difficulty in senior staff (CSO) and administrators to get government orders for travel abroad is a serious constraint to the project. Many times Bangladesh is the only country not represented by senior staff at conferences and workshops. It affects BRRI's position as a major center for rice research and hinders transfer of technology. For collaborative meetings IRRI scientists must always come to Bangladesh. Hopefully this situation may change.

Table 3, Section III shows the only monitoring tour to which BRRI scientists were invited in 1988. Unfortunately the BRRI nominee was unable to attend.

TABLE 3. Short Term Training and Networking 1988

	WHERE	WHEN	SLOTS(Nominees)	FUNDING SOURCE
I. TRAINING COURSES				
1. SIMULATION AND SYSTEMS ANALYSIS FOR RICE PRODUCTION (SSARP)	IRRI	1 FEB-31 MARCH	1. M A SATTAR 2. J K BISWAS 3. BELAYETUL QUADER 4. SHAMSUL ISLAM AKANDA	GOVT OF NETHERLANDS/ IRRI
2. TRAINING AND TECHNOLOGY TRANSFER COURSE(T3C)- i.	IRRI	8 FEB-29 APR	*1. *2. *3.	BRRI/IRRI
3. GENETIC EVALUATION AND UTILIZATION (GEU)	IRRI	8 FEB-27 MAY	*1. GOLAM MOSTAFI *2. Ms NIRU SHAMSUN NAHAR	BRRI/IRRI
4. INTERNATIONAL NETWORK ON SOIL FERTILITY AND FERTILIZER EVALUATION FOR RICE (INSFFER)	IRRI	8 FEB-27 MAY	*1.	BRRI/IRRI
5. CROPPING SYSTEMS TRAINING PROGRAM (CSTP)	IRRI	8 FEB-1 JUL	*1. ABDUL JALIL MRIDA *2. AYUB ALI 3. MD ALAUDDIN	BRRI/IRRI GOVT OF NETHER-LANDS
6. GENETIC STUDIES OF DORMANCY IN RICE	IRRI	15 FEB-15 OCT	1. TULSI DAS	BRRI/IRRI
7. DATA BASE MANAGEMENT FOR GENETIC RESOURCES (DBMGR)	IRRI	4 APR-10 JUN	1.(Ms ZARINA ZEENAT)***	BRRI/IRRI
7a. RICE BLAST TRAINING**	IRRI	1 JUL-OCT 31	1. Mrs NIRU S NAHAR	BRRI/IRRI
8. TRAINING AND TECHNOLOGY TRANSFER COURSE(T3C)- ii.	IRRI	25 JUL-14 OCT	1. MANSUR RAHMAN (DAE/BRRI) 2. SHAFIUL I MAMIN 3. (M K MONDAL, Asst.Ed.) PPRD	BRRI/IRRI
9. WEED SCIENCE TRAINING COURSE (WSTC)	IRRI	25 JUL-30 SEP	1. Md A JALIL MRIDHA SO, AGRONOMY, BARISAL	BRRI/IRRI
10. SPECIAL RICE PRODUCTION TRAINING PROGRAM (SRPTP) ON RAINFED LOWLAND RICE	IRRI	25 JUL- 4 NOV	1. Md HELALUDDIN AHMED 2. ABUL HOSSAIN MOLLAH 3. GAUS ALI	BRRI/IRRI (UPLR SLOTS)
11. INTEGRATED PEST MANAGEMENT (IPM)	IRRI	25 JUL-9 DEC	1. Mrs LININ NAHAR, SO,ENT. 2. Md AYUB ALI, SO, PATH.	BRRI/IRRI

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* SLOTS LOST BECAUSE OF DELAY IN PROJECT APPROVAL
** IN PLACE OF ORIGINALLY SCHEDULED COURSE
*** PARENTHESIS - MEANS NAMED PERSON(S) UNABLE TO PARTICIPATE FOR VARIOUS REASON

(Contd...TABLE 3)

	WHERE	WHEN	SLOTS	FUNDING SOURCE
12. IRRIGATION WATER MANAGEMENT TRAINING (IWMT)	IRRI	29 AUG-7 OCT	1. BILASH C ROY 2. Md ATAUL HUQ 3. (BWDB THAKURGAON)	BRRI/IRRI
13. FARMING SYSTEMS SOCIOECONOMIC RESEARCH (FSSR)	IRRI	3 OCT-2 DEC	1. (M ISLAM U MOLLAH) SO, RCS, RAJSHAHI	BRRI/IRRI
14. SEED HEALTH TESTING TECHNIQUES FOR RICE	IRRI	17 OCT-2 DEC	1. Mrs KAMRUN NAHAR	IRRI/DGISP
15. SECOND GENETIC RESOURCES CONSERVATION & MANAGEMENT TRAINING COURSE	IRRI	JAN'89-JUN'89	1. Mrs ZARINA ZEENAT	IRRI/ITALY

II. WORKSHOPS/MEETING

1. BACTERIAL BLIGHT OF RICE WORKSHOP	IRRI	14-18 MARCH	1. Dr A K SAHA 2. Dr AMINUL HOQUE	IRRI
2. RICE/FISH FARMING RESEARCH AND DEVELOPMENT WORKSHOP	UBON, THAILAND	21-25 MARCH	1. Dr SOMEN DEWAN, BAU 2. Mr M G HOSSAIN, BFRI 3. (Dr NIZAMUDDIN AHMED)	ICLARM IDRC/ IRRI
3. ASSESSMENT OF IMPACT OF FSR WORKING MEETING	IRRI	24 MAR-24 APR	1. AKHTAR HOSSAIN KHAN 2. MAINUR RAHMAN SIDDIQUE 3. RAFIQUL ISLAM	IRRI/ IDRC
4. IMPACT CROPPING SYSTEMS PLANNING WORKSHOP	IRRI	25-29 APR	1. AKHTAR HOSSAIN KHAN 2. MAINUR RAHMAN SIDDIQUE 3. RAFIQUL ISLAM 4. NOEL P MAGOR 5.(NIZAMUDDIN AHMED)	IRRI/IDRC ,, ,, IRRI/BRRI ,,
5. WOMEN IN RICE FARMING SYSTEMS WORKSHOP	IRRI	2-11 MAY	1. Dr (Mrs) KHURSHIDA BANU 2. Miss SHAHIDA SARKAR PAUL	IRRI/ IDRC
6. RICE GRAIN QUALITY STUDY INTERPRETATION AND REPORTING WORKSHOP	IRRI	11-14 JUNE	1. (Dr NURUL HOQUE CHOWDHURY)	IRRI/ IDRC

PARENTHESIS - MEANS NAMED PERSON(S) UNABLE TO PARTICIPATE FOR VARIOUS REASONS.

(Contd...TABLE 3)

	WHERE	WHEN	SLOTS(Nominees)	FUNDING SOURCE
7. THIRD CROP-LIVESTOCK FSR WORKSHOP	SERDANG, MALAYSIA	15-19 AUG	1. Dr M H KHAN, BARC 2.(Dr NAZIMUDDIN AHMED) 3. Prof M A LATIF, BAU	BARC IRRI/BRRI IRRI
8. REVIEW OF IRRI STRATEGIC PLAN FOR THE 1990's	IRRI	8-12 SEP	1.(Dr M A MANNAN) 2.(Dr J L McIntosh)	IRRI BRRI/IRRI
9. IRTP, GLOBAL ADVISORY COMMITTEE MEETING	BANGKOK,THAILAND	24-25 OCT	(Dr N M MIAH)	IRRI/UNDP
10. PROSPERITY THROUGH RICE-II, REVIEW AND STUDY TOUR	BANGKOK, THAILAND	30 OCT-6 NOV	1.(Dr K A HAQ) 2. ABUL QUASEM 3. REZAUL KARIM 4. M A RAZZAQUE 5. JOYNAL ABEDIN 6. A K M HAQUE	IRRI/ADB
11. INTERNATIONAL RICE RESEARCH CONFERENCE (IRRC)	IRRI	7-11 NOV	1.(Dr N M MIAH) 2.(Dr NIZAMUDDIN AHMED) 3. Dr JOINAL ABEDIN,BARI 4. Dr M EAQUB, (BAU) 5. Dr J L McINTOSH 6.(Mr NOEL MAGOR)	BRRI/IRRI BRRI/IRRI IRRI IRRI BRRI/IRRI BRRI/IRRI
12. ASIAN RICE FSR WORKING GROUP MEETING	IRRI	12-15 NOV	1.(HEAD RFS) 2. Mr NOEL MAGOR 3. Dr JOYNAL ABEDIN	BRRI/IRRI '' ''
13. APPROPRIATE AGRICULTURAL TECHNOLOGY FOR FARM WOMEN	NEW DELHI	28 NOV-6 DEC	1.(Ms KURSHIDA BANU)	IRRI
14. FINAL WORKSHOP ON BOTANICAL PEST CONTROL IN RFS	IRRI	12-16 DEC, 88	1. Dr M BAQUI	IRRI/ADB

III. MONITORING TOURS

1. COLD TOLERANCE	PHILIPPINES/ THAILAND INDIA	25 SEP-8 OCT	1. (M A KABIR) PSO, PLANT BREEDING	IRTP
2. SHEATH BLIGHT MONITORING TOUR	INDONESIA	16-28 JAN	1. Dr A SHAHJAHAN	IRTP

PARENTHESIS - MEANS NAMED PERSON(S) UNABLE TO PARTICIPATE FOR VARIOUS REASONS.

3. Short Term Training for 1989

Table 4 shows the slots presently available for short term training at IRRI for 1989. All slots for the first semester have been filled.

Slots for the various Networking activities are not yet available.

Table 5 shows the slots budgeted and training funds available through the BRRI/IRRI project for 1989.

C. Procurement (Table 6)

Table 6 shows the remaining items on order from Phase II that have not yet been received and the new orders made. We have made new orders for scientific journals and library books. However, it may be difficult to get the 1988 Journals that were not procured last year due to funding uncertainties. These journals, however, have been ordered along with those for 1989.

The IRRI-Dhaka office vehicles are getting old and expensive to maintain. Three of these vehicles are about 13 years old. These will be replaced as soon as possible. All other procurement will be on hold until the funding is secured.

D. Distribution of Periodicals, Publications and Seed Received from IRRI, Los Baños.

We have requested IRRI to send us 10 copies of all new publications. This will enable us to provide the latest technical information on rice and rice farm systems to researchers and relevant administrators.

TABLE 4. SHORT TERM TRAINING PRESENTLY AVAILABLE FOR 1989

TRAINING COURSES	WHERE	WHEN	SLOTS (nominees)**	FUNDING SOURCE
FIRST SEMESTER				
1. VARIETAL TESTING OF UPLAND CROPS (VTUC)*	IRRI	16 JAN-10 FEB	HELAL UDDIN NOMANI	BRRI/IRRI
2. SOIL-PHYSICAL MANAGEMENT IN RICE BASED CROPPING SYSTEMS(SPMRCS)*	IRRI	6 FEB- 7 APR	PARAMESH C BHATTACHARJEE	BRRI/IRRI
3. TRAINING & TECHNOLOGY TRANSFER COURSE (T3C)	IRRI	6 MAR-26 MAY	ISLAM UDDIN MOLLAH	BRRI/IRRI
4. GENETIC EVALUATION AND UTILIZATION (GEU)	IRRI	6 MAR-23 JUN	KHWAJA GOIJAR HOSAIN	BRRI/IRRI
5. INTERNATIONAL NETWORK ON SOIL AND SUSTAINABLE RICE FARMING SYSTEMS (INSURF)	IRRI	6 MAR-23 JUN	JATISH C BISWAS	BRRI/IRRI
6. AGRICULTURAL ENGINEERING COURSE (AEC)	IRRI	8-26 MAY	S M MAHFUZUR RAHMAN	BRRI/IRRI
SECOND SEMESTER				
1. INTEGRATED PEST MANAGEMENT (IPM)	IRRI	-	-	1
2. IRRIGATION WATER MANAGEMENT (IWMT)	IRRI	-	-	2
3. FARM MANAGER TRAINING (FMT)	IRRI	-	-	-
4. TRAINING AND TECHNOLOGY TRANSFER COURSE (T3C)	IRRI	-	-	-
5. FARMING SYSTEMS RESEARCH TRAINING	IRRI	-	-	-

* SPECIAL COURSE
** BRRI STAFF UNLESS OTHERWISE INDICATED

TABLE 5. SHORT TERM TRAINING PROPOSED AND BUDGETED FOR 1989

	WHERE	WHEN	BUDGETED SLOTS	AVAILABLE BUDGET
TRAINING COURSES				
I. a. Short Courses (Domestic)	-	-	5	1,500
b. Short courses (Abroad)	IRRI	-	-	-
1. Genetic Resources Division. 9 mo.	-	-	-	-
2. Genetic Evaluation and Utilization, 4 mo.	IRRI	*6 MAY - 23 JUN	1	4,600
3. Statistical Procedures 2 mo.	IRRI		1	2,850
4. Fertility Studies (INSURF) 4 mo.	IRRI	*6 MAY - 23 JUN	1	4,600
5. Upland Rice, 4 mo.	IRRI		1	4,160
6. Irrigation Water Management, 6 weeks.	IRRI		2	4,840
7. Cropping Systems, 5 mo.	IRRI	*6 FEB - 7 APR	2	10,960
8. Socio Economic analysis, 2 mo.	IRRI		2	5,250
9. Integrated Pest Management, 4 mo.	IRRI		1	4,600
10. Training & Technology Transfer, 2 mo.	IRRI	*6 MAR - 26 MAY	2	7,460
11. Agricultural Engineering Course, 3 Weeks	IRRI	*8 MAY - 26 MAY	1	2,150
12. Rice Processing	UPLB		1	2,650
II. Study Tour, Post Harvest Technology.	-		-	-
III. On-the Job Training	-		3	12,280
IV. Use IRRI Research Facilities & Support	IRRI		-	-
V. Research Systems & Management	-		3	9,000

* Short Term Training Courses at IRRI presently available (30 Sep'88)

TABLE 6. Procurement

Req. No.	Items	Suppliers	Status
B86-29	Scientific supplies & equipment	Bangladesh Scientific & Surgical Inst Co.	Procurement postponed
B86-40	Tube solarimeter	Delta-T Devices, England	Not yet found at airport
B86-41	Weather equipment	Bangladesh Scientific and sursgical Institute Company.	Procurement postponed
B86-42	Atomic absorption spectrophotometer	Parkin Elmer Corp	Procurement postponed
B86-42A	Equip for installation AAS	McMaster Carr	,,
B86-43	Lamp for atomic absorption spectrophotometer	Hitachi Ltd	Received by BRRI
B88-3	Proceedings of BRRI-BWDB-IRRI Workshop on Irrigation Water Management (1000 cps)	Local press	Not yet printed
B88-4	Pest and disease handbood (30,000 cps)	Local press	Printed and payment made
B88-6	Economic constaints on turn around time in Bandladesh(300 cps)	Local press	Printed and payment made
B88-7	Stationeries for IRRI Dhaka Office	IRRI Stock	Received by IRRI Dhaka Office
B89-1	73 journals for BRRI Library	M/S.Tulib Enterprise	P.O. not yet received
B89-2	One Mitsubishi Pajero LWB One Toyota Corolla (A T) One Toyota Corolla One Toyota Lite-Ace	Offers obtained from local dealers	P.O. not yet received
B89-3	One Toshiba Plain Paper Copier	,,	P.O. not yet received

E. IRRI Staff Visits (Table 7)

Eight IRRI Staff visited Bangladesh during this quarter. These visits were all related to on-going collaborative research activities.

During Ms Thelma Paris's visit we were invited to BAU to discuss possibilities for collaborative research between BAU and IRRI and BRRI.

F. Financial Reports (Table 8)

Table 8 shows the report of expenditures incurred for the period 1 Jan - 30 Sep 1988 from the USAID funding source.

G. Farming Systems Research Specialist

Mr Magor's Quarterly Report is included as Attachment I. His Government Permission and Visa to work in Bangladesh expired 31 Dec 1988. Processing for a three year extension is progressing slowly but steadily.

He has worked closely with the RFS Division to prepare for extension of the Impact Study and for supplementary funding from NORAD to support on site research in the Impact Study areas. The objective will be to study and remove constraints to adoption of RFS research technologies in these areas.

He has also worked closely with the farming systems research project in Sreepur to develop a more comprehensive economic evaluation of the farm systems under study. This is being done through an ex-ante analysis of the existing and proposed systems.

TABLE 7. IRRI Staff Visits to Bangladesh (and others) (Oct-Dec, 1988)

	Name	Date	Contact Person(s)
1.	Dr Don Jansen	27 Sep - 4 Oct	Simulation & Modelling Team
2.	Mr Jojo Lapitan	23 - 25 Oct	PTR-II Team
3.	Dr H David Catling	27 Nov - 20 Dec	ODA Team
4.	Dr D HilleRisLambers	30 Nov - 4 Dec	Dr N M Miah
5.	Dr Tina David	3 - 5 Dec	Dr Mahbub Hossain, BIDS
6.	Dr Duncan Vaughan	4 - 22 Dec	Germplasm Collection
7.	Dr Bart Duff	12-14 Dec	Rice Quality and Women in Rice Farming Projects
8.	Ms Thelma Paris	12 - 16 Dec	Women in Rice Farming at BRRI, BARI & BAU

TABLE 8. Official Financial Report (USAID), Jan-Sep, 1988.

Name of Contractor : The International Rice Research Institute
Project Title : Rice Research and Training Project Phase III
Grantor : USAID
Grant Amount : $2,000,000.00

Grant Period : From - January 1, 1988
To - June 4, 1991

Reporting Period: From - January 1, 1988
To - September 30, 1988

	BUDGET	Expenditures Jan. 1988 to Sept. 1988	Estimated Expenditures Oct. 1988-Dec. 1988	TOTAL	BALANCE
1. Manpower Training	$1,021,294.00	$ 36.099.09	$ 30,000.00	$ 66.099.09	$ 955,194.91
2. IRRI Scientist Support	757.190.00	87,817.37	105,000.00	192.817.37	564,372.63
3. In-country Travel	48.000.00	0.00	12,000.00	12,000.00	36,000.00
4. IRRI Service Charge	173.516.00	11.772.06	13,965.00	25.737.06	147,778.94
	$2,000,000.00	$135.688.52	$160,965.00	$296,653.52	$1,703,346.48

The undersigned hereby certifies: (1) that payment of the sum claimed under the cited contract is proper and due and an appropriate refund to A.I.D. will be made promptly upon the request of A.I.D. in the event of non-performance, in whole or in part, under the contract or for breach of the terms of the contract, and (2) that information on the fiscal report is correct and such detailed supporting information as A.I.D. may require will be furnished at the contractor's home office or base office as appropriate promptly to A.I.D. on request, and (3) that all requirements called for by the contract to date of this certification have been met.

I hereby certify that amounts invoiced herein do not exceed the lower of (1) the contract price,or (2) maximum levels established in accordance with Executive Order 11627, dated October 15, 1971.

BY : EDWARD N. SAYEGH

TITLE: DIRECTOR FOR FINANCE

DATE :

/ecc

III. OTHER ACTIVITIES - RESEARCH SYSTEMS SPECIALIST

A. Participated in the International Rice Research Conference at IRRI, Los Baños, Philippines 7-11 Nov. Served as Chairman of Working Group on Upland Rice Farming Systems.

B. Prepared paper with Dr R K Pandey on Phosphorus Requirement and Management of Grain Legumes for Symposium on Phosphorus to be held at IRRI in March 1989 (See Appendix II).

C. Lectures

Continued to give lectures for BARC sponsored Research Management Training.

D. Consultations

1.	Dr Doughlas Pickett	USAID-Dhaka
2.	Dr Chuang	IFDC
3.	Dr M Eaqub	BAU
4.	Dr Zainul Abedin	BARI
5.	Dr S M H Zaman	Planning Commission
6.	Dr Don Parker	IMMI/BARC
7.	Dr R N Mallick	CEKKI/BARC

IV. PROBLEMS AND CONSTRAINTS

A. IFAD Funded Rainfed Project

The GOB has given approval for Project but procedures for implementation have not been completed. The Project was approved by IFAD in January 1987.

B. Project Funding

Progress has been made in eliminating differences between the POP's agreed to by CIDA and the GOB. Hopefully the MOU between the GOB and CIDA may be signed soon.

C. Supplies and/or Worn out Project Vehicles

Final permission and assessment of import duties and taxes have been obtained for disposal of these vehicles. We will need to purchase new vehicles soon.

V. PLANS

A. Fully implement Project Training Program

B. Help implement IFAD Project

C. Insure that collaborative research projects fit within BRRI's research program.

D. Follow closely collaborative Irrigation and Water Management Project.

E. Follow closely Rice/Wheat Crop Systems studies to identify possible collaborative research issues.

F. Help BRRI Farming Systems Research to address whole farm issues.

ANNUAL NARRATIVE REPORT
1988

INTRODUCTION

The BRRI/IRRI Project effectively and directly supports the research, training and facilities development activities of BRRI. The Project can only indirectly affect policy and administrative decisions of BRRI by offering opportunities for BRRI scientists and administrators to participate in workshops, meetings and conferences where common research issues and problems are discussed among donors, other National Agricultural Research Systems (NARS) and International Agricultural Research Centers (IARCs). This approach has been successfully used without compromising the integrity of BRRI and the other NARS. These efforts have been adequately covered in the Quarterly Reports and are summarized for the year in the Oct-Dec Quarterly Report.

Rice Production in 1988

Early rains and flooding in some areas in June and July, widespread flooding of unprecedented dimensions in August and September and cyclonic winds and rain in late November have each seriously affected rice production in 1988. It is estimated that the Aman crop production amounted to about 7.16 million metric tons (MMT) which fell short of targeted production of 8.5 MMT by 1.34 MMT. Of this total loss about 0.72 MMT was from Broadcast Aman (B.Aman) or deep water rice. This represents a 52% loss in B.Aman production compared to the average production of 1.36 MMT for the last five years.

These data from the Donor Agency reports are reasonable estimates of losses due primarily to flooding. Flooding and drought are continuing

problems. Drought problems can be partially alleviated by irrigation. Flooding is an annual event but if the intensity continues like the last two years, contingency cropping strategies must be developed to design around the problem.

Production Problems

It is necessary for rice research workers (in particular) to consider contingency strategies to stabilize crop production and farm income. There are several problems which affect rice crop production and the economic well-being of the farmers. We highlight six.

1. Early drought constraining Aus crop establishment and production
2. Early flooding constraining establishment of B.Aman
3. Direct affect of floods causing crop losses
4. Late floods reducing prospects for replanting rice after floods
5. Wet soil from late floods delaying planting of Rabi crops and reducing yields (wheat, pulses and vegetables)
6. Declining productivity of the rice-wheat cropping system in irrigated areas.

Research and Development Implications

In contrast to production problems caused by the vagaries of weather and geographic location there are some benefits from these conditions that should not be overlooked but on the other hand, exploited. These include young soils that are annually rejuvenated, relatively level land areas and nearness to rechargeable sources of ground and surface water. These conditions lend themselves to intensive crop production within an environment where the winter season is cool enough to require changes in crop cultivars and species but not cold enough to hinder production. Thus,

problems with the build-up of insect pests and diseases are minimal compared to more tropical areas but still the climate is mild enough to permit year round cropping. Bangladesh has potential for intensive, stable and sustainable crop systems. The country also has a very comprehensive collection of soil (Fig 1), weather and landuse (Fig 2) data compiled in a usable form by UNDP/FAO for Bangladesh.

There is a need to make better use of these resources. There are some research priorities that may be considered.

1. Lands subject to flooding should be delineated and some risk assessment made. Information is available to do this (Fig 3). Cropping strategies for high risk flood areas should emphasis flood avoidance by growing crops before and after the flooding season. DWR may still be grown as a low input, high risk crop. But more emphasis should be put on cropping these highly productive soils during the Rabi season using supplemental irrigation. There is a need to develop more cold tolerant T.Aman rice varieties suitable for planting after the flood season and for selective use of low input and efficient irrigation systems for high value winter crops. BRRI has already released two new varieties (BR22 and BR23) that are photo period sensitive and may be planted as late as 30 September.

2. Non flood areas should be developed to contribute incrementally to the stable and sustainable food supply. These areas along with Boro rice and winter wheat can represent a food reserve base. One strategy to further develop these areas would be to focus research by agro ecological regions and then by crop season rather than the other way around. If the focus is on regions it is easier to carry

35

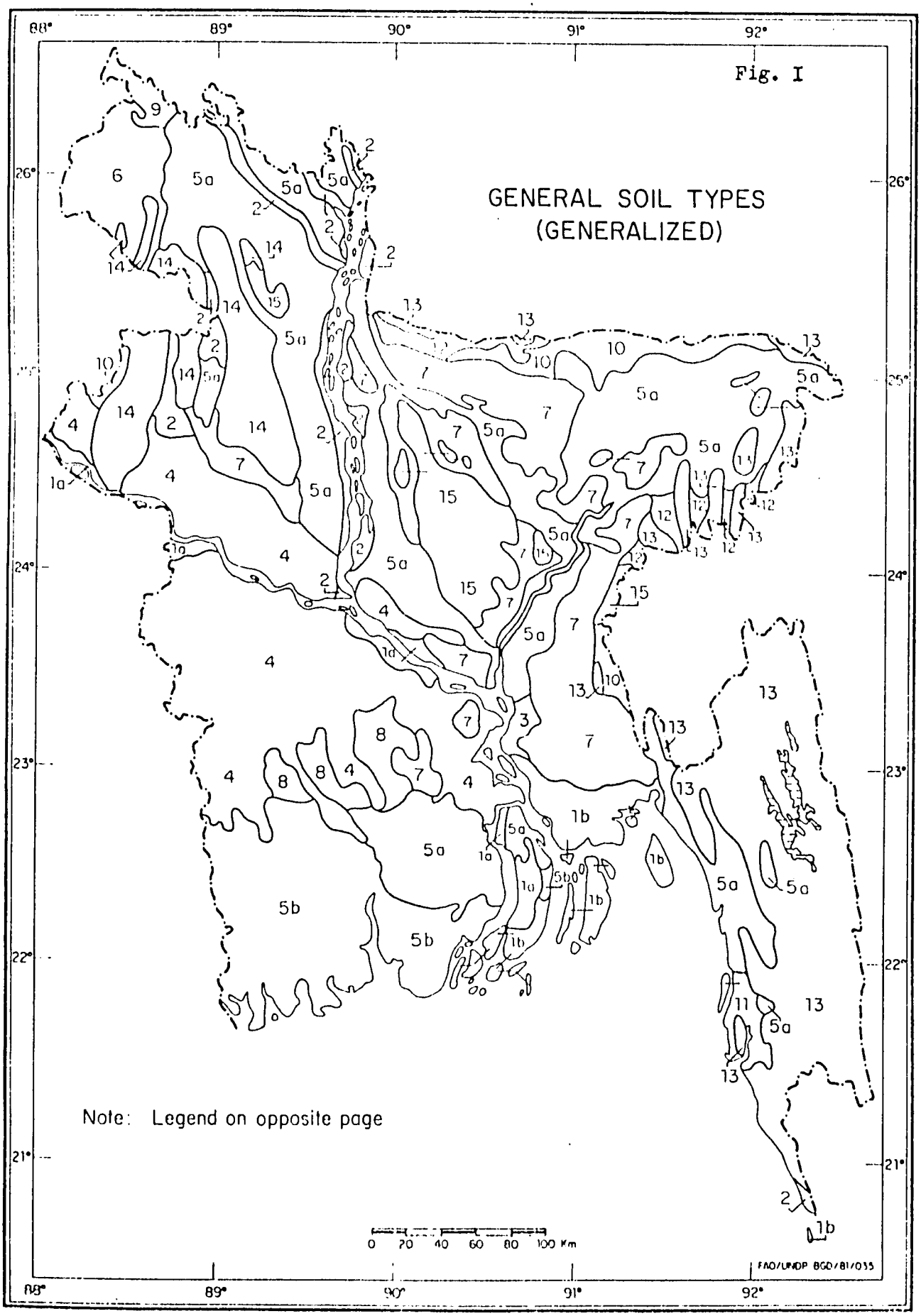
Fig. I
GENERAL SOIL TYPES
(GENERALIZED)
Note: Legend on opposite page
0 20 40 60 80 100 Km
FAO/UNDP BGD/81/035
88°
89°
90°
91°
92°
26°
25°
24°
23°
22°
21°

36

Legend for Figure 1.

GENERAL SOIL TYPES

1a	Calcareous Alluvium (non-saline)
1b	Calcareous Alluvium (seasonally saline)
2	Noncalcareous Alluvium
3	Calcareous Grey Floodplain Soils
4	Calcareous Dark Grey Floodplain Soils
5a	Noncalcareous Grey Floodplain Soils (non-saline)
5b	Noncalcareous Grey Floodplain Soils (seasonally saline)
6	Noncalcareous Brown Floodplain Soils
7	Noncalcareous Dark Grey Floodplain Soils
8	Noncalcareous Dark Grey Floodplain Soils and Peat
9	Black Terai Soils
10	Acid Basin Clays
11	Acid Sulphate Soils
12	Grey Piedmont Soils
13	Brown Hill Soils
14	Shallow and Deep Grey Terrace Soils
15	Deep Red-Brown Terrace Soils

Note: Only the principal General Soil Type of the unit is indicated. A more detailed soils legend is given on the Agroecological Regions and Subregions Map in Report 2.

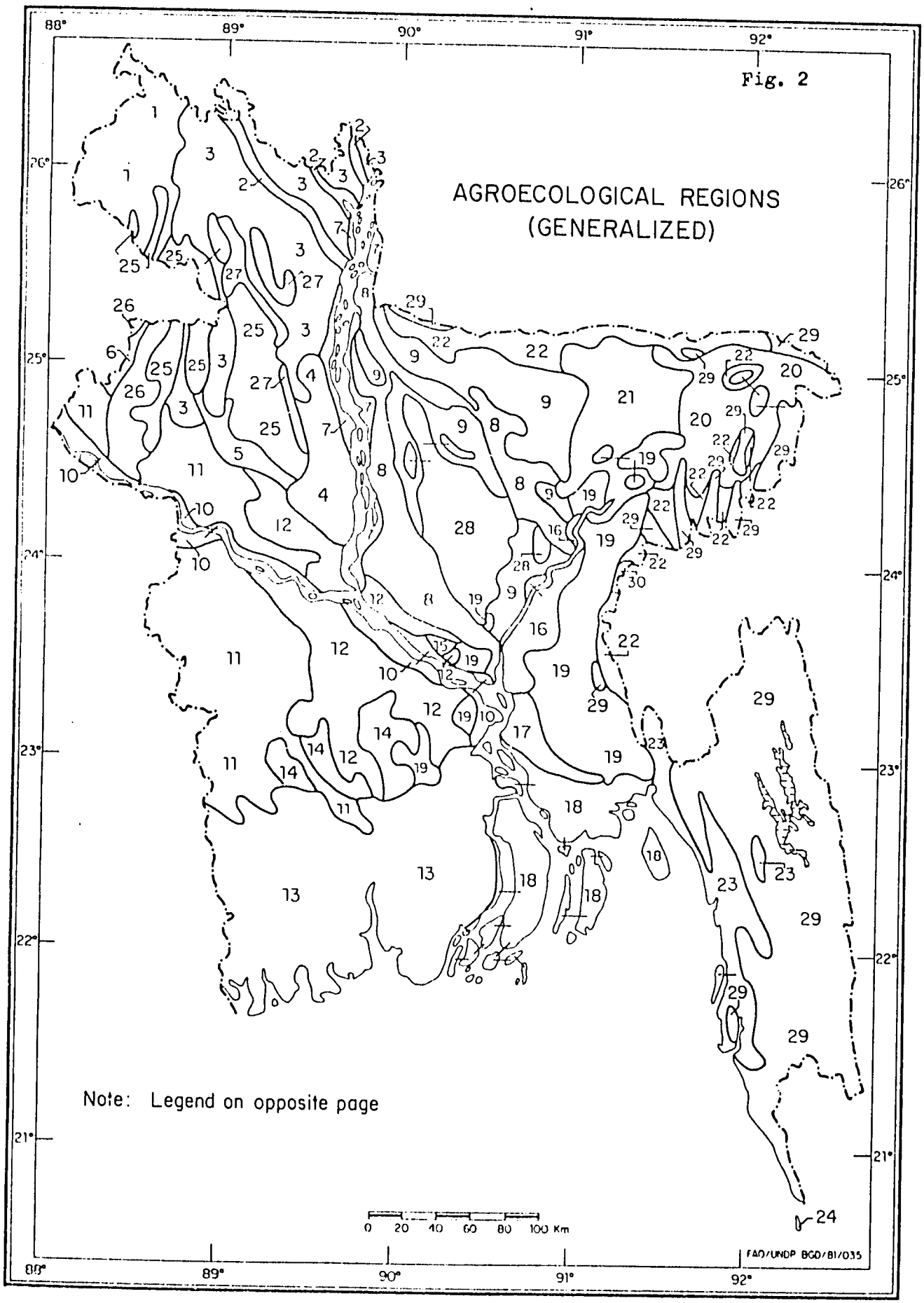
Fig. 2
AGROECOLOGICAL REGIONS
(GENERALIZED)
Note: Legend on opposite page
0 20 40 60 80 100 Km
FAO/UNDP BGD/81/035

Legend for Figure 2.

AGROECOLOGICAL REGIONS

1 Old Himalayan Piedmont Plain
2 Active Tista Floodplain
3 Tista Meander Floodplain
4 Karatoya-Bangali Floodplain
5 Lower Atrai Basin
6 Lower Purnabhaba Floodplain
7 Active Brahmaputra-Jamuna Floodplain
8 Young Brahmaputra and Jamuna Floodplains
9 Old Brahmaputra Floodplain
10 Active Ganges Floodplain
11 High Ganges River Floodplain
12 Low Ganges River Floodplain
13 Ganges Tidal Floodplain
14 Gopalganj-Khulna Bils
15 Arial Bil
16 Middle Meghna River Floodplain
17 Lower Meghna River Floodplain
18 Young Meghna Estuarine Floodplain
19 Old Meghna Estuarine Floodplain
20 Eastern Surma-Kusiyara Floodplain
21 Sylhet Basin
22 Northern and Eastern Piedmont Plains
23 Chittagong Coastal Plain
24 St Martin's Coral Island
25 Level Barind Tract
26 High Barind Tract
27 North-eastern Barind Tract
28 Madhupur Tract
29 Northern and Eastern Hills
30 Akhaura Terrace

29

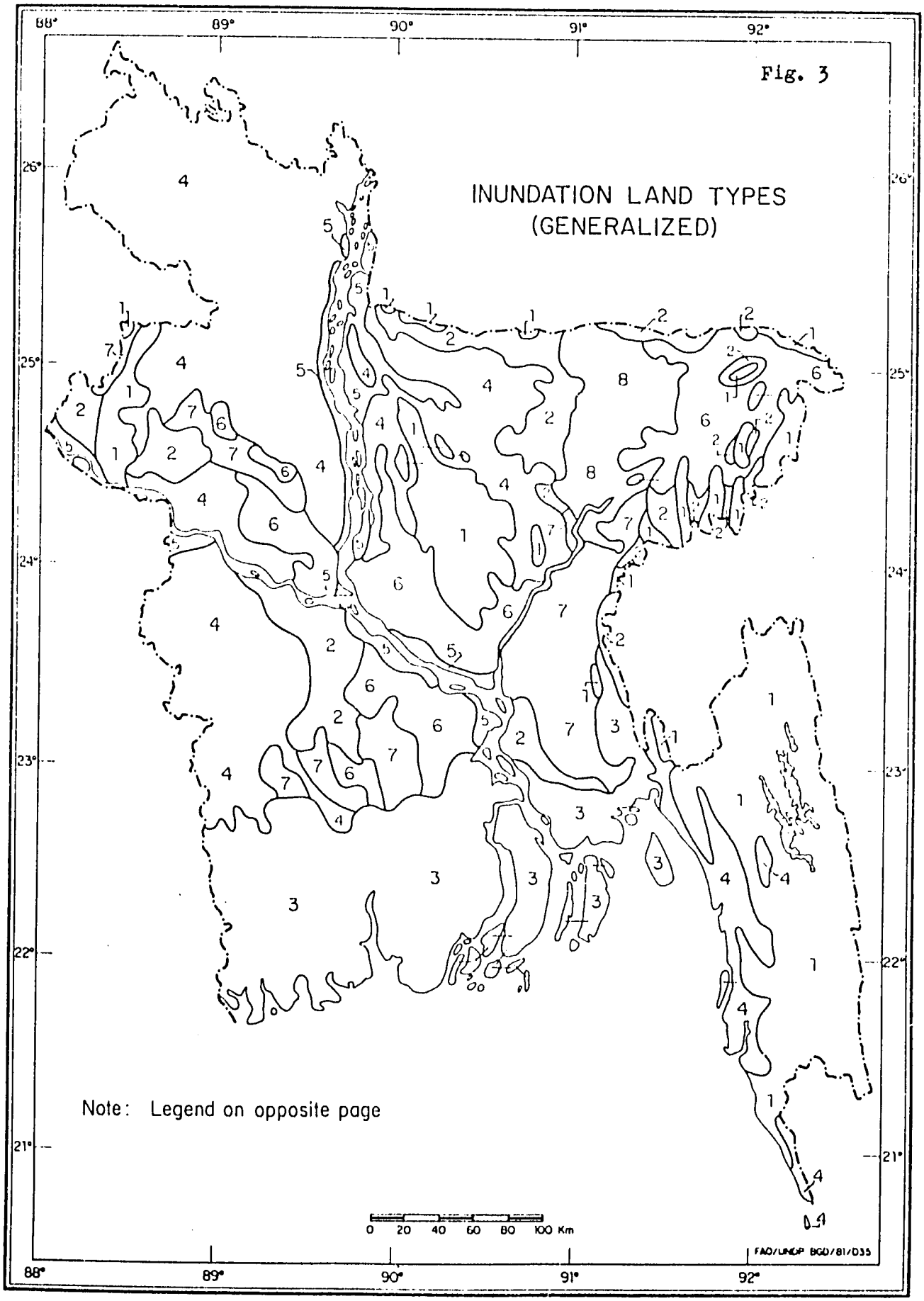
Fig. 3
INUNDATION LAND TYPES
(GENERALIZED)
Note: Legend on opposite page
0 20 40 60 80 100 Km
FAO/UNDP BGD/81/035
88°
89°
90°
91°
92°
26°
25°
24°
23°
22°
21°

Legend for Figure 3.

INUNDATION LAND TYPES

1 Mainly Highland
2 Highland to Medium Lowland
3 Mainly Medium Highland
4 Medium Highland and Highland
5 Medium Highland and Medium Lowland
6 Medium Highland to Lowland
7 Medium Lowland and Lowland
8 Lowland and Very Lowland

out holistic farm systems research and development. For example, in the Khustia-Jessore region of Western Bangladesh there is a contiguous area of about 560,000 hectares of relatively level and fertile land that does not flood. The existing cropping systems most commonly used include direct seeded Aus and jute which are followed by dry land Rabi crops, such as oil seed and pulse crops and wheat. An improved Aus rice having more drought tolerance, earlier maturity and higher yield than commonly grown local varieties would be most beneficial. Widespread introduction of BR20 and 21 varieties that are presently available could double rice yields. Interplanting of corn in the rice, initially at wide spacings could familiarize farmers with corn and stimulate development of industrial and on farm uses. Early maturing rice varieties for Aus and T.Aman would permit more timely planting of Rabi crops and other crops in the crop sequence. Ultimately in this area as in other areas of Bangladesh irrigation will become widely used. But before this eventuality production and farm income could be stabilized and dramatically improved by these simple and low cost interventions. This process may be followed for development of other ecological areas of the country such as the coastal saline soil areas (which produce about one third of the T.Aman rice), the Barind, Madhupur, and Hill tract areas that are distinctly different and not particularly affected by floods.

3. Irrigation has enabled increased and stabilized T.Aman production wherever introduced. It has enabled Boro rice production to be a

major source of rice. Irrigation directly increases and stabilizes rice production by reducing water stress. But also, because of the reduced risk, farmers are willing to supply higher inputs and use MV's. This has had a dramatic impact on rice production.

In deep tubewell irrigation areas where the soils are light (sands and silts) a strategy has been pursued to grow a rice-wheat crop system. The rice crop grown as T.Aman, has performed as expected. Over the past 15 years the area of wheat grown increased rapidly to reach about 0.68 m Ha in 1985. Recently farmers have become reluctant to grow wheat. This has happened not only in Bangladesh but also in Pakistan, India, Nepal and China. The decline in production of the rice-wheat system raises both biological and socio-economic issues. CIMMYT and IRRI are developing a rice-wheat research proposal to study the problems of yield decline. In Bangladesh there is production decline (not necessarily yield decline) simply because wheat at present yield levels is not profitable.

Efficient use of irrigation water is a major problem in many irrigation systems. Many times farmers are content to simply provide supplemental irrigation for late Boro or early Aus. Consequently, particularly in some deep tubewell irrigation systems, the cropping intensity has not been substantially changed by the availability of water[1]. Farmers are not enthusiastic to grow wheat. In the G-K Irrigation Project farmers are satisfactorily growing two rice crops (T.Aus-T.Aman) in the areas where water arrives on schedule. But the

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1 The command area of tubewell 142 in Thakurgaon is 150 Acres. Irrigation is available for T.Aman and for wheat. The area is fully planted to T.Aman but only 10% for wheat.

system is not yet efficient enough to permit widespread production of Rabi crops. As in many irrigation systems drainage is designed to remove surface water only. This is adequate for lowland rice but is not satisfactory for upland crops that may be grown after rice. In the G-K the soil water was just approaching field capacity when we visited on January 5.

BRRI irrigation engineers and agronomists have worked for seven years in the G-K and Thakurgaon Irrigation Projects. The basic engineering and agronomic technologies have been developed to increase yield and intensify crop production. These technologies need to be demonstrated over a larger area in one tertiary or one tubewell command area of these systems in order to demonstrate available technology on a large enough scale that administrators, politicians and farmers can be convinced of the technical feasibility. In the process researchers will be able to get a better perception of the practical problems that farmers and irrigation project managers face and ideas for fine tuning the technology. For 1989 the Thakurgaon Project Engineer has agreed to provide water for early T.Aus provided 30% of the farmers will plan to grow a T.Aus - T.Aman cropping pattern. This is a positive effect resulting from Project activities.

Farm Economy

Many impact studies show that adoption of MV's and new technologies for rice production have been profitable in Bangladesh. The studies of Hossain (BIDS) presented in his publication 'Grain revolution in Bangladesh: its nature and impact on income distribution' are most encouraging. Recently Dr Alaistar Orr, an ODA Economist who works at BRRI

and closely with the BRRI/IRRI Project has shown that with present prices of inputs and market price of rice that adoption of MV's is profitable. Yet we find that the increase in adoption of higher input levels for areas other than irrigated lowland rice is very slow and in some instances may actually be decreasing. It appears that farmers have at their disposal profitable technologies that they do not use.

Farmers generally have little cash and prefer not to take the risk of borrowing money (particularly if no irrigation). Farmers in Bangladesh have been especially affected by the increasing cost of inputs, natural calamities and a rather stable price of rice (due to food grain imports and government policy). On the other hand, the costs of food, clothing, school fees, electricity, and transportation have all increased. Farmers simply do not have the cash to buy inputs. Our research, particularly for farming systems research, must seek to identify ways by which farmers can increase cash income. Recent studies by the BRRI Farming System Division have shown that farmers having off-farm income tended to purchase more inputs and intensify their rice cropping systems compared to farmers who did not have the off farm income. There are, however, on farm technologies involving forage and small ruminant production and agro forestry that can provide some extra cash income. These activities would not likely detract farmers from food crop production but more than likely would promote crop intensification and adoption of new technologies.

Collaborative Research Initiatives

IRRI Scientists develop techniques to increase the production and economic well being of rice farmers. Within this international mandate research issues are also identified that are relevant to the various national rice research programs. IRRI scientists selectively collaborate with national rice research scientists in various aspects of these research efforts. Over the past year BRRI and IRRI scientists have collaborated in 15 different projects. These, for the most part, fall under the BRRI/IRRI umbrella. Two of the projects, Prosperity Through Rice-II and the Rainfed Rice Project have required special GOB approval. These collaborative projects are not unilaterally thrust on BRRI but in all cases require BRRI approval. Some proposed collaborative efforts have been either refused or modified by BRRI. Even in these cases, however, the proposed research has stimulated discussion and thinking.

The research support through the Project relates mostly to rice breeding and germplasm collection, irrigation and water management, agronomy and soil fertility management, integrated pest management and farming systems research. A collaborative research initiative on Women in Rice Farming Systems has been started and involves scientists from several divisions. The Project has supported the Applied Research and Training Division by sending teams of BRRI scientists to IRRI for the Training and Technology Transfer Course. On the other hand, more Project effort is needed to strengthen BRRI administrative support services and publications. This may be accomplished through on the job training opportunities.

FSR Perspective

Research information developed while keeping in mind the whole Farming System can contribute directly to the planning and development processes in Bangladesh agriculture. This is not disciplinary research but rather an approach to research. The BRRI Rice Farming Systems Division has recently begun the shift from a cropping sub-system research to a more holistic farming systems research program at Sreepur.

Over the next 1-2 years it would be useful if BRRI developed 5-6 FSR sites across the key environments (irrigated, rainfed lowland favorable, deep water, upland and coastal areas). Multidisciplinary on farm research is being developed within other institutions such as BARI, BAU, BJRI, BLRI and FRI. Opportunities for multiinstitutional interaction are coming and are to be encouraged.

With more focus on income and not solely on production BRRI can consider the usefulness of alternative agricultural enterprises in the farm systems. This will enable study of neglected areas such as agro forestry, small ruminants, women's issues and intensive vegetable crop production.

More focus on income will promote study of socioeconomic issues relating to the downward trend in the economic mobility of many farm households. Causative factors may be identified and interpreted within a whole farm/community perspective. Technology alone, whether it be monocrop or holistically based and ecologically sound, is not likely to be a solution to rural poverty.

Off-farm Income

Opportunities for generation of off-farm income is very important to rural agricultural production and rural economy. Agriculture research institutions per se have difficulty addressing this issue but it is very relevant to their mandates. The high investment in agriculture in Sitakunda, as was found in the FSR Impact Study, was most likely due to opportunity for off-farm income and resulted in higher agriculture income and production. Given that Bangladesh has 68,000 or more villages and an upazila based administration it would be useful to develop local industries to stimulate rural economics. Such a plan would indirectly support agricultural production and economy and reduce pressure on cities.

Technology Transfer

BRRI has developed effective linkages with Extension to facilitate transfer of systems based technology. From 1982 to 1988 multilocation testing and then pilot production initiatives were carried out to refine and implement technologies for rainfed lowland favorable, rainfed lowland drought prone and irrigated areas. Since that time other institutions such as BARI, BJRI and BAU have followed this process.

It is opportune to bring these activities of the various research institutions together at the Regional and District levels and to transfer the management process to Extension. The demonstration farms concept being developed at each Upazila by the DAE can be very useful for this process. Strong support from the research institutions is needed to develop this institutional outlet for systems based technology.

It is time to classify each FSR site according to the major agroecological environments and to delineate each major environment in each region, district and upazila of the country. The FSR technologies from various research institutions may be tested on the demonstration farms as appropriate. Given the environmental base of BRRI's FSR approach, BRRI may take the initiative in promoting the use of agroecological zone (AEZ) database in FSR and technology transfer.

Participant Training and Networking

Participant training includes post doctoral fellowships, advanced degree programs, short term training, conferences, workshops and monitoring tours. Government restrictions on travel for senior research and administrative officers hinder full participation by BRRI. In many instances IRRI (special projects) provide funding for workshops and monitoring tours. BRRI/IRRI Project funds are generally used for conferences. Following the August-September flood, the GOB restricted all travel for these activities. The training is on schedule considering delays in Project approval. A summary of these activities is included as Table 1.

Procurement

At present there is a shortfall in available funds compared to budgeted funds in the Project Proposal of US$ 670,963.00. Of this amount US$ 595,811.00 has been allocated to procurement for transport, scientific equipment, machinery, supplies and facilitaties improvement. This leaves for use only US$ 477,350.00 out of US$ 1,073,161.00 budgeted for this purpose (Table 2). This presents some constraint to the Project but we hope to identify funds to make up the shortfall.

TABLE 1. SUMMARY of Participant Training and Networking, 1988

I. Post Doctoral Fellowships	Budgeted slots	Offered slots	Used slots	Person months
Dr Nilufer Hye Karim	IRRI/Core	86-88	(1) Finished	11
Dr A K M Rezaul Karim	,,	88-89	(1) New	10
(Dr N H Chowdhury)	''	88-89	-	-
(Dr N M Miah)	''	88-89	-	-
(Dr K A Haq)	''	88-89	-	-
TOTAL			2	21
II. Degree Training				
A. Ph.D Abroad				
Finished	-	-	3	19
Continuing	-	-	5	60
Started (Phase III)	6	5	4	10
TOTAL			12	89
B. M.S. Abroad				
Finished	-	-	2	22
Continuing	-	-	2	24
Started (Phase III)	10	-	-	-
TOTAL			4	46

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(cont'd...Table 1.)

	Budgeted slots	Offered* slots	Used slots	Person months
C. Ph.D In-country				
Finished	-	-	-	-
Continuing	-	-	2	24
Started (Phase III)	16	16	1	2
TOTAL			3	26
D. M.S. In-country				
Finished	-	-	-	-
Continuing	-	-	-	-
Started (Phase III)	4	4	-	-
TOTAL				0
III. Short Term Training				
A. Training Courses (16 events)	32	30	18	57.5
B. Workshops and Meetings (14 events)	23	39	26	4.3**
C. Monitoring Tours	7	1	-	-
TOTAL			44	61.8

* mostly funded by IRRI Core and Projects
** ave of 5 day per meeting per person

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TABLE 2. Funding Sources and Amounts for BRRI/IRRI Project (in US Dollars)

Activity	USAID	CIDA	Other sources	Total
1. Manpower Training	1,021,294	305,220	-	1,326,514
2. IRRI Scientist Support	757,190	90,000	-	847,190
3. Transport, Scientific Equipment, Machinery, Supplies and Facilities Improvement	-	477,350	595,811	1,073,161
4. International Travel	-	162,170	-	162,170
5. In-country Travel	48,000	-	-	48,000
6. Construction Support	-	-	-	
7. IRRI Service Charge	173,516	95,450	65,152	334,118
8. IRRI Dhaka Office	-	299,810	-	299,810
9. Contingency	-	50,000	10,000	60,000
TOTAL PROJECT COST:	$2,000,000	$1,480,000	$670,963	$4,150,963

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PHOSPHORUS REQUIREMENT AND MANAGEMENT OF GRAIN LEGUMES

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ABSTRACT

Phosphorus requirement and management in grain legume production has been reviewed in light of: a) rates of application, b) sources of fertilizer, c) efficiency of utilization of various forms of P fertilizer, and d) interaction with other nutrient elements and water.

Experimental results show the positive response of grain legumes to P on many different soil types in different countries. The magnitude of responses are discussed in relation to liming, use of other nutrients, and sources and placement of P in the soil. In acid soils, liming may be necessary to allow for maximum effect of P fertilizers. P fertilization of grain legume crops may reduce the fertilizer N requirement of these crops in some crop systems. An adequate supply of P is an important factor for balanced fertility for production of grain legumes.

INTRODUCTION

Phosphorus is frequently a primary factor limiting the total protein and dry matter production of grain legumes. Consequently, investigations of P nutrition of grain legumes require detailed understanding of the sources, forms, rates and other factors which may affect uptake and crop performance (Barber 1985). Moreover, considerable emphasis needs to be placed on the efficiency of P utilization by different crops, since costs of P fertilizers may increase due to higher energy costs. Prasad and De (1980) reported that application of P fertilizer was the first step toward increasing legume production in India. Adequate P fertilization on the legume crop may eliminate or considerably reduce the amount needed for succeeding grain crops in a cropping system.

In this paper some of the factors which influence P nutrition of grain legumes are discussed. It is hoped that a better understanding may emerge of crop performance and P uptake in different soils and cropping systems.

REQUIREMENTS AND MANAGEMENT OF P FOR GRAIN LEGUMES

The P requirements of grain legumes in the field differ widely from site to site depending on the status of the availability of soil P and the management required to change the status. The management required depends upon the soil pH, organic matter, mineralogy and level of soil P.

Results of several experiments in Asia have shown that applications of P from 40 - 60 kg P_2O_5/ha are sufficient in many P deficient soils. At Tel Hadia (Syria) 1977-78, application of 50 kg P_2O_5/ha increased seed yield of broad bean significantly (Saxena, 1979).

An example of P uptake by nine grain legumes is shown in Table 1. Cowpea had the lowest uptake of 9.5 kg of P_2O_5 while soybean had the

highest uptake of 27.4 kg P_2O_5/ha. The range of uptake from low to high increased by a factor of three.

In soils with slightly acid to neutral pH's, the P requirement depends on:

1. level of soil P;
2. crops to be grown;
3. expected crop yield; and
4. nature of soil.

A sound and economic P management strategy for crops grown on acidic and infertile soils requires that other factors be taken into consideration. These include:

1. determining rates and placement of P fertilizer to increase its efficiency, both initially and residually.
2. use of cheaper, less soluble forms of P such as phosphate ck (PR), partially acidulated PR, and granulated mixtures of PR with more soluble forms of P.
3. use of stable and green manure to improve P availability.

RATES OF PHOSPHORUS

Several experiments have been conducted with a number of crops to determine the P rates necessary to maximize production. Although some of these experiments have included different P carriers, only triple superphosphate (TSP) will be discussed in this section.

Howeler and Leon (CIAT, 1978) established an experiment on a P deficient Popayan Typic Dystrandept, in Colombia with field beans. They used levels of P ranging from 0 to 2200 kg P_2O_5/ha applied before the first planting (Fig 1). The objective of this study was to determine the levels

of P necessary from both an initial and residual standpoint. The first harvest showed a good yield response up to 800 kg P_2O_5/ha and the second and third crops up to 400 kg P_2O_5/ha. Thus it would appear that 400 to 500 kg P_2O_5/ha would be adequate if only one P application was made. Since the yield of the third harvest was quite low it seems reasonable that these soils with high allophane contents were fixing large amounts of the applied P. One management strategy would be to apply less soluble forms of P initially, or to apply the soluble forms on an annual basis. These kinds of soils in many places are valuable for vegetable crop production. The productivity of the Andepts of Indonesia depends on the generous use of a combination of farmyard and green manure in addition to P.

Pigeonpea responses to P application on cultivators' fields in India have been found to be similar to chickpea or for most situations about 40-60 kg P_2O_5/ha (Kulkarni, 1980a; Singh and Marck, 1983 a). There are, however, situations where higher rates of 50-100 kg P_2O_5 may be used -for example, under New Delhi conditions (Saraf, 1983) and in certain black soil areas (Kanwar, 1986). Higher plant density of pigeonpea may also be used to increase yields but only if it were accompanied by P applications. In a plant population X P interaction study, increasing plant density from 50 to 100 thousand plants/ha increased pigeonpea grain yield by 9% at 40 kg P_2O_5/ha but the use of a higher plant density and P rate increased grain yield by 82% (Ahlawat and Saraf, 1981). Pigeonpeas receiving P were able to extract twice as much soil water from 60-90 cm soil depth as compared to the crop raised without P application (Ahlawat and Saraf, 1982). Phosphorus application is critical for cowpea production on many soils. Singh and Lamba (1971) reported that in low P soils, application of 40 kg P_2O_5/ha increased cowpea grain yield. Kang and Nangju (1983) reported that P

application influenced the contents of other nutrients in cowpea leaves. In a trial conducted at Sitiung, Indonesia using a rotation of peanut and upland rice, results indicated that both crops responded strongly to P fertilization. Peanut needed 80 kg P/ha to reach a yield plateau, whereas rice needed only 20 kg P/ha (Fig 2) (Sri Adiningsih et al, 1988). Application of 50 kg P increased soybean yield dramatically in P deficient soil in Nigeria, Africa. The response was greater when micro-nutrients were also added (IITA 1981).

Relation of P Response with Liming

If soil acidity is high, many times production can be increased if limestone is applied. There may be an exception, however, on newly opened lands with soils high in undercomposed organic materials. The correction of soil acidity by liming may increase Mo availability, supply Ca, improve the response to P and, consequently, increase (legume crop) production. When P fertilizer was broadcast and incorporated at various rates of lime application in Rio Grande do Sul, Brazil an interaction between rates of lime and P was observed. Higher yields were found at higher rates of P and lime application (Table 2).

Placement Effects of P Levels

When phosphate fertilizer is mixed with the soil, part of the P added is adsorbed by the soil, so that its availability to plants is reduced. The amount of P "tied-up" in this way varies with soil properties. As the rate of application is increased, the amount of P "tied up" from each increment added decreases. So, at very high levels of soil P only small amounts of each additional increment added may be tied up by the soil. This is why fertilizer often is banded, to reduce the amount of fixation by the

soil as compared to that occurring when the fertilizer is mixed with all the soil. The restriction of P to a small volume of the soil reduces fixation, at least in the short run, and leaves more of the nutrient in an available form for uptake by plant roots. However, this restriction also means that a small fraction of the root system will be in contact with the fertilizer band. This will tend to reduce uptake. The most efficient placement strategy would be somewhere between the extremes of complete mixing and mixing with 25% of the soil, which occurs with banding at planting. A balance between reduction in availability as fertilizer is mixed with more soil and increase in availability due to contacting more roots will determine the most effective placement.

For Andept soils of Latin America, P fertilization of row crops like beans is generally by row application at planting time. Numerous experiments have been conducted in order to determine which method of application is the best for the different crops.

Howeler and Leon conducted an experiment on a Typic Dystrandept soil near Popayan, Colombia, with varying P rates, sources and methods of application (CIAT, 1978). Three P fertilizers: TSP, basic slag and Huila PR from Colombia were applied in a triangle configuration (Fig 3). The triangle base simulated broadcast application; the tip, band application; and the intermediate section, strip application. Phosphorus was applied at rates of 75, 150 and 300 kg/P_2O_5/ha. Yields were significantly better when TSP was band applied rather than when broadcast or strip applied, especially at the rate of 300 kg/P_2O_5/ha. The band application of 75 kg P_2O_5/ha as TSP was as effective as 300 broadcast. The efficiency of the TSP was increased by reducing P fixation through minimizing soil-fertilizer contact. The method of application did not increase the efficiency of basic

slag. The efficiency of PR, on the otherhand, was slightly higher when broadcast and incorporated.

A second crop was reseeded in the same rows as the first without disturbing the original P treatments (Fig 4). Although banding TSP was beneficial for the first planting, it was not any more effective than other methods of application for the second.

Though more study is needed on the effects of placement for the various P sources, particularly on high P fixing soils, the above results do not support the conventional concept that major savings in fertilizer use can be achieved by localized placement of soluble P sources. For the widely distributed coarse-textured Alfisols and Ultisols in West Africa, method of P placement does not appear to be a critical factor affecting phosphate efficiency.

In India, drilling or placement of P below the surface is a recommended practice in improving the efficiency of fertilizer P in drylands. Surface broadcast of P is not advocated even if incorporated (Kanwar, 1986; Singh and Venkateswarlu, 1977). An average increase in yield of dryland crops due to placement of 40 kg P_2O_5/ha was 200 kg grain (Venkateswarlu, 1986). This is equivalent in value to the cost of 40 kg P_2O_5. In field trials at 5 locations, deep placement of 80 kg N + 40 kg P_2O_5/ha gave an extra 1130 kg sorghum grain over broadcast application (Venkateswarlu and Spratt, 1977). This advantage is two times the monetary value of the NP applied and resulted in an extra 9 kg grain/kg NP applied. Other results from Andhra Pradesh show that placement of P increased the yield of sorghum by 25% and of castor by 16% over broadcast application (Raman and Subba Rao, 1979).

For soybean and chickpea drilling P below the seed increased seed yield

significantly over broadcast P (Singh and Singh, 1986). The sowing of a mixture of seed + fertilizer was superior to broadcast (Table 3).

EFFECTIVENESS OF FERTILIZER CARRIERS

Results from semi-humid areas of West Africa (Kang and Juo,1979) showed greater efficiency of the more soluble forms of (monocalcium, dicalcium and ammonium) phosphates over rock phosphate sources and slags. The effectiveness of various P carriers was studied on two Alfisols and an Entisol and pronounced differences were observed between the single and compound (NP) carriers (Kang and Juo,1979). Ammonium orthophosphate (15-15-0), ammonium polyphosphate (15-62-0) and the less water soluble nitric phosphate (20-20-0, 35% WS) carriers were superior to triple superphosphate and rock phosphate sources. Superiority of the NP sources may be explained by the complementary effect of N. It has been shown that fertilizer N, especially in the ammonium form, enhances uptake of fertilizer P by plants if the P and N are chemically or physically associated (Grunes, 1959, Miller and Ohlrogge, 1958). Long-term trials to compare the effectiveness of some phosphate rocks and superphosphate (TSP) have been conducted at several locations on Ultisols and Oxisols in Sumatra. The results indicated that use of ground, Tunisia PR's were more effective in terms of response and residual effects than TSP (Fig 5) (Sri Adiningsih et al, 1988). Low water solubility and slow release P source can reduce P fixation in acid upland soils. Hence the use of PR in acid upland soils is more logical than using TSP. The effectiveness of PR varies depending on its reactivity, time of application, and soil properties.

Data from studies under dryland conditions are rather limited but in general fertilizers containing substantial proportions of their P in water

soluble form are preferred for field crops both in red and black soils (Kanwar, 1986). In acidic P-deficient soils, powdered rock phosphate has been advocated for grain legumes.

USE OF PARTIALLY ACIDULATED AND MINI-GRANULATED PR

From the experiments discussed, it is apparent that many PR's, although they perform well with time, are initially inferior to the more soluble P sources. In general PR must be finely ground to be effective. This creates an application problem as ground PR is quite dusty and hard to spread evenly on the field. With this in mind, McLean and Wheeler (CIAT, 1978) established a field experiment to determine both the effectiveness of partial acidulation and granule size of both high and low reactivity PRs, on yield of peanuts on a Carimagua Oxisol. The granules were made by taking finely ground PR, partially acidulating it with H_2SO_4, and granulating with a 3.3% KCl binder. Two particle sizes were used: powdered (<200 mesh) and minigranules. Ground, 10% acidulated PR was superior to minigranulated, 10% acidulated PR and other treatments at 100 kg P_2O_5/ha (Fig 6). But otherwise it appears that ground PR was the most effective P source.

Interaction of P with Other Nutrients

Phosphorus can interact strongly with other plant nutrients. It can promote increased efficiency of symbiosis and N fixation by grain legumes. The N concentration in the tops of P deficient legumes is usually low, and good correlations between P and N concentrations in tropical grain legumes have been established. This effect may be attributed to at least three possible functions: root development, nodulation and nodule efficiency and plant metabolism. Numbers and weight of nodules have been shown to increase in a number of legumes from application of P to deficient soils.

In studying P nutrition of plants it is necessary to take into account other nutritional and environmental factors. For example, strong interactions with pH and nutrients, such as, Ca, Al, Zn, and Mo may occur. Furthermore the species or cultivars of plants may have definite characteristics pertaining to one or more of these factors. Greater attention should be given to studies that include quantitative and qualitative assessment of root systems. For example, the role of mycorrhiza and other associated rhizosphere organisms, the utilization and re-utilization of P in relation to dry matter and N reduction in plant systems should be studied further.

Phosphorus application in rice-grain legume systems

In cropping systems, application of P to one crop may eliminate or considerably reduce the requirement of the succeeding crop. Srivastava and Pathak (1970) noted that P fertilizer applied to the legume in a rice-legume cropping pattern was more beneficial than applying the same amount on the rice. On soils testing low in P, 30-50 kg P_2O_5/ha should be applied. Band placement of P fertilizer is generally more efficient than broadcast. Deep placement of P is generally beneficial especially when the surface layers become dry.

On the basis of several years of cropping systems studies in India, P is applied for the dry season crops such as grain legumes rather than for the wetland rice crop. It was assumed grain legumes can not effectively use Fe-P, which is the major transformation product of P, after lowland rice. However, where soil P is very deficient, P application to both crops would be necessary (Mahapatra et al., 1981).

Juber and McIntosh (1983) reported from Indonesian studies that soybeans grown after lowland rice that had received applications of P rarely responded to NPK fertilizer. After upland rice, however, the situation was different and P applications increased soybean yields substantially.

They also reported results from an experiment involving a continuous cropping of a sequence of rice-soybean-corn receiving different fertility treatments (Table 4) on a Typic Dystropept soil. Soybeans grown after lowland rice were not responsive to treatments of NPK, crop residues and manure but tended to grow and yield as well as soybeans grown after upland rice where NPK was added. Soil conditions after lowland rice appeared to enhance P availability. On the other hand, soybeans grown after upland rice responded positively to NPK and NPK plus crop residues and manure treatments.

SUMMARY

Grain legume response to P application differs widely with soil and climate. Proper management of fertilizer P is a major factor in sustaining intensive cropping and high yields of grain legumes and other crops. Phosphorus requirements of crops differ widely but applications of 40 to 80 kg P_2O_5/ha is required in most soils. Band placement is likely to be superior to broadcast P particularly in acid soils with low pH's. Water soluble forms have greater use efficiency than PR and other less soluble forms of P. Management of intensive high yielding crop systems, requires a good understanding of the interactions between P, the soil and other nutrients. Proper management of soil organic matter and application of farmyard and green manures are important to maintain and improve P use efficiency in soils.

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Table 1. Phosphorus uptake of nine grain legumes under field conditions, India

Legume	Uptake per M. ton produce range	average
	kg P_2O_5	kg P_2O_5
Cowpea		9.5
Pea		14.5
Chickpeas	6.2-12.2	8.9
Greengram	20.5-24.3	22.6
Blackgram		10.0
Lentil	7.1-15.3	11.3
Pigeonpea	12.7-21.5	18.0
Soybean	20.7-39.9	27.4
Groundnut(pods)	10.5-42.8	17.2

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Table 2. Effect of liming and P fertilization on soybean yield of an Oxisol. Rio Grande do Sul, Brazil.

P_2O_5 applied,	Soybean production			
	Lime applied, t/ha			
	0	6.6	13.2	19.8
Kg/ha	Grain Yield, kg/ha			
0	1203	2000	2044	1925
150	1438	2205	2262	2380
300	1844	2376	2558	2529
450	1984	2652	2822	2815
600	1804	3053	3230	3205

(Raij 1979)

Table 3. Relative comparison of yield for methods of P application for chickpea and soybean.

Method of P Application	Chickpea	Soybean	
	kg P_2O_5	40 kg P_2O_5/ha	50 kg P_2O_5/ha
Broadcast	100	100	100
Drilled	137	123	169
Mixed with seed	118	123	135

References: Singh and Singh (1986); Venkateswarlu (1985)

Table 4. Cumulative yield of a five year rice- soybean -corn cropping pattern. Bogor, 1974-1979.

Treatment	Rice		Soybean		Corn	
	Lowland	Upland	After LLR	After ULR	LLR-Soy	ULR-Soy
No NPK + No crop residue	6.38	4.37	5.78	4.70	7.71	5.46
No NPK + Crop residue as mulch	7.80	5.07	5.39	4.69	8.45	5.87
No NPK + Crop residue incorporated	9.12	5.23	5.71	5.25	8.84	6.79
No NPK + Animal manure	7.39	5.06	5.97	5.20	8.41	6.38
NPK* + No crop residue	15.36	12.54	5.45	5.74	16.29	16.03
NPK + Crop residue as mulch	18.46	13.10	5.91	5.92	15.98	17.12
NPK + Crop residue incorporated	18.86	12.78	5.71	6.08	16.23	16.24
NPK + Animal manure	15.99	13.31	5.94	5.82	16.16	17.13

*The rates of NPK were 120-19.6-41.5; 20-19.6-41.5 and 120-19.6-41.5 for rice, soybean and corn, respectively.

Source: Suhartatik et al. (1981) as reported by Juber and McIntosh (1983).

FIGURE CAPTIONS

Fig 1. Field bean response to P_2O_5 in Popayan, Columbia (Source: CIAT Annual Report, 1978).

Fig 2. Yield response to an initial broadcast application of TSP on a peanut - upland rice rotation second year after clearing a clayey, Typic Paleudult soil at Sitiung, Sumatra.

Fig 3. The effect of fertilizer distribution, applied at three levels and sources of phosphorus on bean yield in Popayan. Source CIAT, Annual Report 1977.

Fig 4. Bean yield (average of three P levels) showing initial and residual effects of the distribution of fertilizers applied as three sources of phosphorus. Source: CIAT Annual Report 1977.

Fig 5. Comparison of the response of soybean to PR and TSP on Oxisols in Jambi, Sumatra.

Fig 6. Effect of TSP, Florida PR, partially acidulated Florida PR and granule size on yield of peanut grown on a Carimagua Oxisol.

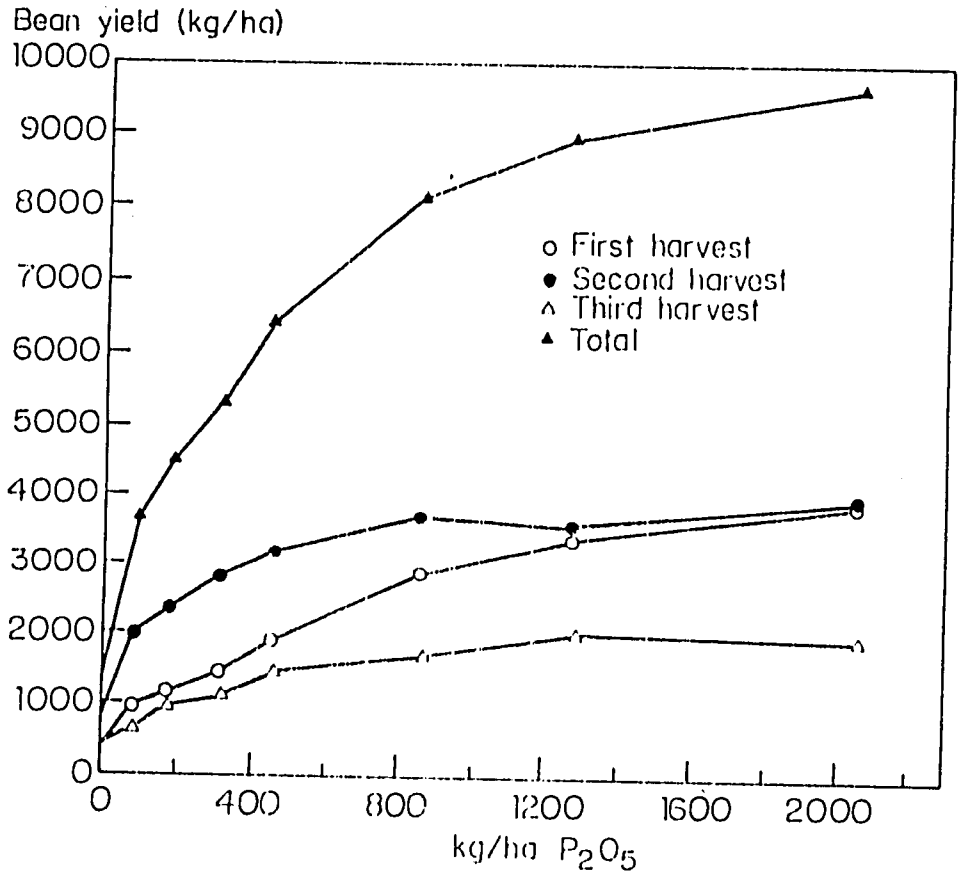
Bean yield (kg/ha)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
400
800
1200
1600
2000
kg/ha P_2O_5
o First harvest
● Second harvest
∧ Third harvest
▲ Total

FIGURE 1.

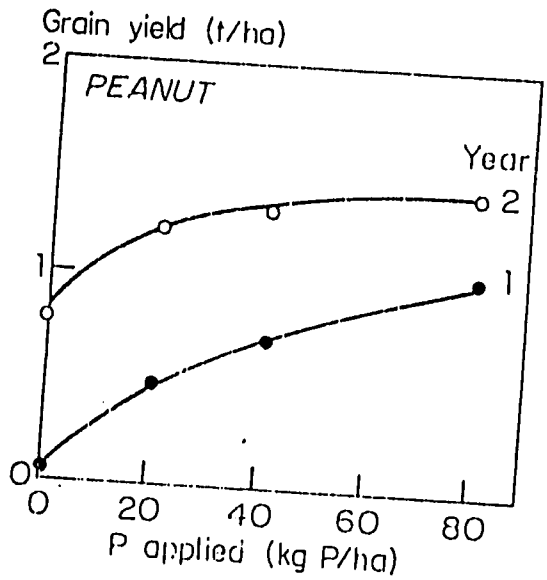
Grain yield (t/ha)
2
PEANUT
Year
2
1
1
0
0
20
40
60
80
P applied (kg P/ha)

FIGURE 2.

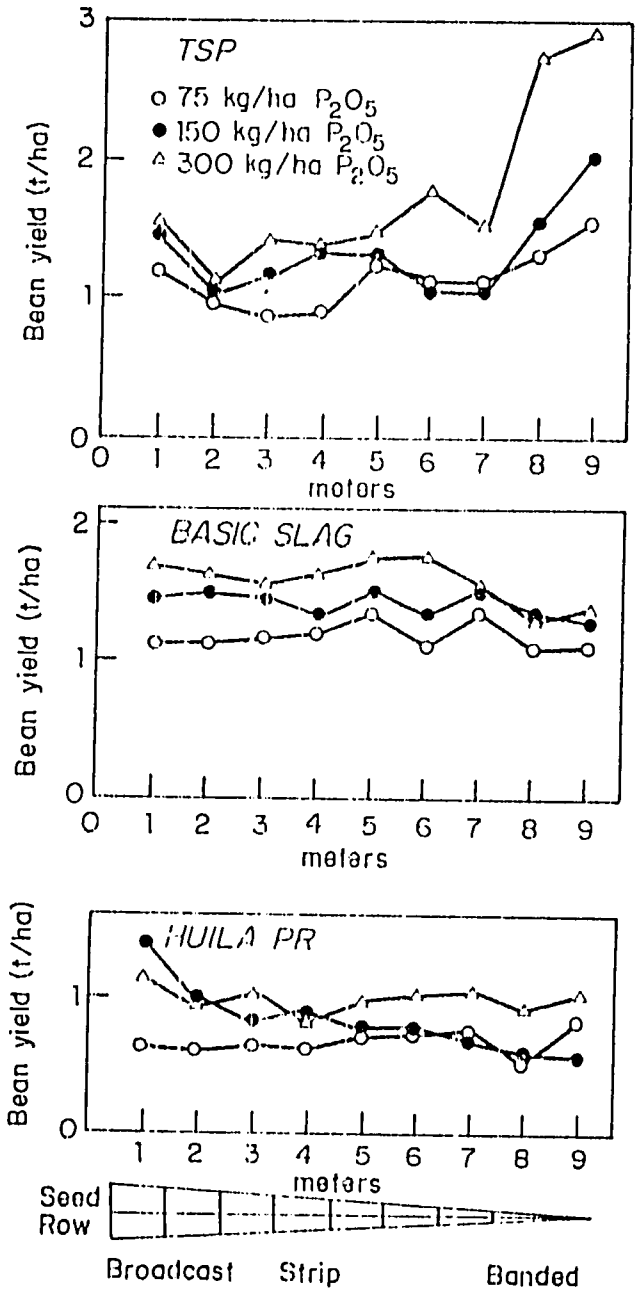
TSP
o 75 kg/ha P_2O_5
● 150 kg/ha P_2O_5
△ 300 kg/ha P_2O_5
Bean yield (t/ha)
meters
BASIC SLAG
Bean yield (t/ha)
meters
HUILA PR
Bean yield (t/ha)
meters
Seed Row
Broadcast
Strip
Banded

FIGURE 3.

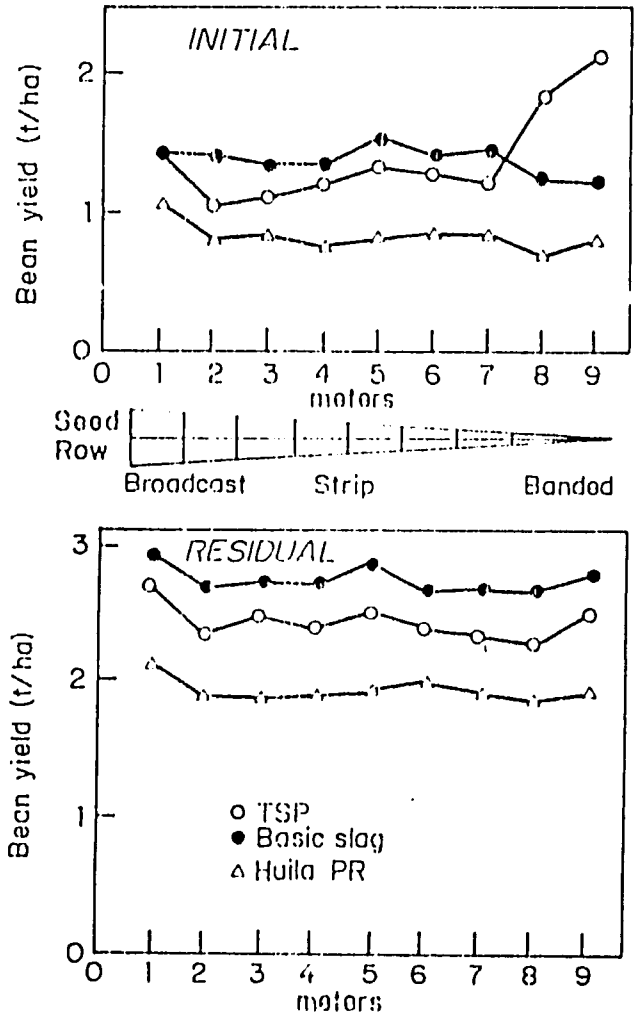
INITIAL
Bean yield (t/ha)
2
1
0
0 1 2 3 4 5 6 7 8 9
meters
Seed Row
Broadcast
Strip
Banded
RESIDUAL
3
2
1
0
o TSP
● Basic slag
△ Huila PR

FIGURE 4.

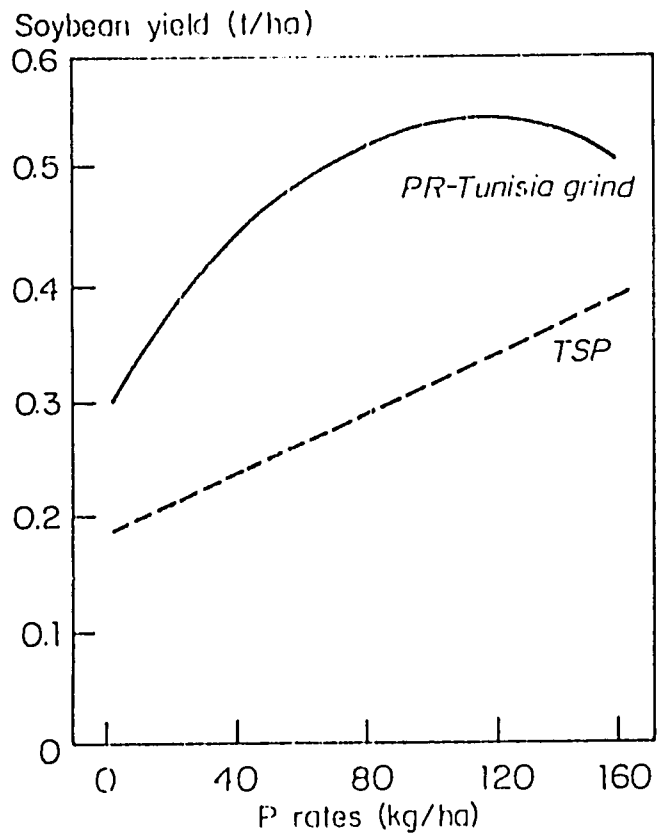
Soybean yield (t/ha)
0.6
0.5
0.4
0.3
0.2
0.1
0
PR-Tunisia grind
TSP
0
40
80
120
160
P rates (kg/ha)

FIGURE 5.

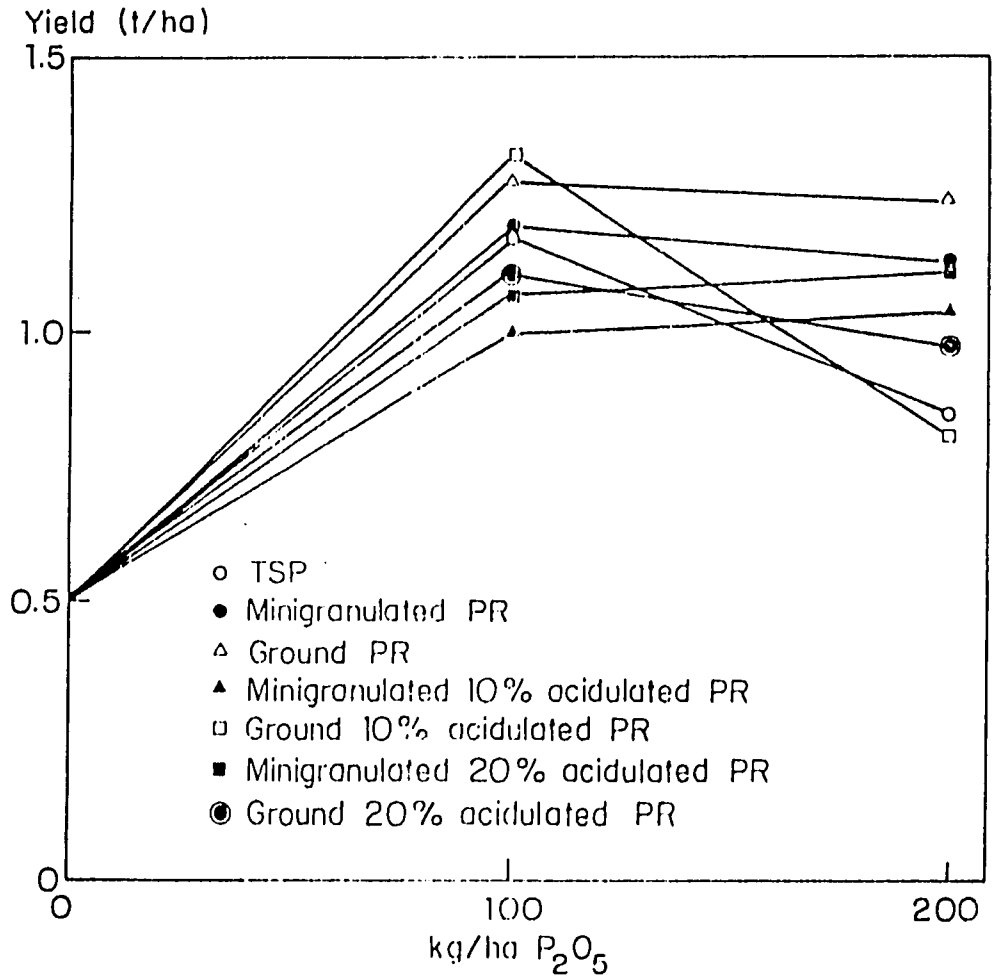
Yield (t/ha)
1.5
1.0
0.5
0
0
100
200
kg/ha P_2O_5
TSP
Minigranulated PR
Ground PR
Minigranulated 10% acidulated PR
Ground 10% acidulated PR
Minigranulated 20% acidulated PR
Ground 20% acidulated PR

FIGURE 6.

ATTACHMENT I.

QUARTERLY REPORT

OCT-DEC 1988

NOEL P MAGOR

AGRONOMIST (FARMING SYSTEMS)

BRRI/IRRI PROJECT, DHAKA, BANGLADESH

I. PRINCIPAL ACCOMPLISHMENTS AND ACTIVITIES

A. Sreepur Farming Systems Research Site

The Sreepur Upland Site is part of the nationally coordinated Farming Systems Research Program under BARC (Jan 1986-Jun 1989). My involvement in this project only began in September with assistance in preparation of the annual report and workplan for the coming year. Attention focused on two areas:

i) Collating and interpreting the whole farm monitoring (Appendix 1) ; and

ii) Developing whole farm model systems through ex ante analysis for testing (partial and intensive intervention) that built on the existing system.

Interventions included goats, rainfed vegetable production, rice mixed with corn and followed by a pulse and introduction of hand irrigation (Rower Pump). Increased biomass for goats will be achieved through extra planting of grass/legume fodder trees near homesteads. Extra generated cash was estimated at Tk 10-12,000 for a small farmer with an additional outlay of Tk 3000. A component study on chickens will be conducted but it will not be included in the model system.

So far in 5 field visits the farmers have ranked potential income sources as goats, vegetables, banana/papya garden, sugarcane and winter rice. It is anticipated that after final farmer review the intervention plan will be initiated by late January.

For each monitored family, a family profile folder is being prepared to enable a greater awareness of the family social/economic position and thereby more creative dialogue during visits.

An experiment review meeting was held at BARC for all livestock experiments, which was followed up with visits to BLRI and also Development Service Centre Goat farm in Savar.

B. Impact Study Phase II

The initial study in the Rainfed lowland environment of Sitakunda and Kamalganj Upazilas of Chittagong and Maulvibazar Districts respectively showed that:

> 'the impact of the technology and the level of adoption was influenced by remoteness or ready access to markets, the diversity of income sources and the level of off farm employment.'

Dr Islam, Director Research, BRRI suggested that rather than take a new site in Phase II as was previously indicated (Quarterly Report 1988, Jul - Sep) it would be more advantageous to further research the issues at the original two sites. The additional emphasis of overcoming the constraints and identifying solutions would assist policy makers and administrators.

The budget revision from one site to two sites has meant a reduction in staff at the site. Data management is being reviewed in light of a reduced site budget and a desire for less intense data gathering.

It is anticipated both sites will be operationalised by the end of January 1989. Revised project proposal is attached (Appendix 2).

C. Intensification of Rainfed Lowland Cropping System

BRRI RFS Division has researched the fine tuning varietal recommendations for the Aus - T.Aman system at both Joydebpur and

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Comilla stations since 1985. Intensification of this system with the establishment of an upland crop after T.Aman is now the major objective. Two issues are being addressed:

i) choice of Aus and T.Aman lines to enable early harvest of T.Aman, and thereby early establishment of the upland rabi crop; and

ii) identification of pulse crops that fit this system.

Timing of operations is important and the initial year experiment has suffered a little from delays in harvest and transplanting of rice crops. It is felt this has delayed sequencing by 10-14 days. In the future this experiment should shift to working with farmer cooperators, rather than at Regional Stations.
(see Trip reports-Appendix 3,4).

D. Asian Rice Farming Systems Working Group Meeting

The 19th meeting was held in Bagio Philippines November 11-14. Sixteen countries participated. From Bangladesh Dr Abedin, OFRD BARI and myself attended. Through this forum IRRI has provided a facilitating role in the development of Farming Systems Research methodology in the Asian region. Traditionally the meeting has centered around country reports coupled with a number of special project papers (such as Crop-Livestock). The emphasis this year was the special areas of research that are listed as follows:

Crop-animal system (with field visit)

Rice-fish system

Assessment of Impact of Farming Systems Research

Women in Rice Farming

Prosperity with rice

Rice-wheat cropping systems

Longterm cropping pattern and fertilizer trials

Establishment of upland crops using inverted T planter

Farmer participation in FSR

Farming Systems Training

Research extension linkage

Issues in sustainable agriculture

Environmental classification for extrapolation

Data management in FSR

Future direction for ARFSN

The highlights for each area are covered in the attached report (Appendix 5). I presented paper on Research-Extension Linkage in FSR (Appendix 7). The 20th meeting will be held in Beijing, China. with programs being stratified by environment. The intention is to enable the above research component sub-systems to be interpreted more within a holistic framework.

II. OTHER ACTIVITIES

A. Women in Rice Farming

Ms Thelma Paris and Mr Bart Duff, Coordinator of IRRI activity on Women in Rice Farming Visited Dec 12-16 and facilitated meetings with Dr Abedin, OFRD BARI; Dr Nizam, RFS BRRI and Ford Foundation, Women's program representative Ms Asmeen Khan.

B. IDRC Technical Report 1987

Assistance was given in drawing together the Rice Farming Systems Divisional activities into an annual technical report for IDRC. The

IDRC project finished Jan 31, 1988. The 1987 Technical Report is available on request.

C. BARC orientation day for Checki Group

D. Consultation

Ms Sylvia Torres (CARE). Use of crop cut in LOTUS irrigation project assessment

Ms Pat McLaughton (CONCERN). Labour and loss of employment time due to recent flood and timing of FFW.

E. Field Crops Research Technical Paper

Submitted redraft of paper on genotype X environment and Aman rice crop.

F. Prepared draft proposal on incorporation of economic mobility study into farming systems research. Emphasis will be on vulnerability in relation to farm size and effect of whole farm intervention in reducing vulnerability.

G. Satkhira Cyclone Assessment (Appendix G)

APPENDICES

1. Whole Farm Monitoring
2. Assessment of Impact of Systems Research on Small farmers in a rainfed environment in Bangladesh, 1989-1991.
3. Trip Report: Comilla, Nov 2, 1988
4. Trip Report: Comilla, Nov 22, 1988
5. Trip Report: Highlights ARFSN Working Group Meeting, Nov 11-14, 1988
6. Trip Report: Meherpur, Satkhira Districts, Dec 6-9, 1988
7. Research-Extension Linkages in FSR in Bangladesh

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SREEPUR FARMING SYSTEMS SITE

Whole Farm Monitoring

Co-operating farmers were selected from each land group for whole farm monitoring. Agriculture income, expenditure, consumption and by product use were monitored on a daily basis. The plot wise labour, power, inputs and outputs were recorded daily to determine costs of production, levels of input use, cultivation practices, cropping patterns sequence and returns on investments.

To compare landtype and cropping pattern distribution, 5 small, 4 medium and 2 large farmers were monitored closely. Average farm size for sample small, medium & large farmer was .85, 1.9, 3.8 ha respectively. Percent of rainfed chala and byde land holding among the different farm group small, medium, large was 76 chala 14 byde, 68 chala 18 byde, 57 chala 22 byde respectively. Irrigated area covers for the small & medium and large farmers are 10%, 14% and 21% respectively (Table 1). It should be noted that the proportion of owned byde land increased with increasing farm size. Smaller farmers owned a greater proportion of chala land.

Sugarcane as sole crop is the main cropping pattern in the chala land for all farm groups and covers about 61% of the total chala land (Table 1). Aus-Fallow, Aus-blackgram and Aus-Brinjal are the other cropping patterns in chala land. The percentage of land under sugarcane was greatest for large farmers. Fallow-T.Aman is the main cropping pattern for the medium large group of farmers in byde rainfed condition. Where as the small farmers have 63% Aus-T.Aman cropping pattern. This indicates a more intensive land use amongst small farmers. Byde irrigated T.Aman-Boro is the main cropping pattern for all farm classes.

Comparison of production, gross return, total cost and net return for major cropping pattern of small, medium and large farmers chala rainfed land type is in Table 2(a). From the table it shows that net return from the sugarcane alone cropping pattern is highest in case of small farmer, though the production and gross return is less than the other group. This bears the intensive care and less hire labour. Production and net returns for Aus-Fallow and Aus-Blackgram cropping pattern were similar for all land classes. Aus-Brinjal was to be the most profitable cropping pattern for the big farmers of rainfed chala land. On 15% byde land that is irrigated the pattern Aman-Boro cropping pattern has the highest yield and net return over all patterns (Table 2b).

Total yearly income, and expenditure for small, medium and large farmers reveals that small farmers have more income from vegetables and livestock sources (Table 3) Farmers from medium and large group have no income from farm labour. From the sample none of the small and big farmers were engaged in business or service. With increasing farm size household expenditure increased from Tk 12,000 per annum to Tk 15,700. Extraordinary spending for Eid festivals and house repairing was 5 to 8 times higher for medium and large farmers compared to small farmers. Level of expenditure on crop inputs and hired labour increased with increasing farm size but expenditure on livestock declined. The medium farmer had the highest balance of Tk 12,447/annum; with the small farmer sharing a negative balance of Tk 773.

Highest agriculture expenditure coincided with the harvesting time of sugarcane in last quarter (December) and January to March in the first quarter, Agriculture income was highest from January to June with the principal source being sugarcane and Jackfruit. The income and expenditure patterns over the year were similar for each class of farmer but the amount increased with increasing farm size.

Table 1. Comparison of land type & cropping pattern distribution for small, medium & large farmers at Sreepur FSR site, 1987-88.

Land category	Percent land type		
	Small	Medium	Large
1) Chala	76	68	57
2) Byde			
i) Rainfed	14	18	22
ii) Irrigated	10	14	21
Total	24	32	43

Farm size : Small : 0.85 ha. Medium : 1.9 ha. Large : 3.8 ha.

Land category	Percent land type		
	Small	Medium	Large
1. Chala			
Sugarcane	62	50	70
Aus-Fallow	20	16	4.5
Aus-Blackgram	7.5	22	10
Aus-Brinjal	0	0	8
2. Byde (Rainfed)			
Fallow-T.Aman	37	100	83
Aus-T.Aman	63	0	17
3. Byde (Irrigated)			
T.Aman-Boro	100	100	100

Note: Minor cropping patterns not included (e.g. Bringal-Fallow, T.Aman seedbed-Blackgram). So percentate total not exactly 100.

Table 2(a). Comparison of production, Gross return, Total cost and net return for major cropping pattern of small, medium and large farmers at Sreepur FSR site, for Chala Rainfed land type, 1987-88.

Land type	Major cropping pattern	Farm size	Production						Gross return (Tk/ha)	Total cost (Tk/ha)	Net return (Tk/ha)
			Product (kg/ha)			Byproduct (kg/ha)					
			Aus	Aman	Boro	Aus	Aman	Boro			
Chala Rainfed	Sugarcane	Small		3940			3800		40160	16721	23439
		Medium		4325			4370		41350	18203	22847
		Large		4178			4225		42564	22127	20437
	Aus-Fallow	Small	1626	-		3226	-		11668	4787	6881
		Medium	2010	-		3860	-		12986	4930	8056
		Large	2120	-		3940	-		13485	5000	8480
	Aus-Blackgram	Small	1726	1292		3019	174		27214	11428	15786
		Medium	1670	1300		3260	175		28215	11925	17629
		Large	1699	1302		3310	175		28642	12500	16142
	Aus-Brinjal	Small									
		Medium									
		Large	1630	17290		3420	-		58952	18680	40272

Figure indicates average of 5 small, 4 medium and 2 large farmers.

Table 2(b). Comparison of production, Gross return, Total cost and net return for major cropping pattern of small, medium and large farmers at Sreepur FSR site, for Byde Rainfed and Irrigated land type, 1987-88.

Land type	Major cropping pattern	Farm size	Production						Gross return (Tk/ha)	Total cost (Tk/ha)	Net return (Tk/ha)
			Product (kg/ha)			Byproduct (kg/ha)					
			Aus	Aman	Boro	Aus	Aman	Boro			
Byde Rainfed	Fallow-Aman	Small	-	3075			5765		19794	6010	13784
		Medium	-	3160			6025		20392	6527	13865
		Large	-	3364			6240		21622	7125	14497
	Aus-Aman	Small	1715	2580		3318	5650		27872	11797	16075
		Medium									
		Large	1870	3070		3010	5070		31210	1387	17383
Byde Irrigated	Aman-Boro	Small	3170	4827			5690	6275	49965	16780	33185
		Medium	3450	5020			5870	7980	53510	17000	36510
		Large	3490	5410			5616	7080	55298	16142	35188

Table 3. Comparison of total income, expenditure and balance (through out the year) for small, medium and large farmers at Sreepur FSR site, 1987-88.

Items	Income Tk/annum		
	Small	Medium	Large
Rice	537	7200	14500
Sugarcane	14250	19050	39262
Vegetables	950	650	350
Fruit	1260	1824	2650
Livestock	640	350	150
Farmlabour	265	-	-
Business/service	-	13727	-
Others	800	250	-
TOTAL	18702	43051	56912

Items	Expenditure Tk/annum		
	Small	Medium	Large
Crop inputs	3200	4490	9635
Labour	1150	2710	7560
Livestock	1235	950	150
Food and others Households expenses	12102	13294	15673
Extra ordinary expenses	1788	9160	14650
TOTAL	19475	30604	47668
Balance	-773	12447	9244

Figure indicates average of 5 small, 4 medium and 2 large farmers.

APPENDIX 2.

ASSESSMENT OF IMPACT OF SYSTEMS RESEARCH ON SMALL FARMERS IN A RAINFED ENVIRONMENT IN BANGLADESH 1989 - 1991

A project proposal submitted to IRRI - IDRC by RFSD, BRRI through Director (Research) and Director General , BRRI Revision December 5, 1988 (original submitted September 22, 1988).

1.1 Introduction:

The Rice Farming Systems Division of the Bangladesh Rice Research Institute has recently conducted an impact study of systems research recommendations at two rainfed sites. This preliminary study showed that farmers had benefited in increased production and farm income from the recommended technologies. It also showed that the impact of the technology and the level of adoption was influenced by remoteness or ready access to markets, the diversity of income sources and the level of off farm employment. This was the indication and more understanding is needed so that necessary policy decisions if appropirate can be taken.

It is proposed as part of a three - year project to continue with this study to enable greater understanding over time and to enable at the same time parallel research to be undertaken that addresses the research/extension and socio economic problems that are emerging. At the same time refinements in the methodology of impact assessment and a further development of this skill within the Institute will be achieved.

1.2 Proposed Sites and Justification:

Sitakunda Site

Located in the Chittagong District, BRRI scientists and Extension workers have conducted multilocation tests of the MV aus MV aman technology for over four years and have completed an initial impact assessment of the site.

The site is near to Chittagong city and is rice deficit. There is much opportunity for off farm employment at factories and diversity of agriculture enterprises is high.

Kamalganj Site

Located in the Moulvibazar district in greater Sylhet the site was operated from 1979-85 for agriculture research and development by the Voluntary Agency HEED. The technolgy developed at the Bogra site in 1975-1979 was introduced through MLT and refined through on site research. An initial impact assessment was made in 1987.

The site is characterised by high varietal adoption but low input use. Kamalganj is rice surplus.It is remote and off farm income sources are minimal.

1.4 Objectives of the Study:

(i) to determine the extent of adoption of the technology by the farmers;

(ii) to examine the relationship between the level of adoption and other factors eg. farm size, land tenure, age and education;

(iii) to determine the extent of resource use and productivity of the crops and cropping patterns according to the extent of adoption;

(iv) to assess the impact of modern farming systems technology on farm income, total income, food consumption and expenditure patterns.

(v) to generate data based information that would be helpful in decision making for the policy planners.

1.5 Hypothesis:

(i) most of the farmers are responsive to the technologies;

(ii) farm size land tenure, age and education level of the respondent have no influence on adoption;

(iii) level of input use and productivity of scarce resources varies according to the extent of adoption;

(iv) level of input use and productivity of scarce resources are higher for modern varieties than local varieties in all crop seasons;

(v) farm income and total income varies according to the extent of adoption;

(vi) the calorie and protein intake also varies according to the extent of adoption;

(vii) the level of dependence on purchase of calories varies according to the extent of adoption;

(viii) the level of expenditure on health, education and social functions varies according to the extent of adoption;

(ix) and the level of debtedness varies according to the extent of adoption.

1.6 Site Operation and Management:

The site will be operated from the head quarter of the BRRI. The day to day management of the project will be done by the Senior Agricultural Economist in the RFS Division under direct supervision of the head, RFS Division. An Agronomist from the RFS Division and an Agricultural Economist

1.8 Fund disbursement:

Fund would be released by IDRC to IRRI as a part of an international program between IDRC and IRRI. IRRI then would provide the appropriate amount (in local currency) supposed to be for Bangladesh (BRRI) to the Director General, BRRI through IRRI country representative in Bangladesh.

1.9 Additional opportunities:

It is also understood that a micro computer and a MS scholarship (in abroad) would be provided to BRRI (RFSD) through this project out of IDRC fund. Detail mechanism would be worked out later by BRRI and IRRI for the computer procurement and the MS program operation.

from the Agricultural Economics Division will assist with the agro-economic and environmental interpretation. Mr. N. P. Magor will also be involved with the project. In addition, another Agricultural Economist from IRRI-IDRC will provide technical consultancy from time to time. One site supervisor and two interviewers/site will be employed. One typist-cum-computer assistant will also be employed and will be responsible for clarical support and data entry.

1.7 Work Plan:

Two years monitoring and survey will be made at the site. The monitoring years will be from April 1989 to March 1991. The rest 9 months of the year will be for data analysis and report preparation. Yearly compilation of data will be made in preliminary report form at the end of each cropping year. While the final data compilation, analysis and report preparation will be done during 9 months of the years i.e. in 1991. One site supervisor and two interviewers per site will be selected in March 1989 and they will be appointed for the period of April 1989 to May 1991. One computer assistant will be for the whole project period. The following schematic work plan will give a clear picture.

(i)	Selection of site supervisor Interviewers and Computer Assistant	Feb - Mar, 1989
(ii)	Training of the site staff	Mar 15-30, 1989
(iii)	Farmers selection	Feb - Mar, 1989
(iv)	Monitoring and entry	Apr 1989- Mar 1991
(v)	Data analysis and reporting	Apr - Dec 1991

BUDGET: IMPACT STUDY 1989-1991 (Bangladeshi Taka).

ITEMS	1989	1990	1991	TOTAL
Operating:				
Site Supervisor 1 at Tk 3000/m/site effec. Jan 1990 increment @100/m	54,000.00	74,400.00	32,000.00	160,400.00
Interviewers 2 at Tk 2000/m/site effec. Jan 1990 increment @50/m	72,000.00	98,400.00	42,000.00	212,400.00
Computer Operator 1 at Tk 2500/m effec. Jan 1990 increment @100/m	15,000.00	31,200.00	32,400.00	78,600.00
Travelling:				
Economist One trip /6 wks X 2 at Tk 2000/m/trip	32,000.00	32,000.00	16,000.00	80,000.00
Agronomist One trip in month at Tk 2000/m/trip	24,000.00	24,000.00	10,000.00	58,000.00
Head RFS Division/Economics Two trips /y at Tk 2000/trip	4,000.00	4,000.00	0.00	8,000.00
Site Supervisor at Tk 300/m X2	7,200.00	7,200.00	3,000.00	17,400.00
Female interviewers at Tk 200/m X 4	9,600.00	9,600.00	4,000.00	23,200.00
Office furniture	6,000.00	-	-	6,000.00
Office rent for 29 months at Tk 200/m/site	4,800.00	4,800.00	2,000.00	11,600.00
Diskette/computer papers	5,000.00	3,000.00	3,000.00	11,000.00
Stationary at Tk 5000/yr	5,000.00	5,000.00	5,000.00	15,000.00
TOTAL TAKA:	238,600.00	293,600.00	149,400.00	681,600.00
US$ 1 = Tk 32.00	7,456.25	9,175.00	4,668.75	21,300.00

Budget Notes

Site supervisor:

One site supervisor/ site will be appointed for the period of 2 years and 5 months starting from April 1st 1989 up to May 1991 on a full time basis. He will supervise the day to day work of the interviewers and will get Tk. 100 / month from Jauary 1st 1990 in addition to his normal salary.

Interviewers:

Two interviewers/ site will be appointed for the same period as the site supervisor will be appointed. They will be located at different place of the study area and will be responsible to collect all the required data and will do required calculations and coding. They will get Tk. 50/month from January 1st 1990 in addition to their normal salary.

Computer Operator:

A computer operator will be appointed for the whole period of the project. He/she will get additional salary of Tk. 100 /month from the second year and another TK. 100/month from the third year untill the end of the project period. He/she will do coding, calculations, data entry and word processing job.

Travelling:

Travel fund would be utilized as per BRRI rules. It is expected that the transport of IRRI will be available as needed but more generally scietists will travel to the site by train. The site supervisor will be provided with Tk. 300/month to cover the travel costs.

Office furniture and rent:

Within the study area an office will be rented for the period of 29 months starting from January 1989 and will be furnished adequately.

Disketts/computer paper/stationery materials:

Disketts, computer paper and stationery materials like duplicating paper, duplicating ink, pencil, file cover, file board etc. will be purchased as and when it will be required.

Appendix 3.

TRIP REPORT: COMILLA, NOVEMBER 02, 1988

Participants: Noel P Magor and Zahurul Islam, SO, Comilla

Flood Damage

Comilla District was very severely affected by the floods (late June/early July) and August-September and subsequently the heavy rain in October. S.M.S. Horticulture, Md Sayed Ali, reported that 50 percent of DWR (deepwater rice) and 40 percent of T.Aman was damaged by flood. The most severely affected upazilas were the low lying upazilas on the Meghna flood plain of Debidwar, Muradnagar and Daudkandi. The district final report stood at:

	Achievement	Complete damage
Aus	207281 acres	46675
T.Aman	244596	88000
DWR	156439	84360

A field visit was made to the Daudkandi area. BRRI had an experiment on mixed Aus/Aman followed by Rabi. This area was totally submerged by rapid flood in July (see trip report 3rd Quarter), with the consequence that the mixed Aus was totally destroyed. The flood in the late August and early September badly damaged the remaining DWR (B.Aman). What survived was damaged at flowering in October by heavy rain. The plot plant population was very sparse and sterility of panicles was extremely high. The anticipated yield was about 250 kg/ha maximum. The amount of biomass was also very low. The farmer reported that he normally harvests about 30 maunds of paddy from DWR but this year he expected 2 maunds. This was very typical of many farmers in the Daudkandi area.

The performance of DWR was influenced by cropping patterns.

Boro rice	- DWR	later sowing of DWR and minimal yield due to early flood.
Rabi crops	- DWR	earlier sowing of DWR and some yield (greatly reduced)

Comilla Regional Station Experiment

BR14 and BR18G7 should be harvested by mid November (latest Nov 20). Unfortunately T.Aman plantings were delayed until late August despite harvesting of Aus in first week of August. This has continued to prove a constraint in conducting cropping pattern experiments at Research Stations. Instructions to clear drains to allow water to drain from fields was given.

Seed for Rabi crops (Khesari, pigeon pea and lentil) and instructions to purchase wheat and pea seed were given. The fodder Dolichus lab lab seed that may prove promising after T.Aman was also provided for observation planting.

Appendix 4.

TRIP REPORT: COMILLA. NOVEMBER 22, 1988

Participants: Noel P Magor, Jerry L McIntosh and
Md Ghani (Comilla Regional Station Head)

Comilla Regional Station

Met with Md Ghani, who had recently joined as Station Head at Comilla Station.

i) The Dolichus lab lab (varieties Ronagal and Highworth) was about 30 to 45 am high with about 95+ percent germination. Petri dish germination tests indication was only 20 and 40 percent germination respectively. The seed had been planted in the organically rich garden which has contributed to some early fusarium wilt (damping off).

ii) No Harvesting of Aman in cropping intensification experiment had been completed. BR14 and BR 1867 were past maturity.

iii) BR22 and BR23, newly released photoperiod sensitive T.Aman was nearly mature. BR23 had a high incidence of Bacterial Leaf Blight, and BR22 showed susceptively to Leaf Scald. Plant height was 125-130 cm, giving additional straw to farmers, compared to BR11.

iv) Late planted T.Aman material (Sept 15) showed poor tillering and small panicles compared to other years. The poor growth may have been due to a fertility problem rather than the time of planting

v) Bush bean seed from Sylhet District but not grown in Comilla or other parts of Bangladesh was given for observation.

Daudkandi

Bush bean seed (1 kg) was given for intercropping with potato. Traditionally in Sylhet District the bush bean is intercropped and eaten as vegetable and dal. It may prove a potential vegetable and dal after DWR.

The participating farmer is very progressive and is cooperating with BARI in 2 experiments.

i) Growing potatoes using water hyacingth as a mulch.

ii) Observation of potato seed.

It was observed that a power tiller was being used in the area for cultivation. The rate was Tk 100/bigha (1/3 acre) per ploughing, which was the same rate as hiring a pair of animals.

APPENDIX 5.

TRIP REPORT:

HIGHLIGHTS ARFSN WORKING GROUP MEETING, NOV 11-14, 1988

1. Crop-Animal System

Dr Calub described the research at three levels namely:

Level 1 Crop-Animal subsystem research. This is equivalent to component research.

Level 2 Integration of Crop and Animal subsystems.

Level 3 Whole farm testing or model approach of intervention as developed in Indonesia.

Issues and comments:

i) The question of lack of methodology was questioned with reference to early pasture research methods. These are known techniques that can be build on.

The description of feed availability over the year should be part of any site description.

ii) How to use interaction of energy and income to advantage (synergism).

iii) India has developed 1 and 2 ha models on an environmental basis.

2. Rice-Fish System

Rice-fish is the fastest growing enterprise in Asia.

Issues and comments

i) In village studies harvesting by farmers is continuous and there is therefore need for close interaction for recording catch.

ii) Need for classification by matrix system such as:

Environment X Fish culture X Species technique

A similar system is needed also for livestock

iii) It was mentioned that adoption of rice-fish may be associated with level of intensity use in agriculture with low adoption where there has been low input use and low cash input system. McKay indicated, however, a reverse trend in Asia; in rainfed unfavourable environment it was found that rice-fish generated cash for other enterprises.

3. Impact Assessments' scheduled to commence in June 1989.

Phase II of Impact Study

Issues and Comments

i) What should be sample size; what are regional implications

ii) For data analysis interfacing dBase and SPSS useful.

iii) There is the danger that 'Impact of FSR' is promising too much. It is not addressing policy, or impact on research institutions/university syllabus. Where there is no impact it is possible there was a lack in use in methodology such as farmer participation. There must be a focus to assess products from certain perspective.

eg Systems crop analysis or farmer participant

iv) FSR approach in technology development is part of continuum of research process and cannot be singled out as sole reason for successful technology.

4. Women in Rice Farming

The goal is to institutionalise women's concern within research and extension activities. IRRI can have a catalytic role.

Issues and comments:

i) It is not just women but household that should be focus.

ii) Where do we go from here?

5. PTR-II

Question raised as to what constitutes research component. However, in reality it is whole farm intervention with before and after and with and without as comparison. It was felt it contradicted FSR but in reality it should be noted that technologies have come from FSR site research.

6. Rice-Wheat System

The presentation approached the issue by identifying researchable issues concerning LOW WHEAT YIELDS. Cropping systems where Rice-rice-wheat and Rice-Wheat.

A. Late Planting Wheat

i) late harvest rice;

ii) Water logging;

iii) delayed turnaround time due to

-poor soil structure
-crop residue
-soil moisture
-inappropriate machinery
-rice threshing

B. Problem in Crop Establishment

i) poor land preparation;

ii) broadcast sowing

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iii) seed quality.

iv) soil moisture; or

v) pathogens.

C. Zero Tillage

Advantages:

i) cost lower

ii) saves irrigation

iii) less weeds

iv) soil structure

v) early planting

vi) uniform stands

vii) uniform fertilizer application

viii) less tractor cost, wear

ix) less fuel, oil.

Disadvantages:

i) suitable drill

ii) stem borer

iii) sustainability

D. Conclusions

i) need a 'cropping systems perspective' that is multi-disciplinary with integration and not separation. Breakdown into components for research, eg. what if rice component fixed.

ii) Sustainability

Methodology for longterm trials with monitoring of fields. May require rotation as on subcontinent declining OM due to fuel crisis.

Issues and comments:

i) In China Rice-rice-wheat sustainable as add 15 ton compost/ha/year. Question of labour cost.

ii) Rice-wheat is mega environment with opportunity for CYMMIT and IRRI to work together with national programs.

7. Longterm Cropping Pattern Trials

Need to handle rotational aspect in longterm trials. eg Sugarcane (3 years) followed by wheat etc. Emphasised need to collaborate with INSFFER. In fact should come under INSFFER.

8. Farm Implements

Inverted T design problems were highlighted in paper by Dr Woodhead.

Issues and comments:

i) Implement inventory is needed and will be compiled by Sam Fujisaka.

ii) New models - may be possible for drawings only to be sent.

iii) Country implements that may be transferable

- Lithao (Philippines) contact Sam Fujisaka
- Treadle/Rower Pump (Bangladesh)
- Forage Chopper (Burma)
- Slicer for GM incorporation (Philippines); contact Garrity
- Paddle Thresher: new design IRRI.

9. Farmer Participation

Types of meetings & persons to consider:

- co-op (NGO)
- class (patron - client)
- Farm leaders.

Important for scientist to be involved and not deligated to field person.

Issues and comments:

i) Start from farmers experiments and build on.

10. Training

The FSR/CSR Training is being revised, and along with this is the proposed shift to moving syllabus into National System, with use of Regional Resource Persons.

Issues and comments:

i) Suggested for Bangladesh that plan 2 week visit during which time a training group is developed.

11. Research Extension Linkage

Papers were presented from Philippines, Bangladesh and Sri Lanka.

The recent development in the Philippines can be considered illustrative of commitment of political will to this process.

> 'The Research-Extension system has been decentralised to Regional level. The FSR approach to research and technology transfer has been adopted as the national approach.'

In the brief report from Bangladesh the need to decentralise MLT was highlighted along with classifying transferable technologies on an environmental basis.

12. Environmental classification for extrapolation

Extrapolation at different levels and between levels:

International	Mega	1:5m
National	Macro	1:1m
Regional	Meso	1:5000 to 25000
Site	Micro	

Example given at micro level: and then moved on to discuss modelling with emphasis on POLYCROP by Angus.

Issues and comments:

i) Need to work with few factors that are delimiters. Should be visible through relating to existing cropping patterns.

ii) Important to demonstrate use of environmental classification across and within countries to establish link between FSR sites.

13. Sustainable agriculture

Dr Ken McKay presented a paper on the growing need to address the issue of the sustainability of the technology that is being developed. Research issues will vary according to the environment:

i) irrigated

over use chemicals
pest management
sustainable fertility
diversity

ii) rainfed lowland

low input fertilizer
low input IPM'
new cropping systems
farmers strategies

iii) uplands

soil stability and improvement
traditional management
low input pest management

For sustainable issue research must address:

methodology
farmer participation
pest management
diversification
soil fertility with combination of OM and chemicals
farmers knowledge and constraints
policy
dynamic of system over time

A major point to come through the presentation was that consideration be given to energy flow along with income flow.

14. Data management

Objectives of this project are:

i) develop DBMS to support on farm trails;

ii) develop methodology for designing test technologies;

iii) develop method to identify recommendation domain; and

iv) pilot test DBMS and methodology developed.

The clients of this project (that initially in Philippines) is field level rather than high powered group.

Issues and comments:

i) hierarchical system is slow on computer;

ii) information retrieval is very important which should be at management level;

iii) cannot handle non traditional experiments.

15. Future ARFSN

i) for coordination from IRRI it must remain rice based.

ii) for next workshop organisation will be basis with on ecosystem basis with an emphasis on being holistic and not component.

iii) must be linked to other IRRI Networks (IRTP and INSURF). For immediate monitoring tours should be combined and be environment specific.

eg. Rainfed lowland

Appendix G.

TRIP REPORT: Meherpur & Satkhira Districts, Dec 6-9, 1988

Participants: Noel P Magor, SKM Rezaul Karim (RFS, BRRI)

Objectives: i) Assessment of damage of cylcone

ii) Observation of cropping of upland favourable environment Meherpur, Jessore, Jenaidah.

iii) Delivery of seed and fertilizer to Meherpur for MLT and collection of MLT results from OAC.

MLT - Meherpur, Gangni, Jessore, Tala.

BRRI has been conducting MLT in this region since 1987 (see trip reports, McIntosh Quarterly Report, Jul-Sep, 1987). The system is dominated by the Aus - Rabi cropping pattern. BRRI has been extending BR21 and BR20 as rainfed upland Aus varieties. MLT for 1988 has been conducted using BRRI Core Funds. The wheat seed was delivered late, with sowing of MLT plots already completed. It was recommended that fertilizer be applied to the wheat variety that farmers had already sown. The centralised distribution of MLT seed and fertilizer has proved expensive and a logistical constraint to its effective management.

Upazila and District Officers in Meherpur and Jessore were visited and Upazila Officer in Tala. The Tala site was an irrigated site, with the T.Aman still in the field.

Rainfed upland environment

Apart from depression in which some T.Aman was still to be harvested, the vast area was under Rabi crops that had been sown in November. Cropping patterns were:

Aus - wheat
Aus - lentil
Aus - lentil + mustard
Aus - mustard
Aus - tobacco

Other systems observed were:

Sugarcane in mill area of Kamalganj

Aus - cotton in Jessore District

Banana plantations

The major source of fuel is cowdung and the availability of cattle feed is quite limited. It was noted, though not observed, that several farmers were now commercially growing ipil ipil as fuel for curing tobacco. Given the neutral alkaline nature of the soil, ipil ipil was observed to grow well on road sides and may have potential for hedge rows in farmers fields to enhance feed and fuel.

Satkhira District - Impact of Cyclone

The damage to the coastal area by the cyclone in late November was extensive. In the 2 day field trip Tala, Asasuni and Shamnagar Upazilas were visited. In the severely affected upazilas of Asasuni and Shamnagar, which are south of Satkhira approximately 90 percent of mud and that houses were severely damaged.

i) Damage to Transplanted Aman rice

The extent of damage depended on stage of maturity of crop (variety and cropping pattern), tidal submergence during cyclonic winds and drainage of water after cyclone.

Immediately around Satkhira there are many shallow tubewells for Boro cultivation. The cropping pattern was Boro - T.Aman with the T.Aman variety being BR11. Most of BR11 was harvested prior to cyclone.

As one moved south of Satkhira the dominant cropping pattern became single T.Aman. In this location:

1. mature standing crops that were not inundated were extensively wind damage.

2. mature standing crops that were inundated with water that had not drained after 10 days suffered over 40% damage due to rotting in the field and germination. The poorly drained rice plain of Asasuni suffered this damage. In this situation the loss of cattle feed will lead to severe shortages.

3. mature standing crop that was inundated with water draining away within few days suffered 20-30% damage with no field germination. The drainage in Shamnagar was better than Asosuni.

4. Immature crop

   some of the local photoperiod sensitive varieties were in early grain filling at the time of cyclone and providing the water drained the damage was limited to less than 20 percent. The area of immature rice was not extensive.

The tentative official District estimate was given as approximately 40 percent. This estimate for south of Satkhira is seen as quite realistic, with the figure being 15-20 percent for the northern upazilas.

ii) Other agriculture damage

It is important to highlight the extensive damage to mature fruit trees (Mango, Jackfruit and coconut) which represent a long term loss of income. Banana tree have been badly damaged but will send up new suckers. Deaths to cattle and goats were considerable and due to feed shortages may be more in the coming year.

iii) Suggested rehabilitation measures for Donor support

1. It is recommended that funding be provided in the coming year to enable the Department of Extension and local NGO's to establish

fruit tree nurseries. Coconut, mango and jackfruit seedlings could be distributed at subsided rate or free of cost.

2. No distribution of livestock (cattle/goats) should be done due to potential crisis in feed.

3. Supply of building materials for repair to school buildings would be a worthwhile.

4. Drainage system for rice land should be assessed by engineers, with FFW projects being used to improve the systems.

Research - Extension Linkages in Farming Systems Research in Bangladesh[1/]

Noel P Magor[2/]

In Agriculture, the Extension and Research Institutions are two major organisations concerned with the development of a stable agriculture system that benefits both the farm and non-farm communities. Linkage in Farming Systems Research (FSR) is the focus of this paper. It will be discussed within the mandate of the Department of Agriculture Extension and the multiinstitutional involvement in FSR under the umbrella of the Bangladesh Agriculture Research Council (BARC) and the complexity of the village environment. The Department of Agriculture Extension (DAE) has two important functions outlined as:-

- to provide farmers with the latest proven results of research and scientific farm techniques for their socio-economic betterment; and
- to act as an efficient bridge between the various research institutions and the farmers so that alongwith the dissemination of production technology to the farmers, the farmer's level adoption problems are also brought to the relevant research institutes for investigation and solution (DAE,1985).

1/ Presented at 19th Asian Rice Farming System Network Meeting held at IRRI, November 1988.

2/ Farming Systems Specialist, BRRI/IRRI Project, Dhaka Bangladesh.

The organizational chart (figure 1) indicates five levels from National, Regional, Zone (District) Unit (Upazila) and block level. There are 9 Extension regions and 26 category I Districts and 42 category II Districts. At the bottom level there are 12640 block supervisor each with a responsibility for approximately 900 farmers (DAE, 1985). Through this chain, recommendations for new technology are expected to reach 10-12 million farm families, the majority of whom operate less than 1 ha.

Research institutions in Bangladesh have a commodity focus but to address the diverse farm environment, as indicated above, a Farming Systems Research Perspective emerged within each institution, with funding and coordination support from BARC. A number of independent donors have also supported the evolution of FSR. At present through BARC alone there are 24 FSR sites. The institutes involved are Bangladesh Agriculture Research Institute (11 sites); Bangladesh Jute Research Institute(4); Sugar Research and Training Institute(3); Bangladesh Agriculture University and Bangladesh Livestock Research Institute (2 each); and Bangladesh Rice Research Institute and Forestry Research Institute (1 each) (Khan, et al 1987).

The Bangladesh agroecological environment is highly complex. The principal environments have been given as rainfed upland favourable, rainfed lowland favourable, rainfed lowland drought prone (Barind Tract), rainfed lowland saline affected, deepwater area, bottom land deeply flooded, hill land and reserve forest and new land (char land) (figure 2). Each of these environments are complexes or associations which adds further to their complexity. The rainfall variation across the country is wide and the year to year variations that result in droughts and floods are also

considerable. Across about twenty five percent of this land irrigation facilities are available. Farms are very small and the resource base of such farm families in terms of cash is quite limited. Many small farmers regularly share in land. Land ownership patterns vary in different parts of the country and social factors at times limit the adoption rate of new agriculture practices. With the very high population density the farming and farm practices are finely tuned to the local environment. The farm enterprises are integrated and involve cropping (rice and non rice crops), cattle, poultry, agroforestry, fisheries, vegetable and fruit cultivation. Some of the enterprises generate cash income but some simply support the system without the generation of cash. The whole family is involved.

Maintaining effective linkage between the above institutions that enables both technology development and transfer and benefits the large number of small farmer families is an important issue for dialogue.

EXISTING RESEARCH-EXTENSION LINKAGES

In overviewing linkage it is important to acknowledge the existence of the Extension-Research commodity communication process that exists between each Research Institution and the DAE. Such commodity linkages will and must continue to exist in the future, and will not be supplanted by special FSR networks. FSR at a specific institute must be an integral part of that institute and must give special attention to the commodity of that institute along with a consideration of the whole farm.

BRRI-DAE linkage may be used as an example. The main interchanges are:-

- o BRRI-DAE Annual Workshop

This annual workshop has been a major forum of interchange. At this time BRRI communicates their latest research findings for rice and Extension gives feedback on farmer problems and reaction to recently introduced technologies. MLT results are fed into this workshop (for example Ahmed et al, 1988).

- Rice production training course

  The four month production course conducted by BRRI has been an invaluable training for DAE's Subject Matter Specialists and Subject Matter Officers and other District and Upazila level staff. It is conducted in two batches each year. The participation of all BRRI Divisions in this training has enabled the most up to date information to be communicated.

- Advanced Line Adaptive Research Trials (ALART) and Farmer Variety Observation Trials (FVOT)

  The adaptability of new rice lines and recently released rice varieties are determined through ALART and FVOT. The ALART, which is set up in selected locations across the country is one of the faster means of identifying the adaptability of the promising lines. The FVOT has provided farmers an opportunity to observe a new variety at the regional level and to decide on adjustment in the cropping system.

- Multilocation Testing (MLT)

  MLT has been defined as the verification process of cropping

systems and farming systems research findings. It has been most strongly utilised for checking the extrapolation area for food crop subsystem findings. BRRI and the DAE began joint MLT in 1982 in five locations and 14 in 1983. (see Quddus et al, 1986).

The linkage through the National Technical Coordination Committee (NTCC), the Regional Technical Committee (RTC) and the District Technical Committee (DTC) concerns the formal procedure for all research institutions and so will be handled separately below.

THE NATIONAL, REGIONAL AND DISTRICT TECHNICAL COMMITTEES

The NTCC is headed by the Chairman of the Bangladesh Agriculture Research Council (BARC) and has as its mandate the linking and coordinating of all research organisations and extension at the national level.

The most formal of the procedures for bringing about extension research linkages are the regional/district technical committees (DAE 1985). There are 26 District committees (DAE, 1985). The District and Region levels are pivotal for effective on going communication between research and extension. Evaluation of research findings of the various institutions takes place at this level. It must be acknowledged that the framework for communication exists structurally and so I will now discuss a few features of effective linkage.

STRENGTHENING THE INTERACTIVE RESEARCH PROCESS

Defining environments

Diversity of environments, coupled with a diversity of activities on any one farm has necessitated a Farming Systems approach to applied research. However, the diversity of environments has created a problem in identifying the status of FSR results. Do the results complement each other and for fertilizer results do they differ with the national recommendations? With the large number of farming systems sites operating under different Research institutions it is important to be able to draw the results together. Interpretation according to environments should be possible. Such an approach will facilitate transfer of technology.

The BARC National FSR coordinating cell has an excellent opportunity here to facilitate this process. BRRI Rice Farming Systems Division used this approach to define target areas for specific cropping systems recommendations (Naseem et al 1987) and the exercise of incorporating all recommendations from the 24 FSR sites can be done. The recently released FAO Soil & Climatic database should be the reference point (FAO, 1988).

The yearly Regional Workshop can then more easily become the forum for enhancing regional dialogue concerning research from different research institution sites.

Whole farm development

The commodity nature of the research institutes makes it difficult for each to address all the complex problems that a farmer faces in his day to day activities. A rice farmer also grows vegetables. A rice farmer may keep

several heads of cattle and face a severe shortage of feed for his ploughing animals for many months of the year. It is important in whole farm development to consider not just the commodities but to focus on the income of the farmer. This is where careful interaction with and monitoring of the farm is essential. Strong technical support for Subject Matter Officers and Block level Extension personnel can help in bringing about overall farm economic development. The Block Supervisor is a very useful resource person due to his day to day contact with farmers in a small geographical location.

Given the above, the research process must therefore be interdisciplinary and integrated. It must be acknowledged that FSR has generally focused on the commodity of the concerned institution. For example BRRI's greatest strength in systems research has been with rice in rice based systems and similarly for jute with jute in a jute based system. Commitment to livestock and fisheries components at BRRI or BARI will be limited unless there is active collaboration with the respective institutions. The BARC National FSR meeting provides a forum for the research institution interaction, but to bring about the involvement of both the Fisheries and Livestock Directorates the Regional and District level meetings are important.

VERIFICATION PROCESS

MLT Management

Traditionally verification trials that have been conducted by the DAE have been on a seasonal basis. The extension planning process is for the

three major cropping seasons. Such an approach has created a dilemma for MLT which are systems recommendations and cover the cropping year. As whole farm recommendations that cover non crop components emerge this will be further exasperated. Research institutions have overcome this problem through providing the funding for MLT and in the case of BARI also the personnel for implementation. It is felt by the author that this is only a short term solution. For the longterm sustainability of MLT, financial management must be by DAE with technical support from research bodies.

Six steps have been defined in FSR methodology (Denning 1986) and are given below with slight modification:

1. Site selection;
2. Site description;
3. Designing improved systems;
4. Testing of improved systems and component studies;
5. Multilocation testing; and
6. Production program.

It is argued that Extension involvement increases as the steps progress. However, with financial management in the hands of the research institution control is by the research institution for the technology verification process. BRRI's experience in this has been an ever increasing demand in time for MLT visits and program expansion with a resulting decline in new innovative systems research. An imbalance in time in new research & technology verification emerged.

A possible solution may be the allocation of a fund from BARC to DAE (or alternatively from the individual research institution) for the conducting of MLT. The fund would be managed at the District or Regional level.

Link to environment

Earlier the importance of linking FSR findings from each institution by environment was mentioned. At the technology transfer stage this is imperative. The District Technical Committee and the Regional Technical Committee must review research recommendations and determine those which should be transferred. In other words it should be the DTC and RTC that determine the technologies to be tested through multilocation testing.

In determining the extrapolation area we need for each region, district, upazila and block a break down of the environmental data.

BARC may play a facilitating role by issuing a loose leaf bulletin based on environment that gives the systems recommendations that have been developed by the respective research institutions. It would be necessary to include non-BARC systems research within such a bulletin. For example, 90 percent of BRRI cropping systems recommendation are from non BARC funded research.

Strenthening decentralisation in Extension management

The small size of Bangladesh supports centralised management but its diversity necessitates local planning. FSR results that have been generated over the last decade will compliment local planning. It is into the Regional and District level planning that the financial management of MLT fits. As more and more production initiatives are launched the Regional and District Technical Committees will become more and more necessary. The link from these to the National level will ensure fund allocation and input allocation.

RECOMMENDATIONS

1. Each research institution strongly support the RTC and DTC as an important linkage point for reviewing FSR findings.

2. BARC develop a loose leaf FSR recommendation bulletin that can be used by RTC and DTC meetings.

3. A concerted effort be made to classify each FSR site by major agroecological environment and the portion of each major environment in each region, district, upazila and block.

4. A funding source be identified to enable the DAE to take up the management of multilocation testing, and pilot production programs.

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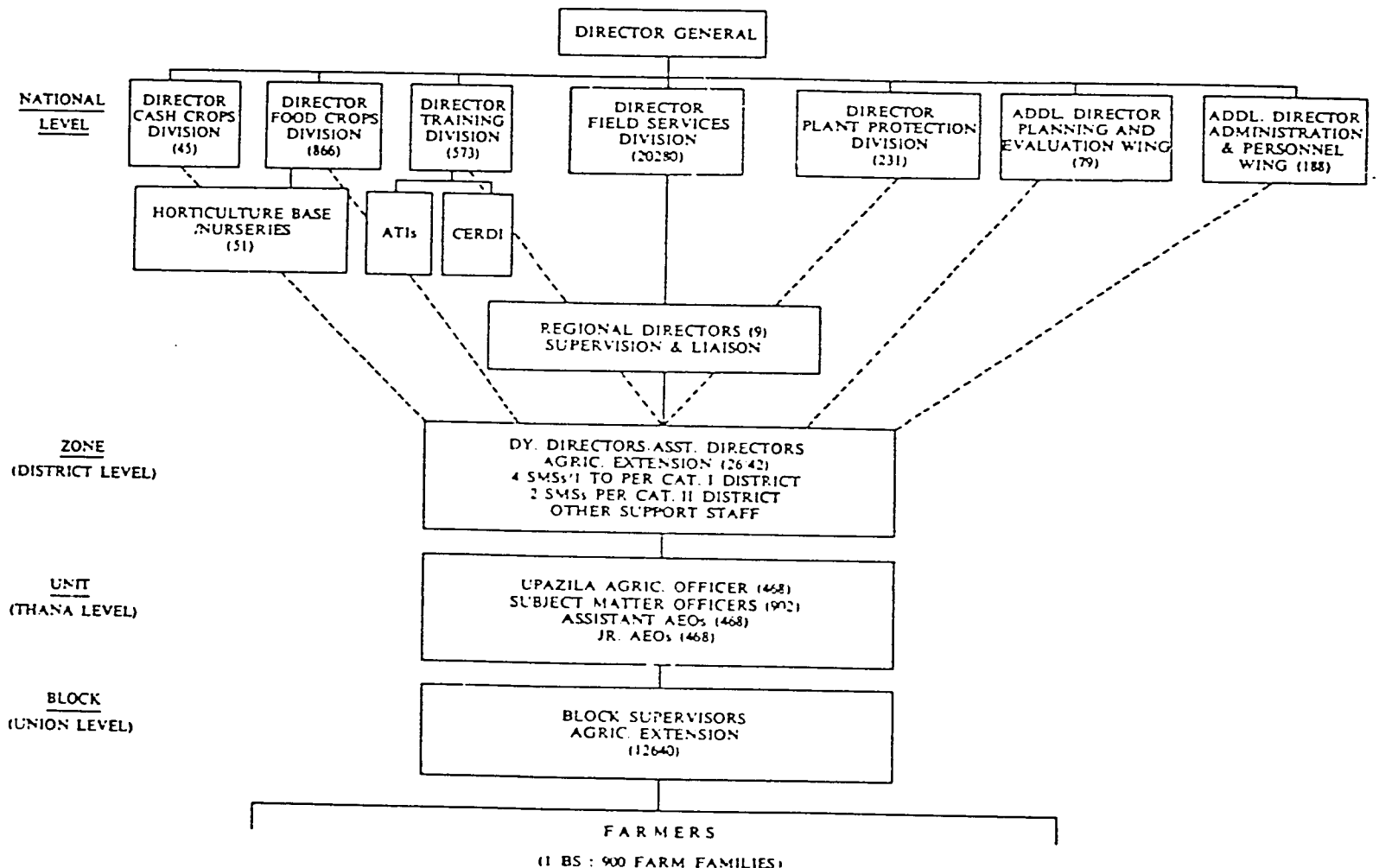
Figure 1. DEPARTMENT OF AGRICULTURAL EXTENSION
ORGANIZATIONAL CHART



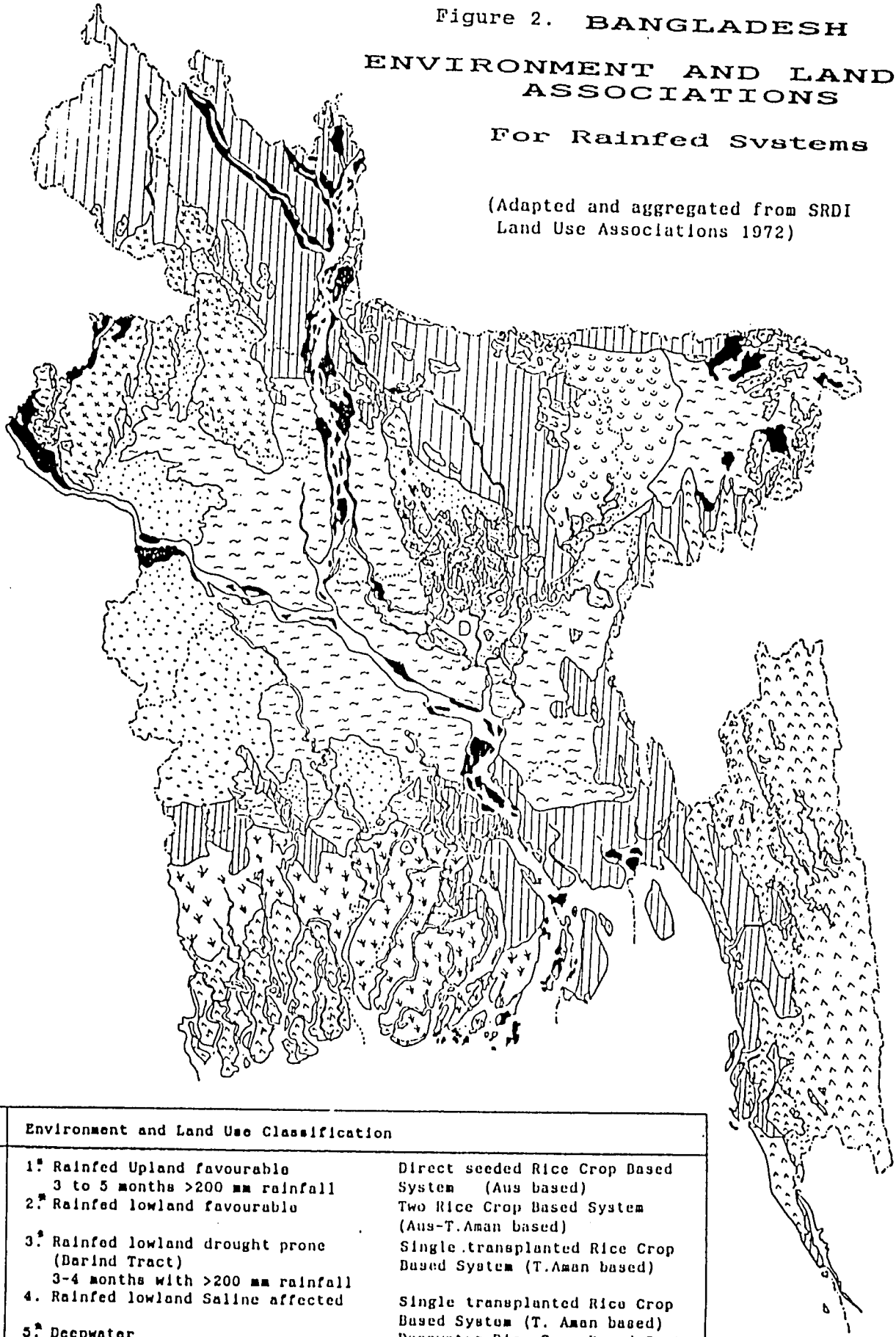
1. Solid lines indicate direct line of Command relationship for staff
2. Dotted lines indicate technical guidance, information exchange and communication.

Figure 2. **BANGLADESH**

ENVIRONMENT AND LAND USE ASSOCIATIONS

For Rainfed Systems

(Adapted and aggregated from SRDI Land Use Associations 1972)



	Environment and Land Use Classification	
	1.* Rainfed Upland favourable 3 to 5 months >200 mm rainfall	Direct seeded Rice Crop Based System (Aus based)
	2.* Rainfed lowland favourable	Two Rice Crop Based System (Aus-T.Aman based)
	3.* Rainfed lowland drought prone (Barind Tract) 3-4 months with >200 mm rainfall	Single transplanted Rice Crop Based System (T.Aman based)
	4. Rainfed lowland Saline affected	Single transplanted Rice Crop Based System (T. Aman based)
	5.* Deepwater	Deepwater Rice Crop Based System
	6. Bottom land deeply flooded	Winter rice crop only
	7. Reserve Forest and Hill Areas	Forest, Gardens, Orchards or Shifting Hill Cultivation
	8. New land (river and ocean) and seasonally flooded grasslands	Grassland

* (irrigated systems dispersed throughout these environments and cover 20-25 percent)