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ISN

MENNONITE CENTRAL COMMITTEE

AGRICULTURE PROGRAM

RESEARCH RESULTS
BANGLADESH
REPORT No. 14
1987

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MENNONITE CENTRAL COMMITTEE

Agricultural Program

REPORT NO. 14

STATION AND CROPPING SYSTEMS RESEARCH RESULTS

July 1987

Dhaka, Bangladesh

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CONVERSIONS, ABBREVIATIONS, DEFINITIONS AND RESEARCH LOCATIONS

CONVERSIONS

To convert Column 1 into Column 2 Multiply by:	Column 1	Column 2	To convert Column 2 into Column 1 Multiply by:
	Length		
1.094	meter, m	yard	0.914
3.281	meter	feet	0.305
0.394	centimeter, cm	inch	2.54
	Area		
2.471	hectare, ha	acre	0.405
	Volume		
0.898	liter	quart (Imperial)	1.11
	Mass		
1.102	tonne, t	ton	0.907
26.81	tonne	maund (82.2 lb)	0.037
2.20	kilogram, kg	pound, lb	0.454
1.07	kilogram	seer (2.06 lb)	0.932
0.035	gram, g	ounce, oz	28.35
0.086	gram	tola (0.4 oz)	11.6
	Yield or Rate		
0.446	tonnes/ha	tons/acre	2.24
10.86	tonnes/ha	maunds/acre	0.092
0.892	kg/ha	lb/acre	1.12
0.011	kg/ha	maunds/acre	92.14
0.434	kg/ha	seers/acre	2.30
	Temperature		
(9/5°C + 32	Celsius	Fahrenheit	5/9 (°F - 32)
	0°C	32°F	
	20°C	68°F	
	30°C	86°F	

Bangladesh Units	English Unit	Metric Units
Tola	0.4 oz	11.6 g
Chattock (5 tola)	2.06 oz	58.3 g
Seer (16 chattock)	2.06 lb	932 g
Maund (40 seers)	82.2 lb	37.29 kg

FERTILIZER

All fertilizers utilized in the trials were urea (45% N), triple super phosphate (45-50% P_2O_5), muriate of potash (60% K_2O) and Gypsum (15% S). All applications are shown in the following order: $N-P_2O_5-K_2O-S$, with the quantities in kg/ha (e.g. 60-40-40-15).

STATISTICS

Where data warrant it, all replicated trials have been statistically analyzed using the analysis of variance (ANOVA) method. In the discussions, when it is mentioned that there were "significant differences" between treatments (e.g. variety, fertilizer rates, etc.) for some factor such as yield, it is understood that statistical analysis has shown a difference that we are 95% confident is real and not due to random chance. A "highly significant" difference means that we are 99% confident that the differences are real. The 95% confidence level is shown in the tables by the superscript symbol "*" and the 99% confidence level by two stars "**".

A significant ANOVA F-test means that one or more real differences exist among the treatments tested, but does not indicate specifically between which of the treatments the differences exist. To compare the treatment means in cases where there are significant differences, Fischer's least significant difference test (L.S.D.) has been used in most cases. Where the L.S.D. test has been used, treatment means are followed by one or more letters. Any two means having at least one letter in common are not significantly different; or conversely, any two means having no letter in common are understood to be significantly different at the 95% confidence level.

The coefficient of variability (C.V.), expressed in terms of the overall mean, is the percent of variation that is due to random error.

MARGINAL ANALYSIS

When appropriate, trials were evaluated economically using marginal analysis. Please use this discussion when refering to trials where marginal analysis was done. Marginal analysis tells us the relative status of different treatments by providing a marginal rate of return (MRR). In some cases profitability of different treatments is also determined.

A series of steps are followed when doing marginal analysis. First, variable cost (VC) is calculated as being the cost of the input which is being varied in the trial (e.g., for a fertilizer trial it would be the cost of the fertilizer for the different treatments). Gross return (GR) is then calculated by multiplying the output's price by the yield. Gross margin (GM) is determined by subtracting VC from GR. At this point the treatments are ranked in descending order of GM and treatments with both higher VC and lower GM are discarded (i.e., they are "dominated").

Now the marginal gross margin (MGM) is determined by subtracting the second-largest GM from the largest GM (this is then done for second-largest, third-largest, etc.). Marginal variable cost (MVC) is determined in the same way, but using VC instead of GM. Marginal rate of return (MRR) is then determined by dividing MGM by MVC (times 100%). As an example, a marginal rate of return of 260% means that for the additional expenditure made for that treatment over the next best, the farmer is receiving Tk.2.60 for every Tk. 1 he invests. Average rate of return (ARR) is found by subtracting the lowest GM from the highest GM (this being average gross margin), and the lowest VC from the highest VC (this being average variable cost). Then average gross margin is divided by average variable cost to determine ARR (for the second treatment's the lowest GM is subtracted from the second-highest GM, and the lowest VC from the second-highest VC, etc.). Finally profit (P) is determined by subtracting VC and fixed costs (FC) from GR.

ABBREVIATIONS/EXPLANATIONS

a) Measurements:

mm	millimeter
cm	centimeter
m	meter
ha	hectare
g	gram
kg	kilogram
t/ha	metric tonne per hectare
lb/a	pounds per acre
^{o}C	temperature, degrees celcius
EC	electrical conductivity (a measure of salt concentration in a solution)
EC_e	EC of the extract of a saturated soil paste (an indicator of soil salinity)
mmho/cm	millimhos per centimeter, a unit used for EC and EC_e
L	liter
pH	a measure of hydrogen ion concentration
#	number
t	metric tonne
000's	thousands
m^2	square meters
ht	height

b) Statistical Terminology (see Statistics section):

CRD	Completely randomized design
RCBD	Randomized complete block design
C.V.	Coefficient of variability
L.S.D.	Least significant difference
R^2	R- squared
$\bar{R}^2$	Adjusted R-squared
NS	Not significant
ANOVA	Analysis of variance

c) Institutions:

ARTD	Adaptive Research and Training Division, BRRI
AVRDC	Asian Vegetable Research and Development Center, Shanhua, Taiwan
BADC	Bangladesh Agriculture Development Corporation
BARI	Bangladesh Agriculture Research Institute, Dhaka
BAU	Bangladesh Agriculture University, Mymensingh
BRRI	Bangladesh Rice Research Institute, Dhaka
CIAT	International Center of Tropical Agriculture, Celi, Columbia
CERDI	Central Extension Resources Development Institute, Dhaka
ICARDA	International Center for Agriculture Research in the Dry Areas, Aleppo, Syria
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, Hyderbad, India
IITA	International Institute of Tropical Agriculture, Ibadan, Nigeria
INTSOY	International Soybean Program, University of Illinois, U.S.A.
IRRI	International Rice Research Institute, Los Banos, Philippines
LRP	Land Reclamation Project (Dutch government)
MCC	Mennonite Central Committee

d) Others:

A	Animal labor
achra/asra	Field rake; 1-2 m wide with iron teeth 10-20 cm apart
ALART	Advanced lines adaptive research trial; Cooperative with BRRI
aman	Rainy season rice crop, July-December
aus	Spring rice crop, March-July
boro	Winter rice crop, December-May
DAP	Days after planting
DAS	Days after sowing
DAT	Days after transplanting
diam	Diameter
dibbling	A seeding method where seeds are dropped by hand into holes made with a pointed stick

F_C	Commercial fertilizer
G	Granular
GM	Gross margin
GR	Gross revenue
ht	Height
HYV	High yielding variety
K	Potassium
K_2O	Potassium
Mc	Moisture content
MLT	Multilocation trial
N	Nitrogen
N_H	Hired labor
P	Phosphorus
P_2O_5	Phosphate
Pt	Plant
rabi	Winter (dry) season, November-April
TP	Topdress of fertilizer
Tk	Taka, Bangladesh currency
TSP	Triple super phosphate
TVC	Total variable costs
VS	Versus
wt	Weight

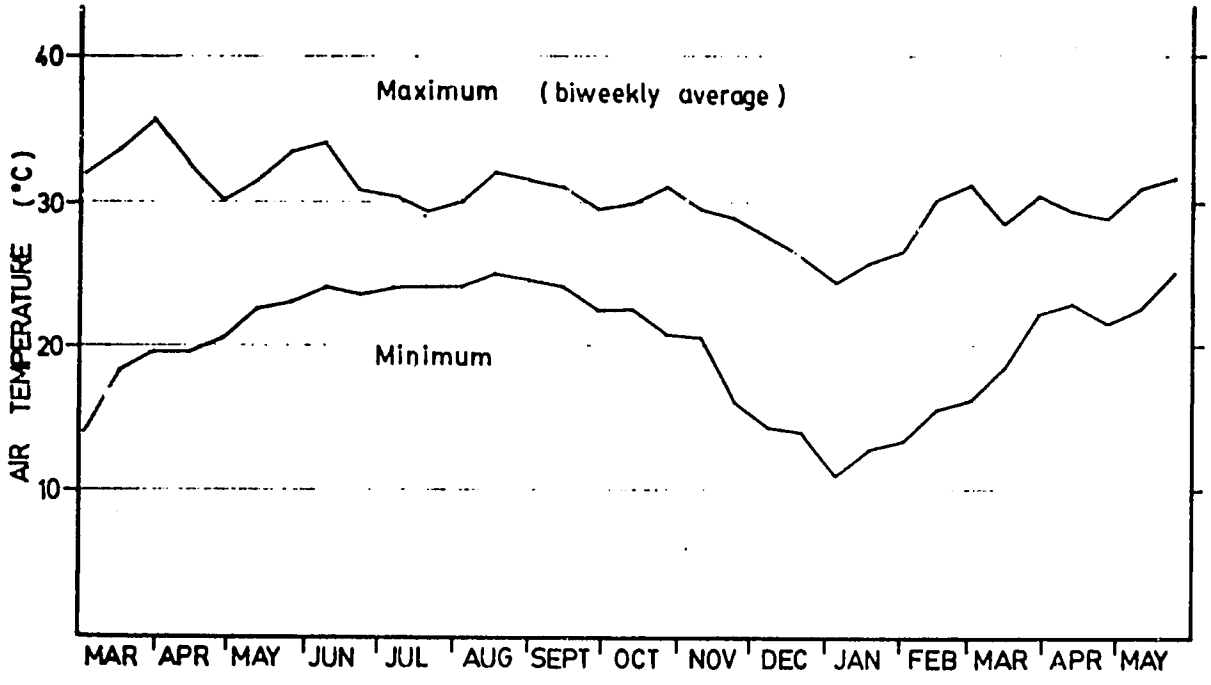
AREAS OF MCC RESEARCH

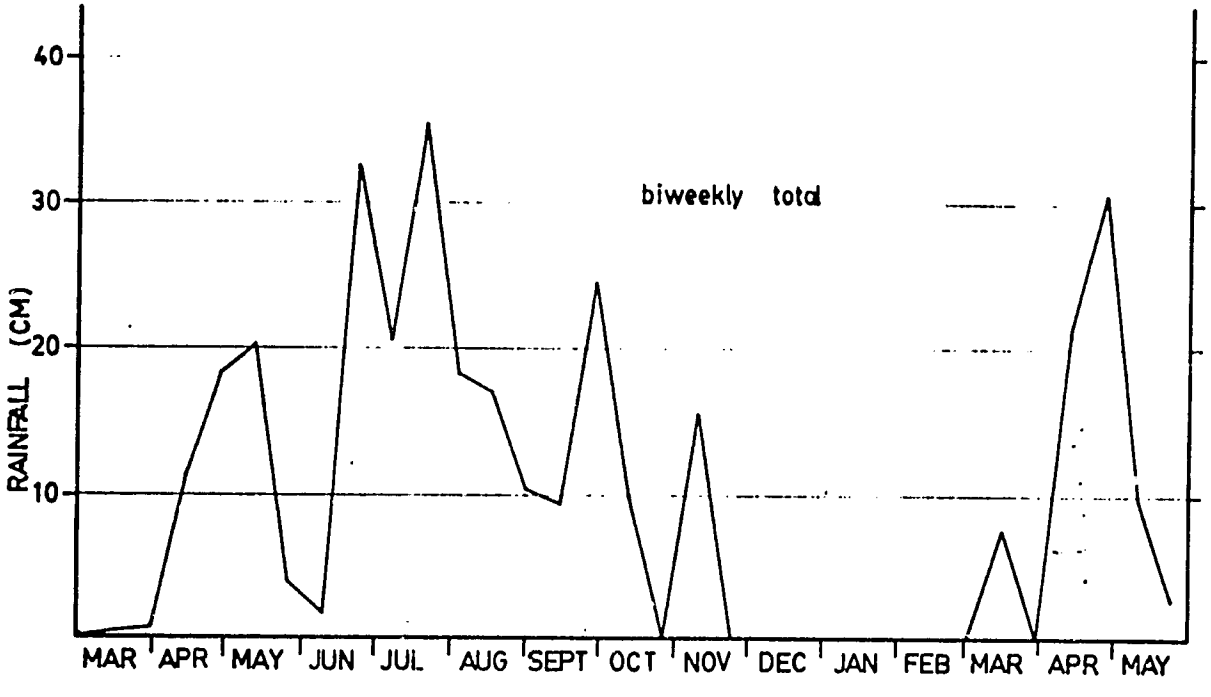
The following is a complete list of the locations at which MCC Research Program conducted research during the period 1986-87. These places are referred to in the body of this report.

Village/Bazar	Upazila	District
Bordain	Chauddogram	Comilla
Char Bata Khaserhat	Sudharam	Noakhali
Char Bata Sulalmiahat	Sudharam	Noakhali
Char Bhatirtek	Sudharam	Noakhali
Char Jabbar Khaserhat	Sudharam	Noakhali
Char Jahajmara	Sudharam	Noakhali
Chitosi Station	Laksham	Comilla
Choumahoni Bazar	Sudharam	Noakhali
Chuadanga	Chuadanga	Chuadanga
Dhagonbhuiyan	Dhagonbhuiyan	Feni
Dhorkora Bazar	Chauddogram	Comilla
Eroain	Laksham	Comilla
Hyderganj	Raipur	Lakshmipur
Keramatpur	Sudharam	Noakhali
Khila	Laksham	Comilla
Mohammad Ali Bazar	Feni	Feni
Nather Petua	Laksham	Comilla
Raipur	Raipur	Lakshmipur
Sonapur	Sudharam	Noakhali
Tetuaya	Nangolkot	Comilla

CLIMATIC DATA 1986 - 1987

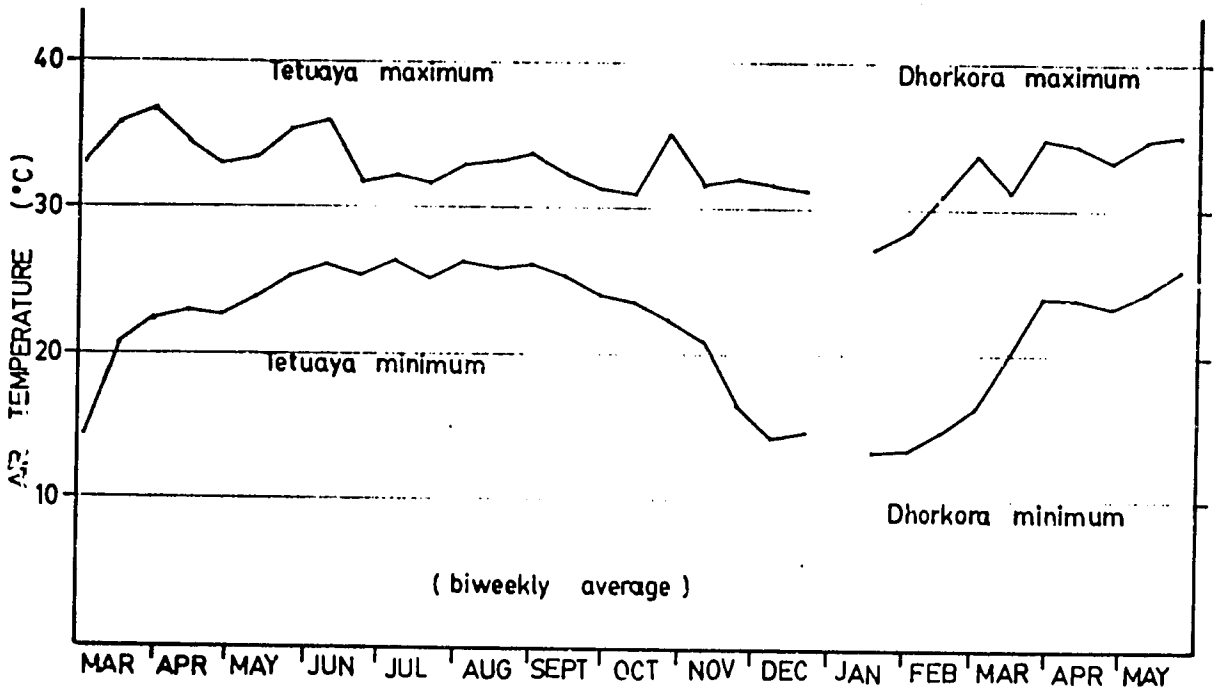
FENI

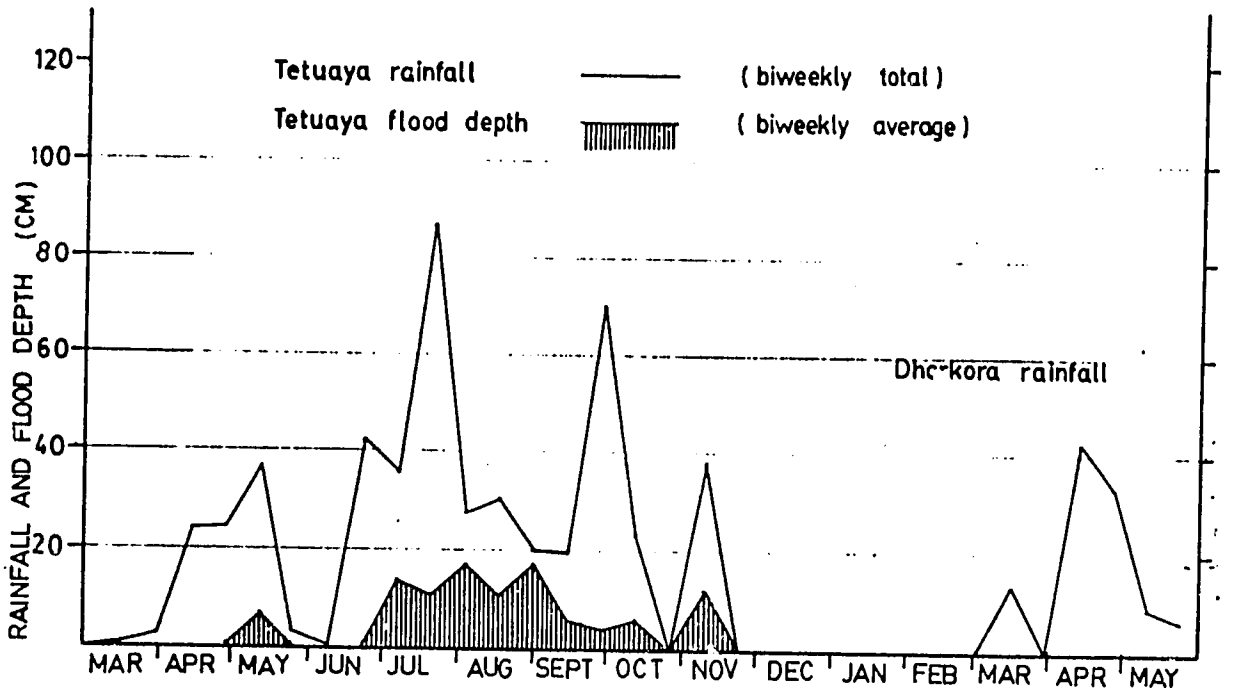




CLIMATIC DATA 1986 - 1987

TETUAYA, NANGOLKOT UPAZILLA AND DHORKORA, CHAUDOGRAM UPAZILLA, COMILLA

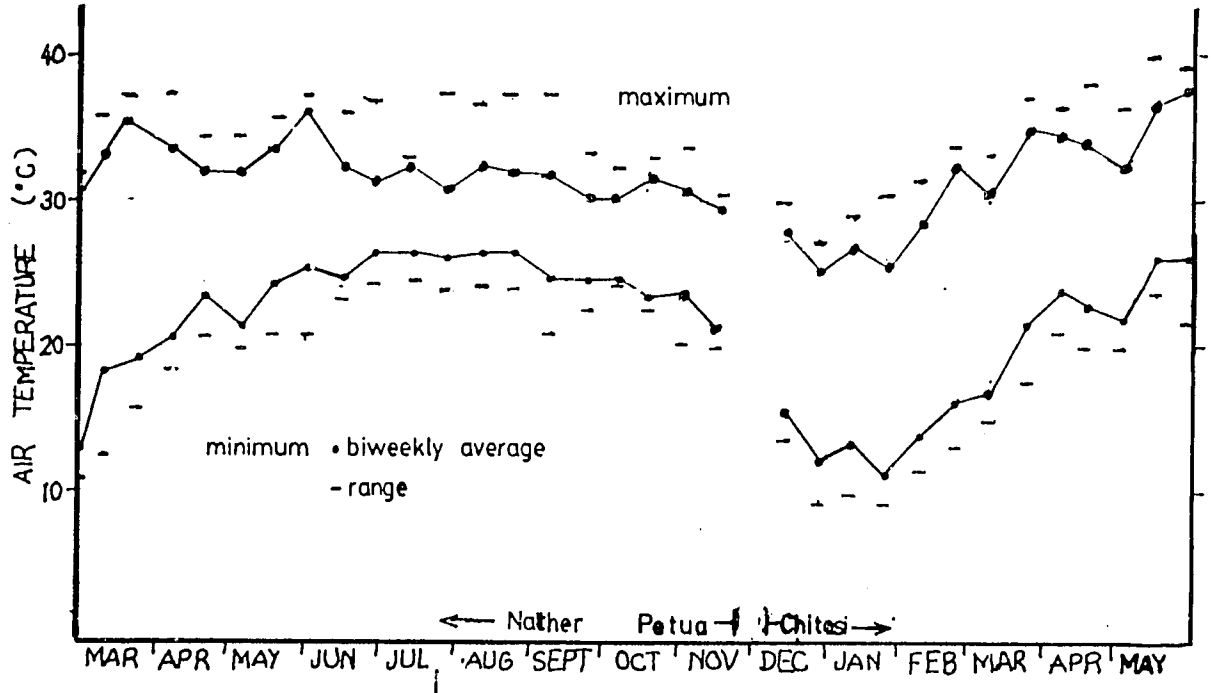


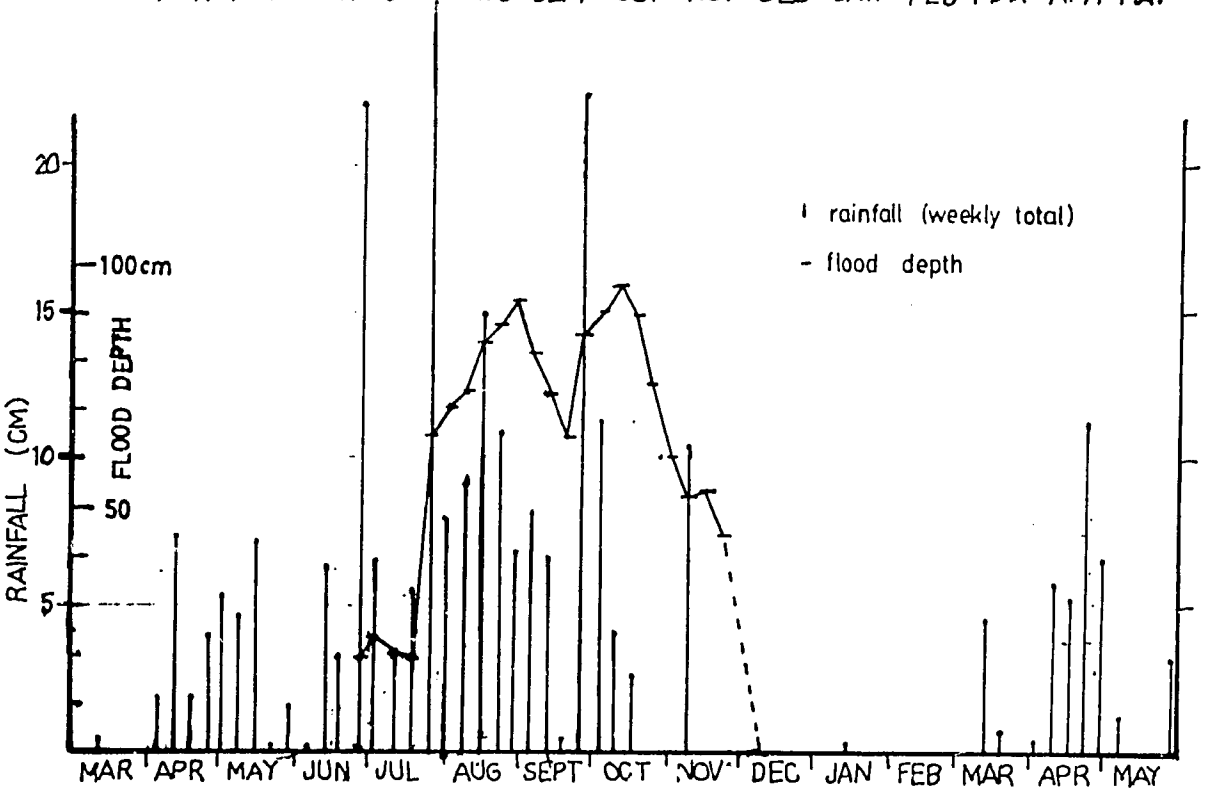


CLIMATIC DATA 1986 - 1987

MCC Medium Lowland C.S. Research Site

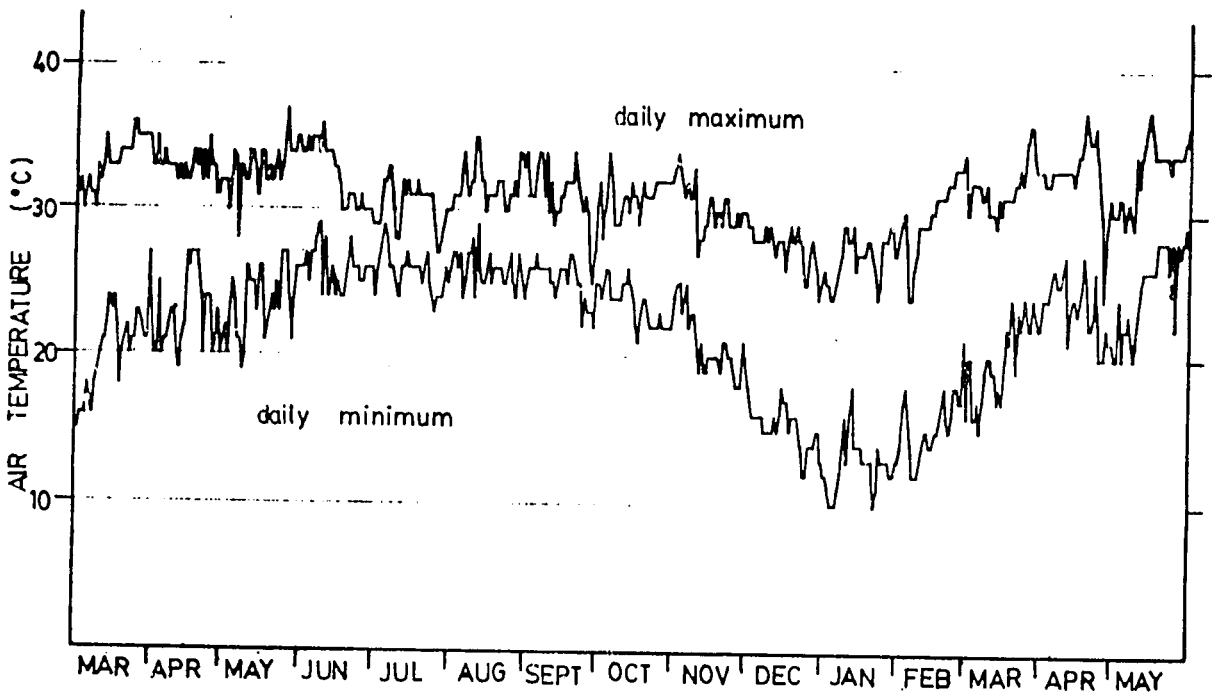
Chitosi Station, Laksam, District Comilla

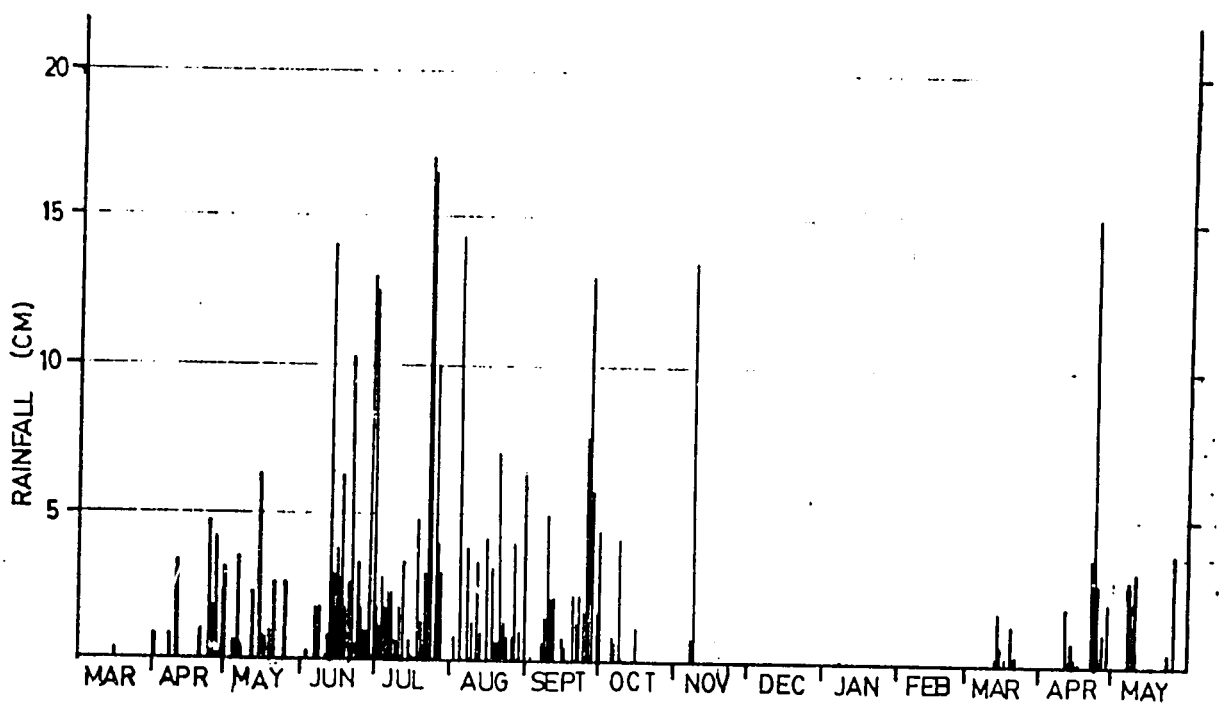




CLIMATIC DATA 1986-1987

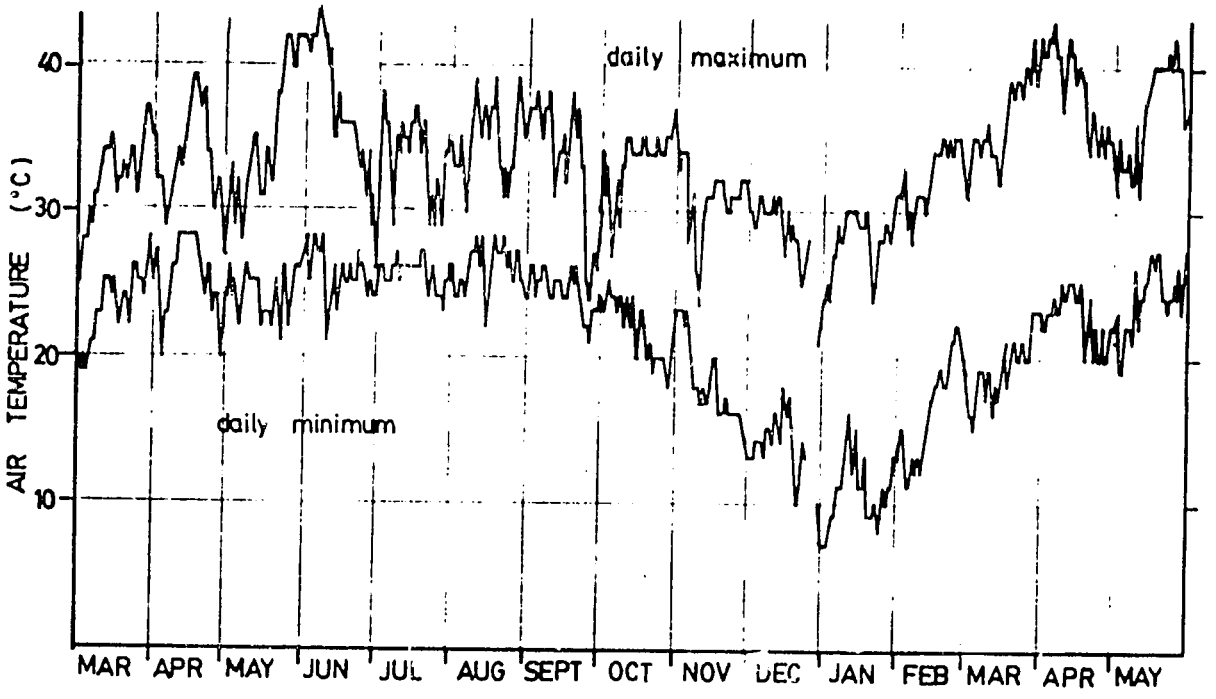
BHATIRTEK, SUDHARAM UPAZILLA, NOAKHALI

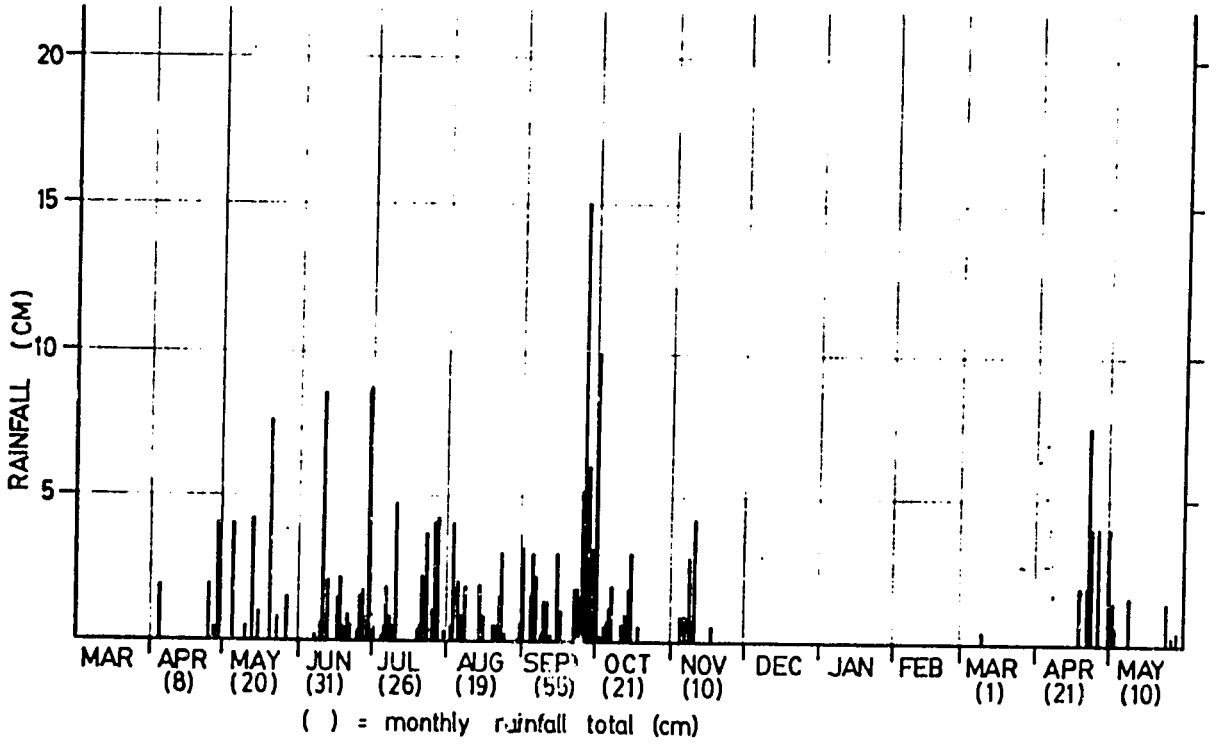




CLIMATIC DATA 1986 - 1987

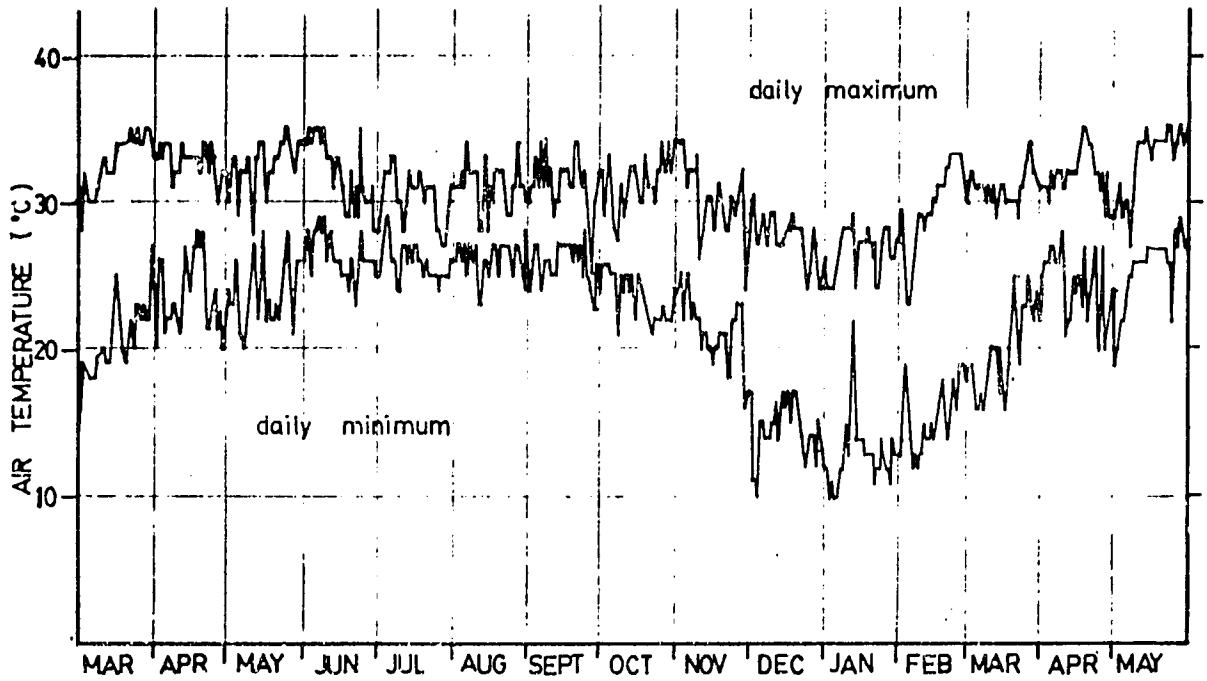
CHUADANGA, SADAR UPAZILA, CHUADANGA

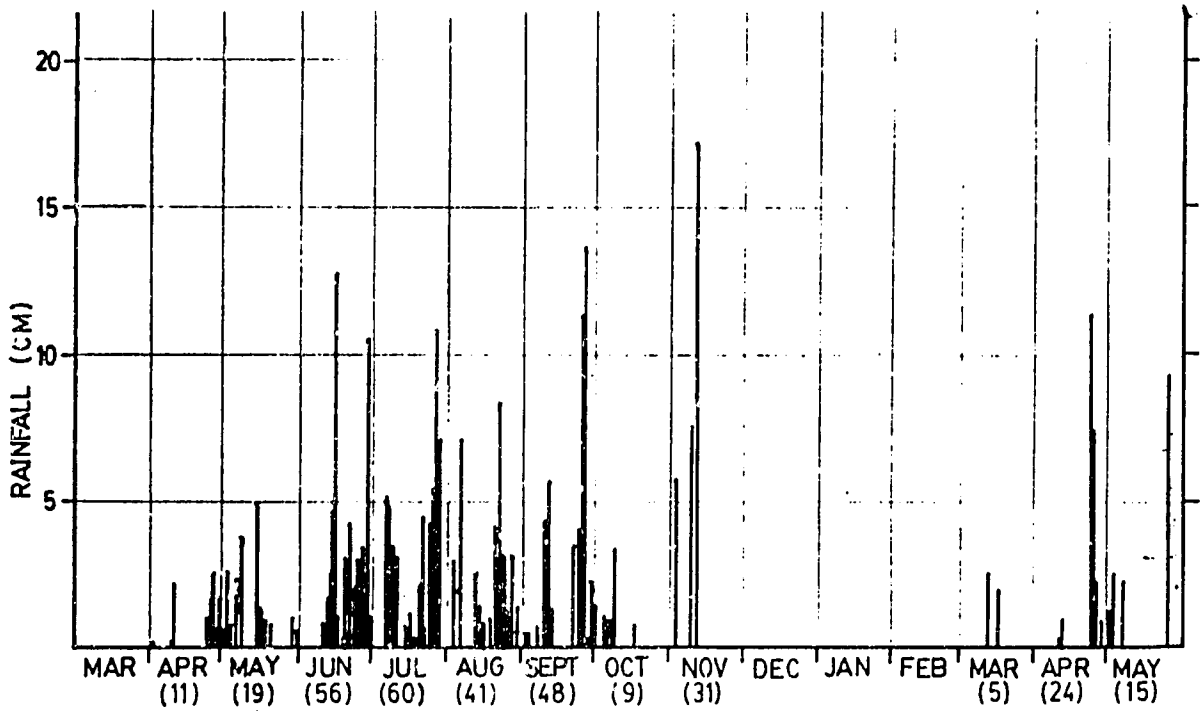




CLIMATIC DATA 1986 - 1987

CHAR BATA, SADAR UPAZILA, NOAKHALI





( ) = monthly rainfall total (cm)

PULSE CROPS

BLACKGRAM

FENI BANGLADESH AGRICULTURE RESEARCH INSTITUTE (BARI) ADVANCED BLACKGRAM YIELD TRIAL

Introduction

Blackgram, or mashkalai (*Phaseolus mungo*), is an important, short duration, pulse crop in parts of Greater Noakhali region in medium highland or highland areas. The crop is usually sown during the rabi season. In this BARI Cooperative trial, seed from five advanced lines of blackgram were tested at the Feni station research site in the rabi season. The last time blackgram was tested at the Feni station research site was three years ago, in an early kharif planting.

Results and Discussion

The plants all developed good stands early in the season. Considerable rat damage, however, occurred in this trial. While all genotypes were affected, B-23 was particularly damaged. Highly significant differences were noted for pods per plant and yield (TABLE 1). MAK-1 had the highest yield, while NG-135 had the highest number of pods per plant. It was interesting that at four weeks after planting, MAK-1 had the least vigorous growth of the five genotypes. Nonetheless, in the end, the yield of this genotype was the highest amongst the five genotypes.

TABLE 1: Feni BARI Advanced Blackgram Yield Trial

Planting date: 16-10-86
Plot size-planted: 4 x 4.8m
-harvested: 3 x 3.6m
Spacing-row: 30 cm
-plant: 6 cm

Design: RCBD
Replications: 4
Fertilizer: 0-60-30

Genotype	Days to flower	Days to maturity	Plant height	Pods per plant	Yield
			cm	#	t/ha
MAK-1	38	108	22.5	20.9 a b	1.48 a
NG-135	38	108	26.0	24.0 a	1.37 a
Ishurdi local	37	101	28.0	14.9 c	1.30 a b
Pant-4-26	38	112	25.2	17.9 b c	1.08 b
B-23	34	108	26.0	16.2 c	0.68 c
Mean	37	107.4	25.6	18.8	1.18
L. S. D. (.05)				4.6	0.26
C. V.(%)			11.8	15.7	14.21

COWPEA

CHAR BATA IITA COWPEA VARIETY TRIAL

Introduction

A collection of fifty cowpea (*Vigna unguiculata*) varieties from IITA was screened for adaptability over the past two years. In the first year, planting was too late for meaningful results, but seed was multiplied from 43 of the 50 varieties. These 43 varieties were tested in a trial with three replications in the 1987 rabi season.

Results and Discussion

Planting was delayed to the fourth of January by late recession of flood waters. By the twelfth of April, 52 mm of rain had been received. This caused sufficient flooding damage to necessitate final harvest of all varieties.

Most of the varieties performed poorly. However, two varieties, VITA 4 and TVX 2724-OIF, appeared outstanding (TABLE 1). Their yields did not match that of the local cultivar (740 kg/ha), however, which was planted on the same date in an adjoining field.

This season was generally a poor one for cowpea cultivation. Therefore, results cannot be taken as conclusive. However, the need for a short-duration cultivar with salinity and flooding tolerance has been illustrated.

TABLE 1: Char Bata IITA Cowpea Variety Trial

Planting date: 4/1/87
Harvest date: 14/4/87
Plot size -planted: 1.8m x 3.5m
-harvested: 1.8m x 3.5m
Plant spacing - row: 45 cm
- plant: 30 cm
Seed rate: 2 seeds/hill

Design: RCBD
Replications: 3
Fertilizer: 20-40-0 (incorporated with last plowing)
Weeding: 25 & 53 DAS

Variety	Days to flower	Days to maturity	Plant stand	100-seed weight	Yield
			#/m^2	g	kg/ha
1. VITA 4	74	100	9	8	520 a
2. TVX 2724-01F	77	100	9	13	450 ab
3. IT82D-807	83	100	10	10	300 bc
4. CES-41-6	72	98	10	12	290 bcd
5. 82D-906	60	95	12	11	270 cde
6. IT82D-755	75	100	11	15	260 cdef
7. IT82D-752	75	100	11	11	260 cdef
8. TVX 1850-01F	76	100	8	12	230 cdef
9. IT82E-32	71	100	8	11	230 cdef
10. IT82D-891	63	91	7	12	210 cdef
11. TVX 4677-082E	72	99	9	12	200 cdef
12. TVX 4677-010E	80	100	10	13	180 cdef
13. IT82D-787	76	100	11	12	170 cdef
14. TVX 289-4G	73	99	11	14	170 cdef
15. IT82D-789	72	100	10	13	160 cdef
16. IT82E-16	76	100	9	12	150 cdef
17. IT82D-744	80	100	9	10	150 cdef
18. TVX 3871-02F	73	95	6	14	150 cdef
19. IT81D-1025-174	74	100	8	10	130 cdef
20. IT82D-889	70	98	6	14	130 cdef
21. VITA 3	80	100	7	15	120 def
22. IT82D-885	70	98	7	15	120 def
23. IT82E-18	75	100	8	15	110 ef

TABLE 1: Continued

Variety	Days to flower	Days to maturity	Plant stand	100-seed weight	Yield
			#/m^2	g	kg/ha
24. IT82D-786	77	100	11	12	100 ef
25. IT82E-13	76	100	6	15	80 f
26. IT82E-60	61	91	3	20	80 f
27. IT82D-768	75	100	4	15	80 f
28. IT82E-9	83	100	6	13	60 f
Mean	74	99	8.4	12.8	190
L. S. D. (0.05)					171
C. V. (%)					54.0

Varieties lost due to flooding:

1. IT82D-713
2. IT81D-1007
3. TVX 3671-7C-02D
4. TVX 35-01D
5. TVX 3381-02F
6. IT81D-1032
7. TVX 4659-03E
8. IT81D-1151
9. IT82D-716
10. IT81D-1020
11. TVX 2949-03D

Varieties lost due to salinity:

1. IT81D-1069
2. TVX 3671-14C-01D
3. TVX 3236-01G
4. IT81D-1064

CHAR BATA COWPEA INOCULANT TRIAL

Introduction

This experiment was conducted to test the effect of *Rhizobium* inoculant prepared by BAU for cowpea (*Vigna unguiculata*) on cowpea cultivation in the char. Comparisons were made with and without N fertilizer to determine the effectiveness of symbiosis for N nutrition.

Results and Discussion

There was a salinity gradient within the blocks of this RCB design. For this reason, variability was high and no significant differences in plant height, nodule number or yield were observed (TABLE 1). Nodules were present on all treatments, suggesting that this soil had a sufficient background population of *Rhizobium*.

Further investigation on soils from different crop histories is recommended.

TABLE 1: Char Bata Cowpea Inoculant Trial

Planting date: 4/1/87
Harvest date: 20/4/87
Plot size-planted: 1.8m x 4.0m
-harvested: 1.8m x 4.0m
Plant spacing: 30 cm x 15 cm
Seed rate: 2 seeds/hill

Design: RCB split-plot
Replications: 4
Fertilizer: variable

Main-plot treatment	Sub-plot treatment	Days to flower	Plant height 15DAS	Plant height 35DAS	Nodule count	Yield
(fertilizer)	(inoculant)		------cm------		#/plant	kg/ha
0-40-0	-	78	6.5	14.5	4.0	880
0-40-0	+	78	6.3	14.3	3.8	740
20-40-0	-	74	6.0	14.8	5.3	740
20-40-0	+	77	5.8	14.8	8.5	600
Mean		77	6.1	14.6	5.4	740
L.S.D. (0.05)			NS	NS	NS	NS
C. V. (%)			8.8	8.6	76.	42

CHITOSI STATION COWPEA PLANTING METHOD TRIAL

Introduction

This trial compared the conventional tillage method for cowpea (*Vigna unguiculata*) with two minimum tillage methods designed to lower input costs. Conventional tillage consists of working up the ground with a kodal. The asra minimum tillage method consists of raking the soil twice with an asra, broadcasting seed and fertilizer, raking the soil twice more and then putting straw over the soil for mulch. The laddered minimum-tillage method consists of broadcasting seeds and fertilizer, laddering the soil four times to get good seed to soil contact and then putting straw over the soil for mulch. The test area drained late due to heavy rains in November, so the soil was very moist at planting time.

Results and Discussion

Cowpea stands where the laddered treatment was used definitely looked worse than the others. There was some cow grazing damage on a few of the plots. Yields were significantly different at the 10% level (TABLE 1).

Research with intercropping cowpea and wheat by the asra minimum tillage method may be useful. How well this technology works in drier years and how well cowpea grows with an earlier planting date should also be researched.

TABLE 1: Chitosi Station Cowpea Planting Method Trial

Planting date-ladder and asra: 14/12/86
-coventional: 20/12/86
Last harvest date: 2/4/86
Plot size-planted: 4 x 4m
-harvested: $4m^2$

Seed rate: 24 kg/ha
Seeding method: broadcast
Fertilizer: 15/40/10
Variety: Chitosi local
Design: RCBD
Replications: 3

Planting method	Flowering date	Plant ht.	Plants/m^2	Yield[a/]
		cm	#	kg/ha
Conventional	16/3/87	99	10	580
Asra	16/3/87	101	9	510
Ladder	16/3/87	99	9	320
Mean		100	9	470
L.S.D. (0.05)			NS	NS
C. V. (%)			14	21

a/ significant at the 10% level

FIELDPEA

CHITOSI STATION FIELDPEA PLANTING METHOD TRIAL

Introduction

The traditional method of planting fieldpea (*Pisum sativum*) is to relay it into the deepwater aman crop. A trial was conducted to see if using the asra minimum tillage technology would increase yields.

The fieldpea was broadcast onto the straw mat of a harvested field for the relay treatment. The asra minimum tillage treatment consisted of removing the straw, raking the soil twice, broadcasting seed and fertilizer, raking the soil twice more, laddering the soil twice and then replacing the straw to act as a mulch.

Results and Discussion

Stands of both treatments looked good. It appears that using the asra minimum tillage technology will not economically enhance fieldpea yields. Yield and plant population differences between the planting methods were not significant (TABLE 1).

Further work with this technology is probably not needed. This information, however, is useful for planning fieldpea/wheat intercropping trials with the asra minimum tillage technology.

TABLE 1: Chitosi Station Fieldpea Planting Method Trial

Planting dates-relay: 3/12/86
-asra: 11/12/86
Harvest date: 12/3/87
Plot size-planted: 4 x 4m
-harvested: $4m^2$

Design: RCBD
Replications: 3
Variety: Laksam local
Seed rate: 75 kg/ha
Fertilizer: 20/40/0

Planting method	Flowering date	Plant ht.	Plants per m^2	Yield
		cm	#	kg/ha
Asra	9/2/87	123	104	1100
Relay	18/2/87	117	96	1000
Mean		120	100	1050
L.S.D. (0.05)		NS	NS	NS
C. V. (%)		8	11	14

MUNGBEAN

CHAR BATA MUNGBEAN INOCULANT TRIAL

Introduction

Pulse cultivation in the char is subject to low yields and high risk. Therefore, farmers seek to minimize input costs. Rhizobium inoculation may reduce or eliminate the need for N fertilizer. This experiment was conducted to determine whether fertilizer, Rhizobium symbiosis, or a combination of the two is best for the N-nutrition of mung bean (Phaseolus aureus). Two cultivars were included, to broaden the scope of conclusions.

Results and Discussion

Germination and early growth of mungbean in this trial were excellent, but final yields were poor. Possible reasons for low yields include disease (powdery mildew, anthracnose) and low temperatures prior to flowering. Daily minimum temperatures as low as 13° persisted until February 10 (36 days after seeding). However, this is not unusual a compared to other years. Lower temperatures can cause bud abortion in some legumes, leading to abnormal plants. Such symptoms were observed this year on both research plots and farmers' fields.

In general, inoculation did not increase nodule number or yield (TABLE 1). Nodulation was good, suggesting that Rhizobium populations in the soil from previous years were sufficient. Although seedlings of the cultivar, '7715' were slightly taller at 15 DAS, the Char Bata local yielded 24% more.

A complete set of seven orthogonal contrasts were performed. Aside from the significant main effects shown by the LSD test, only one significant (p 0.10) interaction was observed. Inoculated plants in the 0 N fertilizer treatment were 16% shorter at 15 DAS than those not inoculated, whereas in the 20 N treatment they were 10% taller. This suggests that inoculated plants without N fertilizer were partitioning more energy towards nodule formation. However, it seems little benefit was obtained in terms of later growth and yield.

The nitrogen applied did not increase mungbean yield. Possibly the soil of this field has built up fertility over time, as it has been used for research for several years.

On-farm use of inoculant cannot be recommended from this trial, but on-farm testing of inoculant would be useful to determine whether it is required on lands previously not sown to mungbeans. Further investigation of diseases and cold tolerance is also required to make extension of profitable mungbean cultivation possible.

TABLE 1: Char Bata Mungbean Inoculant Trial

Planting date: 5/1/87
Harvest date: 8/4/87 (93 DAS)
Plot size: 1.8m x 3.4m
Row spacing: 30 cm
Seed rate: 25 kg/ha

Design: split plot RCBD
Replications: 4
Fertilizer: Variable + 20 kg S/ha (gypsum)
Previous crop: aman

Main treatments - A: 0-40-0 fertilizer incorporated with tillage
B: 20-40-0 fertilizer incorporated with tillage

Sub-plot treatments - 1) Char Bata local cultivar with inoculant
2) Char Bata local cultivar without inoculant
3) CV. 7715 with inoculant
4) CV. 7715 without inoculant

Treatment	Days to flower	Plant height 15 DAS	Plant height 35 DAS	Nodules/plant 29 DAS	Yield (10% M. C.)
		------- cm ------		#	kg/ha
A: 0-40-0	57	5.3	13.6 b	10.0	473
B: 20-40-0	58	5.5	14.3 a	9.1	485
L. S. D. (0.05)	NS	NS	0.2	NS	NS
1) C. B. +	58 a	4.4 b	13.5	9.8	519 a
2) C. B. -	58 a	4.4 b	13.8	8.8	541 a
3) 7715 +	57 b	6.3 a	14.4	10.6	423 b
4) 7715 -	57 b	6.6 a	14.0	9.0	432 b
Mean:	57.5	5.4	13.9	9.5	479
L. S. D. (0.05)	0.9	1.1	NS	NS	59
C. V. (%)	1.6	18.5	10.3	38.8	11.7

SOYBEAN

SOYBEAN VARIETY TRIALS

Introduction

Soybean (*Glycine max*) variety testing is being conducted to find varieties adapted to both production seasons: the kharif season in Chuadanga and the rabi season in Noakhali. The objective is to find a variety either superior to the currently extended Pb-1, or equal, in the event of disease resistance breakdown in Pb-1. The primary selection parameter is the ability to produce high quality seed. The second parameter is yield, followed by reasonably short duration in the rabi season. Other agronomic characters are a also monitored to determine acceptability.

Varieties for testing are obtained from international sources, primarily from India. New varieties are first tested in the date-of-planting screening trials in Chuadanga (kharif) and Raipur (rabi). Those that appear promising are subsequently tested in replicated variety trials.at various planting dates. Those with undesirable characteristics are eliminated from further testing.

CHUADANGA KHARIF SOYBEAN VARIETY DATE OF PLANTING SCREENING TRIAL

Introduction

The purpose of this screening was primarily to evaluate new varieties for quality of seed production. To ensure a range of adverse conditions, five planting dates were selected. In general, weather conditions improve as the season progresses.

The secondary objective of this screening was to get an indication of the general agronomic characteristics of these varieties.

Results and Discussion

Detailed results for yield and seed germination are presented in TABLE 1. Yield generally declined with later planting but germination improved.

The first two planting dates produced the most effective screening for germination. However, results from one individual planting date should be interpreted with caution, since poor germination may be a result of particularly adverse weather during maturation of any one particular variety.

Results for duration, disease rating, plant height and seed weight were averaged over the five planting dates and are presented in TABLE 2. Days to flower and maturity, and plant height, declined with later planting.

Results for six varieties included only for the last planting date are presented in TABLE 3. These varieties were received late and their testing will continue.

TABLE 1: Chuadanga Kharif Soybean Variety Date of Planting Screening Trial

Planting dates: 19/6, 3/7, 16/7, 3/8, 26/8/86 Replications: 1

Plot size: 0.6m x 2.0m Fertilizer: 20-60-20-15

Plant spacing - row: 60 cm + inoculant

plant: 5 cm

Variety	Germination (%)					Yield (t/ha @ 13% MC)[a/]				
	19/6	3/7	16/7	3/8	26/8	19/6	3/7	16/7	3/8	26/8
1. Pb-1	96	99	96	98	95	2.2	1.4	2.0	1.3	1.0
2. Bragg	87	89	87	85	96	1.9	0.7	1.3	1.1	0.5
3. PM-78-6-5-13	99	97	98	97	97	2.9	1.3	1.8	1.5	0.2
4. PK-308	95	88	94	92	98	1.9	0.5	0.6	0.9	0.5
5. PK-327	98	99	97	99	100	2.5	0.4	0.8	1.2	0.8
6. PR-141	97	88	96	99	96	2.5	0.4	0.8	1.2	0.3
7. PR-142	90	75	93	98	95	1.2	0.2	0.2	0.8	0.5
8. PR-154-11	94	94	97	96	-	2.4	0.6	0.9	1.1	1.1
9. PR-165-6	94	89	95	93	98	1.4	0.6	0.8	1.0	0.6
10. PR-21(339)	96	93	94	94	98	2.0	1.3	0.9	1.2	0.8
11. PR-164-20	87	85	85	99	99	2.9	0.5	1.2	1.1	0.8
12. Davis	41	82	97	79	98	1.6	0.6	0.9	0.7	0.7
13. IPB-185-77	47	88	95	85	99	2.0	0.8	1.2	1.1	0.8
14. IPB-139-80	67	88	86	85	97	2.5	1.3	1.4	1.1	0.7
15. IPB-204-77	48	93	97	95	94	2.0	0.9	1.1	1.0	0.4
16. MTD-65	95	95	100	97	99	3.2	1.8	2.3	1.7	0.6
17. AGS-147	40	75	97	90	95	1.7	1.3	1.3	1.5	0.3
18. AGS-2	97	96	100	100	96	2.0	1.6	1.2	1.5	0.1
19. AGS-58	87	64	88	87	99	1.0	0.8	0.7	0.5	0.2
20. AGS-144	54	75	87	86	-	1.1	0.9	0.8	0.4	-
21. AGS-160	74	93	95	98	-	0.8	1.1	1.3	0.6	-
22. AGS-129	51	81	95	91	95	1.4	1.1	1.1	0.9	0.2
23. AGS-162	77	94	96	95	97	2.3	1.1	1.2	0.6	0.3
24. AGS-234	95	97	89	87	99	1.6	0.8	1.1	0.6	0.2
25. AGS-248	49	75	95	94	-	1.4	0.4	0.8	0.2	-
26. AGS-272	95	90	94	89	98	2.3	0.7	1.1	0.8	0.4
27. TGX-814-23D	-	95	95	93	-	-	0.6	0.8	1.7	-
28. G-2120	95	97	98	99	98	1.9	1.4	1.6	1.4	0.5
29. G-2120 M7(69-1)	98	51	96	96	88	0.9	0.5	0.9	0.6	0.2
30. G-2120 M7(69-4)	100	55	96	99	99	1.0	0.3	0.8	0.5	0.1
31. G-2120 M7(35-5)	96	72	97	98	99	1.0	0.2	0.7	0.6	0.1
32. Pb-1 OT	98	99	99	92	92	2.6	0.7	1.6	1.3	0.7
33. BAU-4EW	7	87	95	98	99	0.7	0.5	0.5	0.7	0.6
34. BS-15	91	29	75	93	93	0.9	0.1	0.4	0.7	0.3
35. BS-54	87	96	98	100	99	2.7	1.0	1.0	0.6	0.4
36. Tainung No-15	85	35	95	97	96	0.9	0.3	0.9	0.6	0.2
37. IAC-8	95	93	96	97	98	2.4	0.5	1.6	1.9	0.6
38. IAC-11	96	84	96	93	-	1.1	0.4	1.0	0.5	-
Mean:	84	87	94	95	97	1.7	1.0	1.2	1.1	0.5

TABLE 1: Chuadanga Kharif Soybean Variety Date of Planting Screening Trial

Planting dates: 19/6, 3/7, 16/7, 3/8, 26/8/86 Replications: 1

Plot size: 0.6m x 2.0m Fertilizer: 20-60-20-15 + inoculant

Plant spacing - row: 60 cm

plant: 5 cm

Variety	Germination (%)					Yield (t/ha @ 13% MC)[a/]				
	19/6	3/7	16/7	3/8	26/8	19/6	3/7	16/7	3/8	26/8
39. IAC-12	93	90	75	-		2.2	0.8	1.1	-	-
40. IAC-13	93	85	91	85	96	1.1	0.3	0.9	0.4	0.1
41. Co-1	95	95	98	97	97	1.0	0.8	0.7	0.7	0.1
42. TARI-92512	95	97	95	97	-	1.4	1.5	1.2	1.4	0.1
43. TARI-92596	83	96	96	-	-	1.1	0.8	1.0	-	-
44. Santa Rosa-R.	93	88	88	96	98	1.7	1.4	1.5	1.0	0.1
45. Durga	95	93	99	95	90	2.4	0.9	1.9	1.1	0.1
46. PR-13(114)	-	98	97	-	1.7	-	0.7	0.1	0.1	-
47. Sao Luiz	93	95	93	95	97	3.7	1.7	1.6	0.7	0.1
48. Macs-57	97	97	98	98	-	2.1	1.9	1.4	0.1	-
49. Macs-58	83	93	97	97	93	1.9	1.4	1.2	1.4	0.6
50. ICA-Caribe	-	-	99	99	-	-	-	3.5	3.9	1.9
51. Shih-Shih	95	30	96	97	-	1.2	0.4	0.7	0.9	-
52. ICAL-125	-	-	97	99	-	-	-	1.8	2.5	0.8
53. ICAL-131	93	95	96	100	93	1.5	1.5	1.2	1.0	1.0
54. ICAL-132	88	97	99	95	98	1.2	0.9	1.3	1.3	0.7
55. AGS-167	4	60	93	-	-	1.0	0.9	0.8	-	-
56. TGX-539-5E	93	98	100	100	100	2.5	1.4	2.4	2.3	1.5
57. TARI-D/419	8	37	92	98	-	0.3	0.3	0.6	0.6	-
58. TGX-573-208D	85	96	93	95	98	2.1	1.1	1.7	1.4	0.6
59. TGX-573-209D	95	95	98	98	99	1.5	0.8	1.0	1.3	0.2
60. IAC-6	-	94	97	98	98	-	0.7	1.2	1.1	0.2
61. TGX-811-100	97	97	99	99	99	1.7	0.8	1.7	0.9	0.1
62. TARI-92533	98	98	96	100	-	1.4	0.2	0.7	1.1	0.1
63. TGX-824-4E	97	99	97	100	95	1.2	1.8	1.3	1.1	0.2
64. TGX-849-294D	78	95	98	97	99	1.5	1.6	1.6	1.5	0.5
65. TGX-855-68D	98	100	97	99	99	1.3	1.8	1.9	1.3	0.4
66. TGX-855-78D	99	99	100	97	95	2.5	2.4	2.0	1.1	0.4
67. TGX-888-49C	41	95	93	99	98	1.4	1.2	1.3	1.1	0.2
68. PS-1	-	91	91	98	-	-	0.8	1.7	1.2	-
69. Bossier	95	83	90	99	96	3.1	1.0	1.8	2.5	1.7
70. UFV-1	97	89	99	97	98	2.3	1.9	2.3	1.8	1.0
71. KHSb-2	83	95	87	94	98	1.0	1.0	1.0	1.1	0.8
72. D-75-9207	84	91	95	99	96	1.1	1.8	1.8	1.8	0.6
73. ISRA/IRAT 26/72	99	98	95	95	98	1.5	1.3	2.1	1.9	0.7
74. Hartz	95	89	91	91	96	1.5	1.5	1.1	1.4	0.2
75. TGX-814-26D	-	93	99	97	-	-	1.3	1.3	1.2	-
76. Leflore	97	87	97	93	99	1.3	2.0	1.8	1.1	0.6
77. SJ-2	82	95	96	95	91	2.0	0.5	0.6	0.8	0.1
Mean:	84	87	94	95	97	1.7	1.0	1.2	1.1	0.5

a/ since yields are measured from a single one-row sample, they should be interpreted as a general indication of plant vigor rather than yield potential

TABLE 2: Chuadanga Kharif Soybean Variety Date of Planting Screening Trial

Planting dates: 19/6, 3/7, 16/7, 3/8, 26/8/86 Replications: 1

Plot size: 0.6m x 2.0m Fertilizer: 20-60-20-15 + inoculant

Plant spacing - row: 60 cm

plant: 5 cm

Variety	Days to[a/] flower	Days to[a/] maturity	Disease[a/] YMV[a/]	Disease[a/] BP[a/]	Plant[a/] height (cm)	100-seed[a/] weight (g)
1. Pb-1	46	106	1.4	2.4	55	10.0
2. Bragg	35	112	1.6	1.0	35	13.1
3. PM-78-6-5-13	46	106	1.2	2.4	46	9.8
4. PK-308	39	112	1.6	1.0	30	10.2
5. PK-327	38	105	1.8	1.0	26	8.7
6. PR-141	54	116	1.4	1.6	40	11.4
7. PR-142	53	120	1.8	1.2	37	9.3
8. PR-154-11	50	124	3.0	1.0	38	10.3
9. PR-165-6	46	122	2.2	1.0	42	11.2
10. PR-21(339)	55	124	3.2	1.0	50	13.0
11. PR-164-20	45	119	2.0	1.0	51	11.5
12. Davis	36	102	1.6	1.0	32	12.0
13. IPB-185-77	36	102	1.2	1.0	32	11.5
14. IPB-139-80	38	108	1.0	1.0	32	13.5
15. IPB-204-77	39	102	1.0	1.0	30	12.9
16. MTD-65	44	104	3.0	1.0	57	15.0
17. AGS-147	38	102	2.4	1.2	51	13.3
18. AGS-2	54	106	1.2	2.0	67	5.4
19. AGS-58	39	101	1.0	2.4	38	11.2
20. AGS-144	38	98	1.0	2.5	39[b/]	10.9[b/]
21. AGS-160	43	100	1.2	1.8	40	9.2[b/]
22. AGS-129	39	105	2.3	1.0	47	13.4
23. AGS-162	40	103	1.2	2.4	43	11.0
24. AGS-234	40	103	1.0	2.6	45	11.8
25. AGS-248	37[b/]	98[b/]	1.0	2.4	28[b/]	10.3[b/]
26. AGS-272	37	112	1.4	1.0	27	12.8
27. TGX-814-23D	52	115	2.3	1.0	48	9.0[b/]
28. G-2120	54	107	1.0	1.8	62	5.5
29. G-2120 M7(69-1)	38	87	1.0	1.6	39	4.5
30. G-2120 M7(69-4)	38	87	1.0	1.6	40	4.5
31. G-2120 M7(35-5)	38	87	1.0	1.6	35	4.7
32. Pb-1 OT	46	106	1.5	2.6	55	10.0
33. BAU-4EW	40	95	1.4	1.6	44	11.9
34. BS-15	39	89	1.4	2.2	26	8.4
35. BS-54	48	101	3.2	2.2	51	7.9
36. Tainung No-15	37	88	2.5	1.3	33	11.2
37. IAC-8	45	110	1.8	1.0	46	12.8
38. IAC-11	44[b/]	107[b/]	1.0	2.8	43[b/]	10.0[b/]
39. IAC-12	43[b/]	108[b/]	1.8	1.0	27[b/]	9.8[b/]
40. IAC-13	40	104	1.5	1.0	24	9.3[b/]
Mean	44	108	1.9	1.4	44	10.4

TABLE 2: Chuadanga Kharif Soybean Variety Date of Planting Screening Trial

Planting dates: 19/6, 3/7, 16/7, 3/8, 26/8/86 Replications: 1

Plot size: 0.6m x 2.0m Fertilizer: 20-60-20-15 + inoculant

Plant spacing - row: 60 cm

plant: 5 cm

Variety	Days to[a/] flower	Days to[a/] maturity	Disease[a/ d/] YMV	Disease[a/ d/] BP	Plant[a/] height (cm)	100-Seed[a/] weight (g)
41. Co-1	47	104	2.5	2.3	49	7.0
42. TARI-92512	46	111	3.3	1.8	67	10.9[b/]
43. TARI-92596	46[b/]	104[b/]	2.0	1.3	73	9.5[b/]
44. Santa Rosa-R	46	116	1.0	1.0	35	10.1
45. Durga	45	110	1.8	1.0	34	9.3
46. PR-13(114)	52[b/]	122[b/]	2.3	1.0	49[b/]	9.5[b/]
47. Sao Luiz	44	108	1.5	1.0	30	11.0
48. Macs-57	48[b/]	106[b/]	1.3	2.2	42[b/]	9.8[b/]
49. Macs-58	46	112	3.8	1.0	53	13.1
50. ICA-Caribe	50[b/]	136[b/]	2.0	1.0	73[b/]	11.0[b/]
51. Shih-Shih	36[b/]	88[b/]	2.0	1.8	29[b/]	11.0[b/]
52. ICAL-125	50[b/]	133[b/]	3.0	1.0	63[b/]	11.4[b/]
53. ICAL-131	45	109	2.6	1.0	48	9.8
54. ICAL-132	45	108	2.4	1.0	47	10.0
55. AGS-167	40[b/]	96[b/]	1.3	2.6	36[b/]	13.3[b/]
56. TGX-539-5E	57	123	2.0	1.0	54	10.2
57. TARI-D/419	34[b/]	96[b/]	2.2	2.5	34[b/]	10.4[b/]
58. TGX-573-208D	41	108	2.0	1.[illegible]	66	9.7
59. TGX-573-209D	47	110	3.4	1.0	44	8.6
60. ICA-6	50[b/]	114[b/]	3.0	1.0	39[b/]	10.1[b/]
61. TGX-811-100	52	112	3.0	1.0	50	7.8
62. TARI-92533	50	112	2.8	1.8	49[b/]	9.3[b/]
63. TGX-824-4E	48	112	3.2	1.0	46	7.4
64. TGX-849-294D	46	107	2.0	1.0	53	8.8
65. TGX-855-68D	60	124	3.6	1.0	83	10.6
66. TGX-855-78D	60	125	3.0	1.0	83	9.8
67. TGX-888-49C	47	106	2.2	1.2	44	9.1
68. PS-1	48[b/]	116[b/]	3.0	1.0	71[b/]	16.1[b/]
69. Bossier	46	119	1.6	1.0	42	13.7
70. UFV-1	46	123	2.8	1.0	44	12.0
71. KHSb-2	45	112	1.4	1.0	41	10.3
72. D-75-9207	49	125	2.6	1.0	55	11.4
73. ISRA/IRAT 26/72	53	125	2.2	1.0	57	13.3
74. Hartz	52	129	1.5	1.0	43	10.1
75. TGX-814-26D	51[b/]	115[b/]	2.3	1.0	52[b/]	10.3[b/]
76. Leflore	37	106	1.0	1.4	38	12.1
77. SJ-2	51	109	1.2	2.0	40	10.2
Mean:	44	108	1.9	1.4	44	10.4

a/ mean over five planting dates
b/ indicates means adjusted for one or two missing planting dates
c/ rating scale of 1-5 where 1 = no symptoms and 5 = severe symptoms
d/ YMV = yellow mosaic virus; BP = bacterial pustule

TABLE 3: Chuadanga Kharif Soybean Variety Date of Planting Screening Trial

(Varieties included for 26/8 planting date only)

Plot size: 0.6m x 2.0m

Plant spacing - row: 60 cm
plant: 5 cm

Replications: 1

Fertilizer: 20-60-20-15 + inoculant

Variety	Days to flower	Days to maturity	Disease[a/] YMV[c/]	Disease[a/] BP[c/]	Plant height	100-seed weight	Germination	Yield
					cm	g	%	t/ha
Ankur	39	107	-	-	19	10.7	-	0.3
Gaurav	39	97	1	1	28	12.7	98	1.0
JS-2	31	87	2	1	16	-	-	0.1
PK 262	38	100	-	-	24	11.5	94	0.6
PK 416	34	93	1	1	26	12.0	100	0.7
Shilajeet	34	87	2	1	15	9.8	-	0.1
Mean:[a/]	44	108	2	1	25	11.2	97	0.5

a/ rating scale of 1-5 where 1= no symptoms and 5= severe symptoms

b/ mean of all varieties for 26/8 planting date

c/ YMV= yellow mosaic virus; BP= bacterial pustule

CHUADANGA KHARIF SOYBEAN VARIETY TRIAL

Introduction

The purpose of this trial is to test promising varieties from screening trials more precisely for performance in early and late planted kharif conditions. The most important criteria for this season is seed quality, followed by yield, resistance to yellow mosaic virus (YMV) and other desirable agronomic traits.

Results and Discussion

In the early-planted treatment, field weathering during seed maturation was more severe (TABLE 4). This resulted in lower seed germination and a more effective screening for varieties capable of producing high quality seed.

Among the five varieties in the highest germination class, PK-308, MTD-65, Pb-1 and Pb-1 OT yielded well in the early planting. However, in the later planting, MTD-65 and G-2120 yielded more than Pb-1 and Pb-1 OT.

In terms of diseases, MTD-65 appeared to be the most susceptible to YMV, and Pb-1 and Pb-1 OT the most susceptible to bacterial pustule.

TABLE 4: Chuadanga Kharif Soybean Variety Trial

A:

Planting date: 19/06/86 Design: RCBD

Plot size - planted: 2.25m x 2.75m Replications: 4

harvested: 1.35m x 2.75m Fertilizer: 20-60-20-15 plus inoculant

Plant spacing - row: 45 cm

plant: 5 cm

Variety	Days to flower	Days to maturity	Disease[a/] BP	Disease[a/] YMV	Plant height	Lodging	Plant stand	100 seed wt.	Germination	Yield[c/]
			#[b/]	#[b/]	cm	#[b/]	#/m^2	g	%	t/ha
Bragg	39	129	1.0	1.0	49	1.0	45	14.0	75 b	2.42 a
PK-308	44	131	1.0	1.8	42	1.0	45	10.4	93 a	1.86 b
MTD-65	51	120	1.0	3.0	95	3.0	45	16.4	98 a	1.81 b
Pb-1 OT	53	122	3.0	2.0	103	3.0	45	9.8	99 a	1.76 bc
Pb-1	53	122	3.0	1.8	84	3.5	46	9.9	98 a	1.62 bc
AGS-162	45	110	1.0	1.0	58	2.0	43	10.0	68 b	1.50 c
G-2120	59	115	1.0	1.0	84	2.3	45	5.3	97 a	1.35 cd
BAU-4EW	40	107	1.0	1.3	75	2.0	42	13.8	4 c	1.10 de
AGS-129	39	109	1.0	2.8	64	2.0	45	13.6	8 c	1.06 e
AGS-160	46	107	1.0	2.0	70	2.5	43	9.1	69 b	0.93 e
Mean:	47	117	1.4	1.8	72	2.2	45	11.2	71	1.54
LSD (.05)	1.0				10.0	0.7	1.9	0.66	8.4	0.27
C.V.(%)	1.52				9.5	23.0	2.9	4.04	8.16	11.8

B:

Planting date: 27/08/86 Plot size - planted: 2.4m x 3.75m

Plant spacing: 30cm x 5 cm harvested: 1.8m x 2.75m

Variety	Days to flower	Days to maturity	Disease[a/] BP	Disease[a/] YMV	Plant height	Lodging	Plant stand	100 seed wt.	Germination	Yield[c/]
			#[b/]	#[b/]	cm	#[b/]	# /m^2	g	%	t/ha
Bragg	35	98	1.0	2.0	32	1.0	35	15.4	97	1.23 bc
PK-308	35	97	1.0	1.8	26	1.0	54	11.6	99	1.28 bc
MTD-65	40	90	1.0	2.0	49	1.5	63	16.2	96	1.83 a
Pb-1 OT	40	90	1.0	2.0	48	1.8	61	11.0	97	1.33 bc
Pb-1	40	92	1.0	2.0	35	1.0	44	11.5	97	1.24 bc
AGS-162	40	96	1.0	1.5	33	1.0	39	15.7	97	1.24 bc
G-2120	48	97	1.0	1.0	48	1.5	64	6.9	99	1.57 ab
BAU-4EW	40	92	1.0	2.0	39	1.0	56	15.2	96	1.20 c
AGS-129	41	95	1.0	2.0	38	1.0	57	15.3	95	1.74 a
AGS-160	40	90	1.0	2.0	47	2.0	64	10.1	96	1.33 bc
Mean:	40	94	1.0	1.8	40	1.3	54	12.9	97	1.40
LSD (.05):		1.2			6.2	0.4	12	1.1	NS	0.35
C.V.(%)		0.85			10.8	23.7	14.9	5.94	2.64	17.2

a/ BP= bacterial pustule; YMV= yellow mosaic virus

b/ rating scale of 1-5 where 1= no symptoms and 5= severe symptoms

c/ yields corrected to 13% MC

CHUADANG. KHARIF SOYBEAN DATE OF PLANTING X VARIETY TRIAL

Introduction

Early planting in kharif season is desirable, since stand establishment is facilitated by the onset of monsoon rains, and yields are generally higher. Certain varieties, however, are susceptible to the increased field weathering at seed maturation. This trial was conducted to determine the yield and seed production potential of six of the most promising soybean varieties on four different dates of planting. The experiment was arranged as a split-plot with planting dates as main plots and varieties as subplots.

Results and Discussion

Heavy rains after planting reduced stands and plant height on the June 5 and July 6 planting dates (TABLE 5). However, the June 5 planting apparently recovered through extensive branching, resulting in higher number of pods per plant. Yield declined significantly for plantings later than June 5.

For all variables measured, except for days to flower and maturity there was no significant interaction between varieties and dates of planting. Across all planting dates, the varieties Pb-1, Pb-1 O.T. and MTD-65 were significantly higher-yielding. Their seed quality was also excellent. G-2120, despite its lower yield, is still of interest due to high seed quality and rabi season performance. PK-7394 is no longer being considered, due to poor seed quality in this and other trials.

In general, days to flower and maturity are less with later plantings (TABLE 6). The two shortest-duration varieties, G-2120 and MTD-65, show the greatest difference from the other varieties at earlier planting dates. This may indicate less photoperiod sensitivity. However, both these varieties are longer in duration than Pb-1, when grown in the rabi season.

TABLE 5: Chuadanga Kharif Soybean Date of Planting x Variety Trial

Plot size - planted: 2.25m x 3.0m
harvested: 1.35m x 2.0m
Plant spacing - row: 45 cm
plant: 5 cm

Design: split - plot RCBD
Replications: 3
Fertilizer: 0-60-20-15

Planting date	Plant stand	Plant height	Lodging[a/]	YMV[b/]	Pods/ plant	100-seed weight	Germination	Yield
	#/m^2	cm			#	g	%	t/ha
May 25	39 a	73 a	3.3	1.1	37 b	10.5 ab	92	2.81 a
June 5	24 b	58 b	2.8	1.3	79 a	10.3 b	94	2.81 a
June 23	40 a	75 a	3.0	1.3	25 b	10.8 a	93	1.98 b
July 6	34 a	56 b	2.5	2.1	27 b	10.8 a	95	1.50 b
Mean:	34	65	2.9	1.5	42	10.6	94.0	2.28
LSD (0.05):	10	9.2			31	0.47	NS	0.50
C.V. (%):	37.2	17.3			89.5	5.39	4.10	26.7

Variety	Plant stand	Plant height	Lodging[a/]	YMV[b/]	Pods/ plant	100-seed weight	Germination	Yield
	#/m^2	cm			#	g	%	t/ha
Pb-1 O.T.	36 ab	85 a	2.3	1.3	48 ab	9.8 d	97 a	2.98 a
Pb-1	37 ab	69 c	2.8	1.2	50 a	9.8 d	95 a	2.73 a
MTD-65	33 bc	82 ab	2.5	2.5	44 ab	15.4 a	96 a	2.58 a
PK-308	32 bc	38 d	1.0	1.3	29 b	10.7 c	90 b	1.88 b
G-2120	39 a	77 b	2.0	1.3	51 a	5.3 e	97 a	1.87 b
PK-7394	28cc	43 d	1.0	1.3	29 b	12.6 b	86 b	1.62 b
LSD (0.05):	5.3	6.7			21	0.75	3.4	0.54
C.V. (%):	18.3	12.2			60.3	8.46	4.39	28.5

a/ rated on a scale of 1-5; 1= no lodging; 5= complete lodging

b/ YMV= yellow mosaic virus; rating scale of 1 to 5 where 1= no symptoms and 5= severe symptoms

TABLE 6: Chuadanga Kharif Soybean Date of Planting x Variety Trial

Days to Flower:

Variety	May 25	June 5	June 23	July 6	Mean
Pb-1 O. T.	73 a A[a/]	64 b B	51 c B	49 c B	59 B
Pb-1	71 a A	64 b B	51 c B	49 c B	59 B
MTD-65	66 a B	62 b B	50 c B	48 c B	57 C
PK-308	57 a C	54 b D	44 c C	40 d C	49 F
G-2120	70 a A	67 b A	57 c A	56 c A	63 A
PK-7394	58 a C	57 a C	49 b B	47 b B	53 D
Mean	66 a	61 b	50 c	48 d	56

LSD (.05): planting date means: 1.6 planting dates for one variety: 2.9
variety means: 1.4 varieties within planting dates: 2.7

C.V. (planting dates): 3.38% C. V. (varieties): 2.8%

Days to Maturity:

Variety	May 25	June 5	June 23	July 6	Mean
Pb-1 O. T.	147 a C[a/]	139 b C	122 c C	113 d C	130 C
Pb-1	147 a C	136 b CD	122 c C	113 d C	130 C
MTD-65	141 a D	133 b DE	120 c CD	111 d C	126 D
PK-308	155 a B	143 b B	130 c B	120 d B	137 B
G-2120	137 a E	131 b E	118 c D	112 d C	125 D
PK-7394	162 a A	152 b A	138 c A	126 d A	145 A
Mean	148 a	139 b	125 c	116 d	132

LSD (.05): planting date means: 2.1 planting dates for one variety: 4.1
variety means: 2.0 varieties within planting dates: 3.9

C. V. (planting dates): 1.95% C.V. (varieties): 1.78%

a/ lower case letters indicate significant differences across colums; upper case letters indicate significant differences across rows

CHUADANGA KHARIF SEASON FARMERS SOYBEAN VARIETY TRIAL

Introduction

This trial was conducted to determine the performance of three promising varieties from the soybean station testing program in farmers' fields in comparison to Pb-1. These three varieties were planted on the same date as the farmers' Pb-1.

Results and Discussion

Yield differences were not significant at the 5% level, but MTD-65 and Pb-1 tended to yield the most (TABLE 7). These two varieties were also shortest in duration. Seed quality at harvest was significantly lower for the variety Pk-308.

TABLE 7: Chuadanga Kharif Season Farmers Soybean Variety Trial

Planting date: 17/6-11/8/86
Harvest date: 16/10-21/11/86
Plot size - planted: $100m^2$
harvested: $3 \times 1m^2$

Design: RCBD, 1 farm = 1 block
Replications: 10
Fertilizer: farmers' management

Variety	Days to flower	Days to maturity	Plant stand	Yield	Seed germination
			plants/m^2	t/ha	%
MTD-65	47 c	113 b	121 ab	1.84	94.5 a
Pb-1	50 b	113 b	135 ab	1.78	95.3 a
G-2120	61 a	116 ab	152 a	1.58	96.1 a
PK-308	41 d	117 a	110 b	1.52	81.6 b
Mean:	50	115	129	1.68	91.9
LSD (0.05):	1.3	3.1	32	NS	6.2
C. V. (%):	2.62	2.57	23.9	27.3	6.53

CHUADANGA RABI SOYBEAN VARIETY DATE OF PLANTING SCREENING TRIAL

Introduction

The purpose of this trial was to screen fifty-six of the most suitable varieties in the testing program, for tolerance to cold weather during flowering. For this purpose two planting dates were used; November 17 for severe cold stress and December 18 for comparison without cold stress. Varieties in the second planting were also evaluated for seed quality (germination), as field weathering was more severe during maturation of the second planting.

Results and Discussion

The currently extended variety, Pb-1, and past extended varieties Bragg and Davis all had visible cold damage symptoms, and yielded less in the first planting than in the second (TABLE 8). Among the varieties with a low cold damage rating, many were long in duration. These may avoid cold stress through delayed flowering, rather than possess actual cold tolerance. Varieties which showed a good combination of short duration, minimal cold damage and good yield in the first planting included G2120 M7(69-1), IAC-12 and UFV-1.

Seed germination was low for a few of the varieties in the second planting. In some cases low seed quality may be due to the co-incidence of maturity with rainy weather. The varieties maturing 126, 139 and 143 DAS matured under rainy circumstances.

TABLE 8: Chuadanga Rabi Soybean Variety Date of Planting Screening Trial

Planting dates: 17/11, 18/12/86
Plot size: 0.4m x 5.0m
Plant spacing - row: 40 cm
plant: 5 cm
Replications: 1
Fertilizer: 20-60-20-15
Irrigation: 11/12, 3/1, 8/2, 22/2, 11/3, 26/3, 3/4

Variety	Days to flower 17/11	Days to flower 18/12	Days to maturity 17/11	Days to maturity 18/12	Plant height (cm)[a/]	Cold damage[b/] 17/11	Germination (%)[c/] 18/12	Yield[d/] t/ha @ 13% MC 17/11	Yield[d/] t/ha @ 13% MC 18/12
1 Pb-1	42	61	110	108	36	4	98	0.4	1.5
2 Bragg	41	57	98	110	28	3	97	0.4	0.6
3 Davis	44	60	109	118	30	3	97	0.5	1.1
4 PK-327	41	57	92	106	21	3	99	0.5	0.9
5 PR-142	55	73	128	143	43	1	85	1.6	1.2
6 PR-164-20	51	71	108	126	36	2	90	0.9	0.6
7 MTD-13	52	69	108	110	32	4	95	0.5	0.8
8 MTD-65	48	70	102	115	41	2	99	0.9	0.6
9 AGS-58	51	72	120	126	36	2	73	0.7	0.5
10 AGS-160	52	74	121	126	44	1	97	0.9	0.8
11 AGS-162	52	74	125	133	42	2	94	1.2	0.3
12 AGS-234	51	74	121	126	53	1	81	1.0	1.2
13 AGS-272	38	57	92	105	24	1	99	0.7	0.8
14 G2120 M7(69-1)	55	71	117	110	51	1	99	2.0	0.6
15 Pb-1 O.T.	42	61	110	103	39	4	100	0.4	1.0
16 BS-15	51	72	108	119	31	2	97	0.7	0.3
17 Tainung No.15A	47	65	110	105	43	2	95	0.7	0.3
18 Tainung No.15B	-	65	-	114	44[e/]	-	100	-	0.3
19 IAC-8 A	52	74	121	147	71	1	90	0.5	1.1
20 IAC-8 B	52	-	140	-	86[e/]	1	-	0.6	-
21 IAC-11	51	71	120	126	52	2	97	0.1	1.6
22 IAC-12	52	71	111	126	40	1	85	1.1	0.8
23 Co-1	55	74	120	133	64	1	-	0.2	0.9
24 Santa Rosa R.	44	67	108	121	29	3	98	1.1	0.7
25 Durga	50	73	121	126	43	2	99	1.0	1.4
26 Sao Luiz	46	71	108	121	26	3	99	0.8	1.1
27 Macs-57	44	65	108	106	34	4	99	0.4	1.1
28 Shih-Shih	46	67	110	105	41	2	99	0.6	0.8
29 IAC-6	64	74	128	150	56	1	93	1.8	1.4
30 BAU-4EW	51	71	117	121	50	2	99	1.2	0.6
Mean:	51	70	116	123	45	1.9	93	0.9	0.9

TABLE 8: Chuadanga Rabi Soybean Variety Date of Planting Screening Trial

Planting dates: 17/11, 18/12/86 Replications: 1

Plot size: 0.4m x 5.0m Fertilizer: 20-60-20-15

Plant spacing - row: 40 cm Irrigation: 11/12, 3/1, 8/2, 22/2, 11/3, 26/3, 3/4

plant: 5 cm

Variety	Days to flower 17/11	Days to flower 18/12	Days to maturity 17/11	Days to maturity 18/12	Plant height cm a/	Cold damage (17/11) b/	Germination (%) (18/12) c/	Yield t/ha @ 13% MC 17/11 d/	Yield t/ha @ 13% MC 18/12 d/
31 D-75-9207	47	65	102	119	32	2	97	0.6	0.5
32 PK-308	38	57	92	121	33	2	99	0.6	1.7
33 TGX-573-208D	46	71	120	126	64	1	96	0.5	1.6
34 TARI-92533	59	71	110	121	69	2	98	0.7	1.3
35 TGX-824-4E	54	72	110	121	46	2	96	0.4	0.5
36 TGX-849-294D	59	74	133	126	60	1	97	1.6	1.0
37 TGX-888-49C	69	86	137	126	65	1	97	2.4	1.2
38 KHSb-2	51	80	125	135	53	1	96	1.6	1.1
39 Leflore	52	73	121	126	56	2	94	1.5	0.8
40 SJ-2	43	67	121	126	51	2	96	1.1	0.9
41 PR-141	55	73	125	133	52	1	97	1.9	0.9
42 ICAL-131	54	80	133	126	51	1	100	1.5	0.7
43 ICAL-132	59	77	131	133	61	1	95	1.2	1.0
44 ICA-Caribe	-	63	-	110	27 e/	-	99	-	1.1
45 TGX-539-5E	59	74	121	133	49	1	98	0.8	0.8
46 ICAL-125	-	71	-	121	53 e/	-	99	-	1.5
47 PS-1	71	77	147	152	81	1	28	1.1	1.0
48 PR-13(114)	65	82	133	139	65	1	89	0.9	0.5
49 ISRA/IRAT 26/72	59	80	131	139	63	1	91	1.9	0.9
50 UFV-1	51	71	110	126	38	1	57	1.0	1.1
51 TGX-814-26D	71	96	133	154	77	1	92	1.0	1.2
52 TGX-814-23D	71	-	140	-	69 e/	1	-	1.1	-
53 Ankur	-	71	-	139	52 e/	-	89	-	0.9
54 Gaurav	-	59	-	111	43 e/	-	99	-	2.1
55 PK-416	-	59	-	111	37 e/	-	99	-	1.2
56 PK-262	-	63	-	111	37 e/	-	99	-	1.5
Mean:	51	70	116	123	45	1.9	93	0.9	0.9

a/ mean of two planting dates

b/ visual rating of bud blight symptoms (1= no damage; 5= severe); first planting date only

c/ germination results for second planting date only

d/ samples are from single-row plots and should be interpreted as relative plant vigor rather than yield potential

e/ means corrected for one missing planting date

RAIPUR RABI SOYBEAN VARIETY DATE OF PLANTING SCREENING TRIAL

Introduction

The purpose of this trial was to evaluate fifty-three varieties for their adaptation to the Noakhali rabi season climate under conventional cultivation. The two planting dates used were at the beginning and end of the recommended planting season.

Results and Discussion

Results are shown in TABLE 9. In the first planting date, varieties with longer duration tended to have higher yields ($r = 0.49$, $p < 0.001$). In the second planting date, however, there was no significant correlation between days to mature and yield. Short-duration varieties are normally preferred, partly because it is thought that field weathering is less severe when maturity occurs early, and higher seed quality is obtained. However, in this trial there was no significant correlation between days to mature and seed quality (germination), on either planting date.

Twenty-three varieties had higher average yield than Pb-1, but all were of substantially longer duration except for MTD-65, G2120 M7(69-1) and Macs-57. These three varieties appear to have potential to replace Pb-1 in its present cropping system, although their performance is not greatly superior.

TABLE 9: Raipur Rabi Soybean Variety Date of Planting Screening Trial

Planting dates: 17/12/86, 26/1/87 Replications: 1

Plot size - planted: 0.4m x 5.0m Fertilizer: 20-60-20

- harvested: 0.4m x 5.0m Irrigation: none

Plant spacing - row: 25 cm

plant: 5 cm

Variety	Days to flower 17/12	Days to flower 26/1	Days to maturity 17/12	Days to maturity 26/1	Plant height[a/] cm	Germination(%) 17/12	Germination(%) 26/1	Yield(t/ha) 17/12	Yield(t/ha) 26/1
1 Pb-1	65	56	119	103	54	93	97	1.6	1.7
2 Bragg	52	45	114	103	34	96	96	0.9	1.4
3 Davis	74	55	138	106	37	89	94	1.1	0.8
4 PK-327	54	45	120	98	24	95	95	1.2	1.0
5 PR-142	92	66	151	134	80	94	-	1.7	
6 PR-164-20	73	56	141	117	67	97	85	2.5	1.5
7 MTD-65	70	57	123	104	62	94	100	1.7	2.2
8 AGS-160	86	62	139	109	69	99	91	2.4	1.1
9 AGS-162	81	62	140	111	61	96	87	1.7	1.3
10 AGS-234	81	57	137	111	76	91	95	2.8	1.3
11 AGS-272	53	44	123	103	35	96	85	0.7	1.2
12 G2120 M7(69-1)	75	55	120	99	76	100	95	1.7	1.7
13 Pb-1 OT	65	55	121	101	62	97	94	1.5	1.6
14 BS-15	74	55	126	99	48	91	97	1.6	1.4
15 Tainung No. 15	63	55	123	104	51	94	95	1.9	1.1
16 IAC-8 A	88	61	149	117	43	92	83	1.3	0.8
17 IAC-8 B	-	66	-	123	65	-	-	-	-
18 IAC-11	80	58	138	118	82	98	89	2.5	1.0
19 IAC-12	92	63	143	118	67	97	82	2.6	1.6
20 Co-1	93	62	140	112	94	91	92	2.0	1.0
21 Santa Rosa R.	62	55	140	109	48	96	89	2.3	1.8
22 Durga	76	58	140	110	69	97	94	2.8	2.1
23 Sao Luiz	62	54	136	109	38	90	91	1.7	2.1
24 Macs-57	67	56	125	103	53	89	93	1.8	
25 Shih-Shih	68	52	123	100	47	91	93	1.7	1.5
26 IAC-6	102	71	159	125	92	83	-	2.0	-
27 BAU-4Ew	75	57	133	107	76	89	85	1.9	2.3
Mean:	77	56	135	109	63	94	91	1.9	1.4

TABLE 9: Raipur Rabi Soybean Variety Date of Planting Screening Trial

Planting dates: 17/12/86, 26/1/87 Replications: 1

Plot size - planted: 1.0m x 5.0m Fertilizer: 20-60-20

harvested: 0.5m x 5.0m Irrigation: none

Plant spacing - row: 40 cm

plant: 5 cm

Variety	Days to flower		Days to maturity		Plant height[a/]	Germination (%)		Yield[b/]	
	17/12	26/1	17/12	26/1		17/12	26/1	17/12	26/1
					cm			t/ha	
28 D-75-9207	63	65	136	117	55	91	95	2.3	1.5
29 PK-308	60	51	130	110	43	87	93	1.8	1.2
30 TGX-573-208D	77	58	139	114	110	91	89	2.4	1.2
31 TARI-92533	81	63	129	110	83	95	95	2.3	1.1
32 TGX-824-4E	74	58	130	111	62	96	97	1.4	1.1
33 TGX-849-294D	92	63	141	112	83	98	80	2.4	1.2
34 TGX-888-49C	98	64	140	111	80	95	89	2.9	1.8
35 KHSb-2	94	63	144	121	75	91	-	1.6	-
36 Leflore	93	64	147	117	80	97	87	2.3	1.3
37 SJ-2 A	53	45	128	118	100	95	92	1.6	0.6
38 SJ-2 B	92	-	145	-	34	95	-	0.4	-
39 PR-141	93	67	150	132	74	89	-	2.2	-
40 ICAL-131	94	64	141	113	89	96	87	2.7	1.5
41 ICAL-132	93	63	141	113	75	96	95	2.6	1.2
42 TGX-539-5E	91	71	151	138	74	99	-	1.7	-
43 PS-1	94	72	151	124	89	89	-	2.5	-
44 PR-13 (114)	95	66	150	125	79	86	-	2.2	-
45 ISRA/IRAT 26/72	91	63	151	128	78	92	-	2.2	-
46 UFV-1	73	64	146	118	50	97	91	2.3	1.5
47 TGX-814-26D	97	72	150	128	89	99	-	2.5	-
48 TGX-814-23D	97	68	150	136	78	98	-	1.2	-
49 Gaurav	60	52	127	110	53	98	90	2.0	1.8
50 PK-416	57	52	124	109	48	93	95	1.2	1.7
51 PK-262	68	53	120	107	49	94	92	2.5	2.3
52 Shilajeet	52	44	106	98	13	96	65	0.7	0.4
53 JS-2	53	46	111	99	10	99	89	0.6	0.5
Mean:	77	58	135	109	63	94	91	1.9	1.4

a/ mean of two planting dates

b/ samples are from single row plots and should be interpreted as relative plant vigor rather than yield potential

CHUADANGA RABI SOYBEAN VARIETY TRIAL

Introduction

This trial was conducted to compare the performance of twelve genotypes under irrigated rabi season conditions. Rabi season cultivation is highly dependent on irrigation, since soil moisture is extremely low.

Results and Discussion

Although irrigation was given six times, moisture stress occurred due to non-availability of water at critical times. The stress was likely most severe between 37 and 61 days after seeding, near the flowering stage. Early flowering varieties tended to yield better (TABLE 10). The correlation coefficient (r) between yield and days to flower was -0.472, significant at the 10 percent level. There was no significant relationship between yield and days to maturity.

PK-327, being a variety of short duration and stature, performed very well under the moisture stress. Santa Rosa R., BAU-4EW, and AGS-234 produced poorly-germinating seed. Pb-1 performed reasonably well; the off-type yielded slightly but not significantly more. Macs - 57 performed comparably. G2120 M7(69-1) and MTD-65, varieties performing well in other tests, yielded poorly here, likely due to their late flowering accompanied by moisture stress.

TABLE 10: Chuadanga Rabi Soybean Variety Trial

Planting date: 23/12/86
Plot size - planted: 2.5m x 3.75m
harvested: 2.0m x 2.75m
Plant spacing - row: 25 cm
plant: 5 cm

Design: RCBD
Replications: 4
Fertilizer: 20-60-20-15
Irrigation: 6 times; 27, 37, 61 78, 93 and 101 DAS
Weeding: Once; 34 DAS

Variety	Days to flower	Days to maturity	Plant height	Plant stand	Pods/ plant	100-seed weight	Germi-nation	Yield[a/]
			cm	/m^2	#	g	%	t/ha
PK-327	56	103	30 f	81	9.2 cde	10.2 de	99 a	1.54 a
Bragg	56	107	45 de	81	9.0 de	14.9 b	97 ab	1.40 ab
Santa Rosa R.	67	120	60 c	81	11.2 bcd	11.3 d	50 cd	1.39 ab
Pb-1 O.T.[b/]	62	105	60 c	81	12.7 ab	9.9 e	99 a	1.38 ab
Macs 57	62	105	51 d	81	15.0 a	9.5 a	99 a	1.32 ab
Sao Luiz	66	120	42 e	77	12.5 ab	12.9 c	82 b	1.31 ab
BAU-4EW	67	120	81 a	81	10.2 bcd	16.5 a	64 c	1.28 b
Pb-1	62	104	51 d	81	12.0 bc	9.0 e	99 a	1.24 b
AGS-234	72	120	82 a	81	11.3 bcd	13.7 bc	46 d	1.20 b
AGS-160	77	120	72 b	81	10.4 bcd	10.0 e	82 b	1.17 b
G2120 M7(69-1)	69	111	67 bc	81	9.9 bcd	8.3 f	99 a	0.86 c
MTD-65	66	111	66 bc	81	6.3 e	14.7 b	100 a	0.69 c
Mean:	65	112	58.8	81	10.8	11.7	84.6	1.23
LSD (.05):			8.0	NS	2.9	1.2	16	0.24
C. V. (%):			9.38	3.42	18.6	7.11	12.8	13.4

a/ yields corrected to 13% moisture content

b/ OT = off-type

RAIPUR RABI SOYBEAN VARIETY TRIAL

Introduction

Raipur is the centre of the main soybean extension area in the greater Noakhali region. A desirable variety for this area must have: 1) good seed quality, 2) short duration and 3) high yield. In this trial ten varieties were selected from seed quality performance results in Chuadanga. These ten were compared with Pb-1, the current extension variety, and Bragg, another extension variety discontinued due to poor seed quality.

Results and Discussion

Several varieties performed well in comparison with Pb-1 (TABLE 11). Of particular importance are the varieties Macs-57, MTD-65 and Pb-1 OT, because their yields were high without longer duration. Sao Luiz was the only variety with yield significantly higher than that of Pb-1, but long duration may hinder its acceptability.

TABLE 11: Raipur Rabi Soybean Variety Trial

Planting date: 23/12/86

Plot size - planted: 2.5m x 3.75m

harvested: 2.0m x 2.75m

Plant spacing - row: 25 cm

plant: 5 cm

Design: RCBD

Replications: 3[a/]

Fertilizer: 20-60-20 + inoculant

Weeding: once; 28 DAS

Variety	Days to flower	Days to maturity	Plant height	Pods/ plant	100-seed weight	Germi-nation	Yield T
			cm		g	%	t/ha
1. Sao Luiz	67	133	50 g	17 cde	16 abc	93	3.48 a
2. Macs-57	67	119	59 efg	24 b	12 e	97	3.33 ab
3. MTD-65	68	121	74 bcd	13 ef	18 a	96	3.33 ab
4. Pb-1 OT[b/]	64	118	69 cde	21 bc	13 de	97	3.14 abc
5. Santa Rosa R.	72	139	66 def	22 bc	12 e	99	2.97 abcd
6. Bragg	54	118	36 h	12 f	17 ab	96	2.88 abcd
7. Pk-327	54	118	31 h	14 def	14 cde	95	2.86 abcd
8. Pb-1	65	118	56 fg	22 bc	13 de	96	2.75 bcd
9. BAU-4EW	75	132	99 a	19 bcde	16 abc	82	2.58 cd
10. AGS-160	88	135	85 b	30 a	12 e	98	2.58 cd
11. G-2120 M7(69-1)	69	117	78 bc	32 a	6 f	99	2.53 cd
12. AGS-272	54	118	36 h	11 f	15 bcd	93	2.45 d
Mean:	66	124	62	20	14	95	2.91
LSD (.05):			11	6	2		0.64
C.V. (%):			10.8	17.8	8.9		13.1

a/ one of the original 4 replications was discarded due to non-uniform soil type

b/ OT = off-type

CHAR BATA SOYBEAN PLANTING METHOD X VARIETY TRIAL

Introduction

Soybean cultivation on the char relies mostly upon reserve moisture in the soil. Earlier-planted crops generally have better soil-moisture conditions and go through less salinity stress. However, early-sown soybeans can be sensitive to cool temperatures. This trial was conducted to determine the performance of six promising genotypes from the soybean variety selection program. Performance under early-planted no-till conditions is compared with that under conventional conditions.

Results and Discussion

As observed last year, the two types of Pb-1 and MTD-65 performed better than the other varieties with conventional tillage (TABLE 12). Overall yield levels were 30% lower than those observed last year.

In the no-till planting conditions, however, Pb-1 did rather poorly compared to MTD-65, G-2120 and AGS-160. There are two possible explanations for this interaction. First, varieties may differ in sensitivity to the cold stress accompanying early planting. Those with delayed flowering may avoid cold stress. Second, a significant rainfall (25 mm) occurring 94 days after the early planting may have enhanced late pod-filling of the later-maturing varieties.

This trial has shown that no-till cultivation of soybean can be feasible provided that good soil moisture is present at seeding, and the right variety is selected. For seeding dates earlier than December, however, further varietal testing for cold tolerance is required.

TABLE 12: Char Bata Soybean Planting Method x Variety Trial

Seed rate: 100 kg/ha
Fertilizer: 20-50-0 at planting + inoculant
Soil salinity (ECe): 4.2 mmho/cm on 10/3/87

Design: split-plot RCBD
Replications: 4
Previous crop: BR11 aman

Planting method	Planting date	Plot size planted	Plot size harvested	Row spacing
A No-till[a/]	9/12/86	1.75m x 4m	1.25m x 3m	25 cm
B Tillage[b/]	22/12/86	1.8m x 4m	1.2m x 3m	30 cm

Variety	Days to flower	Days to maturity	Plant density	Plant height	100 seed weight	Yield
			#/m^2	cm	g	t/ha
A: No-till						
Pb-1 O.T.	48 c	97	40 c	36 c	9.8 d	0.82 d
MTD-65	58 c	104	43 bc	46 b	14.1 a	1.57 b
Pb-1	49 d	104	37 c	38 c	11.6 b	1.13 c
PK-327	46 f	117	29 d	18 d	10.5 c	0.78 d
G-2120 M7(69-1)	61 b	113	48 b	76 a	5.1 f	1.57 b
AGS-160	63 a	119	62 a	76 a	7.1 e	2.01 a
No-till mean:	54	109	45	48	9.7	1.31
LSD (0.05)	0.8		6.6	7.8	0.56	0.26
B: Tillage						
Pb-1 O.T.	59 e	104	69	69 b	10.0 b	2.01 a
MTD-65	62 c	106	68	71 b	12.8 a	1.99 a
Pb-1	61 d	104	70	65 b	10.3 b	1.93 ab
PK-327	52 f	104	69	30 c	9.9 b	1.71 bc
G-2120 M7(69-1)	68 b	106	69	89 a	5.6 d	1.59 c
AGS-160	76 a	119	65	83 a	7.3 c	1.47 c
Tillage mean:	63	107	69	68	9.3	1.78
LSD (0.05):	0.8		NS	7.8	0.56	0.26
Overall mean:	59	108	56	58	9.5	1.55
LSD (0.05):	1.6		7.1	5.9	NS	0.18
C. V. (%):	0.98		8.3	9.2	4.1	11.5

a/ dibbled seed into north side of rice hills, on 25cm x 15 cm spacing

b/ conventional tillage with fertilizer incorporated

c/ LSD for comparing planting method means

CHAR BATA SOYBEAN VARIETY SALINITY SCREENING TRIAL

Introduction

Saline charland is not currently a soybean production area but it may have potential for soybean extension. To determine whether there are any differences in salinity tolerance among twelve promising soybean genotypes, this screening trial was performed. The trial was laid out in a field with a salinity gradient. Of the four replications planted, three had fairly consistent salinity levels (ECe) around 9.1 mmho/cm, but one was considerably lower (4.1 mmho/cm). This replication was therefore excluded.

Results and Discussion

Significant differences in emergence and yield were observed among cultivars (TABLE 13). Emergence and yield were highly correlated (r = .80), suggesting that tolerance to salinity at emergence was most important. Plant losses after emergence were highly variable and no differences were significant.

This experiment has shown that some of these varieties can be considered for future extension in saline charland. Further testing is required, however, to determine the salinity tolerance of these soybean varieties in comparison to other competing pulse crops.

TABLE 13: Char Bata Soybean Variety Salinity Screening Trial

Planting date: 1/1/87
Plot size - planted: 0.3m x 10m
harvested: 0.3m x 10m
Plant spacing - row: 30 cm
plant: 5 cm

Design: RCBD
Replications: 3
Fertilizer: 20-50-0 (incorporated with last plowing)
Soil salinity (ECe)[c/]: 9.1 ± 2.5 mmho/cm

Variety	Days to flower	Days to maturity	Emergence (30 DAS)	Plant Loss[a/]	Yield[b/]
			plants/m^2	%	kg/ha
MTD-65	61	110	29 a	18	1030 a
SJ-2	63	104	23 abc	45	900 ab
Pb-1	54	110	21 abc	31	730 abc
Santa Rosa R.	59	140	24 abc	35	680 abc
G-2120 M7(69-1)	4[illegible]	110	27 ab	36	560 abcd
Pb-1 O.T.	52	110	21 abc	50	520 bcd
BAU-4EW	60	117	22 abc	44	520 bcd
Macs-57	52	110	15 cd	41	490 bcd
AGS-160	51	117	21 abc	26	420 bcd
Pk-327	48	110	19 abc	31	400 bcd
Sao Luiz	52	117	18 bc	45	250 cd
AGS-272	48	110	8 d	43	70 d
Mean:	54	114	20.6	37.1	548
LSD (.05):			9.6	NS	510
C.V. (%):			27.5	65.1	55.1

a/ plant loss = percentage of plants lost between 30 DAS and maturity

b/ yield samples are from single-row plots and should be interpreted as indicators of relative plant vigour rather than as potential yield

c/ 6 samples taken 0-20 cm deep on 12/2/87

Conclusions

Extensive testing has shown promising possibilities for new soybean varieties. In particular, MTD-65 and G2120 performed well in the Chuadanga kharif season. In the Noakhali area, MTD-65, G2120 M7 (69-1) and Macs-57 compared favorably with Pb-1. Other longer-duration varieties with cold tolerance performed well with earlier rabi seeding.

Testing has shown that certain varieties performed well in specific cropping systems and locations. In the future it may be necessary to extend different varieties for different situations. However, at present, Pb-1 appears to be the most adapted variety for performance across our extension areas in Chuadanga and Noakhali.

SOYBEAN CROPPING PATTERN TRIALS

CHUADANGA LATE KHARIF SOYBEAN MINIMUM TILLAGE OBSERVATION

Introduction

To ensure stable production of soybean, it is necessary to diversify planting dates to avoid weather risks. This diversification implies fitting soybean into as many different cropping patterns as possible. The objective of this observation was to assess the potential of planting soybean directly after aus and jute harvest. The only tillage given was to plow one time at 30 cm spacing. Seeds were placed in the furrows and covered by hand.

Results and Discussion

Soybean following jute was seeded two weeks later than that following aus. Contrary to expectation, however, yield following jute was higher than that following aus (TABLE 1). The reason for this was that the soybean following aus grew taller and was badly lodged at harvest due to rains on 8 to 10 November. Although both plantings matured on the same date, the soybean following jute was shorter and more able to resist lodging.

In terms of potential production, both cropping systems appear feasible for soybean. Further testing is required for two reasons: 1) to determine year-to-year fluctuations, and 2) to compare the profitability in comparison to competing crops in the current cropping systems.

TABLE 1: Chuadanga Late Kharif Soybean Minimum Tillage Observation

Plot size: 15m x 10m
Row spacing: 30 cm
Weeding: none
Variety: Pb-1

Replications: 1
Fertilizer: 0-60-20-15
Tillage: seeded into furrows after one plowing

Treatment	Days to flower	Days to maturity	Plant height	Plant stand	Pods/ plant	Yield
			cm	#/m^2	#	t/ha
1. seeded 12/8/86 after aus	35	99	64	100	10	1.1
2. seeded 26/8/86 after jute	40	85	41	90	10	1.3

CHUADANGA CROPPING PATTERN TRIAL

Introduction

This trial was a repeat of last year's cropping pattern trial, with bitter-gourd and mungbean substituting for sesame. The objective was to find a more profitable rotation than growing only soybeans in the kharif season. "Buro" is a locally-grown grassy species producing a millet - like grain, "Kaon" is a type of millet widely grown in Comilla. The aus variety used was an experimental line approximately nine days shorter in duration than IR50.

Results and Discussion

Aus and maize yields were very poor (TABLE 1). Soybean grown after maize performed very well, likely due to residual fertilizer from the maize crop. Soybean did not perform well after aus, likely due to later planting.

Soybean yield following buro was significantly higher than that following kaon. However kaon itself was both higher yielding and more valuable than buro.

Okra was the highest-returning early kharif crop, followed by mungbean and yard-long bean. Soybean following each of these produced acceptable but lower yields. These three rotations appear promising. This trial is to be continued for one more year with a more thorough economic analysis.

TABLE 1: Chuadanga Cropping Pattern Trial

Planting date: 29/3/86
(okra - 9/4/86)
Plot size - planted: 14-20m^2
harvested: 12m^2

Design: RCBD
Replications: 3
Kharif crop: soybean, cv. 'Pb-1'
Kharif fertilizer: 0-60-20-15 + inoculant
Kharif plant spacing: 40 cm x 5 cm

Cropping pattern	Summer Crop	Variety	Fertilizer	Plant spacing	Harvest date	Kharif planting date
				cm		
A	yard-long bean	MCC	20-40-55	80 x 15	10/6	15/7
B	okra	Pusa Sawani	40/25/25-80-35	50 x 30	15/7	31/7
C	maize	local	40/20/20-60-20	70 x 25	8/7	15/7
D	bittergourd	MCC	20/20-40-5 a/	150x150	3/7	15/7
E	mungbean	Mubarak	20-40-20	30 x 5	17/6	15/7
F	kaon	Laksam local	15/15-20-20	broadcast	6/7	15/7
G	buro	Chuadanga local	local rate	broadcast	6/7	15/7
H	aus	IR9708-51-1-2	40/20-40-10	broadcast	1/8	1/8

Cropping pattern	Summer Crop yield	Summer Crop gross revenue b/	Kharif Soybean crop: Days to flower	Days to maturity	Plant stand	Yield @ 13% MC
	kg/ha	Tk/ha			#/m^2	t/ha
A	1790	7,160	43	106	26	1.21 c
B	6390	19,170	41	97	51	1.23 c
C	400	-	43	105	33	1.84 a
D	630	2,840	43	106	28	1.53 abc
E	700	9,390	43	106	25	1.32 c
F	1040	5,200	43	106	35	1.35 b
G	660	2,640	43	106	27	1.71 ab
H	320	1,720	40	98	48	1.15 c
Mean:		6,870	42	104	34	1.42
LSD (0.05):						0.38
CV (%)						15.5

a/ in addition, 4 t/ha cowdung was applied

b/ based on estimated market prices

CHUADANGA LATE-KHARIF SOYBEAN-BLACKGRAM TRIAL

Introduction

Blackgram is a common crop grown in the late kharif season following aus. It is a rather low-input broadcast-sown crop requiring no weeding. This trial was conducted to determine whether soybean could be economically cultivated in the same manner. Since soybean is generally less competitive against weeds, a treatment with higher seed rate and one with intercropping with blackgram were compared with two varieties of soybean and one local variety of blackgram as single crops. The hypothesis was that higher seed rate or intercropping would reduce weed competition.

Results and Discussion

The soybean variety Pb-1 produced a higher yield and approximately equal gross revenue in comparison to blackgram (TABLE 1). The variety G-2120 responded to higher seed rates but yielded less than Pb-1. The intercrop of soybean with blackgram produced the highest gross return and appears to be a viable alternative for farmers. Some questions regarding seeding and harvesting costs remain unanswered and will be addressed in future trials.

TABLE 1: Chuadanga Late-Kharif Soybean-Blackgram Trial

Planting Date: 26/8/86 | Design: RCBD

Plot size - planted: 3.5m x 5.0m | Replications: 2

harvested: 5 x $1m^2$ | Fertilizer: none

Seeding method: broadcast | Irrigation: none

Treatment	Crop Species	Seed Rates (kg/ha)
1	blackgram	local rate
2	soybean (cv. 'Pb-1')	80
3	soybean (cv. 'G-2120')	60
4	soybean (cv. 'G-2120')	100
5	Pb-1 + blackgram	40 / ½ x local rate
6	G2120 + blackgram	30 / ½ x local rate

Treatment	Days to flower	Days to maturity	Plant height	Plant stand	Weed Rating b/	Yield	Gross Revenue a/
			cm	#/m^2		t/ha	Tk./ha
1 blackgram	44	83	32	-	1	1.28	13,730
2 soybean	41	86	38	93	2	1.61	14,470
3 soybean	48	92	44	104	2	1.00	8,990
4 soybean	48	92	49	180	2	1.32	11,870
5 soybean	41	86	36	48	1	0.45	16,710
blackgram	44	80	31	-	1	1.18	
6 soybean	48	90	34	81	1	0.40	16,410
blackgram	44	83	31	-	1	1.13	
Mean:	45	87	37	101	1	1.40	13,700

a/ assuming blackgram sale at Tk. 10.73/kg and soybean at Tk. 8.99/kg

b/ rated on a scale of 1 to 5 where 1= no weeds; 5= severe weeds

NOAKHALI RABI SOYBEAN SEED STORAGE TRIAL

Introduction

Sealed polythene bags have proven to be the most effective method of soybean seed storage through the monsoon season. However, all past trials have used high quality bags supplied from Dhaka by MCC. For farmers, use of bags available in Noakhali markets would be more convenient, though these are of lower quality. To test whether these bags would be as effective for seed storage, paired comparisons on Pb-1 seed were run on thirteen farms in Sonapur, Hyderganj and Jahajmara. After storage in double bags from April/May to December/January, soil emergence of a 300 seed sample was measured.

Results and Discussion

Seed stored in MCC-supplied bags had an average of 72% emergence, compared to 63% for that stored in locally purchased bags. The difference was statistically significant at the 1% level. Thus, it appears that a high-quality bag is important.

Thirty-two other farmers in Jahajmara, Raipur, Hyderganj and Haimchar stored Pb-1 seed in MCC - supplied bags. Average emergence was 71%, +/- 27%. Although seed can be stored acceptably, there is variation among the farmers in their success. Careful attention is still required for reliable seed storage in polythene bags.

CHITOSI SOYBEAN SEEDING METHOD OBSERVATION

Introduction

Presently soybeans are being planted with full tillage. If tillage could be reduced perhaps production would be more economical. If a cold tolerant soybean variety were to be introduced to allow for November planting of soybeans then relaying soybeans into deepwater aman would become feasible.

With this in mind, advantage was taken of the extremely late drainage in December of 1986 to broadcast the soybean seed directly on the mat of deepwater rice straw to try and get an idea of how soybeans would do when relayed into deepwater aman. After broadcasting the seed children observers were encouraged to run around on the straw to jostle the seeds through the straw down to the moist soil. The other treatments were (2) broadcasting seed, laddering the soil twice, and then returning straw to the soil as a mulch; (3) the asra minimum tillage; and (4) conventional tillage.

Results and Discussion

The no tillage soybeans did not nodulate well and germinated poorly. They looked N-deficient and stunted. The laddered soybeans also looked poor relative to those that got more tillage. The plant height, plant population and yield all increased with increased tillage (TABLE 1).

Given the very low input costs of relaying soybeans and that relayed soybeans would fit into the cropping pattern better than tilled soybeans, it might be that some farmers would prefer to grow a lower input-lower output soybean crop that fits well into their cropping pattern rather than grow a higher input-higher output soybean crop that makes rice planting a little more awkward. This technology should be tried in farmers' fields to test it economically against other planting methods and to learn what the farmers think of it. Of primary concern, though, is having a soybean variety that can be planted early when soil conditions are good for relaying.

TABLE 1: Chitosi Soybean Seeding Method Observation

Plot size - planted: 4 x 4m
- harvested: $4m^2$

Variety: Pb-1

Seeding method: broadcast

Seedrate: 70 kg/ha

Fertilizer: 15-40-40

Seeding Method	Planting date	Flowering date	Harvest date	Plant ht.	Plants/m^2	Yield
				cm	#	t/ha
Relay	13/12/86	29/2/87	10/4/87	40	27	.85
Ladder	14/12/86	29/2/87	9/4/87	47	28	1.45
Asra	13/12/86	29/2/87	6/4/87	54	46	1.72
Conventional	15/1/87	16/3/87	16/4/87	57	53	2.38
Mean				50	39	1.60

OILSEED CROPS

GROUNDNUT

CHAR BATA ICRISAT GROUNDNUT VARIETY TRIAL

Introduction

Charland groundnut (*Arachis hypogea*) cultivation can involve a large amount of risk for two reasons. First, cultivation, fertilizer and seed costs are high. Second, because of its long duration, flood damage during the month of May can prevent the crop from attaining full maturity. For this reason, a successful charland variety must be of short duration. The sixteen varieties tested in this trial were received through BARC from ICRISAT. A two-replicate trial with these varieties, performed last year, did not reveal any variety superior to Dhaka-1, which is locally cultivated.

Results and Discussion

Due to late recession of flood water in December, planting was considerably delayed. Emergence was very slow and final stands were only one-half of the 16 plants per square meter planted. Heavy rains in late April hampered growth, and final yields were low.

No variety proved superior to Dhaka-1 (TABLE 1). The variety HYQ(CG)S-11 produced a yield close to that of Dhaka-1, as it did last year, but it took considerably more days to flower.

Further testing of groundnut in the char should only be done with varieties of shorter duration. Due to the high-risk nature of its cultivation, the adoption of peanut cultivation by subsistence farmers is likely to be limited.

TABLE 1: Char Bata ICRISAT Groundnut Variety Trial

Planting date: 31/12/86
Plot size - planted: 2m x 4m
harvested: 1.2m x 3.4m
Plant spacing: - row: 40 cm
plant: 15 cm

Design: RCBD
Replications: 4
Fertilizer: 20-60-20
+ 1 kg Boron per hectare

Variety	Days to flower	Days to maturity	Plant Stand[a/] 25 DAS	Plant Stand[a/] Final	Yield
			------#/m^2------		kg/ha
1. Dhaka-1	77	139	8 a	8 a	1290 a
2. HYQ(CG)S-12	88	145	7 ab	7 ab	770 ab
3. HYQ(CG)S-15	86	146	8 a	8 a	670 bc
4. HYQ(CG)S-10	84	146	5 ab	5 ab	650 bcd
5. HYQ(CG)S-49	88	143	8 a	7 ab	560 bcde
6. HYQ(CG)S-14	82	140	5 ab	5 ab	380 bcde
7. HYQ(CG)S-13	85	139	5 ab	4 ab	150 cde
8. HYQ(CG)S-19	82	143	4 ab	4 ab	130 cde
9. HYQ(CG)S-20	86	139	7 ab	7 ab	90 de
10. HYQ(CG)S-18	84	143	3 b	3 b	90 de
11. M-13	91	153	8 a	8 a	30 e
Mean:	85	143	6	6	437
L.S.D.@ 5%			4	4	570
C.V. (%)			45	49	89.2
Varieties observed in less than four replicates:					
12. TG-1[b/]	84	139	9	9	1290
13. HYQ(CG)S-11[b/]	92	139	9	9	1120
14. HYQ(CG)S-21	84	138	7	7	970
15. TG-9	86	143	9	9	360
16. HYQ(CG)S-16	86	139	5	5	210

a/ F-test significant at 10% level only

b/ the correct identity of these two varieties is uncertain

MUSTARD

CHAR BATA RELAYED MUSTARD FERTILIZER RATE TRIAL

Introduction

The relay seeding method has been fairly successful for establishment of mustard (Brassica spp.) stands. On more saline fields, however, it has been observed that fertilized stands establish well, whereas non-fertilized stands are damaged by salinity. A possible explanation is that fertilizer enhances deeper root growth, allowing plants to escape the accumulating salinity near the soil surface. To test this hypothesis, this fertilizer rate trial was conducted in a field with medium salinity.

Results and Discussion

Due to late rains in November, flood water remained in the field until aman harvest, preventing actual relaying of seed into standing aman. Instead, seed was broadcast over wet soil immediately following amon harvest.

Although yields were not high, they responded linearly with increasing fertilizer rates (TABLE 1). The slope of the response was 2.7 kg mustard per kg of fertilizer active ingredient. At Tk. 7.50 per kg for mustard and Tk. 12 per Kg for N and P_2O_5, the rate of return to fertilizer expense is 1.68. This rate of return is likely not high enough to be accepted by resource-poor farmers, but in other years when earlier seeding is possible, yields could be higher.

TABLE 1: Char Bata Relayed Mustard Fertilizer Rate Trial

Planting date: 27/11/86
Harvest date: 18-21/2/87
Plot size - planted: 3m x 3m
harvested: 2m x 2m
Seeding method: broadcast
Seed rate: 10 kg/ha

Design: Latin Square
Replications: 5
Fertilizer: variable[a/]
Previous crop: BR11 aman

Fertilizer rate[a/]	Days to flower	Days to maturity	Plant stand[b/]	Plant height	Yield
			plants/m^2	cm	kg/ha
0-0-0	37	83	17 d	15 d	25 d
20-15-0	42	84	65 c	51 c	168 c
40-30-0	40	85	71 bc	65 bc	215 bc
60-45-0	40	83	91 ab	77 ab	343 ab
80-60-0	41	84	103 a	83 a	410 a
Mean	40	84	69.5	58.2	232
L.S.D.@ 5%			26	18	135
C. V. (%)			27.1	22.2	42.2

a/ fertilizer was applied ½ at seeding and ½ at 18 DAS

b/ plant stand at harvest

CHAR BATA RELAYED MUSTARD FERTILIZER METHOD TRIAL

Introduction

Fertilizer application to relayed mustard (*Brassica* spp.) on saline fields has been shown to greatly enhance plant survival and yield. One hypothesis is that fertilizer stimulates deeper rooting, allowing plants to escape the saline accumulation near the soil surface. This trial was performed to determine whether deeper placement of fertilizer would enhance the effect, and whether timing of application was important. Field conditions were identical to those of the preceding mustard fertilizer rate trial.

Results and Discussion

The best results were obtained by splitting both N and P applications (TABLE 2). Dibbling fertilizer into holes to increase depth of placement did not significantly increase yield. The poor yield resulting from treatment D suggests that the second application of N was essential, and that phosphate was especially necessary at the first application.

TABLE 2: Char Bata Relayed Mustard Fertilizer Method Trial

Planting date: 27/11/86
Harvest date: 19-22/2/87
Plot size - planted: 3.0m x 3.0m
harvested: 2.0m x 2.0m
Seed rate: 10 kg/ha, broadcast

Design: Latin square
Replications: 5
Fertilizer rate: 80-60-0
Previous crop: BR11 aman

Fertilizer application methods:

A) all fertilizer broadcast at seeding
B) ½ fertilizer broadcast at seeding; ½ broadcast 15 DAS
C) ½ fertilizer broadcast at seeding; ½ dibbled 15 DAS
D) all N broadcast at seeding; all P dibbled 15 DAS
E) ½ N broadcast at seeding; ½ N and all P dibbled 15 DAS

Application method	Days to flower	Days to maturity	Plant Stand 11 DAS	Plant Stand final	Plant height	Yield
			-----plants/m^2---		cm	kg/ha
A	40	84	78	70	76 bc	280 bc
B	41	84	93	82	83 ab	430 a
C	40	84	104	91	88 a	480 a
D	47	86	82	74	71 c	160 c
E	48	87	89	78	82 ab	380 ab
Mean	43	85	89	79	80	345
L.S.D. (.05)			NS	NS	9	149
C.V. (%)			25.0	28.2	8.3	31.4

CHAR BATA RELAYED MUSTARD SEED RATE TRIAL

Introduction

Salinity tends to hasten maturity and decrease the size of many crop species. This trial was conducted with mustard (*Brassica* spp.) to determine whether these effects might increase the optimum plant density from that normally recommended.

Results and Discussion

Yields in this trial were extremely low. The field used for this trial was slightly higher, drier and likely more saline that that used for the above two trials.

Despite the low yields, there was a strong linear yield response to seed rate, with a slope of 15 kg yield per kg seed (TABLE 3). However, because of the unrepresentative growing conditions, a general recommendation cannot be made. The necessity of a moist seedbed without excessive salinity has been emphasized.

TABLE 3: Char Bata Relayed Mustard Seed Rate Trial

Planting date: 23/11/86
Harvest date: 14-17/2/87
Plot size - planted: 2.0m x 4.0m
harvested: 1.5m x 3.0m
Seeding method: broadcast

Design: Latin Square
Replications: 5
Fertilizer: 80-60-0
½ at seeding; ½ at 17 DAS
Previous crop: BR11 aman

Seed rate	Days to flower	Days to maturity	Plant Stand initial	Plant Stand final	Plant height	Yield
kg/ha			---plants/m^2----		cm	kg/ha
3	49	85	25 d	17 d	38	40 d
6	49	85	34 d	26 d	31	58 d
9	49	85	54 c	45 c	39	109 c
12	49	85	83 b	75 b	40	162 b
15	50	84	103 a	94 a	38	211 a
Mean	49	85	60	52	37	116
L.S.D.(.05)			17	18	14	46
C.V.(%)			20.3	25.5	27.0	28.5

CHAR BATA MUSTARD VARIETY OBSERVATION ON SALINE LAND

Introduction

Seven lines of *Brassica juncea* received from BAU were observed in comparison with two *B. campestris* varieties (Tori-7 and Australian) and one local variety (*B. juncea*). A higher field with earlier drainage of flood water and higher salinity was chosen for this observation. Soil salinity in the 0-20 cm depth was measured at 5.3 + 3.9 mmhos/cm on Feb. 12, indicating a moderate limitation of crop growth.

Results and discussion

Yield estimates are somewhat inaccurate due to height differences and shading among varieties. However, no variety appeared to be superior to the local variety (TABLE 4). Plant stand for variety M-283 was low, indicating seed germination problems.

TABLE 4: Char Bata Mustard Variety Observation on Saline Land

Planting date: 27/11/86
Harvest date: 12-25/2/87
Plot size: 0.25m x 5.0m
Row spacing: 25 cm

Replications: 1
Fertilizer: 60-40-0 at seeding incorporated with tillage
Previous Crop: aman seed bed

Variety	Days to flower	Days to maturity	Plant stand[a/]	Yield
			plants/m^2	kg/ha
Char Bata local	46	89	400	640
M-284	45	89	290	600
Tori-7 (Maghi)	37	77	220	560
M-263	48	89	280	400
M-121-4	43	89	160	400
Australian	45	80	380	320
M-258	57	89	260	320
M-154	55	89	300	320
M-36-E-2-7	60	89	280	240
M-283	56	90	42	40
Mean	49	87	260	380

a/ plant stand at harvest

CHITOSI MUSTARD COMPANION CROP TRIAL

Introduction

Mustard (*Brassica* spp.) is difficult to fit into the deepwater aman cropping pattern because late drainage forces late planting of mustard which makes the mustard crop vulnerable to aphid attack in late January and February. If a suitable companion crop could be found that would deter aphids, it would give farmers the option of planting mustard even if late drainage of the flood waters delayed planting.

In this trial four different companion crops-garlic (*Allium sativum*), onion (*Allium cepa*), coriander (*Coriandrum sativum*) and marigold (*Tagetes* spp.) were planted individually with mustard, and in one treatment the four companion crops were all planted as a mixture together with mustard. The mustard was broadcast in at 10 kg/ha and the comparion crops were line-sown in 60 cm lines with the following seedrates: coriander - 12 kg/ha, onion - 1 plant/15 cm, garlic - 1 plant/15 cm, Marigold 9 plants/plot and the mixture treatment included all 4 companion crops at half the above mentioned seedrates. As a check, one treatment included only mustard planted at a 15 kg/ha seedrate. The mustard was sown using the asra minimum tillage method. The asra minimum tillage method was done as follows:

(The straw was removed from the soil; the soil was raked twice with an asra; mustard seed and fertilizer were broadcast on; the soil was raked twice more with an asra; the soil was laddered; then the companion crops were line sown in and the straw placed back on the soil to act as a mulch. Later sown companion crops were planted through the mulch.)

Results and Discussion

The mustard grew very well. Aphids didn't attack until late in the season so they didn't affect yield much. The marigolds were planted late and were shaded by the mustard so they didn't grow well. The coriander, garlic and onions seemed to grow alright but they didn't appear to deter any aphids. Yield differences and differences in aphid count between treatments were not significant (TABLE 5).

Because the companion crops didn't appear to deter any aphids and to facilitate the planting of the next rice crop, the companion crops were removed from the field before they all reached maturity, so no data is given here about companion crop yield.

If further work of this type is to be done, marigold and coriander should be tested again.

In this trial the marigolds were planted late and so were shaded out by the mustard so they should probably be tested again. Coriander should probably be tested again at higher seedrates and marigold should be tested again with perhaps direct seeding of the marigold with the mustard.

TABLE 5: Chitosi Mustard Companion Crop Trial

Planting dates:
- mustard and coriander: 10/12/86
- garlic: 13/12/86
- transplanted marigold: 31/12/86
- transplanted onion: 5/1/86

Harvest date: 16/2/87

Plot size - planted: 4 x 4m
- harvested: 2 x 1.8m

Fertilizer: 65/80/35

Design: RCBD

Replications: 4

Insecticide: none

Mustard Variety: Laksam local

Companion crop varieties: all local

Companion crops	Mustard flowering date	Mustard harvest date	Mustard plant ht.	Mustard plants/m^2	Aphid[a/] count	Mustard yield
			cm	#	#	kg/ha
Mono-mustard	7/1/87	16/2/87	47	211	49	490
Garlic/mustard	7/1/87	16/2/87	49	213	63	480
Onion/mustard	7/1/87	16/2/87	48	225	54	460
Marigold/mustard	7/1/87	16/2/87	52	187	55	450
Coriander/mustard	7/1/87	16/2/87	48	219	59	440
Mixture/mustard	7/1/87	16/2/87	49	186	65	430
Mean			49	207	58	460
L.S.D.(.05)			NS	NS	NS	NS
C.V. (%)			7	13	20	8

a/ the aphid count was made by counting the aphids on 3 pods per plant on 3 plants right next to the companion crop row at 3 different times. Those values were then averaged down to aphids/plant and analyzed with ANOVA

FENI MUSTARD TRIAL WITH NEEM AND TOBACCO LEAF EXTRACTS FOR APHID CONTROL

Introduction

In Bangladesh, the most important pest of mustard (*Brassica* spp.) is the aphid (*Lipaphis pseudobrassicae* Kalt). Populations of this insect increase from late December through February, and aphids are most damaging on late planted mustard. The insect feeds on young leaves, shoots and flowers. When populations are high, aphids can suck the plant tissues dry. Seed yield can be dramatically reduced if the infestation is not controlled. While commercially available synthetic insecticides are perhaps effective for aphid control, their cost, and the related environmental degradation from their use, makes them a less than desirable control measure.

In this trial, two plant-derived (organic) solutions were tested for ability to control aphids. The first was derived from the leaves of the neem tree (*Azadirachta indica*). This plant's leaves, stems and seed kernels are known to contain an insecticidal compound called azodiractin. The second solution was an extract from commercially available, dried and cured tobacco leaves. The third treatment involved the synthetic foliar insecticide, Nogose. The fourth treatment served as a control.

Results and Discussion

Aphid populations were low this past rabi season. This fact certainly had a large impact on this experiment. As TABLE 6 shows, the control treatment (no pesticide applied) had the most aphid-infested plants two days after the second application of the three pesticides. The other three treatments had a comparable number of infested plants. Plants considered "infested" had anywhere from approximately 25 to several hundred aphids on the leaves, stems, flowers and other plant parts. In this year's trial, the populations of aphids did not reach the high levels hoped for. Nonetheless, yield differences were statistically significant (TABLE 6). Those plots receiving the neem leaf extract treatment yielded the highest. The neem treatment yielded significantly higher than either the tobacco leaf extract or foliar insecticide treatments, but not significantly better than the control. It is unclear why the control, despite having many more aphid infested plants, yielded higher than either the tobacco leaf extract or foliar insecticide treatment. Perhaps the latter two treatments affected pollination in some way, leading to low seed production. Perhaps another explanation exists.

Economic analysis indicated that the neem treated control measure was the most profitable. This was based on a zero variable cost for the neem treatment, since it was assumed that a farmer could simply obtain a supply of leaves from a nearby, or an owned, tree. The gross return was 3563 taka/ha for the neem treatment, and 3381 taka/ha for the control (which had the next highest gross return and, also, a zero variable cost). The tobacco extract and Nogose insecticide treatments were dominated, since they had variable costs of 625 taka/ha and 1250 taka/ha, respectively.

Further testing is necessary to determine the effectiveness of neem and tobacco leaf extracts. Also, after discussions with a scientist at Bangladesh Agricultural University, it was learned that applying neem leaves to extremely hot water reduces the effectiveness of the active agents. Therefore, next year the neem leaves will be added to lukewarm water in order to best extract the active agents. Also, 100g leaves per liter water will be tried next year instead of 50g per liter water.

TABLE 6: Feni Mustard Trial with Neem and Tobacco Leaf Extracts for Aphid Control

Planting date: 3/12/86	Design: RCBD
Harvest date: 1/3/87	Replications:
Plot size - planted: 4 x 5m	Fertilizer: 20-30-10
harvested: 3 x 4m	Variety: Senali
Seed rate: 10 kg/ha	Insecticide: Applied at 50 and 56 DAP

Aphid treatment	Number of infested plants two days after pesticide application	Yield
		kg/ha
Neem extract[a/]	12.5	333 a
Control[b/]	64.5	316 a
Tobacco extract[c/]	18.2	252 b
Insecticide[d/]	12.0	214 b
Mean	26.8	279
L.S.D. (0.05)		54.4
C.V.(%)		12.2

a/ neem leaf extract prepared by adding 50g crushed leaves per liter hot water. The solution was allowed to steep for 24 hours before use

b/ the control was sprayed with fresh water only

c/ tobacco leaf extract was prepared with cured, dried, crushed leaves at the rate of 10g per liter hot water. The solution was allowed to steep for 24 hours before use

d/ the foliar insecticide "Nogose" was applied at a rate of 20 oz per hectare

CEREAL CROPS

RICE

FENI DHANCIA GREEN MANURE TRIAL

Introduction

There has been considerable interest in Bangladesh in recent years in the use of dhancia (Sesbania aculeata) as a green manure. This is a robust, leguminous plant which will become woody after three months, so it is necessary to cut it down after one to two months and incorporate it into the soil.

Of special interest is the possibility that growing dhancia instead of aus (Oryza sativa) will enhance the soil nitrogen and organic content level to such an extent that the aman (Oryza sativa) crop's yield, after dhancia, would surpass that of the combined yield of aus and aman grown consecutively.

Even if the yield was not greater than the combined aus and aman yield, if the net profitability was higher for dhancia followed by aman, farmers might still be interested in using dhancia as a green manure.

In this trial, the aman variety BR-11 was grown in plots which, during the previous season, had either dhancia or the aus variety Purbachi grown in them. In one dhancia green manure treatment, 80 kg per hectare nitrogen was applied to the BR-11 crop. In the other dhancia treatment, no nitrogen was applied to the BR-11 crop. The third treatment involved BR-11 plus 80 kg per hectare of nitrogen, following Purbachi.

The dhancia plants were cut down at ground level 59 days after planting, the stems and leaves cut into around ten cm sections, and the entire biomass then incorporated into the soil. The aman rice crop was planted one week later.

Results and Discussion

The BR-11 grew well, as did Purbachi, and yields were high. No significant differences for yield were noted, however the highest yield was from the dhancia plus 80 kg nitrogen treatment (TABLE 1). Significant differences were noted in plant height and panicles per m^2. The BR-11 grew highest when dhancia was incorporated into the soil along with 80 kg

nitrogen. BR-11 receiving dhancia plus 80 kg nitrogen produced significantly more plants (panicles) per m^2 than BR-11 receiving only nitrogen from the dhancia biomass.

The Purbachi yielded 3.91 t/ha, a sizeable yield. Where farmers are growing aus, and good, stable yields are the norm, it is unlikely that dhancia would benefit them financially. In terms of risk, however, there would certainly be less in growing dhancia. For fields in which aman is sown, but not aus, dhancia appears to provide a large quantity of nitrogen to the soil. Dhancia could be profitable in that situation. More testing should be done with dhancia to try to determine how much inorganic nitrogen fertilizer it can replace and still result in a good aman yield.

TABLE 1: Feni Dhancia Green Manure Trial

Planting date - aus: 2/4/86
- dhancia: 16/4/86
- aman: 21/6/86

Transplanting date: 27/7/87

Harvest date - aus: 12/7/86
- Dhancia: 14/6/86
- harvested: 4 x 4m

Spacing - row: 25 cm
plant: 15 cm

Design: RCBD

Replications: 3

Fertilizer-Purbachi: 0/20/20/20-40-40 plus zinc and sulphur; N at 0/20/40/60 DAP

BR-11:0/30/30/20-60-40 with N to 0/10/40 DAT and at panicle initiation

Treatment	Days to flower	Days to maturity	Plant height	Panicles per m^2	Yield
			cm	#	t/ha
Purbachi (aus) + 80N	126	155	99 b	383 a	4.57
Dhancia + Zero N	120	150	94 c	259 b	4.93
Dhancia + 80 N	126	155	104 a	276 a	4.98
Mean	124	153.3	99	272	4.83
L.S.D. (.05)			3	10	NS
C.V. (%)			1	2	7

Aus and Dhancia Data

Treatment	Days to flower	Days to maturity	Plant height	Plants per m^2	Yield
			cm	#	t/ha
Purbachi	77	102	75.5	294	3.91
Dhancia			163	459	

1987 CHAR BATA SESBANIA GREEN MANURE EXPERIENCE

Introduction

Research at BRRI has shown positive effects of *Sesbania* green manure on succeeding aman (*Oryza sativa*) yield. This technology could be adopted in rice cropping systems in areas where aus (*Cryza sativv*) production is not possible; for example, on saline fields. Research at the LRP Pilot Polder in Char Thika has also suggested that *Sesbania* can reduce soil salinity to some extent. Therefore an experiment to determine the effects of *Sesbania* was attempted.

Field preparation involved only two cross ploughings in late March. On April 14, after a shower of 14mm rain, seed was broadcast at 29 kg/ha. The seed was of a local cultivar purchased in the Hyderganj area.

Results and Discussion

Soil samples taken on March 31 had an ECe of 12 mmhos/cm from two replications and 18 mmhos/cm from two replications in another field. Where the ECe (salinity) was low, emergence was good; where it was high, emergence was fair. The stand was almost completely destroyed following 190 mm of rain received on April 24 and 25. This experience suggests that more careful attention must be paid to drainage during the early stages of *Sesbania* stand development.

CHAR BATA COWPEA GREEN MANURE TRIAL

Introduction

Research by BRRI has shown positive effects of green manure on the following aman (*Oryza sativa*) crop. Previous MCC research at Feni has tested dhancia (*Sesbania aculeata*) as a green manure. In this trial, the local cowpea (*Vigna unguiculata*) cultivar was tested for its possible contribution to a following aman crop.

Results and Discussion

The aman variety used was badly lodged at harvest. Rice yield following green manure was 18% higher (TABLE 2). This difference was significant at the 10% level.

A small experiment like this one cannot determine all of the benefits of green manure. Further experimentation could determine whether the increased yield arises from a nitrogen contribution or from more subtle effects on soil structure and soil organic matter. The length of incubation time required between green manure incorporation and rice transplanting should also be researched.

TABLE 2: Char Bata Cowpea Green Manure Trial

Green manure species: Cowpea
Green manure planting date: early January
Green manure incorporation date: late April
Aman planting date: 2/8/86
Aman cultivar: Kartiksail
Fertilizer: 20-40-0 (N at 10 DAT)
Spacing: 25 cm x 15 cm
Seedling age: 33 days

Plot size - Planted: 5m x 25m
- harvested: 5m^2
Replications: 3
Flowering date: 14/10/86
Maturity date: 20/11/86
Design: RCBD

Aman data:

Treatment	Plant height	Panicles/m^2	Yield a/
	cm		t/ha
Green manure	126	229	2.62
Fallow	124	212	2.21
Mean	125	221	2.42
L. S. D. (0.05)	NS	NS	NS a/
C. V. (%)	3.9	5.5	7.1

a/ yield difference significant at the 10% level

FENI AMAN TIME OF UREA PLACEMENT TRIAL

Introduction

The Bangladesh Agricultural Research Council (BARC) recommends that one-third of the nitrogen used to fertilize HYV aman (Oryza sativa) be applied just prior to transplanting (1985 Fertilizer Recommendation Guide). The remaining nitrogen, according to the recommendation, should be applied in two equal installments, once at rapid tillering stage and once at 5-7 days before panicle initiation.

In this trial, two fertilizer treatments were tested. Nitrogen in one treatment was applied in three equal installments: at 10 and 40 days after transplanting, and once at panicle initiation. Nitrogen in the

other treatment was applied in four equal installments: at zero, 20 and 40 days after transplanting, and at panicle initiation. In both treatments the total nitrogen applied was equivalent. Two different varieties, Pajam and BR-11, were utilized in this grial.

Results and Discussion

Significant mean differences between varieties were indicated; however, no significant differences based on fertilizer application method were detected; also, no significant interaction effects between variety and fertilizer application method were noted (TABLE 3).

It appears that with BR-11 and Pajam, at least, time of fertilizer placement based on these two different methods, has no effect on plant yield.

TABLE 3: Foni Aman Time of Urea Placement Trial

Planting date: 21/6/86
Transplanting date: 28/7/86
Plot size - planted: 3.9 x 4m
harvested: 3 x 3m
Spacing - row: 25 cm
plant: 15 cm

Design: Split plot
Replications: 4
Fertilizer[a/] - F1:0/27/27/27-60-40-15 N at 0/10/40/DAT and at panicle initiation
F2:20/20/20/20-60-40-15 N at 0/20/40 DAT and at panicle initiation

Treatment	Days to flower	Days to maturity	Plant height	Plants per m^2	Yield[b/] F1	Yield[b/] F2
			cm	#	t/ha	t/ha
Variety						
Pajam	117	144	112	229	2.96	3.25
BR-11	126	158	92	234	3.98	3.99
Mean			102	231.5	3.47	3.62
C. V.(%)					8	8

a/ for fertilizer treatment 1("1") urea was applied in equal installments at 10 and 40 days after transplanting (DAT) and at panicle initiation; for fertilizer treatment 2("F2") urea was applied in equal installments at Zero, 20 and 40 days after transplanting, and at panicle initiation

b/ the mean yield of BR-11 was significantly higher than Pajam at the 1% level

CHAR BATI AUS SEEDING METHOD TRIAL

Introduction

The salinity level in the upper soil layer is high in charland soils following the intermittent spring thundershowers. Salts rise to the surface with the capillary flow of water and concentrate near the soil surface. Rice (*Oryza sativa*) seedlings sown by the traditional broadcast method are damaged by the high salt concentrations in the upper soil layer. To circumvent this problem, farmers plant the seeds in the bottom of small holes made with a sharpened wooden post. The seedlings then develop in soil with a lower salt concentration than is prasent at the soil surface. BRRI has suggested that stands can be improved by dibbling rice seeds in the bottom of the furrow made with a plough. This technique was tested to quantify its effect on rice performance relative to traditional methods.

Discussion

This trial was originally sown in late March but needed to be resown due to uneven emergence. The second seeding date was later than normally practiced by most farmers; however, salinity fluctuations were still intense because of a prolonged dry period in May. The yield of Boilam dibbled in the furrow was not significantly greater than Boilam seeded by broadcasting and laddering, but was significantly greater than the yield obtained by the traditional dibbling method (TABLE 4). This observation is contrary to the anticipated result. The popularity of the labour intensive dibbling method, however, suggests that farmers find the technique more successful than this trial indicates.

TABLE 4: Char Bata Aus Seeding Method Trial

Seeding date: 22/4/86
Harvest date: 17-18/8/86
Plot size - planted: 3m x 4m
- harvested: $5m^2$
Spacing - row: 25 cm
- hill: 15 cm

Design: RCB
Replications: 4
Seedrate: 75 kg/ha
Fertilizer: 20/20/20-40-0
(N at 16, 40, and 57 DAS)
Variety: Boilam

Seeding method	Days to flower	Days to harvest	Plant ht.	Tillers m^2	Yield
			cm	#	t/ha
Broadcast and laddered	88	118	81	304	1.92 ab
Dibbled	88	118	91	310	1.71 b
Dibbled in furrow	88	118	90	275	2.05 a
Mean	88	118	87	296	1.89
L.S.D. (.05)	NS	NS	NS	NS	0.26
C. V. (%)	1	1	7	28	8

CHAR BATA AMAN TRANSPLANTING METHOD OBSERVATION

Introduction

Weather in Noakheli District is unpredictable during the seedling stages of aman (Oryza sativa). If heavy rain occurs shortly after young seedlings are broadcast on the beds the number of seedlings that can be harvested from the seedbed for transplanting is reduced. If the heavy rain occurs just after transplanting, seedlings on lower elevation fields may remain submerged for several days and the seedlings may die. If the remaining stocks of seed are insufficient to replace the lost seedlings, the farmers will need to purchase seedlings.

A trial was conducted to determine whether a single seedling transplanted twice could produce yields equal to the traditional planting system. Farmers generally transplant their rice seedlings directly from seedbeds into production fields placing two to four 30 day old seedlings per hill. If the seedlings are older, the tillering capacity of each seedling is less and a greater number of seedlings per hill must be placed to achieve maximum yield. Method #1 in this trial was the traditional method using 30 day old seedlings and one transplanting operation. The recommended system using 20 day old seedlings transplanted once is infrequently followed in the char region due to the high probability of submergence of these short seedlings, especially for high yielding varieties. Older seedlings are taller and are less susceptible to submergence. Method #2 in this trial involves two transplanting operations. The first seedbed is prepared in the usual way but the seedlings are transplanted into a second seedbed at the 2 leaf stage (10-15 DAP) with one seedling per hill placed in a 5 cm grid pattern. These seedlings are transplanted again at the 8-leaf stage into the production field at the same hill density as method #1, but with only one seedling per hill.

Results and Discussion

For the variety BR11, hills established from single seedlings yielded equal to those having 2-4 seedlings/hill (TABLE 5). Stands looked equal for both treatments. Gap filling is very important when only one

seedling/hill is transplanted. Seedlings which died left noticeable "holes" in the rice stand as the adjacent hills were not able to compensate adequately for the missing hill. A difference in plant maturity was not observed between the two stands of rice.

There are several advantages for the single seedling single hill technique. It reduces the seed requirement for a given area of land by capitalizing on the plant's tillering ability. Second, it reduces the land area needed for the first seedbed. Perhaps the season for some summer vegetables could be extended for an extra few weeks. Third, the workload of the farmer is spread over a longer period, but the total amount of work is also increased. The extra labor input would exceed the value of the saved seed under normal circumstances; yet this quantity of rice could be important when seedbeds have been destroyed and rice seed is especially valuable.

TABLE 5: Char Bata Aman Transplanting Method Observation

Seedbed date: 30/6/86

Transplanting date -

Method #1: 30/7/86

Method #2: 14/7 and 10/8/86

Plot size - planted: $75m^2$

- harvested: $5-1m^2$ samples

Spacing - row: 25 cm

- hill: 15 cm

Design: Observation

Replication: 1

Variety: BR11

Fertilizer: 20/20/20-25-0 with N at -

Method #1: 11, 26, and 52 DAT

Method #2: 10 Days after first trans.; 10 and 41 Days after second trans.

Insecticide: 0.84 kg Ripecord/ha at 57 DAT

Planting Method	Days to flower	Days to maturity	Plant height	Panicles/ m^2	Yield
			cm	#	t/ha
#1: Transplanted one	113	148	103	221	4.66
#2: Transplanted twice	115	150	107	216	4.61

FENI AUS ALART TRIAL

Introduction

Several advanced lines of rice (*Oryza sativa*) were tested during the aus season in an Advanced Lines Adaptive Research Trial (ALART) in cooperation with BRRI. The trial was conducted at the MCC Feni Research Station.

Results and Discussion

BR-673-14-1-4 matured very late resulting in heavy damage by birds. Therefore, yield data was not recorded for this variety. Among the other varieties, Purbachi had the highest yield and the shortest time to maturity but yield differences were not significant (TABLE 6).

TABLE 6: Feni Aus ALART Trial

Planting date: 16/4/86
Harvest date: 27/7-25/8/86
Plot size-planted: 3.9m x 5m
-harvested: $12m^2$
Planting method: line sown
Seed rate: 5-6 seeds per hill

Spacing-row: 25 cm
-plant: 15 cm
Design: RCBD
Replications: 2
Fertilizer: 12/24/24-40-40-17
N-P-K-S (Kg/ha)
N at 0/20/40 DAS

Variety	Days to flower	Days to maturity	Plant ht.	Panicles/Hill	Yield
			cm	#	kg/ha
Purbachi	75	100	75 c	13.0 bc	2550
IR 25890-82-5-3	83	110	75 c	14.4 b	2410
IR 7156-720-3-2-1-1	102	130	82 b	12.8 c	2130
IR 50	80	105	70 d	16.4 a	2020
BR 1	90	117	67 d	12.6 c	1760
BR 673-14-1-4	116	144	99a		
Mean	92	118	78	13.4	2040
L. S. D. (.05)			4	1.5	NS
C. V. (%)			3	6	20

CHAR BATA DIRECT-SEEDED SHORT DURATION AUS VARIETY TRIAL

Introduction

Nara bhanga ("stubble-breaking") is the common rotation in many regions of the char. This refers to an aus/aman/fallow rotation. The traditional aus (*Oryza sativa*) grown is either IR8 or one of the local varieties. Cultivation of a shorter duration high yielding variety has potential to reduce risk and to increase yield. Four selections tested by BRRI in previous ALART trials were grown with the most popular local, Boilam, as check at Char Bata. Two of the four lines, BR201-193-1 and BR1656-22-1, have been released for extension as BR20 and BR21, respectively.

Discussion

Adverse weather during the 1986 aus season stunted growth severely. Early rains in late April were followed by drought until mid-June. Very high temperatures were associated with the drought and many tillers died during this stress period, when flooding began in late June, these varieties recovered well from the drought stress. BR 20 had the highest yield but it was not significantly higher than the local variety, Boilam (TABLE 7). It has, however, out-yielded Boilam by 200 - 300 kg/ha at the research station over the past three years. BR20 has adequate height to avoid flood damage during flowering, and short duration to fit into traditional Boilam cropping patterns. Its tolerance to drought and salinity is adequate to survive growing conditions in the charland, and its kernel size is acceptable to the charland people.

TABLE 7: Char Bata Direct-seeded Short Duration Aus Variety Trial

Seeding date: 9/4/86

Plot size - planted: 1.75m x 3.75m

- harvested: 1.25m x 3.30m

Spacing - row: 25 cm

- hill: 15 cm

Design: RCBD

Replications: 4

Seed rate: 75 kg/ha

Fertilizer: 20/20/20-40-0 with N at 18, 38, 67 DAS

Insecticide: 1.1 kg Roksian/ha at 18 DAS

Variety	Stand	Days to flower	Days to maturity	Plant ht. at 52 DAS	Plant ht. at harvest	Panicles m^2	Yield
	%			cm	cm	#	t/ha
BR 20	80 b	91 a	122 ab	78 a	104 b	228 a	1.83 a
IR 9729-67-2	81 b	93 a	123 a	87 a	114 a	181 b	1.81 a
Boilam	90 a	92 a	120 bc	86 a	110 ab	240 a	1.64 ab
BR 21	58 c	85 b	118 c	64 b	80 c	161 b	1.33 bc
IR 9209-205-3-2	80 c	78 c	110 d	47 c	61 d	147 b	0.92 c
Mean	78	88	119	72	92	191	1.50
L. S. D. (.05)	9	3	2	11	8	36	0.45
C. V. (%)	7	2	1	10	5	12	20

CHAR BATA DIRECT-SEEDED LONG DURATION AUS VARIETY TRIAL

Introduction

Several long duration lines have been released to replace IR8 during the aus (*Oryza sativa*) season. The lines BR3, BR12, BR14, BR15, BR16 and two earlier maturing lines, BR9 and BR203-26-2, were grown in a RCBD at Char Bata.

Discussion

No data was collected from this trial because most of the varieties died due to an unidentified cause. The longer duration lines were all affected while the shorter duration lines grew and developed normally. During the drought in May, the leaves of the plants began to turn brown, symptoms which resembled nitrogen deficiency or moisture stress. Nitrogen application failed to arrest this condition. When flooding occurred in mid June, the condition was aggravated and the top growth of the rice plants died off completely. The most likely cause for the strange phenomenon is drought and heat stress at a critical growth stage. No literature to substantiate this hypothesis, however, could be found. Two varieties, BR9 and BR203-26-2, did survive and produced normal yields.

CHAR BATA EARLY-MATURING AMAN VARIETY TRIAL

Introduction

Nine aman (*Oryza sativa*) varieties were tested in a field representative of the higher land where Rajasail rice is usually grown. Because this type of field dries up more quickly it is important to find varieties which mature early. Varieties were selected on the basis of early maturity from results of the trial conducted last year.

Results and Discussion

Rice bug damage completely destroyed the IR50 variety shortly before flowering. The severity of the attack was likely due to much earlier flowering, it being the only host available at that time. Statistical analysis was performed only on the remaining varieties.

The varieties Rajasail and BR316-15-4-4-1 were both of short duration, but their low yields were associated with different causes. Rajasail had a high proportion of lodged plants, whereas BR316-15-4-4-1 suffered from stem borer, rice bug and blast disease.

All varieties except for BR315-12-1-4-1 and Pajam had some stem borer infestation. These two varieties, along with Rajasail and BR11, suffered from leaf roller. Leaf spot disease was observed on all varieties. A cyclonic storm in November caused some kernel abortion. Due to all these conditions, yields were about 40 percent lower than those obtained last year.

As in past years, it appears that BR11 is the highest yielding aman variety for farmers and that there are, as yet, no experimental lines that surpass it (TABLE 8). However, this year the water stayed on the fields until later than usual were that not the case, the shorter duration varieties may have compared more favorably.

TABLE 8: 1986 Char Bata Early-Maturing Aman Variety Trial

Seeding date: 30/6/86
Transplanting date: 29/7/86
Plot size - planted: 2m x 3.9m
- harvested: 1.5m x 3.6m
Spacing: 25 cm x 15 cm
Seed rate: 2-3 plants/hill

Design: RCBD
Replications: 4
Fertilizer: 20/20/20-25-0
N applied 9, 26 and 40 DAT
Previous Crop: Linseed
Weeding: Once, 28 DAT
Insecticide: Ripcord, 70g/ha 26 DAT
Furadan, 17 kg/ha 44 DAT

Variety	Days to flower	Days to maturity	Plant height	Panicles/m^2	Kernel weight	Yield
			cm	#	g/1000	t/ha
BR11	113 a	150 a	87 c	214 ab	25 d	2.88 a
BR15-12-1-4-1	112 a	145 b	85 c	203 b	26 c	2.56 ab
BR1-46-5-C5	106 c	142 c	85 c	212 ab	25 d	2.52 ab
Pajam	112 a	146 b	102 b	195 b	18 e	2.24 bc
BR51-282-8-HR50	109 b	142 c	82 c	201 b	25 d	2.24 bc
Kartiksail	107 c	142 c	115 a	231 a	30 a	1.71 c
Rajasail	101 d	125 e	119 a	230 a	28 b	0.98 d
BR316-15-4-4-1	101 d	137 d	99 b	147 c	28 b	0.87 d
Mean	108	141	97	204	26	2.00
L. S. D. (.05)	1	1	6	24	1	0.59
C. V. (%)	0.8	0.6	4.4	7.8	1.9	20.0

CHAR BATA LATE-MATURING AMAN VARIETY TRIAL

Introduction

Sixteen aman (*Oryza sativa*) varieties were tested in a field representative of the lower land where Kalamota rice is usually grown. Because this type of field remains flooded for a longer period, later-maturing varieties were selected for this trial. Both currently recommended and experimental varieties were included.

Results and Discussion

The variety BR14 was the first to flower but then was completely destroyed by rats. The rats appear to be particularly attracted to rice at the flowering state.

Nizersail, Kalamota and BR222-26-358 had a great deal of lodging. Leaf spot disease was observed on all varieties except BR10, BR593-676-4-1-2, BR593-698-5-1-8 and BR51-201-1-HR97. On the latter variety, narrow spot was also observed. Leaf scald was observed on all varieties except Nizersail, Kalamota, BR14, BR51-201-1-HR97, BR51-74-6-J1, BR51-49-6-HR50 and BR222-26-358. Blast was observed on Nizersail, BR10, BR593-676-4-1-2 and BR593-698-5-1-8.

Leaf roller insect damage was observed on all varieties except BR222-26-358. Stem borer was seen on all varieties except BR236-10-2-2-1, BR51-49-6-HR50, BR51-74-6-J1 and BR51-282-8-HR50.

None of the experimental varieties tested surpassed the three currently recommended HYV varieties, BR10, BR11 and BR4(TABLE 9). These three yielded far more grain than the local varieties. The shorter stature of the HYV varieties increases their susceptibility to flood damage. In the Char Bata market high kernel weights are preferred. In these two respects, the HYV varieties fall short of the local varieties to a small extent.

TABLE 9: Char Bata Late-Maturing Aman Variety Trial

Seeding date: 17/07/86
Transplanting date: 14/8/86
Plot size - planted: 2m x 3.9m
- harvested: 1.5m x 3.6m
Spacing: 25 cm x 15 cm
Seed rate: 2 - 3 plants/hill

Design: RCBD
Replications: 4
Fertilizer: 20/20/20-25-0
N applied 10, 31 and 54 DAT
Weeding: two times
Insecticide: Furadan, 17 kg/ha 28 DAT

Variety	Days to flower	Days to maturity	Plant height	Panicles/m^2	Kernel weight	Yield
			cm	#	g/1000	t/ha
BR10	108 cd	139 e	98 cd	189 bc	24 e	3.71 a
BR16-127-4-3	108 cd	138 f	103 bc	193 bc	25 de	3.69 a
BR593-698-5-1-8	110 b	141 c	84 c	259 a	27 c	3.59 ab
BR236-10-2-2-1	110 b	141 c	99 bcd	201 bc	24 e	3.56 abc
BR11	106 ef	138 f	99 bcd	213 bc	25 de	3.43 abcde
BR4	110 b	141 c	100 bcd	186 cd	24 e	3.34 abcde
BR51-201-1-HR97	109 bc	138 f	98 cd	203 bc	25 de	3.14 abcde
BR51-49-6-HR50	110 b	140 d	104 b	219 b	25 de	3.05 bcde
BR51-74-6-J1	109 bc	141 c	100 bcd	212 bc	24 e	3.01 cde
BR593-676-4-1-2	109 bc	139 e	96 d	196 bc	26 cd	3.00 cde
HR51-282-8-HR50	103 g	135 g	100 bcd	155 d	26 cd	2.90 de
Cisadone	107 de	138 f	90 e	175 cd	30 b	2.80 e
Nizersail	114 a	144 b	125 a	195 bc	20 f	1.26 f
BR222-26-358	105 f	139 e	104 b	209 bc	24 e	1.05 f
Kalamota	114 a	150 a	121 a	220 b	32 a	0.77 f
BR14	89 h	-	-	-	-	-
Mean	108	140	101	201	25	2.82
L. S. D. (.05)	1	1	6	33	1	0.58
C. V. (%)	0.7	0.4	4.0	11.2	3.3	14.3

FENI TRANSPLANTED AMAN VARIETY TRIAL

Introduction

Several aman (*Oryza sativa*) varieties were tested at the Feni Research Station. This trial was conducted to compare some new varieties with some well established varieties. BR-11 and Pajam are perhaps the most popular aman varieties among farmers in Feni and Comilla Districts. In the MCC 1984 Feni transplanted aman variety x fertilizer trial (see MCC 1985 Research Results), BR-11, BRC 16-127-4-3 and Pajam yielded best among eight tested varieties. The line BRC 16-127-4-3 has consistently yielded well in past years' trials.

Results and Discussion

No significant differences in yield were found among the varieties tested (TABLE 10). BR-11 yielded the highest, IR-50 yielded the lowest. BRC 16-127-4-3 again this year yielded well. Considering IR-50's extremely early maturity relative to Pajam and BR-11 (established varieties among farmers in Comilla and Feni Districts) and low yield, further testing with this line is probably unwarranted. Bird damage on IR-50 occurred in this trial. Researchers at BRRI have cautioned that varieties with too early maturity are prone to attacks from birds and rats. Thus, maturity close to that of the locally important varieties is an important selection criterion. Significant differences in plant height and panicles per m^2 were noted. The variety Pajam was the tallest, significantly taller than all varieties but BR-850-9-1-1; this perhaps in part accounts for the popularity of Pajam among farmers, since it provides more straw yield for cattle feed.

TABLE 10: Feni Transplanted Aman Variety Trial

Planting date: 21/6/86
Transplanting date: 27/7/86
Plot size - planted: 3.9 x 3.5m
- harvested: 2.5 x 3.0m
Spacing - row: 25 cm
- plant: 15 cm

Design: RCBD
Replications: 3
Fertilizer: 0/30/30/20-60-40-15
N at 0/10/40 DAP and at panicle initiation
Pesticide: 16 kg/ha Furadon at 80 DAP

Variety	Days to flower	Days to maturity	Plant height	Panicles per m^2	Yield
			cm	#	t/ha
BR-11	127	158	91 c	219 cd	4.12
BRC-16-127-4-3	126	156	93 c	225 bc	3.97
BR-850-9-1-1	120	151	112 a	237 b	3.68
Pajam	116	143	114 a	222 bc	3.46
BR-14	105	130	98 b	206 d	3.28
IR-50	89	112	67 d	309 a	2.64
Mean	114	142	96	236	3.52
L. S. D. (.05)			2	15	NS
C. V. (%)			1	3	11

NATHER PETUA STATION DEEPWATER RICE VARIETY TRIAL

Introduction

Some recently developed aman (Oryza sativa) lines received from BRRI were included in a variety trial with some local lines to see if the newer lines had some advantages over the presently grown local lines. No fertilizer was applied in this trial. Plots were line sown (25 cm lines) rather than broadcast to prevent mixing of seed. All the plots were hand weeded twice.

Results and Discussion

BR 308-2B-2-1 was included in the trial, but rats showed a preference for it and so it was not included in this analysis. Rice yields in this area were generally depressed due to heavy rains in October and November. The best of the new lines, Janaki and IR 11185-0-0-0-88-2 did as well as the local lines and looked good in the field (TABLE 11). These two lines are presently being tested against two local lines in a trial being conducted in an on-farm trial at Chitosi station. Of special concern in dealing with these lines, especially IR 11185-0-0-0-88-2, is how much the HYV plant type influences mixed aus/aman cropping, and relay planting of rabi season crops. The lines not included in the farmers' field trial have been planted in an observation at the Chitosi station Research Station.

TABLE 11: Nather Petua Station Deepwater Rice Variety Trial

Seeding date: 1/4/86-2/4/86 Seed rate: 100 kg/ha

Plot size - Planted: 4 x 4m Fertilizer: none

- harvested: 2 x 2m Planting method: line sown - 25 cm lines

Replications: 4

Variety	Flowering Date	Harvest Date	Plant height	Panicles per m^2	Yield
			cm	#	t/ha
Sadapankaish	27/10/86	28/11/86	193 b	90 ab	1.34 a
Janaki	22/10/86	24/11/86	202 a	82 abc	1.16 ab
Gilamite	27/10/86	24/11/86	201 a	88 ab	1.15 ab
Gorcha	27/10/86	24/11/86	198 ab	96 ab	1.13 ab
IR-11185-0-0-0-88-2	2/11/86	6/12/86	151 e	107 ab	1.08 ab
Keora	22/10/86	16/11/86	175 c	96 ab	1.05 ab
BR-224-2B-2-5	27/10/86	16/11/86	169 c	111 a	.96 b
UC-493	2/11/86	6/12/86	159 d	77 bcd	.89 bc
Karticksail	19/10/86	18/11/86	176 c	53 cde	.56 cd
DWCB-B-110-H3-B	2/11/86	6/12/86	154 de	31 ef	.44 de
IR-11288-B-B-118-1	2/11/86	6/12/86	157 de	49 de	.44 de
CN-540	5/10/86	6/12/86	152 de	17 f	.23 de
IR-7691-OT-4-2-2-1	2/11/86	6/12/86	153 de	15 f	.19 e
Mean			172	70	.82
L. S. D. (.05)			7	31	.35
C. V. (%)			3	30	30

CHAR BATA DEEPWATER AMAN VARIETY TRIAL

Introduction

The charland region is not considered a deep water rice (*Oryza sativa*) area. Some areas, however, cannot grow HYV rice because of the risk of submergence during intense rainfall events. Many HYV lines also tiller poorly in deeper flooded areas. A trial was conducted with some deepwater aman lines received from BRRI to test the suitability of improved deepwater lines for deeper flooding charland areas.

Results and Discussion

The deepwater lines were not very acceptable for transplanting. The stems were very tender and tore easily when the seedlings were uprooted. The plants grew poorly, stands looked very ragged, and lodging was a serious problem for all but the three IR lines. Yields, too, were less than the usual 2.5 -3.0 t/ha yields one can usually expect from the traditional variety, Kalamota, which is well suited to this growing environment (see the Bhatirtek Cropping Systems Site Report). Of the new lines tested, IR 21178-43-1-2-2-2 yielded the best (TABLE 12).

TABLE 12: Char Bata Deepwater Aman Variety Trial

Transplanting date: 28/8/86 Design: RCBD

Plot size - planted: 2m x 3.75m Replications: 3

- harvested: 1.5m x 3.45m Fertilizer: 20/20-25-0 with N at 10 & 30 DAT

Spacing - row: 25 cm

- hill: 15 cm

Variety	Plant height	Tillers /m^2	Yield
	cm	#	t/ha
IR21178-43-1-2-2-2	88 bc	155	2.22 a
Cisadone	85 bc	134	1.99 ab
IR11185-B-B-850-1	90 bc	185	1.74 abc
DWCT156-1-2-0-1	89 bc	149	1.57 bc
IR1178-42-1-3-3-1-3	92 b	148	1.55 bc
DWCT156-1-2-0	85 bc	120	1.47 bc
DWCT131-4-1-2-2-0	81 c	126	1.47 bc
DWCT156-0-0-0	82 bc	131	1.29 c
DWCT134-1-3-B	81 c	118	1.22 c
Namsaqui 19	106 a	101	0.56 d
Mean	88	137	1.51
L. S. D. (.05)	11	NS	0.54
C. V. (%)	7	18	21

FENI TRANSPLANTED DEEPWATER AMAN VARIETY OBSERVATION

Introduction

Ten lines of transplanted deepwater aman (*Oryza sativa*) were tested at the Feni Research Station in 1986. Originally, these lines were direct-seeded in March; during April, however, heavy rains caused flooding. Many of the lines did not tolerate this flooding well, so seedbeds for all lines were started on May 21. This trial is thus the result of these ten lines - seedbed planted on May 21 and later transplanted into an area with less flooding depth. It should be noted that the Feni location is in a medium highland area not a deepwater area. These lines were planted close to the road, where there is a bit deeper flooding (maximum 75 cm in 1986). As such, the best of these lines will be tested at MCC's medium lowland site (true deepwater area) at Chitosi Station, Comilla District, in 1987.

Results and Discussion

The plants performed well in the early growth period. Flooding was minor, and varied from 3-4 cm to 75 cm during the time flooding levels were measured (June 1 through October 14, 1986) most of the time flooding depths ranged from 3-25 cm. Most lines lodged considerably, as might be expected from deepwater rice grown in low water depth conditions. The exceptions were IR 21071-42-1-3-3-1-3, IR 21178-43-1-2-2-2 and IR 11185-B-B-850-1, which did not dodge much, if at all.

In this trial, the lines DWTC-156-0-0-0 and IR-11185-B-B-850-1 both yielded 4 tons or more per hectare (TABLE 13). More testing of some of these lines will be done at Chitosi Station in 1987.

TABLE 13: Feni Transplanted Deepwater Aman Variety Observation.

Planting date: 21/5/86
Transplanting date: 17/6/86
Plot size - planted: 5 x 6m
- harvested: 3 x 3m
Spacing - row: 25 cm
- plant: 15 cm

Fertilizer: 20/20-40-20
N at 0/39 DAT
Irrigation: none
Pesticide: none

Variety	Days to flower	Days to harvest	Plant height	Panicles/m^2	Yield
			cm	#	t/ha
DWCT-156-0-0-0	144	174	120	146	4.29
IR-11185-B-B-850-1	152	183	112	156	4.00
IR-21178-43-1-2-2-2	163	192	105	197	3.38
Cisadane	137	169	119	190	3.03
DWCT-156-1-2-0-1	143	174	118	185	2.56
DWCT-156-1-2-0	146	176	101	159	2.26
IR-21071-42-1-3-3-1-3	137	169	121	202	2.24
DWCT-134-1-3-B	144	174	111	181	2.02
DWCT-131-4-1-2-2-0	143	174	113	152	1.61
Nam Saqui-19	128	158	140	130	1.33
Mean	144	174	116	170	2.67

FENI DIRECT-SEEDED DEEPWATER RICE VARIETY OBSERVATION

Introduction

Twenty-four lines of direct-seeded deepwater rice (Oryza sativa) were tested at the Feni Research Station in 1986. This location is not in a deepwater area. However, a lower lying area adjacent to the Station was utilized to test these lines.

Results and Discussion

Maximum flooding at the site was 75 cm during the last week of July. During August and September, minimum water depth was 4 cm and maximum was 45 cm. Thus, in terms of flooding level, these lines were not given a real rigorous test and yields cannot be used as a selection criterion. Yields ranged from 4.17 t/ha (Habigang Aman 4) to 1.33 t/ha (Habigang Aman 1) as shown in (TABLE 14). The lines BKN-6988-52-1-3-0 and B-4259-48-1-3-BR-4 tillered well with resulting high numbers of panicles per m^2. The most promising of these lines will be tested at the Chitosi Station medium lowland site in 1987.

TABLE 14: Feni Direct-Seeded Deepwater Rice Observation

Planting date: 4/6/86
Transplanting date: 6/7/86
Plot size - planted: 3 x 4.95m
- harvested: 2.5 x 3.75m

Spacing - row: 25 cm
- plant: 15 cm
Fertilizer: 0/30/20-40-0
N at 0/10/40 DAT

Variety	Days to flowering	Days to maturity	Plant height	Panicles per hill	Panicles per m^2	Yield
			cm	#	#	t/ha
Habiganj Aman 4	137	168	160	5.3	140	4.17
BKN-6988-52-1-3-0	144	176	93	8.0	228	3.77
B-4259-48-1-3-BR-4	144	177	105	7.8	223	3.66
IR-11185-B-B-850-1	144	176	106	5.1	144	3.30
CN 540	136	168	94	4.9	129	2.84
DWCT-156-1-2-0	130	162	137	4.8	133	2.76
DWC-B-110-HB-B-BRRI	151	179	151	4.5	125	2.61
G-5560	150	177	183	4.5	98	2.30
Kartikshail	137	168	160	5.6	147	2.20
DWC-B-283	135	165	160	3.3	88	2.11
Pathkola HR-16	142	172	154	5.7	149	2.11
IR-11288-B-B-421	130	162	148	4.4	130	2.11
Badol 613	139	170	154	4.9	128	2.05
Habiganj Aman-2	138	169	208	5.9	154	1.99
IR-11185-0-0-88-2	142	172	144	4.8	127	1.93
Khama 4918-X-12	150	179	152	4.8	128	1.83
Goda	137	168	142	6.0	156	1.74
Haniganj-Aman-8	138	169	221	4.5	147	1.71
BR-516-48-3	139	169	155	4.0	106	1.67
BR-224-2B-2-5	133	168	154	6.5	171	1.62
DWC-B-14-1-X-6	140	171	181	5.6	147	1.58
Sadapankaish	139	169	188	4.5	117	1.57
BR-311-B-5-4	139	170	147	5.5	145	1.51
Habiganj Aman-1	135	166	172	5.8	158	1.33
Mean			153	5.3	142	2.27

NATHER PETUA SOYBEAN-DEEPWATER AMAN CROPPING PATTERN TRIAL

Introduction

Because soybeans (*Glycine max*) are usually harvested in April and May after broadcast aman (*Oryza sativa*) planting in deepwater aman areas it is difficult to place them into the deepwater aman cropping pattern. In this trial conducted at the Nather Petua Research Station, rice was relayed into a stand of soybeans and planted after soybeans to compare the effect on rice yield of the various methods. In one pattern soybeans were dibble planted (45 cm row, 5 cm plant spacing) in December and the rice was relayed in early March. In the two other patterns soybeans were broadcast in (30 kg/ha) and line sown (60 cm row, 5 cm line spacing) in January, and the rice relayed into these plots in mid-February. Another pattern was line sowing soybeans (30 cm row - 5 cm plant spacing) in January and then, after soybean harvest, transplanting in deepwater aman as soon as conditions permitted. As controls, one pattern was December planted soybeans with rice dry seeded after the soybean harvest and another pattern was rice sown into a fallow plot in March.

Results and Discussion

The soybeans did very poorly. They did not nodulate, either due to poor inoculant or poor technique used in applying the inoculant. The rice grew equally well in each treatment (TABLE 15); however, because the soybeans didn't grow very tall, it is difficult to reach any conclusions about how much they competed with the rice. The soybeans planted in December were probably planted too early and may have received some cold-damage. Transplanting deepwater aman in this environment is very risky and probably should not be considered as a consistent option. It should probably only be considered for those cropping patterns that include a rabi season crop of such high value that the farmer could absorb the loss of the deepwater aman crop without too much harm.

TABLE 15: Nather Petua Soybean - Deepwater Aman Cropping Pattern Trial

Planting dates:-	Soybeans	rice
Dibble planted soy (45 x 5 cm)	10/12/86	2/3/87
Dibble planted soy (30x5 cm)	10/12/86	24/3/87
Broadcast soy (30kg/ha)	2/1/86	10/2/87
Line sown soy (60x5 cm)	2/1/86	10/2/87
Line sown soy (30x 5 cm)	2/1/86	1/7/87 (transplanted)
normal rice		4/3/87

Plot size - planted: 3 x 5m
- harvested: 4m

Fertilizer - soybean: 20/60/20
rice: 0/40/0

Rice seed rate: 100 kg/ha

Design: RCBD

Replications: 4

Treatments	Flow. date Soy	Flow. date rice	Harv. date soy	Harv. date rice	Plant ht. soy	Plant ht. rice	Heads/m^2 soy	Heads/m^2 rice	Yield soy	Yield rice
					cm	cm	#	#	t/ha	t/ha
D.p. 45 x 5 cm	12/2	22/10	16/3	17/11	35	166	28c	109	.37b	1.12
D.p. soy 30 x 5 cm	12/2	22/10	16/3	17/11	35	166	521	77	.37b	[illegible]
Broadcast soy 30 kg/ha	2/3	22/10	16/4	17/11	30	165	39b	116	.68a	1.21
Line sown soy 60 x 5 cm	2/3	22/10	16/4	17/11	31	165	20c	165	.50ab	.96
Line sown soy 30 x 5 cm	2/3	22/10	16/4	17/11	29	167	41b	167	.65a	1.36
Normal rice		22/10		17/11		165		165		1.04
Mean					32	165	36	99	.51	1.13
L. S. D. (.05)					NS	NS	10	NS	.25	NS
C. V. (%)					14	1	19	34	32	29

WHEAT

CHAR BATA WHEAT SEED RATE TRIAL

Introduction

Wheat (*Triticum aestivum*) yields in the char are limited by soil salinity. Plants on saline soil tend to be small, with few tillers. This experiment was done to find whether higher plant density might compensate for the reduced size of salt-affected plants.

Results and Discussion

Because the soil was slow to dry, seeding was delayed beyond the usual recommendation for wheat. Insect problems (wireworm, cutworm and stem borer) during the seedling stage caused general reductions in plant stands; so much so that there was less than one head at harvest for every plant emerged (TABLE 16).

Yields were low because of the above two reasons. However, there was a significant linear response of yield to seed rate. The slope of the response was 8.4 kg yield per kg of seed, and there was no significant deviation from linearity.

This result suggests that higher seed rates may be able to increase wheat yields on moderately saline soil. However, because of the high costs of these seed rates, it will be necessary to examine methods of controlling the thinning of stands caused by insects.

TABLE 16: Char Bata Wheat Seed Rate Trial

Planting date: 28/12/86
Harvest date: 25-26/3/87
Plot size - planted: 3.0m x 3.0m
- harvested: 2.0m x 2.0m
Row spacing: 20 cm

Design: Latin square
Replications: 8
Fertilizer: 60-40-0 at seeding
Previous crop: BR11 aman
Variety: Akbar

Seed rate	Days to flower	Days to maturity	Plants/m^2 16 DAS	Heads/m^2 at harvest	Plant height	Grain yield
kg/ha			#	#	cm	kg/ha
50	54	91	98	84	54	240
100	54	91	148	135	56	600
120	53	90	194	172	52	930
140	53	90	233	204	54	1080
150	53	90	202	182	54	920
160	53	90	237	208	51	1100
180	52	90	250	236	54	1270
200	51	90	325	310	56	1580
Mean	53	90	211	191	54	964
L.S.D.(.05)			49	43		266
C. V. (%)			22.7	21.9		26.9

CHAR BATA WHEAT VARIETY TRIAL

Introduction

This trial was performed to test the recommended wheat (*Triticum aestivum*) varieties of Bangladesh for their performance under late-sown saline char-land conditions. The trial was seeded in a tilled, moderately saline field.

Results and Discussion

Due to late seeding, salinity, and insects causing stand reduction, yields were low (TABLE 17). There were no significant differences in plant density, heads per square meter, plant height or yield. However, the varieties Agrani and Akbar flowered significantly earlier. This feature could enable these varieties to escape heat stress during flowering. However, it was evidently of no benefit to yield this past year.

TABLE 17: Char Bata Wheat Variety Trial

Planting date: 27/12/86
Harvest date: 22-25/3/87
Plot size - planted: 3.0m x 3.0m
- harvested: 2.0m x 2.0m
Row spacing: 20 cm
Seed rate: 150 kg/ha

Design: Latin Square
Replications: 5
Fertilizer: 60-40-0 at seeding (incorporated with last plowing)

Variety	Days to flower	Days to maturity	Plants/m^2 16 DAS	Heads/m^2 at maturity	Plant height	Yield
			#	#	cm	kg/ha
Barkat	56 b	91	225	211	49	1050
Agrani	51 d	88	193	190	49	1000
Ananda	57 a	91	207	213	49	880
Akbar	52 c	89	185	182	47	860
Kanchan	57 a	91	215	232	48	810
Mean	54	90	205	206	48	919
L.S.D. (.05)	0.5		NS	NS	NS	NS
C. V. (%)	0.7		21.8	23.2	3.8	30.8

FENI LATE-PLANTED IRRIGATED WHEAT OBSERVATION

Introduction

Normally, wheat (*Triticum aestivum*) is grown under rainfed conditions in Bangladesh. In this trial, of interest was how four important Bangladesh wheat varieties would perform under both irrigated and rainfed conditions. Since many farmers in MCC extension program's target group have rower pumps, this information might be of value to the farmer that could potentially irrigate. Under late-planted conditions, moisture stress becomes a limiting factor to production, since February and March are often extremely dry.

Results and Discussion

Severe bird damage occurred at the time of grain ripening, so yield data are not reliable. Yields per plot were based on extrapolation from the yield of undamaged heads within each plot. The number of plants per harvest area was then determined, and the extrapolation computed.

Irrigated wheat yields were much higher than non-irrigated wheat yields (TABLE 18). In the case of Kanshon, for example, the yield of the irrigated plot was over seven times the yield of the non-irrigated plot. If space permits, this trial will be run again in 1987-88.

TABLE 18: Feni Late-planted Irrigated Wheat Observation

Planting date: 15/12/86
Harvest date: 12/3/87-14/3/87
Plot size - planted: 4.5 x 5.0m
- harvested: $3m^2$
Planting: broadcast

Seed rate: 120 kg/ha
Fertilizer: 60-60-10
Irrigation: 16 and 44 DAP
Pesticide: none

Variety	Plant height	Plant stand/m^2	Total Irrigation time per 22.5m plot	Yield[a/]
	cm	#	minutes	t/ha
Irrigated				
Akbar	63	180	60	1.44
Kanchon	70	222	60	1.89
Sonalika	70	225	60	2.10
Annando	69	204	60	1.48
Mean	68	208	60	1.73
Not irrigated				
Akbar	58	70	nil	0.40
Kanchon	62	86	nil	0.25
Sonalika	61	105	nil	0.49
Anando	60	104	nil	0.44
Mean	60	91	nil	0.39

a/ because of intense bird damage to the plots around the time of harvest, yields per plot were based on extrapolations from undamaged heads within each plot; thus, the yield data is not very reliable.

1986 CHITOSI STATION WHEAT-PULSE INTERCROPPING TRIAL

Introduction

In a wheat (*Triticum aestivum*) - rice (*Oryza sativa*) rotation yields are known to decrease over time. Because the sustainability of such a rotation (wheat/rice) is in question and because pulse intercropping might produce more income, soybeans (*Glycine max*), chickpea (*Cicer arietinum*) and cowpea (*Vigna unguiculata*) were intercropped with wheat at the Chitosi Station research station to try and get an initial idea of which pulses might work best in this environment (deepwater rice area).

The wheat was planted using the asra minimum tillage technique (straw removal - 2 rakings - broadcast wheat seed and fertilizer - 2 rakings - 2 ladderings - re-application of straw). The pulses were line sown (80 cm lines) after broadcasting the wheat seed and the completion of the remaining tillage. The wheat was planted at 2/3 normal seedrate (80 kg/ha) and the pulses at about ½ normal seedrate (Soybean - 40 kg/ha; chickpea - 25 kg/ha; cowpea 17 kg/ha).

Results and Discussion

The wheat and chickpea were severly damaged at the seedling stage by armyworms. The soybeans and cowpeas were left untouched by the armyworms. Removal of the straw mulch detered the armyworms, however the damage done before straw removal was severe enough that the trial was abandoned. Removal of the mulch exposed the armyworms to being eaten by birds and also reduced soil moisture levels. It was thought that high soil moisture levels caused by heavy rains in early October and November (which delayed flood recession until the first week of December) probably contributed heavily to the armyworms being such a problem this year.

VEGETABLES

Bean

FENI GREEN (BUSH) BEAN RESPONSE TO COWDUNG FERTILIZER TRIAL

Introduction

In a trial conducted last year at the Feni Research Station with green (bush) bean, (*Phaseolus vulgaris*), and reported in the 1986 RESEARCH RESULTS (p.75), it was noted that the green beans in one spot responded well to an accidental application of cowdung. As a result, in this year's trial the response of green bean to three different cowdung treatments were compared with a non-cowdung treatment control. Since cowdung is readily available to many farmers, a significant boost in bean yield might encourage some farmers to divert this multiple use product from a fuel source to a fertilizer. The variety June Green was utilized.

Results and Discussion

The plants grew well and there was no evident damage from diseases or insects. Clearly, plant height was significantly affected by increased cowdung application (TABLE 1). Treatments receiving 20 ton/ha of cowdung grew the highest with a mean of 36 cm. The number of pods per plant and number of plants harvested were not affected significantly by differing rates of cowdung.

The yields produced under the different fertilizer regimes were significant at the 10% confidence interval. It is of interest that the smallest cowdung application, 5 tons/ha, resulted in the highest yields, 540 kg/ha (TABLE 1). It appears from these results that application of more than 5 tons/ha of cowdung only increased the green matter of the green beans, while perhaps slightly reducing yields.

It should be noted that further research with green (bush) bean, at the Feni Station at least, will not continue for the present. This is because June Green is not a registered variety in Bangladesh; and, yet, it has proven to be a much better yielding variety than Contender, the approved (released) variety in Bangladesh. In addition, MCC Extension is not extending green (bush) bean. Until something changes, further research is not deemed necessary.

TABLE 1: Feni Green (Bush) Bean Response to Cowdung Fertilizer Trial

Planting date: 7/12/86
Harvest date: 8/3/87
Plot size - planted: 4.2 x 5m
harvested: 3 x 4m
Spacing - row: 30 cm
plant: 30 cm[a/]

Design: RCBD
Replications: 4
Fertilizer: 40-40-52
cowdung - see below
Irrigation: 15 DAP
Variety: June Green

Cowdung treatment	Plant height	Pods/ plant	Plants harvested	Dry bean[b/] Yield
	cm	#	#	kg/ha
No cowdung	25 a	5.4	165	422
5 tons/ha	27 b	5.8	185	540
10 tons/ha	32 c	6.3	173	497
20 tons/ha	36 d	5.7	181	488
Mean	30	5.8	176	487
L.S.D. (0.05)	2	NS	NS	NS
C.V. (%)	4	10.4	12	11

a/ because of a seed shortage at planting, a 30cm plant to plant spacing was used instead of the recommended 10 cm spacing

b/ significant at the 10% level

FENI YARD LONG BEAN POLE SPACING TRIAL

Introduction

The regular support system for the climbing barboti or yard long bean (*Vigna unguiculata* var. *sesquipedalis*) vines requires a fair amount of bamboo and is, therefore, expensive. It was thought that input costs could be reduced with different plant spacing and support systems. The three treatments tested in this trial were: 1) four to five seeds in a small circle every 45 cm; row spacing of one meter; and a two meter tall bamboo post in the center of each hill; 2) similar to treatment one except with one meter tall bamboo posts; and, 3) the regular practice with a 90 x 15 cm row x plant spacing and bamboo support along the entire row in a cross hatch design.

Results and Discussion

The trial, planted on 2 February, 1986, did not perform very well. Many seedlings died due to beanfly attack. Those plants that survived, suffered from a yellow mosaic virus infestation, drought, breaking of the support system because of frequent spring storms and another beanfly infestation. The average yield in the trial was 1.6 t/ha. Two observations include: 1) the one meter pole system was probably insufficient in height; and 2) the two meter pole system was probably tall enough, but because of its height it had a great tendency to fall over in the spring storms. A better system would be to have a pole running parallel to the ground at about a 1.75 m height, held aloft by the tying together of the tops of the poles of two adjacent rows. This should help to give some stability to the support system.

FENI YARD LONG BEAN DATE OF PLANTING TRIAL

Introduction

A major problem with summer season borboti or yard long bean (*Vigna unguiculata* var. *sesquipedalis*), production is the beanfly, which can attack and usually kill the plant at any stage of growth. A trial was set up to see if certain planting dates had a tendency to escape the beanfly infestation and produce good yields.

Results and Discussion

The beanfly caused considerable damage to the plants regardless of the planting date (TABLE 1). All the plants suffered from yellow mosaic virus as well; especially the plants from the latter two planting dates. The earlier planted plots had lower plant stands because the cold weather caused many of the seedlings to become weak and die.

TABLE 1: Feni Yard Long Bean Date of Planting Trial

Planting date: variable
Plot size - planted: 4.5 x 3.6m
harvested: 2.7 x 2.5m
Spacing - row: 90 cm
plant: 15 cm

Design: RCBD
Replications: 3
Fertilizer: 20-40-55
Irrigation: as necessary
Pesticide: Malathion as necessary

Planting date	Days to[a/] harvest	Plants per pod	Plants[b/] per m^2	Beanfly[c/] rating	Yield
dd/mm/yy				(1-5)	t/ha
15/12/85	98-134	6	2.8	3	2.35
6/1/86	96-112	7	3.2	3	2.51
27/1/86	79-91	5	4.3	3	2.17
17/2/86	64-70	2	5.8	2	1.70
Mean		5	4.0	3	2.18
L.S.D. (0.05)					NS
C.V. (%)					25

a/ harvest range

b/ target plant population was 7.4 plants per m^2

c/ a rating of "1" indicates that there was no affect and "5" indicates that the plants were completely destroyed by the beanfly

FENI YARD LONG BEAN DATE OF PLANTING OBSERVATION

Introduction

Yard long bean (*Vigna unguiculata* var. *sesquipedalis*) is an important rainy season vegetable in Bangladesh. A member of the pulse family, it is grown on highland ground, particularly around the bari sites. In this trial, yard long bean was planted at three week intervals for the period beginning April 7, 1986 through April 20, 1987 on highland. Of special interest was whether or not Barboti could be grown during other periods than it normally is grown (MCC Vegetable Calender recommends sowing dates from mid-December through mid-August).

Results and Discussion

For many of the planting dates the yard long bean failed to produce any yield. Yard long bean planted on April 7 and April 28 was damaged by early rains, while yard long bean planted on June 30, August 11, September 9, and September 22 was damaged by monsoon rains. No yield was obtained for any of those planting dates, except June 30. Beans planted in December, January, February and March produced poor, insect and disease damaged stands, or no stands, or no stands at all. Bean rust and virus diseases were very hard on these plants. Rust was epidemic from December through March. Bean fly larvae were also a problem from December on into February. Fruits which did develop from plants planted December through March were of poor, unmarketable quality.

Planting dates which eventually resulted in viable yields are presented in TABLE 1. These dates do indicate that perhaps yard long bean can be planted in October and November with good results (the M.C.C. vegetable calender indicates otherwise).

TABLE 1: Feni Yard Long Bean Date of Planting Observation

Plot size - planted: 3.9 x 1.8m
harvested: 3.9 x 1.8m

Spacing - row: 90 cm
- plant: 15 cm

Variety:- Kagong Notaki

Replications: 1

Fertilizer: 20-40-55

Irrigation:

For planting date: 13/10/86 - 29/11/86 and 30/12/86

For planting date: 3/11/86 - 26/11/86, 30/12/86 and 11/1/87

Planting Date[a]	Days to flower	Days to harvest[b]	Pods harvested	Yield
dd/mm/yy			#	t/ha
19/5/86	42	52-78	210	2.79
30/6/86	38	51[c]	55	0.71
21/7/86	35	48-60	83	1.28
13/10/86	44	57-76	375	6.41
3/11/86	44	60-75	81	1.27
24/11/86	41	55-60	78	1.11
Mean	41	54-67	147	2.26

a/ those planting dates which did not produce a yield are not included

b/ range from first to last harvest

c/ only one harvest of pods could be done before rain damage occurred

BITTER GOURD

FENI BITTER GOURD DATE OF PLANTING TRIAL

Introduction

A date of planting trial was conducted to see how bitter gourd (*Momordica charantia*) responds to planting date. Of particular interest were the differences in fruit borer attacks between planting dates. The earlier planted bitter gourd plots should yield earlier, with the earlier ripening fruit escaping the fruit borer infestation. The earlier ripening fruit would also demand a higher price on the market.

Results and Discussion

Only two of the 32 original seedlings from the first planting date survived. The plants that did survive grew very vigorously and produced an early yield (TABLE 1). The plots of the remaining planting dates all had full plant stands. The fruit borer infestation arrived with the development of the first fruit, so the damage due to the fruit borer insect was not escaped by any of the planting dates. Percent bad fruit differences were not significant. If a full plant stand had been attained from the first planting date a possible yield could have been about 20 t/ha which is quite substantial. Further work should be done to see if transplanting the earlier planted seedlings would increase the survival rate and thus increase the final plant stand.

TABLE 1: Feni Bitter Gourd Date of Planting Trial

Planting date: variable

Plot size - planted: 3 x 6m

harvested: 3 x 6m

Spacing: 1.5 x 1.5m

Trellis: yes

Design: RCBD

Replications: 2

Fertilizer: 20/20-40-5 plus cowdung at 4 t/ha urea given at 0/25 DAP

Insecticide[a/]: malathion plus gur mixture

Planting date	Days to[b/] harvest	Good fruit	Good fruit	Bad fruit	Bad fruit	Bad[c/] fruit	Total Yield
dd/mm/yy		#/m^2	t/ha	#/m^2	t/ha	%	t/ha
15/12/85	99-154	6.1	4.93	1.8	0.80	14	5.73
6/1/86	84-139	11.7	11.8	3.1	1.57	12	13.40
27/1/86	69-118	8.6	8.99	2.6	1.89	11	10.88
17/2/86	69-97	3.8	3.20	1.4	0.75	19	3.96
Mean		7.6	7.23	2.2	1.25	14	8.49
L.S.D. (0.05)						NS	5.79
C.V. (%)						45	21

a/ the mixture is considered a bait spray and was applied at weekly intervals from 3 April to 4 May, 1986

b/ the range in days from the first to the last harvest

c/ calculated on a weight basis

FENI LATE-PLANTED CABBAGE SPACING OBSERVATION TRIAL

Introduction

In Bangladesh, the heads of cabbage (Brassica oleracea var. capitata) are known to become smaller the later in the rabi season cabbage is planted. Hence, this trial was conducted to determine whether late-planted cabbage, when spaced close together, could make up for the yield loss attributed to late-planting. The normal MCC recommended spacing for cabbage is row = 60 cm and plant = 45 cm. In this trial, one treatment utilized this spacing. The other treatment utilized a spacing of row = 40 cm and plant = 30 cm. Also of special concern in this study was whether the smaller sized cabbages would sell at the bazar, and for what price.

Results and Discussion

As TABLE 1 shows, this observation trial consisted of only two replications. Thus, the significance of the yield difference between spacing treatments should be viewed with at least a small amount of skepticism. Nonetheless, the yield difference is very large. As expected, the weight per head and head diameter was clearly larger for the normally spaced plants. The smaller cabbage heads were marketable, but at a slightly lower price than the larger heads (Tk. 1.5 versus Tk. 2.0 per head). Nonetheless, the number of marketable heads was substantially greater for the close-spaced cauliflowers, and, the input costs were the same except for slightly higher seed costs.

The marginal rate of return (MRR) was 258% for the close-spaced cabbages (TABLE 2). This means that for each additional taka of inputs for this treatment, a 2.58 taka increase in profit was realized above the row-60 cm, plant-45 cm treatment. Thus, close-spaced cabbages resulted in higher profits. Further research should be conducted with this technique, including different planting dates, and perhaps different varieties.

TABLE 1: Feni Late-planted Cabbage Spacing Observation Trial

Planting date: 16/10/86

Transplanting date: 17/11/86

Plot size - planted: 2 x 6m

harvested:

row: 60 cm plant: 45 cm: $4.8m^2$

row: 40 cm plant: 30 cm: $6.9m^2$

Spacing: (see below)

Design: RCBD

Replications: 2

Variety: Atlas-70

Fertilizer: 40/40-80-105-28

N at 5/30 DAT

Irrigation: 43, 63, 72, 85 and 92 DAP

Insecticide: Basudin

(soil insecticide) at

24 kg/ha at 0 DAP

Treatment spacing	Days to maturity a/	Weight per head	Heads harvested b/	Head diameter	Market price per head	Yield
		g	#	cm	Tk.	t/ha
Row: 60 cm plant: 45 cm	92-110	1510	23	25	2.00	50.20
Row: 40 cm plant: 30 cm	90-104	1050	52	21	1.50	79.00
Mean		1280	34	23	1.75	64.60
L.S.D. (0.05)						7.87
C.V. (%)						1

a/ harvest range in days after planting

b/ while plants were harvested from a $4.8\ m^2$ area in the 60 cm x 45 cm treatment, this was adjusted by multiplying by 1.44 to give a yield adjusted to $6.93m^2$ the harvest area of the 40 cm x 30 cm treatment

TABLE 2: Marginal Analysis of Feni Late-planted Cabbage Spacing Observation Trial

Spacing treatment		Row: 40 cm plant: 30 cm	Row: 60 cm plant: 45 cm
Gross return[a/]	(Tk./ha)	113,043	66,667
Variable costs[b/]	(Tk./ha)	25,568	12,620
Gross margin	(Tk./ha)	87,475	54,047
MGM	(Tk./ha)	33,428	
MVC	(Tk./ha)	12,946	
MRR	(%)	258	
ARR	(%)	258	

a/ based on a price of 2 taka/ha for the larger heads from the row = 60 cm plant = 45 cm treatment, and 1.5 taka/ha from the smaller heads from the row = 40 cm, plant = 30 cm treatment

b/ based on cost of 4 taka/gram for seed, and 375 g seed/ha for the normal spacing (row = 60 cm, plant = 45 cm) and 842 g seed/ha for close spacing (row = 40 cm, plant = 30 cm); and a cost of 40 taka/hour for labor

CAULIFLOWER

FENI LATE-PLANTED CAULIFLOWER SPACING OBSERVATION TRIAL

Introduction

Late-planted cauliflower (Brassica oleracea var. botrytis) is known to produce smaller heads, and lower yields than early planted cauliflower. In this trial, cauliflowers in one treatment were spaced much closer together than in the other treatment, to see if the yield loss attributed to smaller head size could be made up for by close spacing. The second treatment involved transplanting the cauliflower at the normal spacing. The variety Early Snowball, popular with farmers in Bangladesh, was utilized.

Results and Discussion

A rather dramatic boron deficiency resulted in 75% unmarketable heads for the close-spaced cauliflowers (row-40 cm, plant-30 cm), and 50% unmarketable heads for the normal spaced plants (row-60 cm, plant-45 cm). This deficiency was caused by the boron deficient soil, an extremely long duration variety, and having sprayed boron only once during the growing season. This demonstrates how long duration cauliflower may need greater than normal attention as regards micronutrient deficiencies. Weight per head was much higher for the normal spaced cauliflowers (TABLE 1). These heads also commanded a higher price at the market. Total yield per plot, however, was significantly higher (at 1% level) for the close-spaced treatment. Yields are not reliable due to only two replications (note, this was only an "observation" trial). See the Feni Late-planted Cabbage Spacing Observation Trial, too, in regard to higher yields for close spaced plants (in this report). This trial should be repeated with more replications, and perhaps more planting dates, next year.

TABLE 1: Feni Late-planted Cauliflower Spacing Observation Trial

Planting date: 16/10/86
Transplanting date: 12/11/86
Plot size - planted: 4.8 x 5.0m
harvested: 3 x 4m
Spacing - variable
Variety - Early Snowball

Design: RCBD
Replication: 2
Fertilizer: 38/38-76-102-28
N given at 5/30 DAT
Cowdung - 20 t/ha
Oilcake - small amount
Irrigation: 41, 52, 61, 74, 82, 92, 100 DAP

Treatment spacing	Days to harvest a/	Head diameter	Weight per head	Market price per kg	Yield b/
		cm	g	taka	t/ha
Row-60 cm plant-45 cm	105-115	16	775	2.5-3.0	28.4 a
Row-40 cm plant-30 cm	105-115	8	424	1.5-2.0	34 b
Mean		12	600	2.0-2.5	31.2
L.S.D. (0.05)					3.8
C.V. (%)					1

a/ harvest range in days after planting

b/ for the row-60 cm, plant-45 cm, treatment, 50% of heads were of good quality and 50% were unmarketable; for the row-40 cm, plant-30 cm, treatment, only 25% of heads were good quality and marketable. The unmarketable heads were affected with boron deficiency, causing browning. Also, since only two replications were conducted yield data is not reliable

FENI BROADCAST VS. HILL COWDUNG PLACEMENT CAULIFLOWER TRIAL

Introduction

The MCC Extension Program has expressed an interest in how yields of rabi season vegetables are effected by the hill placement versus broadcasting of cowdung. In this trial, using cauliflower (Brassica olerarea var. botrytis) variety, Early Snowball, two levels of cowdung were applied either broadcast or hill placed. No micronutrient fertilizers were applied, so the potential of the cowdung to provide important micronutrients - like boron and molybdenum - was also examined.

Results and Discussion

Hill placement of cowdung resulted in the highest yields, but the differences were not significant (TABLE 1). Average head diameter was higher for the hill placement treated cauliflower. Hill placement also resulted in higher average weights per head, and these values were significant at the 10% level; orthogonal comparisons revealed significance at the 5% level for hill placement versus broadcasting of cowdung.

Boron deficiency resulted in 90% percent of the heads being unmarketable at harvest. This probably indicates that even with considerable application of cowdung, boron should be applied to cauliflower plants.

TABLE 1: Feni Broadcast vs. Hill Cowdung Placement Cauliflower Trial

Planting date: 21/10/86
Transplanting date: 18/11/86
Harvest date: 2/2/87
Plot size - planted: 2.4 x 3.2
harvested: 1.2 x 2.4m
Spacing - row: 60 cm
plant: 40 cm
Variety: Early Snowball

Design: RCBD
Replications: 4
Fertilizer: 40/40-80-110-30
5 and 30 DAT
Cowdung - applied two days before transplanting
Irrigation: Seven times at one to two week intervals
Pesticide: none

Cowdung treatment	Heads harvested/plot	Average head diameter	Average weight[a/] per head	Yield
	#	cm	g	t/ha
Broadcast 20 tons/ha	8	18.4	807	33.7
Broadcast 10 tons/ha	8	18.1	883	36.7
Hill placement 20 tons/ha[b/]	8	20.2	1101	45.8
Hill placement 10 tons/ha	8	21.8	960	40.0
Mean	8	19.6	938	39.0
L.S.D. (0.05)		NS	NS	NS
C.V. (%)		11.7	16	15.8

Orthogonal Comparisons

Hill vs. broadcast	*
Broadcast 20 t/ha vs. 10 t/ha	NS
Hill 20 t/ha vs. 10 t/ha	NS

a/ these values are significantly different at the 10% level

b/ application of dung by mixing it with the soil from a 0.5m x 0.5m x 0.5m hole, and replacing the soil-dung mixture into the same hole

FENI CAULIFLOWER LIMITING FERTILIZER TRIAL

Introduction

The cauliflower (*Brassica oleracea* var. *botrytis*) variety Early Snowball has continued to be an important MCC extension variety. This trial was intended to be a seedbed limiting fertilizer trial, however early hard rains washed out the first seedbed. As other seedlings were available, it was decided to run a limiting nutrient trial with the transplanted cauliflower instead. Sulfur was applied to all treatments. One, or more, major nutrients (N, P, K) were removed, depending on the treatment, except for one treatment which contained all nutrients.

Results and Discussion

Highly significant differences for treatments occurred for head diameter, average weight per head and yield (TABLE 1). Clearly, nitrogen was the single most important nutrient for good cauliflower yields. Nitrogen doubled the yields. In terms of head diameter and average weight per head, nitrogen again was the most important nutrient for proper cauliflower development. The results of this trial reinforce our understanding that proper fertilization is essential for good cauliflower growth and yields.

In TABLE 2, the marginal analysis of this trial can be seen. The most profitable treatment, based on this analysis, was that receiving 80-0-110 (N-P-K in kg/ha). This treatment was over 2100% more profitable than the next best treatment (80-0-0) based on the MRR. This demonstrates that the application of nitrogen not only boosts the yield of cauliflower, but also leads to much higher profits.

TABLE 1: Feni Cauliflower Limiting Fertilizer Trial

Planting date: 21/10/86
Transplanting date: 16/11/86
Harvest date: 31/1/87-9/2/87
Plot size - planted: 2.4 x 3.2m
harvested: 1.2 x 2.4m
Spacing - row: 60 cm
plant: 40 cm
Variety: Early Snowball

Design: RCBD
Replications: 3
Fertilizer: variable (see below)
Cowdung - 10 t/ha
Boron - at 40 DAP
Irrigation: Six times, at one to two week intervals
Insecticide: Basudin (soil insecticide) at 24 kg/ha and 0 DAP

Fertilizer treatment	Plants harvested	Head diameter	Average weight per head	Yield
Kg $N-P_2O_5-K_2O$-5/ha	#	cm	g	t/ha
0-0-0-30	7.7	118 d	344 c	14.32 c
80-0-0-30	7.7	182 a	736 ab	30.64 ab
0-80-0-30	9	116 d	396 c	16.52 c
0-0-110-30	7.3	96 e	325 c	13.53 c
80-0-110-30	8.3	182 a	815 a	33.95 a
0-80-110-30	6.7	129 c	355 c	14.80 c
80-80-0-30	9.7	178 a	709 ab	29.52 ab
80-80-110-30	8	164 b	615 b	25.62 b
Mean	8.0	145	537	22.36
L.S.D. (0.05)	NS	6	129	5.36
C.V. (%)	28.7	23	14	13.65

TABLE 2: Marginal Analysis of the Feni Cauliflower Limiting Fertilizer Trial

Fertilizer treatment		80-0-110	80-0-0	0-0-110	80-80-0[a/]	80-80-110	0-80-0	0-80-110
Gross return[b/]	(Tk./ha)	169,750	153,200	67,650	147,600	128,100	82,600	74,000
Variable costs[c/]	(Tk./ha)	1,711	978	733	1,956	2,689	978	1,711
Gross margin	(Tk./ha)	168,039	152,222	66,917	145,644	125,411	81,622	72,289
MGM	(Tk./ha)	15,817	85,305					
MVC	(Tk./ha)	733	245					
MRR	(%)	2,158	34,818					
ARR	(%)	10,340	34,818					

a/ fertilizer treatments 80-80-0, 80-80-110, 0-80-0 and 0-80-110 are not included in marginal analysis because they were dominated (their variable costs are higher and gross margins lower than the other treatments)

b/ based on a valuation of cauliflower at taka 5/cauliflower

c/ based on urea = taka 5.50/kg; TSP = taka 5.50/kg; muriate of potash = taka 4.00/kg

FENI CAULIFLOWER VARIETY X PLANTING X SEEDLING AGE TRIAL

Introduction

Cauliflower (*Brassica oleracea* var. *botrytis*) often needs to be planted at later than optimum times due to late rains which wash out seedbeds. Also, the date of transplanting can affect the eventual performance of the crop. This trial was designed to test two different cauliflower varieties for performance when planted on either November 11 or November 25, and when transplanted at either 20 or 25 days after sowing. The two varieties tested were Early Snowball and Tropical 55 Days.

Results and Discussion

Because of the late planting, combined with late maturity of these varieties, no viable heads formed for either variety. Too much heat in late January and early February was probably responsible for this.

FENI CAULIFLOWER VARIETY TRIAL

Various varieties of cauliflower (Brassica oleracea var. botrytis) continue to be tested each year at the Feni Research Station on order to determine the best of the available varieties in Bangladesh. Cauliflower continues to be an important vegetable in MCC extension program's subsistence farmer program. Of especial interest are early maturity and good yield. Early Snowball and Tropical 55 Days are the MCC extension varieties at present.

Results and Discussion

Because of excessive rain, September seedbed-planted cauliflower could not be transplanted. As such, new seedbeds had to be started. These were started on October 16, 1986. Early Snowball duration was 30-35 days longer than most other varieties, yet it had a significantly higher yield than all other varieties (TABLE 1). Snow king had a respectable yield (24.75 tons/ha) and early maturity. This variety has performed well in past MCC trials, producing a fine white head. The variety is still unreleased in Bangladesh. In Noakhali, late-planting is necessary because of overly moist soils earlier in the season. Thus, the late market gets flooded by cauliflower, reducing prices. The search for a higher yielding early maturing variety thus continues, and Snow King could potentially help fill that gap.

Early Snowball had a significantly larger average weight per head than other varieties. MCC-produced Tropical 55 Days seed was planted in this trial and compared with imported seed of the same variety. Yields were nearly identical, but the MCC-produced Tropical 55 Days had a slightly longer duration and significantly larger head diameter (TABLE 1). These results are of interest, especially since MCC extension program is interested in the effect on cauliflower of farmers producing their own seed. This was the first year this has been tested. This coming year a similar trial will again be attempted.

TABLE 1: Feni Cauliflower Variety Trial

Planting date: 16/10/86
Transplanting date: 17/11/86
Plot size - planted: 2.4 x 3.2m
harvested: 1.2 x 2.4m
Spacing - row: 60 cm
plant: 40 cm

Design: RCBD
Replications: 3
Fertilizer: 40/40-80-110-30-N at 5 and 30 DAT
Cowdung - 10 t/ha to each hill
Oilcake - small amount per hill
Irrigation - Six times at one to two week intervals
Pesticide: Basudin, 24 kg/ha at 0 DAP

Variety	Days to maturity[a/]	Head diameter	Average weight per head	Yield
		cm	g	t/ha
Early Snowball	105-115	17 b	880 a	36.52 a
Snow King	75-85	21 a	580 b	24.75 b
Tropical 55 Days (MCC produced seed)[b/]	80-90	20 a	500 bc	20.69 bc
Tropical 55 Days (Imported)[c/]	75-85	18 b	480 bcd	20.04 bcd
Agrahani	70-75	16 c	390 cd	16.19 cd
Tropical 45 Days	70-75	17 b	350 d	14.47 d
Mean		18	530	22.11
L.S.D. (0.05)		1.4	145	6.11
C.V. (%)		4	15	15

a/ harvest range in days after planting

b/ seed of this variety stored for one year by MCC after seed production in farmers fields

c/ seed of this variety imported

DATA SHAK

FENI SHADED DATA SHAK TRIAL

Introduction

It has often been observed that summer season gourds often take a few weeks to establish a good crop canopy. Farmers often make use of this by growing an amaranth crop, locally called data shak (*Amaranthus* spp.), in between the gourd hills while the gourd plants are growing. A trial was conducted to observe which gourds grew the best in combination with the data shak.

Results and Discussion

The gourd seeds germinated very well and full plant stands were established. The data shak seed did not do very well however, and an adequate stand was finally established on the third planting attempt. Therefore, the data shak plants did not benefit from a shadeless environment, except for the sole data shak plots, and growth was severely repressed by the gourd plants. The gourds, with the exception of cucumber, had a very dense foliage and blocked out most of the light. The cucumber plants did not grow well and yielded very poorly (TABLE 1).

TABLE 1: Feni Shaded Data Shak Observation Trial

Planting date - gourds: 4/2/86
data shak: 13/4/86

Harvest area - gourds: 4.5 x 4.5m^2
data shak: 4m^2

Spacing - gourds: 1.5 x 1.5m

Seed rate - data shak: 1.5 kg/ha

Fertilizer - gourds: 20-40-25 plus cowdung at 4 t/ha
data shak: 40-20-25 plus cowdung at 10 t/ha

Irrigation: as necessary

Pesticide: malathion on snake and bitter gourds

Gourd type	Data shak	Days to[a/] harvest		Yield	
		gourd	data shak	gourd	data shak
				t/ha	t/ha
Snakegourd	no	76-129		7.82	0
Snake gourd	yes	72-127	41-63	9.50	2.29
Bitter gourd	no	72-114		5.61	0
Bitter gourd	yes	72-114	41-63	5.34	1.55
Cucumber	no	87-108		0.63	0
Cucumber	yes	87-108	41-63	0.59	7.48
none	yes		41-63	0	6.02

a/ range in days to harvest

PAPAYA

FENI PAPAYA VARIETY TRIAL

Introduction

Three varieties of papaya (*carica papaya*) - Feni local, Taiwan variety ("Known you No. 1", F1-hybrid), and Kushtia BADC Dwarf - were tested at the Feni Research Station to compare their performances. Seedlings were transplanted at 25 days after sowing.

Results and Discussion

The plants did well initially. However as the rainy season progressed, the plants turned yellow and began to die. This dying process started in August. By September, it was clear that all the papaya plants would die. Incidently, and importantly, two or three papaya plants were planted under the eaves of the Research Station office, and these plants did extemely well. They eventually yielded abundant fruit. It seems clear that papaya needs a less water-logged soil, and perhaps more shade, than was available in this trial at the Feni Station. The Research Station office provided shade, and the eaves protection from excessive rain. Also the roots of the papaya could grow underneath the mud floor of the office into drier soil. Thus, those plants planted hard by the office thrived, while the other plants in the actual trial died.

TOMATO

FENI BANGLADESH AGRICULTURE UNIVERSITY (BAU) ZONAL TOMATO TRIAL

Introduction

MCC has cooperated with BAU in testing promising tomato (*Lycopersicon esculentum*) varieties for a number of years. This past year, we again received seed from BAU to conduct a zonal varietal trial. Special interest continues to focus on bacterial wilt resistance and higher yield. Roma-VF continues to be one major MCC tomato extension variety; this variety served as a check.

Results and Discussion

There was considerable wilt, possibly both bacterial and fungal, in this year's trial. Since the proper pathological equipment to test for these organisms, and distinguish them, was not present, the two are simply combined. While in all cases the plants wilted and died, in some cases the split stem was black inside, and in other cases not at all blackened. Raton had the best wilt resistance, followed by Manik.

In terms of total yield, yield per plant, and fruits per plant, Roma-VF came out on top (TABLE 1). Significant differences between genotypes were noted for each of those three parameters. Roma-VF did not have a significantly higher total yield or yield per plant than BAU/TM0003 or ASA-4.

It is interesting to note that the two highest yielding varieties, Roma-VF and BAU/TM0003, also succumbed the most to wilt.

TABLE 1: Feni Bangladesh Agriculture University (BAU) Zonal Tomato Trial

Planting date: 19/10/86
Transplanting date: 18/11/86
Plot size-planted: 5 x 6m
harvested: 4 x 4.8m
Spacing - row: 60 cm
plant: 50 cm
Design: RCBD

Replications: 3
Fertilizer: 63-80-30
N given as basal dose
Cowdung - 10 t/ha
Oilcake - 350 kg/ha
Flood irrigation - twice
Pesticide - none

Genotype	Days to[a/] flower	Days to[a/] harvest	Wilt[b/] rating	Fruits per plant	Yield per plant	Total yield
			1-5	#	g	t/ha
Roma-VF	66	83-114	4	46.7 a	1810 a	60.34 a
BAU/TM0003	61	83-114	4	13.0 e	1672 ab	55.75 ab
ASA-4	65	86-114	3	28.7 bc	1653 ab	55.13 ab
Manik	61	83-114	2	32.3 b	1462 bc	48.73 bc
BAU/TM00013	66	86-114	3	22.7 d	1416 bc	47.18 bc
Raton	59	83-114	2	26.7 cd	1258 c	41.63 c
Mean			1.83	28.3	1545	51.46
L.S.D. (.05)				5.55	297.7	9.78
C.V.(%)				10.8	10.58	10.44

a/ harvest range

b/ wilt rated with 1 = no effect and 5 = all affected. Both bacterial and fungal wilts may have been present

FENI TOMATO VARIETY BACTERIAL WILT SCREENING OBSERVATION TRIAL

Introduction

Probably the most serious disease encountered by tomatos (*Lycopersicon esculentum*) in Bangladesh is bacterial wilt. The organism causing bacterial wilt (*Xanthomonas phaseoli* var. *sojense*) persists in soil for more than 12 months. Therefore, it is necessary to rotato non-solanaceous crops with tomato, or use resistant varieties, in order to decrease disease incidence. There are no bacterial wilt-resistant tomato varieties in Bangladesh. Two varieties, however, Manik and K-7, are known to possess tolerance to this disease. Bacterial wilt will normally kill tomato plants within a few days after the first symptoms are seen. In this trial, six varieties of tomato were tested for wilt resistance at the Feni Research Station.

Results and Discussion

Seedbed planting was 15/9/86. Five plants, per variety, were transplanted 31 days later. Six varieties were tested: Manik, Ratton, K-7, Roma-VF, Marglobe and Large Red. All plants of Roma-VF, Marglobe and Large Red were killed by wilt or insects before flowering. By the time ripe tomatos were being produced, K-7 was reduced to two remaining plants and Ratton to three. Only Manik withstood the wilt and insects and had five fruit bearing plants throughout the experiment. Manik produced 124 fruits from the five plants, with a total yield equivalent of 39 t/ha. Conclusion: the varieties Manik (especially) and Ratton should be looked at in the future for their bacterial wilt resistance.

FENI BROADCAST VERSUS HILL COWDUNG PLACEMENT TOMATO OBSERVATION TRIAL

Introduction

Most farmers in the Greater Noakhali region (Feni, Noakhali and Lakshmipur Districts) and Comilla District are known to broadcast cowdung onto their tomato (*Lycopersicon esculentum*) fields. In this trial the effect of placing cowdung directly under tomato plants was compared with broadcasting cowdung randomly in the plot. To accomplish this, 0.5m x 0.5m x 0.5m holes were dug, and cowdung mixed with this soil before placing the soil back into the hole. Of most interest in this trial was the influence that hill placement of cowdung might have on the yield of MCC extension tomato variety Roma-VF.

Results and Discussion

A small increase in yield occurred for tomatos receiving hill placement of the cowdung fertilizer (TABLE 1). This trial utilized an MCC extension variety, Roma-VF, and should be conducted in a larger, replicated trial next year.

TABLE 1: Feni Broaccast Versus Hill Cowdung Placement Tomato Observation Trial

Planting date: 19/10/86
Transplanting date: 20/11/86
Plot size - planted: 3 x 2.25m
harvested: 3 x 2.25m
Spacing - row: 90 cm
plant: 40 cm
Variety: Roma-VF

Replications: 2
Fertilizer: 100-100-135-25
N given at 0 and 30 DAT
Cowdung - 20 t/ha
Oilcake - small quantity
Irrigation: 44, 51 and 60 DAP

Cowdung treatment	Days to flower	Days to maturity	Percentage good fruit	Yield
				t/ha
Hill placement	56	107-129	95	65.97
Broadcast	56	107-129	95	63.48

MISCELLANEOUS VEGETABLE TRIALS

FENI RABI VEGETABLE SEED TREATMENT SEEDED TRIALS

Introduction

Tomato (Lycopersicon esculentum), cauliflower (Brassica oleracea var. botrytis), and cabbage (Brassica oleracea var. capitata) seedbeds can be started around September 1 in the Greater Noakhali region. Highland must be used, since heavy rains continue into September. Additionally, a bamboo-plastic roof is necessary to keep heavy rains off the seedbeds. One advantage of early planting is the fact that farmers can get their produce to the market earlier, when the supply is low, and the demand high; the price is highest then. One of the annual problems faced by farmers planting vegetabel seedbeds is ants, which can carry off an entire seedbed of seeds in a single night. As a deterent to ants, many farmers use an ash-kerosene mixture, which is spread in a bordering line around the seedbed. The results are variable, depending on the frequency of application, amount of rain, and the tenaciousness of the ants (among, perhaps, other things).

The leaves, stems and fruits of the neem tree (Azadirachta indica), and a few close relatives, are known to contain insect-repelling agents. The neem tree is found in much of the South Asian subcontinent. Also, Tobacco leaves are known to be insecticidal. In this study, extracts from the dried, crushed leaves of neem and tobacco were used as two seed treatments. The neem leaves were obtained from a tree in Feni town. The tobacco leaves were purchased in Feni (smokeable tobacco leaves). In each case, 10g of dried, crushed leaves were added per 100 ml hot water and allowed to steep overnight. Seeds of tomato, cauliflower and cabbage were soaked separately in these mixtures for 20 minutes just before planting. These treatments were compared with an untreated control and Furadan (a commercially available, synthetic insecticide) treated soil for ability to deter ants from the seedbeds.

Results and Discussion

Originally, an observation trial was conducted only with cabbage seed. This was planted on September 15, 1986, but the trial was washed out by heavy rains early on. Next, tomato, cauliflower and cabbage seedbeds were planted on October 21. The results of these three trials are in TABLES 1-3. As shown in the TABLES, no significant differences between treatments for

seedlings emerged, or seedlings surviving, were obtained for any of the vegetables. However, ant pressure appeared to be much lower during this period than it was in September. This probably explains the lack of differences between treatments (note that the control fared no worse than the other treatments, based on the statistical analysis). In the cabbage trial, a significant difference (at the 1% level) in plant heights was obtained - the Furadan treatment seedlings being taller than the other treatments seedlings (TABLE 3).

It was felt that this past year's trials were not a fair test for these various treatments, since ant pressure was seen to be minor at the critical time (just after planting). These trials will be repeated in 1987 with earlier planting dates and, perhaps, more planting dates.

TABLE 1: Feni Tomato Seed Treatment Seedbed Trial

Seedbed planting date: 21/10/86
Plot size - planted: 0.5 x 0.5m
harvested: 0.5 x 0.5m
Spacing - row: 8 cm
plant: 3 cm
Variety: Roma-VF

Design: Latin square
Replications: 3
Fertilizer: 0-108-0
Irrigation: none

Seed treatment[a/]	Seeds planted	Seedlings emerged	Seedlings Surviving	Average[b/] seedling height
	#	#	#	cm
Untreated (Control)	100	62	49	8.1
Neem leaf[c/] extract	100	76	74	8.8
Furadan[d/]	100	65	59	9.5
Mean	100	67.4	60.8	8.8
L.S.D. (0.05)		NS	NS	NS
C. V. (%)		20	24	6

a/ note: tobacco leaf extract was not used in this trial
b/ twenty days after planting
c/ ten g dried, crushed neem leaves per 100 ml hot water; this mixture allowed to steep overnight. Seeds soaked for 20 minutes in mixture prior to planting
d/ applied at 1.6 g/m^2 to the seedbed

TABLE 2: Feni Cauliflower Seed Treatment Seedbed Trial

Seedbed planting date: 21/10/86

Plot size - planted: 0.5 x 0.5m

harvested: 0.5 x 0.5m

Spacing - row: 8 cm

plant: 2 cm

Variety: Early Snowball

Design: Latin square

Replications: 4

Fertilizer: 0-108-0

Irrigation: none

Seed treatment	Seeds planted	Seedlings emerged	Seedlings surviving	Average seedling height[a/]
	#	#	#	cm
Untreated (Control)	150	129	84	7.4
Neem leaf extract[b/]	150	104	87	7.3
Tobacco leaf extract[c/]	150	123	94	7.6
Furadan[d/]	150	126	90	7.6
Mean	150	120	89	7.5
L.S.D. (0.05)		NS	NS	NS
C. V. (%)		12	16	5

a/ twenty days after planting

b/ ten g dried, crushed neem leaves per 100 ml hot water; this mixture allowed to steep overnight. Seeds soaked for 20 minutes in mixture prior to planting

c/ same procedure as for neem leaf extract

d/ applied at 1.6 g/m^2 to the seedbed

TABLE 3: Feni Cabbage Seed Treatment Seedbed Trial

Seedbed planting date: 21/10/87

Plot size - planted: 0.5 x 0.5m

harvested: 0.5 x 0.5m

Spacing - row: 8 cm

plant: 2 cm

Variety: Atlas-70

Design: Latin square

Replications: 4

Fertilizer: 0-108-0

Irrigation: none

Seed treatment	Seeds planted	Seedlings emerged	Seedlings surviving	Average[a/] seedling height
	#	#	#	cm
Untreated (Control)	150	104	89	118 a
Neem leaf extract[b/]	150	113	103	118 a
Tobacco leaf extract[c/]	150	112	102	119 a
Furadan[d/]	150	114	85	127 b
Mean	150	111	95	120
L.S.D. (0.05)		NS	NS	3
C.V. (%)		10	15	1

a/ twenty days after planting

b/ ten g dried, crushed neem leaves per 100 ml hot water; this mixture allowed to steep overnight. Seeds soaked for 20 minutes in mixture prior to planting

c/ same procedure as for neem extract

d/ applied at 1.6 g/m^2 to the seedbed

CHAR BATA VEGETABLE IRRIGATION AND PLASTIC MULCH TRIAL

Introduction

Vegetable cultivation in the char is usually limited to highlands around homes, where salinity is low. Large areas of rice land lie fallow during the rabi season because salinity precludes the cultivation of crops. Although the salinity tolerance of most vegetables is not high, the potential returns to their cultivation could justify intensive techniques aimed at reducing salinity effects.

The objective of this experiment was to test using ground-water irrigation in combination with a plastic mulch designed to prevent evaporation. The purpose of preventing evaporation was to reduce resalinization.

Two sources of water were used. One was from a tubewell in the freshwater recharge zone of a pond. The EC of this water source was approximately 2 mmhos/cm. The second source was from a tubewell, tapping typical groundwater for the char, with an EC of approximately 6 mmhos/cm. The two sources were applied to two separate 21 m long trenches. Each trench was divided into four 4.5m sections; two sections 30 cm deep and two sections 50 cm deep. On either side of the trench in each section were three vegetable species subplots. The three species were yard-long bean (*Vigna unguiculata* var. *sesquipedalis*), bitter gourd (*Momordica charantia*), and okra (*Abelmoschus esculentus*).

The trenches were 50 cm wide. Excavated soil was placed on both sides to make smooth hills 0.5m wide. Seeds were planted, starting on these hills, extending outward from the trench, in rows 3m long by 0.5m apart. Immediately after planting, the trench and hills were covered by a clear 6-mil polyethylene sheet. The sheet was supported by a bamboo pole running longitudinally down the center, and anchored on the sides into the soil; forming a long "tent" over the trench and soil. Thus, seeds were planted both under the plastic mulch and outside of it. At seedling emergence, small holes were made in the plastic for the plants to grow through.

The experiment was designed in this way so that comparisons could be made between the soil under the plastic mulch, that immediately outside and that farther from the effect of the irrigation water supplied by the trench.

A total of 106,000L was applied to the plot area (336m^2) within 23 days after seeding. This was calculated by: 14 days rower pump irrigation x 6 hours per day x 60 min./hr. x 21 L/hr. measured output. Thus, total water applied was equivalent to 320 mm of rainfall.

Results and Discussion

Emergence of all three species was poor, and of those that emerged, many died; and the rest of the plants grew slowly and did not produce any appreciable yield. There was no visible difference in growth between mulched and unmulched plants.

Two reasons accounted for this. First, salinity levels at the start of the experiment were high; above the tolerance range of the species seeded (TABLE 1). Second, within 20 days after seeding, temperatures above 40°C were recorded underneath the plastic mulch. Although attempts were made to partially ventilate beneath the plastic, temperatures at 2 pm were generally 10°C above ambient. Thus, many seedlings beneath the mulch died of heat damage after emergence.

Resalinization was not reduced by the plastic mulch. In fact, results indicate it was enhanced (TABLE 1). The explanation for this is not clear. The irrigation water applied leached mostly downward in the soil; this is indicated by the large amount of irrigation water absorbed within a relatively short time. Therefore, the lateral flow required to desalinize the mulch-covered areas did not occur. Another explanation is that higher temperatures coupled with partial ventilation actually increased evaporation from the soil.

Conclusions

High temperatures observed under the plastic mulch indicate that this technique is appropriate for earlier planting dates only. This is a possible method allowing earlier planting of these species for more favorable seasonal distribution of produce.

The high water consumption of this experiment suggests that shallower channels and lining to prevent downward seepage should be considered. It may also be desirable to consider more efficient methods such as trickle irrigation.

TABLE 1: Char Bata Vegetable Irrigation and Plastic Mulch Trial

Planting date: 26/1/87
Plot size: 1.5m x 3.0m
Plant spacing: 50 cm x 50 cm
Plant species: a) yard-long bean
b) bitter gourd
c) okra

Main plots: 2 water sources
Secondary plots: 4 replications
Tertiary plots: 2 trench depths
Quaternary plots: 3 plant species
Fertilizer: 40-80-40 plowed in

Distance from trench	Soil salinity (ECe) Jan. 21	Soil salinity (ECe) Mar. 8	Soil moisture
	---------mmho/cm---------		%
0.5 (under plastic)	8.8 ± 2.6[a/]	14.1 ± 5.7[a/]	20.4 ± 2.2[a/]
1.0 (outside plastic)	-	11.1 ± 4.8	23.9 ± 2.9
2.0 (" ")	10.0 ±	11.6 ± 5.4	24.6 ± 3.0
Mean:	9.4	12.9	23.0

a/ Mean of 16 observations ± standard error

TILLAGE METHODS

FENI MAIZE TRENCH TILLAGE TRIAL

Introduction

A major constraint to improved maize (*Zea mays*) production in Bangladesh is poor soil penetration by plant roots. The problem is that the roots do not penetrate the plow pan formation. Previous MCC research indicated that maize roots proliferate only the top 7 centimeters of the soil. This past year, a trench tillage trial was again conducted with maize. Two years ago (see MCC Annual Report: Research Results 1986, p. 95) a similar trial was conducted using two replications; in that trial, yields were not significantly different; root penetration differences, however, were highly significant (plants receiving tillage had much deeper penetration). Based on this information, it was decided to repeat the trial again this past year. As in the previous year's trial, the trench dimensions were 5 cm wide and either 10 cm or 20 cm deep, depending on the treatment, with the trench formed in a row where the seed was later planted. Fertilizer was placed at the bottom of the trench.

Results and Discussion

Relative to the year before, this past year's maize grew higher and yielded better. The mean yield for all treatments was 1.52 t/ha (TABLE 1). The 20 cm trench tillage treatment resulted in significantly higher yields and root penetration. Orthogonal contrasts (contrast comparisons) indicated highly significant differences for root penetration and yield, and a significant difference in plant height, for 10 and 20 cm trench depth treatmets versus no trench (0 cm trench depth). In addition, the 20 cm trench depth treatment resulted in a significantly higher yield and root penetration than the 10 cm trench depth.

These results indicate that digging a trench through the plow pan to a 20 cm depth can result in both significantly deeper root penetration and yield, compared with no trench tillage. This trial should be repeated in the coming year, and the results shared with national research personnel in Bangladesh.

TABLE 1: Feni Maize Trench Tillage Trial

Planting date: 26/11/86
Harvest date: 25/3/87
Plot size - planted: 4.2 x 5m
harvested: 2.8 x 4m
Spacing - row: 70 cm
plant: 20 cm
Variety - Super Sweet

Design: RCBD
Replications: 3
Fertilizer: 80-60-20
plus small amount of zinc
Irrigation: 15, 27, 47, 63, 89 and 100 DAP
% seed moisture: 17%

Trench depth	Plant height	Root penetration	Plants harvested	100 Seed weight	Yield
cm	cm	cm	%	g	t/ha
0	128 b	24 b	55	18	1.41 b
10	172 a	30 b	50	17	1.50 b
20	151 ab	40 a	51	18	1.67 a
Mean	150	32	52	17.7	1.52
L.S.D. (0.05)	27	7	NS	NS	0.11
C.V. (%)	8	9	15	2	3
Orthogonal contrasts					
0 cm vs. 10 cm + 20 cm	*	**			**
10 cm vs. 20 cm	NS	*			*

CHAR BATA TILLED MUSTARD VARIETY TRIAL (BAU)

Introduction

Five lines of *Brassica juncea* received from BAU were tested in comparison to the local variety (*B. juncea*) and the released variety, Tori-7 (Maghi), (*B. campestris*). Previous trials have indicated that of the released mustard varieties, only Tori-7 performs comparably with the local under saline charland conditions on tilled soil. Major problems for the crop are soil salinity, aphid attack and high temperatures towards the end of the season.

Results and discussion

Because of a cyclonic rainstorm in mid-November, water remained late in the fields, delaying tillage and planting operations beyond the usual time for sowing mustard. For this reason, yields were low (TABLE 1).

Tori-7 yield was much higher than that of the other lines, likely due to its shorter duration and thus avoidance of late season heat stress. None of the other lines had superior yield to that of the local variety.

TABLE 1: Char Bata Tilled Mustard Variety Trial

Planting date: 23/12/86
Harvest date: 22/2-17/3/87
Plot size - planted: 2.0m x 3.0m
harvested: 1.5m x 2.0m
Seed rate: 10 kg/ha, broadcast

Design: RCBD
Replications: 4
Fertilizer: 60-40-0 at seeding, incorporated with last tillage
Previous crop: Kartiksail aman

Variety	Days to flower	Days to maturity	Plant stand[a/]	Plant height	Yield
			plants/m^2	cm	kg/ha
Tori-7 (Maghi)	29 d	61 d	103	25 d	325 a
Char Bata local	41 b	78 b	90	68 c	180 b
M-258	42 b	78 b	138	83 b	146 bc
M-284	38 c	77 c	112	68 c	125 bc
M-36-E2-7	50 a	84 a	64	95 a	104 bc
M-263	42 b	78 b	83	71 c	63 bc
M-154	41 b	78 b	108	72 bc	46 c
Mean	40	76	99	69	141
L.S.D. (.05)	2.2	0.6	NS	12	129
C.V. (%)	3.69	0.57	45.7	11.3	61.3

a/ plant stand at maturity

CHAR BATA WHEAT AND SOYBEAN TILLAGE TRIAL (BAU-LRP-MCC joint project)

Introduction

This experiment was done to confirm observations from last year where deeper tillage appeared to stimulate growth and yields of wheat (*Triticum aestivum*) and soybean (*Glycine max*). A new plow, designed by Dr. Rafique Sarkar of BAU, has a steel moldboard designed to till more deeply with less draft requirement. In this trial, 5 passes were given with each plow in their respective treatments, resulting in a tillage depth of 14.5 cm for the conventional plow and 16.0 cm for the new moldboard plow.

Similar experiments were conducted in two other locations. A complete report on the three experiments has been written by R. I. Sarkar and S. K. Mondal, entitled Effect of Deeper Tillage on Soil Parameters and Crop Growth. This paper was presented at the Workshop on Integrated Farming System Planning, LRP, BWDB, Noakhali, 13-16 June, 1987.

Results and Discussion

Yields of soybean were good, whereas those of wheat were moderate, owing to late seeding (TABLE 1). There were no significant differences between the tillage treatments for plant stand, plant height, root dry matter distribution or yield.

Possible reasons for the lack of response are: 1) the differences in plowing depths were not large; 2) for wheat, late sowing may have reduced the potential for deeper root penetration; 3) soil moisture during tillage may require more attention. The theoretical benefits of deeper tillage on saline soil require further investigation, possibly with other tillage implements.

TABLE 1: Char Bata Wheat and Soybean Tillage Trial (BAU-LRP-MCC joint project)

Planting date: 22/12/86

Plot size - planted: 3m x 8m

harvested: 1.4m x 7m (wheat)

1.2m x 7m (soybean)

Row spacing: wheat- 20 cm

soybean- 30 cm

Seed rate: wheat- 150 kg/ha

soybean- 70 kg/ha

Design: split-plot RCBD

Replications: 3

Fertilizer - wheat: 30/30-50-0, N at 0 + 20 DAS

Soybean: 20-50-0 + inoculant

Previous crop: aman

Variety: wheat - Akbar

soybean - Pb-1

Tillage means:	Days to flower	Days to mature	Plant Stand[a/] 25 DAS	Plant Stand[a/] final	Plant height	Root DM[b/] distribution	Grain yield
			Plants/m^2		cm	%	t/ha
Conventional Plow	57	97	109	97	68	17	2.20
Moldboard Plow	57	96	105	94	65	21	2.01
L.S.D. (.05)	NS	NS	NS	NS	NS	NS	NS
Crop means:							
Wheat	54	88	162	143	63	19	2.11
Soybean	60	106	52	48	70	19	2.10
L.S.D. (.05)	1.0	0.9	35	29	NS	NS	NS
Tillage x Crop means:							
Conventional Plow							
Wheat	54	88	164	142	65	17	2.21
Soybean	60	105	55	51	72	16	2.19
Moldboard Plow							
Wheat	53	87	160	144	62	21	2.01
Soybean	60	106	50	45	69	21	2.00
Mean	57	97	107	95	67	19	2.10
L.S.D. (.05)[c/]	1.5	1.3	49	41	NS	NS	NS
C.V. (%)	1.1	0.6	20	19	6.9	29.4	11.4

a/ heads/m^2 for wheat

b/ root DM distribution= $\frac{\text{100 x root dry matter in 10-20 cm depth}}{\text{root dry matter in 0-20 cm depth}}$

c/ LSD for crop means within one tillage treatment

CHAR BATA MINIMUM-TILLAGE SEEDING METHOD X CROP TRIAL

Introduction

Most charland rabi crops, deependent on residual soil moisture, benefit from earlier planting, because growth then occurs earlier with respect to the drying out of the soil. Traditional tillage with plow and ladder tends to delay planting. In this experiment, simple tillage methods to facilitate earlier seeding were compared.

Results and Discussion

Mustard (Brassica spp.) performed well but did not respond to the seeding method treatments. At Tk. 7.5 per kg, the farmer would receive Tk. 4200 per hectare in gross return from Tk. 1400 in seed and fertilizer expense. Seeding would require little labour, since broadcasting into stubble performed as well as the other seeding methods.

Wheat (Triticum aestivum) performed equally in each treatment, but yield levels were marginal, economically speaking. At Tk. 4 per kg, the wheat yield would return only about 1000 Tk./ha after deducting fertilizer and seed costs. This would be a rather low return to the farmer's investment of time for seeding and harvesting.

Fieldpea (Pisum sativum) and khesari (Lathyrus sativus) performed very poorly (TABLE 1). These two crops, especially khesari, normally perform well when relay-seeded into standing aman. Because of late drainage, relay seeding was not possible. Seeding was delayed until after aman harvest. Field pea produced more yield with either broadcast or dibbled seeding methods than with a straw mulch.

TABLE 1: Char Bata Minimum Tillage Seeding Method x Crop Trial

Planting date: 4/12/86
Harvest date: 22/2-10/3/87
Plot size - planted: 4m x 4m
harvested: 2m x 2m

Design: split-plot RCBD
Replications: 4
Previous crop: Kartiksail aman

Seeding methods:

A) Broadcast fertilizer, achra, broadcast seed, cross achra, cross ladder
B) Dibble into rice stubble (15 x 25 cm spacing)[a/], broadcast fertilizer
C) Broadcast fertilizer, achra, broadcast seed, cross achra, mulch with straw

a/ mustard was broadcast rather than dibbled

Crops	Variety	Seed rate	Fertilizer	Days to flower	Days to maturity
1) Wheat	Akbar	150 kg/ha	60-40-0	56	95
2) Fieldpea	large-seed white	90 "	40-40-0	56	92
3) Khesari	Char Bata local	35 "	40-40-0	64	92
4) Mustard	Char Bata local	13 "	60-40-0	42	81

Parameter	Seeding method	Wheat	Fieldpea	Khesari	Mustard	Mean	LSD (.05)
Plant stand (15 DAS) (plants/m^2)	A	131 B[b/]	30 C	13 C	206 A	95	48
	B	144 B	40 C	24 C	218 A	106	48
	C	141 B	29 C	9 C	232 A	102	48
	Mean:	138 B	33 C	15 C	218 A	101	28
	LSD(.05)	NS	NS	NS	NS	NS	CV= 32.4%
Yield (kg/ha)	A	860 A	360 abBC	70 C	580 AB	470	310
	B	710 A	470 aAB	160 B	540 A	470	310
	C	690 A	170 bB	30 B	550 A	360	310
	Mean:	760 A	330 C	90 D	560 B	433	180
	LSD(.05)	NS	291	NS	NS	NS	CV= 49.6%

b/ lower-case letters indicate significant differences across rows;
upper-case letters indicate significant differences across columns

BHATIRTEK CROPPING SYSTEMS SITE REPORT, 1986-87

INTRODUCTION

MCC conducts cropping systems research in the Sudharam charland at Bhatirtek village. Work has proceeded there since June, 1985, consisting of: 1) monitoring of agronomic practices for selected crops, 2) monitoring of economic performance of selected crops, 3) on-farm trials testing changes to present technologies, and 4) socioeconomic research. This report summarizes these activities over the aus, aman, and rabi seasons. Nitae Chandra Das, the site manager, was assisted by Raymond Quiah and Abdul Malek in data collection. Socioeconomic work was coordinated by Jerry Buckland and agronomic work was directed by Gary Kruger. Subject to personnel constraints, the site will be transferred in November, 1987 to Char Matua Union of Sudharam Upazila.

CLIMATE

Meteorological data is summarized in the CLIMATIC DATA section of this report. Rainfall and temperature throughout the reporting period, are outlined in the FIGURES in that section.

CROPPING PATTERN MANAGEMENT AND PERFORMANCE

The major cropping pattern for the region is fallow - t. aman - fallow. Aus and rabi crops are cultivated to a limited extent. One major factor influencing cropping patterns and their performance is the extremes of weather experienced over the course of the year. During the past year, the main aberations in weather were 1) a prolonged hot, dry period just prior to the monsoon; 2) heavy rains in early November; and 3) early flooding of fields in April. Each factor severely curtailed agricultural production in the region.

The hot dry spell during the aus season sharply thinned stands of direct seeded aus due to salinity and drought stress. Many aus seedlings could not be transplanted as rainfall was scarce during the transplanting period. Preparation of aman seedbeds was urgent when flooding did begin in mid-June.

Aman crops looked excellent up to early November as heavy rainfall during late September and early October restored flooded conditions. A November storm, however, lodged mature Rajasail into standing water causing substantial losses in yield and quality, and substantially increasing harvest costs. Karjasail/Kalomota yield was reduced 10-50% due to "cita", the removal of pollen by wind prior to fertilization. BR 11 fields were not damaged because they were not fully mature at the time of the storm and have much shorter stem length. Most aman was harvested with water still standing in the fields.

Sowing of rabi crops was prevented or delayed by the flooded or wet soils. Khesari and some linseed was destroyed because it was relayed prior to the November storm. Reseeding was possible in only a limited number of cases. Sweet potato, peanut, chilli pepper, and cowpea were sown two weeks to a month later than normal. The early flooding in April damaged some stands of these crops, seriously reducing their yields. Mungbean and cowpea were attacked by pod borers which destroyed some fields entirely.

The agronomic practices and economic performance for alternative crops during the aus, aman, and rabi seasons are presented in TABLES 1 - 9. TABLE 3 compares the practices and costs for growing local Rajasail and HYV seedlings. BR11 seedlings are much more difficult to uproot and to transplant than the local, and therefore, require significantly more labour. More effort was also invested in weeding, a reflection of its higher yield potential and reduced competition with weeds at the seedling stage. The yield of BR11 was still less than its potential. Fertilizers need to be applied at recommended times in larger quantities. BR11 yields need to be improved over present levels through improved practices to warrant the increased cash costs and risk associated with its cultivation.

Among the common rabi crops, highest returns over cash costs were received from sweet potato. Lentil and peanut also produced high returns. Sesame and soybeans proved highly profitable. Sesame had very low input costs because land preparation was provided by family-owned draft power. Sesame yielded high returns to cash inputs. The practices, costs, and returns of eggplant, tomato and garlic, are included in TABLE 8 and 9. Garlic has very high seed costs, but provides excellent returns to cash.

One of the greatest concerns of farmers is the availability of quality seed of improved varieties. MCC assisted them in procuring seeds that the local market does not provide. We sold 100 kg BR11; 42 kg soybean seed; imported vegetable seeds; and distributed sweet potato Tripti vines to 34 farmers for multiplication.

TABLE 1: Agronomic Management Practices, Bhatirtek, 1986 Aus Season

Item	Boilam	IR8
No. of fields	9	10
Field size-mean (ha)	0.20	0.10
# plowings	5	4
# ladderings	22	19
Weeding (mandays/ha)	62	70
Hill spacing (cm)	19 x 22	16 x 17
Seedrate (kg/ha)	57	69
Planting date	11/3	14/3
Flowering date	5/7	3/8
Harvest date	26/7	25/8
Field days	137	164
Fertilizer (kg/ha)		
TSP (basal)	22(1)[a/]	26(1)
Urea (TD_1)	-	34 at 103 DAS (8)
Cowdung (basal)	0.77 t/ha(1)	2.76 t/ha(1)
Ash (Basal)	1.54 t/ha(2)	3.46 t/ha(2)
Insecticide	0	3

a/ the number in parenthesis indicates the number of farmers who applied the specified management practice

TABLE 2: Economic Performance, (Averages) Bhatirtek, 1986 Aus Season

Item	Boilam	IR8
No. of fields	8	10
Labour cost (Tk/ha)	7119	7179
Land preparation	1304	1451
Planting	1482	1602
Weeding	2901	3153
Harvesting	1269	974
Family	6417	5912
Hired	2807(2)[a/]	1408
Material cost (Tk/ha)	476	1273
Seed	437	550
Fertilizer	309(1)[b/]	698(8)
Pesticides		547(3)
Total costs (Tk/ha)		
Cash costs	476	2540
Variable costs	7595	8452
Yield (t/ha)	1.87	2.19
Product value (Tk/kg)	3.85	4.75
Return (Tk/ha)		
Gross	7200	10400
Over cash costs	6724	7860
To variable costs	-395	1948
To cash costs	15.1	4.09
To variable costs	0.95	1.23

a/ the number in parenthesis indicates the number of farmers utilizing hired labor.

b/ the number in parenthesis indicates the number of farmers that used the particular input.

TABLE 3: Agronomic Practices and Costs (Averages) for Aman Seedbed Preparation, Bhatirtek, 1986

Item	Rajasail	BR11
No. of fields	5	5
Land preparation		
# plowings	6	6
# ladderings	16	13
Seedrate (kg/ha)	621	591
Seedbed size (ha)	0.09	0.04
Seeding date	28/6	29/6
Weeding (mandays/ha)	39(2)[a/]	35(2)
Fertilizer (kg/ha)		
basal TSP	17(1)[b/]	17(1)
basal manure	(1)	-
topdress urea	8(1)	26(1)
Uprooting (man days/ha)	69	116
Uprooting date (1st)	2/8	3/8
Labour costs (Tk/ha)	4630	6487
Land preparation	1544	1544
Seeding	103	103
Weeding	223	200
Uprooting	2760	4640
Material cost (Tk/ha)	4057[c/]	3902[c/]
Seed	3999 @ 6.44 Tk/kg	3802 @ 6.60 Tk/kg
Fertilizer	291[d/]	501[e/]
Total cost (Tk/ha)	8687	10389

a/ the number in parenthesis indicates the number of farmers surveyed

b/ the number in parenthesis indicates the number of farmers utilizing the specified management practice

c/ fertilizer cost is averaged over 5 replications and the average fertilizer cost is added to seed cost.

d/ cost of 8 kg N/ha & 17 kg P_2O_5/ha

e/ cost of 26 kg N/ha & 17 kg P_2O_5/ha

TABLE 4: Agronomic Management Practices, Bhatirtek, 1986 Aman Season

Item	Rajasail	Kartiksail	BR11	Karjasail
No. of fields	10	5	5	10
Field size-mean(ha)	0.12	0.13	0.07	0.18
# plowings	5	4	5	4
# ladderings	11	9	15	8
Weeding (man days/ha)	12	10	25(4)[a/]	10
Seeding age (days)	38	31	40	47
Transplanting date	1/8	30/7	8/8	17/8
Flowering date	12/10	17/10	23/10	5/11
Harvest date	9/11	13/11	20/11	5/12
Field days	101	106	107	110
Fertilizer (kg/ha)				
TSP (basal)	21(1)[a/]	31(2)	42(3)	-
Urea - TD_1[b/]	-	10 at 21 DAT(1)	32 at 24 DAT(5)	16 at 25 DAT(3)
- TD_2[c/]	13 at 32 DAT(7)	18 at 32 DAT(2)	30 at 53 DAT(1)	12 at 58 DAT(2)
Insecticide	0	0	4	0
Yield (t/ha)	1.85	2.15	2.63	2.41

a/ the number in parenthesis indicates the number of farmers who applied the specified management practice

b/ top dressing #1

c/ top dressing #2

TABLE 5: Economic Performance (Averages) Bhatirtek, 1986 Aman Season

Item	Rajasail	Kartiksail	BR11	Karjasail
No. of fields:	10	5	5	10
Labour cost (Tk/ha)	3882	3629	5152	3657
Land preparation	1451	1647	1204	1266
Transplanting	1165	785	1939	1006
Weeding	411	375	780	359
Harvesting	855	821	1229	1026
Family	1777	2619	1606	1062
Hired	2106	1009	3546	2594
Material cost (Tk/ha)	652	1094	2128	726
Seed	491	828	946	580
Fertilizer	199(8)[a/]	443(3)	798	243(6)
Pesticide	-	-	480(4)	-
Total cost (Tk/ha)				
Cash	2700	2103	4949	3099
Variable	4532	4640	7280	4382
Yield (t/ha)	1.85	2.15	2.63	2.41
Product value (Tk/kg)	4.50	4.50	4.50	5.00
Return (Tk/ha)				
Gross	8325	9675	11835	12050
Over cash costs	5625	7572	6886	8951
Over variable costs	3793	5035	4555	7668
To cash costs	3.08	4.60	2.39	3.89
To variable costs	1.84	2.09	1.63	2.75

a/ the number in parenthesis indicates the number of farmers who applied the specified management practice.

TABLE 6: Agronomic Management Practices, Bhatirtek, 1986-87 Rabi Season

Item	Linseed	Mustard	Lentil	Sweet potato	Wheat	Peanut	Soybean	Chilli pepper	Cowpea	Mungbean	Sesame
# fields	4	3	3	10	5	3	6	7	4	3	3
Field size (ha)	0.11	0.04	0.03	0.08	N/A[a/]	0.06	0.08	0.09	0.05	0.13	0.09
# plowings	0	0	3	5	N/A	5	N/A	5	4	3	3
# laddarings	0	0	10	20	N/A	23	N/A	23	17	4	13
Seeding date (avg)	16/11	26/11	27/11	17/12	22/12	31/12	1/1	5/1	10/1	29/1	5/3
Seed rate (kg/ha)	9	7	10	N/A	160	92	70	N/A	20	13	6
Seeding method[b/]	B	B	B	T	B	D	D	T	D	B	B
Fertilizer (Kg $N-P_2O_5-K_2O$/ha)	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0[c/]	0-26-0(1)[d/]	0-0-0[c/]	0-0-0	0-0-0	0-0-0	0-0-0
Weeding (man days/ha)	0	0	0	62	N/A	76	N/A	69	45	0	0
Flower date (1987)	25/1	16/1	24/1	N/A	23/2	N/A	25/2	15/3	26/3	29/3	19/4
Harvest date (1987)	5/3	23/2	28/2	7/5	16/3	17/5	5/4	21/4	12/4	19/4	19/5
Plant density (000's/ha)	1,430	900	980	175	1,930	129	610	150	116	240	580
Plant ht. (cm)	24	32	32	61	45	53	34	31	56	24	63
Yield (t/ha)	0.09	0.09	0.63	13.0	0.38	1.32	0.78	0.20[e/]	0.34	0.31	0.51

a/ not available

b/ B = Broadcast, T = Transplanted, D = Dibbled

c/ selected treatment of fertilizer trial

d/ # of farmers who performed selected management practice

e/ yield of dry chilli peppers

TABLE 7: Economic Performance (Averages), Bhatirtek, 1986-87 Rabi Season

Item	Sweet potato	Lentil	Peanut	Sesame	Soybean	Mungbean	Wheat	Chilli pepper	Cowpea	Mustard	Linseed
# fields	10	3	3	3	5	3	6	7	4	3	4
Labour cost (Tk/ha)	9377	3416	11470	2592	5140	2113	5151	7564	6060	1253	902
Land preparation	1899	1389	2264	1235	1776	875	2192	2132	2007	0	0
Planting	2203	166	1333	27	1024	47	56	1370	787	86	55
Fertilizing	0	0	0	0	56	0	56	0	0	0	0
Weeding	2306	0	2933	0	1166	0	1166	2670	1798	0	0
Harvesting	2969	1861	4940	1330	1118	1191	1737	1392	1468	1167	847
Family	7171	3416	11305	2592	N/A a/	2113	N/A	6712	5813	1253	902
Hired	2206	0	165	0	N/A	0	N/A	852	247	0	0
Material cost (Tk/ha)	1733	738	2346	92	1025	283	2273	1259	381	129	92
Seed	1733	738	2243	92	700	283	1168	1259	381	129	92
Fertilizer	0	0	103	0	325	0	1105	0	0	0	0
Cash cost (Tk/ha)	3939	738	2511	92	1025	283	2273	2111	628	1382	994
Variable cost (Tk/ha)	11110	4154	13816	2684	6165	2396	7480	8823	6441	129	92
Yield (t/ha)	13.0	0.63	1.32	0.51	0.97	0.31	0.93	0.20	0.34	0.09	0.09
Product value (Tk/kg)	1.50	15.00	8.00	11.00	6.50	10.50	5.00	22.00	8.50	15.50	8.50
Returns (Tk/ha)											
Gross	19500	9450	10560	5610	6305	3255	4650	4400	2890	1447	765
Over cash costs	15561	8712	8049	5518	5280	2972	2377	2289	2262	1318	673
Over variable costs	8390	5296	-3256	2926	140	859	-2830	-4423	-3551	65	-229
To cash costs	4.95	12.80	4.21	61.0	6.15	11.50	2.05	2.08	4.60	11.22	8.32
To variable costs	1.76	2.27	0.76	2.09	1.02	1.36	0.62	0.50	0.45	1.05	0.71

a/ not available

TABLE 8: Agronomic Management Practices for Local Spices and Vegetables, Bhatirtek, 1986-87

Item	Eggplant	Tomato	Garlic
# fields	5	2	2
Field size (ha)	0.03	0.003	0.02
# plowings	7(1)[a/]	N/A[b/]	5
# ladderings	28(1)	N/A	28
Hand-plowings	4	2	0
Planting/transplanting date	21/10	16/12	18/12
Seedling age (days)	35	32	N/A
Seedrate (kg/ha)	N/A	N/A	142
Fertilizer			
Basal manure (t/ha)	18.4(1)[a/]	0	0
Basal P_2O_5 (Kg/ha)	137(4)	244	0
Basal N (Kg/ha)	106(1)	0	0
TD1[c/]	86 at 31 DAT(2)	144	0
TD2[d/]	86 at 78 DAT(5)	0	0
Flowering date	27/12	23/1	N/A
Harvest date (first)	24/1	11/3	15/3
Plant density (000's/ha)	80.3	62.5	274
Plant ht. (cm)	73	116	40
Yield (t/ha)	16.42	24.71	2.25

a/ number of farmers who applied management practice.

b/ not available

c/ top dressing #1

d/ top dressing #2

TABLE 9: Economic Performance (Averages) of Local Spices and Vegetables, Bhatirtek, 1986-87

Item	Eggplant	Tomato[a/]	Garlic
No. of fields	5	2	2
Labour cost (Tk/ha)	17279	16922	11721
Land preparation	5765	5765	2316
Planting	1918	1918	3705
Irrigation[b/]	4573(3)[c/]	4573(1)[d/]	0
Weeding	3291	3291	3199
Harvesting	3561	3561	2501
Family	10083	N/A	11721
Hired	7196	N/A	0
Material cost (Tk/ha)	6919	22349	6093
Seed	2948	18182	6093
Fertilizer	3971	4167	0
Cash cost (Tk/ha)	14115	22349[d/]	6093
Variable cost (Tk/ha)	24198	39171	17814
Yield (t/ha)	16.42	24.71	2.25
Product value (Tk/kg)	2.25	2.00	15.00
Returns (Tk/ha)			
Gross	36945	49420	33750
Over cash costs	22830	27071	27657
Over variable costs	12747	10249	15936
To cash costs	2.62	2.21	5.54
To variable costs	1.53	1.26	1.89

a/ labour costs for eggplant used to estimate labour costs for tomato

b/ cost of irrigation estimated from last year's report

c/ number of farmers who used specified management practice

d/ assumed that all labor was conducted by family members

ON-FARM TRIALS

Aus Variety MLT Trials

Two trials were conducted at each of three locations in the char region. The results for the short duration aus (*Oryza sativa*) varieties are shown in TABLES 10 - 12, for Bhatirtek, Char Jabbar Kasherhat, and Char Bata Dulalmiahat, respectively. The results for the long duration varieties are shown in TABLES 13 - 15, respectively. Seed for the HYV lines was supplied by MCC. The farmer provided management and other inputs.

Results for the short duration varieties were consistent over all locations. The local, Boilam, averaged 0.44 t/ha higher yield than the best HYV line, BR20 (TABLE 16). The other two lines yielded poorly because of 1) insufficient plant height to escape high flood levels; and 2) poor plant stands arising from low tolerance to high salinity.

As in previous years, the results for the long duration varieties were less conclusive. At Bhatirtek, the stands of BR12 and BR14 died out from salinity and moisture stress. There were no significant differences in yield among the remaining varieties (TABLE 13). At the other two sites, BR9 and an unreleased line, P.203-26-3, yielded well relative to the other four lines (TABLE 14 and 15).

TABLE 10: Bhatirtek Short Duration Aus Variety MLT Trial

Seeding date: 9-18/3/86
Plot size - planted: $25m^2$
harvested: $5m^2$

Design: RCBD
Replications: 4
Fertilizer: 0 - 23 kg P_2O_5/ha
Seedrate: 80 kg/ha

Variety	Days to flower	Days to harvest	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
Boilam	116 a	133	106 a	171	1.85 a
BR20	115 a	133	86 b	175	1.60 a
IR9209-205-3-2	101 b	133	53 c	116	0.00 b
IR 50	103 b	133	57 c	134	0.00 b
Mean	109	133	76	149	0.86
LSD (.05)	6	NS	11	NS	0.55
C.V. (%)	3		9	26	20

TABLE 11: Char Jabbar Short Duration Aus Variety MLT Trial

Seeding date: 23/3-1/4/86
Plot size - planted: $25m^2$
harvested: $5m^2$

Design: RCBD
Replications: 5
Fertilizer: none
Seedrate: 80 kg/ha

Variety	Days to flower	Days to harvest	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
Boilam	106 a	129 a	110 a	261 a	1.84 a
BR20	102 a	127 a	103 a	267 a	1.73 a
IR50	97 b	120 b	62 b	168 b	0.57 b
IR9209-205-3-2	96 b	121 b	63 b	158 b	0.51 b
Mean	100	124	85	214	1.16
LSD (.05)	4	5	7	36	0.37
C.V. (%)	3.0	3.0	6.1	11.9	22.8

TABLE 12: Char Bata Short Duration Aus Variety MLT Trial

Seeding date: 1-8/4/86
Plot size - planted: $25m^2$
harvested: $5m^2$

Design: RCBD
Replications: 5
Fertilizer: 7-11 kg N/ha
0-14 kg P_2O_5/ha
Seed rate: 74 kg/ha

Variety	Days to flower	Days to harvest	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
Boilam	94 a	128 a	104 a	315 a	2.85 a
BR20	96 a	128 a	89 b	301 a	1.91 b
IR9209-205-3-2	86 b	123 b	67 c	235 b	0.85 c
IR50	84 b	123 b	65 c	247 b	0.78 c
Mean	90	125	81	274	1.60
LSD (.05)	4	1	7	41	0.16
C. V. (%)	3.2	0.6	5.8	10.9	7.3

TABLE 13: Bhatirtek Long Duration Aus Variety MLT Trial

Seeding date: 10-18/3/86

Plot size - planted: $25m^2$

harvested: $5m^2$

Insecticide: Diazinon, Dimecron, Basudin or none

Design: RCBD

Replications: 5

Seed rate: 80 kg/ha

Fertilizer: 12 to 53 kg N/ha
0 to 28 kg P_2O_5/ha
0 to 5.76 t ash/ha
0 to 2.76 t cowdung/ha

Variety	Days to flower	Days to maturity	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
IR8	141 a	159	71	135	2.03
BR203-26-3	131 b	157	75	170	1.99
BR9	132 b	157	76	143	1.87
BR16	141 a	159	78	128	1.83
Mean	136	158	75	144	1.93
LSD (.05)	6	NS	NS	NS	NS
C.V. (%)	3	2	18	31	18

TABLE 14: Char Jabbar Long Duration Aus Variety MLT Trial

Seeding date: 18-25/3/86
Plot size - planted: $25m^2$
harvested: $5m^2$

Design: RCBD
Replications: 5
Seed rate: 80 kg/ha
Fertilizer: 0 to 85 kg N/ha

Variety	Days to flower	Days to maturity	Plant height	Tillers m^2	Yield
			cm	#	t/ha
IR8	126 a	156	81	312 a	2.46
BR9	116 bc	143	84	308 ab	2.35
BR16	125 a	155	87	278 ab	2.29
BR12	125 a	156	88	250 bc	2.14
BR203-26-3	114 c	144	84	301 ab	2.05
BR14	120 b	150	86	200 c	1.53
Mean	121	151	85	275	2.16
LSD (.05)	6	NS	NS	60	NS
C. V. (%)	4		5	17	21

TABLE 15: Char Bata Long Duration Aus Variety MLT Trial

Seeding date: 1-8/4/86
Plot size - planted: $25m^2$
harvested: $5m^2$

Design: RCBD
Replications: 4
Seed rate: 74 kg/ha
Fertilizer: 0 - 14 kg N/ha
0 - 10 kg P_2O_5/ha

Variety	Days to flower	Days to maturity	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
BR203-26-3	114 b	140 b	87	369 a	4.20 a
BR9	116 b	140 b	88	349 a	3.86 ab
BR14	111 b	142 b	87	309 b	3.57 b
BR12	125 a	148 a	81	294 b	2.68 c
IR8	129 a	149 a	81	277 b	2.58 c
BR16	129 a	149 a	86	293 b	2.49 c
Mean	120	145	85	315	2.23
LSD (.05)	5	5	NS	34	0.41
C. V.	2.7	2.1	7.3	7.7	8.5

TABLE 16: Charland Aus Variety MLT Trial Summary

Short Duration Variety	(10 locations) Yield (t/ha)
Boilam	2.20 a
BR20	1.76 b
IR9209-205-3-2	0.68 c
IR50	0.68 c
Mean	1.33
L.S.D. (.05)	0.26
C. V. (%)	25

Long duration Variety	(9 locations) Yield (t/ha)
BR9	3.02 a
BR203-26-3	3.00 a
IR8	2.51 b
BR14	2.49 b
BR12	2.38 b
BR16	2.38 b
Mean	2.63
L.S.D. (.10)	0.48
C. V. (%)	23

Char Bata Aus Tillage Method Trial

A moldboard plow developed by researchers at BAU, Mymensingh was demonstrated in farmers' fields. The objectives of the trial were to obtain farmers impressions of the moldboard plow and to determine if the yield of aus (Oryza sativa) was increased by plowing to greater depth. The moldboard plows design reduces draft requirements which facilitates the deeper tillage. Although the time required for each pass is longer, satisfactory soil tilth is also achieved in fewer passes with the moldboard plow.

Farmers were very interested in the plow but feared it would break too easily. When oxen slumped their shoulders, the plow dug very deeply putting great strain on the joints of the plow.

Aus yields and other growth parameters were not affected by the tillage treatment (TABLE 17). No observations of tillage depth were taken. Therefore, it is unknown whether the tillage depth for the moldboard plow was greater than for the traditional plow.

TABLE 17: Char Bata Aus Tillage Method Trial

Seeding date: 17/3-3/4/86
Plot size: 2000 - 4500m^2
Variety: Boilam

Design: RCBD
Replications: 8
Fertilizer: 0 - 11 kg N/ha

Plow	Plant height	Tillers/ m^2	Yield
	cm	#	t/ha
Local plow	104	314	2.61
Moldboard plow	103	310	2.56
Mean	104	312	2.59
L.S.D. (.05)	NS	NS	NS
C. V. (%)	1	2	3

Charland Aus Phosphate Fertilizer Rate MLT Trials

Application of TSP to the aus (Oryza sativa) variety Boilam at planting time increased plant height, panicles/m^2, and yield in the four trials conducted at Char Bata and Bhatirtek (TABLE 18-19). There was no residual effect from phosphate applied during the previous aman or rabi season (TABLES 18-B & 18-C). When the trials were analyzed together, the trends of plant characteristics and yield were satistically significant. Differences however, were small (TABLE 20). Yield increased an average of 0.13 t/ha with an application of 45 kg P_2O_5/ha. The marginal revenue was low for all rates of fertilization. Application of phosphate to Boilam during the aus season is not recommended unless crop risk is very low.

TABLE 18: Char Bata Aus Phosphate Rate MLT Trials

A) Phosphate not applied to soil within last year

Seeding date: 2-13/4/86 Design: RCBD

Plot size - planted: $25m^2$ Replications: 5

harvested: $5m^2$ Variety: Boilam

Rate of phosphate	Plant height	Tillers/m^2	Yield
Kg P_2O_5/ha	cm	#	t/ha
0	98 a	296 a	2.68 a
15	99 a	303 ab	2.73 a
30	103 b	308 b	2.80 b
45	104 b	321 c	2.80 b
Mean	101	307	2.75
LSD (.05)	3	10	0.06
C. V. (%)	2	2	2

B) Phosphate applied to previous aman crop (seeding date: 1-12/4/86)

Rate of phosphate	Plant height	Tillers/m^2	Yield
0	96 a	300 b	2.69
15	99 b	298 b	2.73
30	100 b	302 b	2.79
45	105 c	316 a	2.82
Mean	100	304	2.76
LSD (.05)	3	10	NS
C. V. (%)	2	2	3

C) Phosphate applied to previous rabi crop (seeding date: 15/4-8/5/86)

Rate of phosphate	Plant height	Tillers/m^2	Yield
0	101 b	301 c	2.40 a
15	101 b	301 c	2.44 ab
30 30	102 b	305 b	2.47 bc
45	105 a	314 a	2.52 c
Mean	102	305	2.46
LSD (.05)	3	4	0.06
C. V. (%)	2	1	2

TABLE 19: Bhatirtek Aus Phosphate Rate MLT Trial

Seeding date: 10-22/3/86 Design: RCBD

Plot size - planted: $25m^2$ Replications: 4

harvested: $5m^2$ Variety: Boilam

Rate of Phosphate	Plant height	Tillers/m^2	Yield
Kg P_2O_5/ha	cm	#	t/ha
0	101	136	1.37
15	102	175	1.42
30	107	179	1.45
45	102	184	1.50
Mean	103	169	1.44
LSD (.05)	NS	34	NS
C. V. (%)	4	12	5

TABLE 20: Charland Aus Phosphate Rate MLT Trial Summary

Rate of Phosphate	Cost of fertilizer a/	Plant height	Tillers/ m^2	Yield	Average b/ revenue	Marginal b/ revenue
Kg P_2O_5/ha	Tk	cm	#	t/ha		
0	0	99 b	265 c	2.33 c	-	-
15	164	100 b	274 b	2.38 b	137	137
30	328	103 a	278 b	2.43 a	1.37	1.37
45	492	104 a	289 a	2.46 a	1.19	0.82
Mean		101	277	2.40		
LSD (.05)		2	8	0.04		
C.V. (%)		3	4	2		

a/ price of fertilizer = 10.94 Tk/kg P_2O_5 = 5.25 Tk/kg TSP

b/ price of rice = 4.50 Tk/kg

average revenue = $\frac{\text{value of yield increase due to fertilizer}}{\text{cost of fertilizer}}$

marginal revenue = $\frac{\text{value of yield increase due to additional increment of fertilizer}}{\text{cost of additional increment of fertilizer}}$

Bhatirtek BRRI Aman ALART Variety Trial

Eight advanced research lines of aman (*Oryza sativa*) were grown in farmers' fields at the request of BRRI's Adaptive Research and Training Division (ARTD). The trial tested the suitability of several photosensitive progeny of Pajam which were blast and tungro resistent. Both replications were badly affected by trips, stem borer, and leaf hopper at tillering stage. Winds associated with a cyclonic storm damaged the rice yields seriously by increasing sterility. The top yielding varieties were the accepted HYV in the region, BR11, and a new research line, BR716-7-2-1-1, which has done well in other areas of Bangladesh (Table 21).

TABLE 21: Bhatirtek BRRI Aman ALART Variety Trial

Seedbed date: 6/7/86
Transplanting date: 5 & 7/8/86
Seedling age: 30 & 32 days
Spacing - row: 25 cm
plant: 15 cm
Plot size: - planted: 2m x 5m
harvested: 1.5m x 4.5m

Replication: 2
Fertilizer: Rep1 - 82/27-60-40-10 with N at 7 and 45 DAT
Rep2 - 27/27/27-60-10 with N at 14, 28, and 48 DAT
Insecticide: 10.5 kg Furadan 3G/ha
2 1 Aeromal 57 E.C./ha

Variety	Days to flower	Days to maturity	Plant height	Tillers/ m^2	Sterility	Yield
			cm	#	%	t/ha
BR716-7-2-1-1	115	150	105	174	36	2.09 a
BR 11	106	135	81	183	-	1.93 a
BR 1185-2R-6	110	145	98	140	34	1.75 b
Nizersail	112	147	129	247	34	1.49 c
BR 539-17-4-3-3-1	116	149	97	147	48	1.39 cd
BR 539-89-2-3-1-2	117	151	86	187	41	1.32 cd
BR 1196-2R-87	117	150	92	223	37	1.31 d
BR 539-17-4-3-1	116	149	89	180	35	1.29 d
Mean	114	147	97	185	38	1.57
L.S.D. (.05)	2	2	11	NS		0.17
C. V. (%)	1	1	5	19	11	5

Aman Variety MLT Trials

Two main landtypes are found in the char during the aman (Oryza sativa) season, each with its own best adapted local variety. Rajasail is grown on land which drains more quickly following the end of the rains. Karjasail and Kalomota are grown in lower areas which are subject to greater flooding depth, and therefore, these fields maintain standing water about three weeks longer. The difference in maturity between the two types of photosensitive local varieties is five weeks.

Five lines received from BRRI through ALART trials were tested under farmer's management in fields of these two types. Trials in Rajasail fields were conducted near Bhatirtek, Char Jahajmara, and Char Bata Khaserhat (TABLE 22-24). BR11, the presently extended variety for the area, yielded the highest at each of these locations. Over the three locations, the yield of BR11 was 27% higher than the local variety, a difference of 0.51 t/ha (TABLE 28). For the other land type, trials were conducted in Karjasail fields near Bhatirtek and Char Jabbar Khaserhat (TABLE 25 - 26), and in Kalomota fields near Char Bata Khaserhat (TABLE 27). Under the deeper flooding conditions, BR11 tillered less and yielded lower than the local varieties. An unreleased line, BR593-698-5-1-8, yielded well in these fields. It has a similar photosensitive response to the local varieties and excellent tillering capability. BR11 does not yield well under deeper flooding because tillering is inhibited. Therefore, it is not suited to this environment (TABLE 28).

TABLE 22: Bhatirtek Aman Variety MLT Trial with Rajasail

Seedbed date: 30/6/86 (HYV)
Seedling age: 29-34 days (HYV)
29-40 days (Local)
Transplanting date: 29/7-4/8/86
Plot size - planted: $25m^2$
harvested: $5m^2$

Design: RCBD
Replications: 5
Fertilizer: 0-19 Kg N/ha
0-22 Kg TSP/ha
Insecticide: 10.5 Kg Furadan 3G/ha

Variety	Days to flower	Days to maturity	Plant height	Panicles/ m^2	Yield
			cm	#	t/ha
BR11	117 ab	137 a	83 b	176 ab	2.22 a
BRC16-127-4-3	116 abc	136 a	86 b	141 b	2.16 a
BR222-2B-358	120 a	138 a	97 a	211 a	2.00 ab
BR51-46-5-C5	105 e	129 b	81 bc	137 b	1.95 ab
Rajasail	112 cd	126 b	99 a	165 ab	1.74 b
BR51-282-8-HR50	108 de	130 b	77 c	142 b	1.66 b
Mean	113	133	87	162	1.96
L.S.D. (.05)	4	4	5	46	0.34
C. V. (%)	3	2	4	21	13

TABLE 23: Jahajmara Aman Variety MLT Trial with Rajasail

Seedbed date: 30/6/86
Transplanting date: 28-30/7/86
Plot size - planted: $16m^2$
harvested: $6m^2$

Design: RCBD
Replications: 5
Spacing - row: 25 cm
Fertilizer: 0-60 Kg N/ha
0-35 Kg P_2O_5/ha

Variety	Days to flower	Days to maturity	Plant height	Plants m^2	Yield
			cm	#	t/ha
BR11	120	142	84	139	2.13 a
BR222-2B-358	120	143	100	185	2.09 ab
BRC16-127-4-3	116	141	93	138	1.59 abc
BR51-282-8-HR50	112	139	82	139	1.50 bc
BR51-46-5-C5	109	138	81	122	1.47 bc
Rajasail	107	133	105	154	1.40 c
Mean	114	139	91	146	1.70
LSD (.05)	4	5	8	21	0.63
C.V. (%)	3	2	6	11	25

TABLE 24: Char Bata Aman Variety MLT Trial with Rajasail

Seeding date: 30/6/86
Transplanting date: 29/7 - 7/8/86
Spacing: Random

Design: RCBD
Replications: 5
Fertilizer: 11-28 Kg N/ha
Insecticide: 16 Kg Furadan 3G/ha

Variety	Days to flower	Days to maturity	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
BR11	122 a	146 ab	91 c	348 b	2.49
BRC16-127-4-3	119 a	147 a	88 c	326 b	2.36
BR51-282-8-HR50	108 c	143 ab	80 d	349 b	2.34
Rajasail	102 d	129 c	97 b	343 b	2.31
BR222-2B-358	120 a	145 ab	103 a	414 a	2.28
BR51-46-5-C5	113 b	141 b	80 d	336 b	2.22
Mean	114	142	90	353	2.33
L.S.D. (.05)	4	6	5	49	NS
C. V. (%)	2	3	4	10	22

TABLE 25: Bhatirtek Aman Variety MLT Trial with Karjasail

Seedbed date: 17/7/86 (HYV)
Seedling age: 26-35 days (HYV)
40-54 days (local)
Transplanting date: 13-21/8/86
Plot size - planted: $16m^2$
harvested: $5m^2$

Design: RCBD
Replications: 5
Fertilizer: 0-13 Kg N/ha
Insecticide: 10.5 Kg Furadan 3G/ha

Variety	Days to flower	Days to maturity	Plant height	Panicles/ m^2	Yield
			cm	#	t/ha
BR593-698-5-1-8	110 bc	135 b	75 c	199 a	2.74 a
Karjasail	127 a	151 a	114 a	180 ab	2.45 ab
BR51-74-6-J1	112 bc	134 bc	81 bc	113 bc	2.20 bc
BRC16-127-4-3	109 bc	132 bc	87 b	129 c	2.07 bc
BR11	107 c	130 c	83 b	141 c	2.00 c
BR236-10-2-2-1	113 b	134 bc	83 b	138 c	1.99 c
Mean	113	136	87	155	2.24
L.S.D. (.05)	7	4	7	37	0.44
C. V. (%)	5	2	6	18	15

TABLE 26: Char Jabbar Aman Variety MLT Trial with Karjasail

Seeding rate: 17/7/86 (for HYV)
Transplanting date: 13-28/8/86
Spacing: Random

Design: RCBD
Replications: 5
Fertilizer: 42-71 Kg N/ha

Variety	Days to flower	Days to maturity	Plant height	Panicles/ m^2	Yield
			cm	#	t/ha
BR593-698-5-1-8	108	138	76 c	207	2.23
BR51-74-6-51	110	137	88 b	140	2.04
BR11	103	133	87 b	157	1.98
BR236-10-2-2-1	110	137	88 b	171	1.96
BRC16-127-4-3	110	137	90 b	175	1.95
Karjasail	117	137	120 a	121	1.87
Mean	109	137	91	162	2.00
L.S.D. (.05)			6	NS	NS
C.V. (%)	2	3	5	22	17

TABLE 27: Char Bata Aman Variety MLT Trial with Kalomota

Seeding date: 17/7/86
Transplanting date: 24/8-1/9/86
Spacing: Random

Design: RCBD
Replications: 5
Fertilizer: 11-14 Kg N/ha
Insecticide: 16 Kg Furadan 3G/ha

Variety	Days to flower	Days to maturity	Plant height	Tillers/ m^2	Yield
			cm	#	t/ha
BR51-74-6-J1	119	151	86 c	305 bc	3.27 a
BR593-698-5-1-8	112	147	61 e	390 a	3.16 a
Kalomota	116	148	105 a	312 bc	2.85 b
BR236-10-2-2-1	114	147	91 b	323 b	2.65 b
BR11	114	150	68 d	288 bc	2.36 c
BRC16-127-4-3	116	150	87 c	278 c	2.29 c
Mean	115	149	83	316	2.76
L.S.D. (.05)			3	37	0.21
C.V. (%)	4	2	3	9	6

TABLE 28: Charland Aman Variety MLT Trial Summary

With Rajasail (15 locations)		With Karjasail (15 locations)	
Variety	Yield (t/ha)	Variety	Yield (t/ha)
BR11	2.42 a	BR593-698-5-1-8	2.71 a
BRC16-127-4-3	2.26 ab	BR51-74-6-J1	2.50 ab
BR222-2B-358	2.16 abc	Karjasail (or Kalomota)	2.39 bc
BR51-46-5-C5	1.98 bc	BR236-10-2-2-1	2.20 cd
BR51-282-8-HR50	1.94 bc	BR11	2.11 d
Rajasail	1.91 c	BRC16-127-4-3	2.10 d
Mean	2.11	Mean	2.34
L.S.D. (0.05)	0.32	L.S.D. (0.05)	0.24
C. V. (%)	20	C. V. (%)	14

Bhatirtek/Char Bata Deepwater Aman Variety Observation

Ten deepwater aman (Oryza sativa) varieties received from BRRI were grown as an observation in fields of the locals, Karjasail and Kalomota. These local varieties are sown in regions where flash flooding up to 50 cm occur, but they are not considered suitable for deepwater areas. In the observation, the deepwater lines tillered poorly, lodged, and yielded lower than Karjasail and Kalomota (TABLE 29). The IR21178 line had stronger stems, however, and remained erect through maturation. The deepwater varieties were not better suited to the char region than the two local varieties that are presently being grown in the deeper flooding charlands.

TABLE 29: Bhatirtek/Char Bata Deepwater Aman Variety Observation

Seedbed date: 17/7/86
Transplanting dates: 20 & 31/8/86
Plot size - planted: 2m x 5m
harvested: $6m^2$
Spacing - row: 25 cm
hill: 15 cm

Design: Observation
Replications: 2
Fertilizer: Rep 1 - none
Rep 2 - 14-0-0 with N at 57 DAT
Maximum flood depth: 29 cm

Variety	Days to flower	Plant height	Panicles/ m^2	Yield
		cm	#	t/ha
Karjasail/Kalomotta	118	106	306	3.15 a
IR21178-43-1-2-2-2	119	89	239	2.51 ab
Cisadane	120	86	229	2.24 abc
DWCT131-4-1-2-2-0	116	94	244	2.14 bc
IR11185-B-B-850-1	123	96	257	1.92 bcd
DWCT134-1-3-B	110	97	212	1.69 bcd
DWCT156-1-2-0-1	114	90	234	1.65 bcd
DWCT156-1-2-0	114	95	251	1.58 bcde
DWCT156-0-0-0	112	103	234	1.49 cde
IR21178-42-1-3-3-1-3	105	100	228	1.12 de
Nam saqui - 19	93	101	235	0.64 e
Mean	113	96	242	1.83
LSD (.05)	10	9		0.99
C.V. (%)	4	4	13	24

Bhatirtek Soybean Fertilizer Trial

Soybean (Glyine max) is a new crop to farmers in the Bhatirtek area. A fertilizer trial was conducted in farmer's fields near Choumahoni Bazar to acquaint local farmers with the crop and to investigate the fertilizer needs for growing soybeans under slightly saline soil conditions (TABLE 30). Fields were selected which were suitable for chilli, cowpea, and mungbean production, and prepared as for other rabi crops. Fertilizer was broadcast prior to the final land preparation. Soybeans were sown by the traditional dibble planting method used for aus cultivation placing 3-4 seeds/hole. Date of planting for the six replications was dispersed over the Bengali month Poush. Seeds were properly coated prior to planting with Rhizobium inoculant supplied by Bangladesh Agricultural University, Mymensingh. Farmers were very pleased with initial stands but salinity did damage some plots in early February. Urea did not increase plant growth or yield; phosphorus applied at 25 Kg P_2O_5/ha (the lower rate) increased yields economically.

TABLE 30: Bhatirtek Soybean Fertilizer Trial

Planting date: 23/12/86-7/1/87 Design: RCBD

Flowering date: 19/2-2/3/87 Replications: 6

Maturity date: 27/3-10/4/87 Variety: PB-1

Plot size - planted: 5m x 5m Seedrate: 70 kg/ha

harvested: $5m^2$

Fertilizer treatment	Plant height	Plant density	Yield
Kg $N-P_2O_5-K_2O$/ha	cm	$\#/m^2$	t/ha
0-0-0	34	61	0.78
20-0-0	31	61	0.66
0-25-0	34	65	0.97
20-25-0	32	70	0.99
0-50-0	32	69	0.93
20-50-0	33	62	0.97
Mean	32	65	0.88
L.S.D. (.05)	NS	NS	NS
C.V. (%)	10	13	33
Contrast F values			
No N vs N	NS	NS	NS
No P vs P	NS	*	**

Response to fertilization with 0-25-0

Yield response: 250kg x 6.50 Tk./kg = 1625 Tk.

Cost of fertilizer: 25kg x 13 Tk./kg = 325 Tk.

Return to fertilizer: $\frac{1625 \text{ Tk.}}{325 \text{ Tk.}} = 5.0$

Charland Wheat Fertilizer MLT Trials

Wheat (Triticum aestivum) has become the second most important cereal crop grown in Bangladesh. Acreage in the Sudharam char is very limited. This is due to the late maturity of aman rice grown on the sweeter portions of the region. Still farmers are interested in wheat cultivation because it could supplement food stocks needed for the hunger months of the rainy season. A wheat fertilizer trial was conducted in the Char Bata Khaserhat, Bhatirtek, and Keramatpur regions to demonstrate wheat cultivation practices to local farmers (TABLE 31 - 33). Previous research showed that tillering was very low when wheat is sown late; therefore, a high seedrate was selected. Wheat seed and fertilizer were broadcast prior to the final land preparation and incorporated by ploughing and laddering. Seeding date was very late for wheat, but wet soil conditions prevented sowing at an earlier date. The crop emerged well but insects and salinity thinned the plant density during the initial growth period. The summary results (TABLE 34) show clearly that days to flowering are decreased, while plant height, plant density, and yield are increased when nitrogen and phosphorus are applied. Responses to phosphorus were evident only when nitrogen was applied. Overall yields were low, mainly due to late seeding and poor tillering. Because of the low yield, returns to labour are poor as shown by the low return to total cost relative to the return to cash. Wheat cultivation in the char region requires timely seeding at a high seed rate, adequate N-P fertilization, and weeding to ensure satisfactory economic returns.

TABLE 31: Char Bata Wheat Fertilizer MLT Trial

Planting date: 11-23/12/86 Design: RCBD

Harvest date: 19-29/3/87 Replications: 6

Plot size - planted: $25m^2$ Seedrate: 160 kg/ha

harvested: $25m^2$ Variety: Akbar

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plant density	Yield
Kg $N-P_2O_5-K_2O$/ha			cm	$\#/m^2$	t/ha
0-0-0	60 a	92	47 d	156 c	0.83
0-25-0	60 a	92	58 c	181 b	0.80
0-50-0	58 a	92	63 bc	176 b	0.88
60-0-0	57 a	92	62 bc	173 b	0.68
60-25-0	52 b	92	69 ab	179 b	1.03
60-50-0	49 b	92	72 a	202 a	1.04
Mean	56	92	62	178	0.88
L.S.D. (.05)	4	NS	8	16	NS
C.V. (%)	6		12	8	24
Contrast					
No N vs N	**		**	**	NS
No P vs P	**		**	**	**

TABLE 32: Bhatirtek Wheat Fertilizer MLT Trial

Planting date: 15-31/12/86 , Design: RCBD

Harvest date: 8-21/3/87 Replications: 5

Plot size - planted: $25m^2$ Seedrate: 160 kg/ha

harvested: $5m^2$ Variety: Akbar

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plant density	Yield
Kg/ha			cm	$\#/m^2$	t/ha
0-0-0	63	82	45 b	193	0.38 b
0-25-0	62	82	44 b	191	0.42 b
0-50-0	62	82	45 b	186	0.39 b
60-0-0	62	82	40 b	212	0.53 ab
60-25-0	60	82	52 a	207	0.70 a
60-50-0	59	82	53 a	215	0.73 a
Mean	62	82	47	201	0.52
L.S.D. (.05)	2	NS	7	NS	0.23
C. V. (%)	2		12	25	33
Contrast F Values					
No N vs N	**		NS	NS	**
No P vs P	**		**	NS	NS
N x P	**		**	NS	NS

TABLE 33: Keramatpur Wheat Fertilizer MLT Trial

Planting date: 18/12/86-1/1/87
Harvest date: 14-25/3/87
Plot size - planted: 5m x 5m
harvested: $5m^2$

Design: RCBD
Replication: 6
Seed rate: 160 kg/ha
Variety: Akbar

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plant density	Yield
Kg $N-P_2O_5-K_2O$/ha			cm	$\#/m^2$	t/ha
0-0-0	60	86	49 b	114 bc	0.50 c
0-25-0	60	86	48 b	97 c	0.49 c
0-50-0	60	86	51 b	107 bc	0.41 c
60-0-0	58	86	55 b	135 b	0.79 b
60-25-0	58	86	66 a	181 a	1.03 a
60-50-0	58	86	67 a	133 b	0.95 ab
Mean	59	86	56	128	0.69
L.S.D. (0.05)			6	33	0.22
C. V. (%)			8	21	27
Contrasts					
No N vs N			**	**	**
No P vs P			**	NS	NS
N x P			**	NS	NS

TABLE 34: Charland Wheat Fertilizer MLT Trial Summary

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plant density	Yield
Kg $N-P_2O_5-K_2O$/ha			cm	#/m^2	t/ha
0-0-0	61 a	87	47 c	152 b	0.58 b
0-25-0	61 a	87	51 bc	154 b	0.58 b
0-50-0	60 a	87	53 b	154 b	0.57 b
60-0-0	59 a	87	53 b	171 ab	0.67 b
60-25-0	56 b	87	63 a	188 a	0.93 a
60-50-0	55 b	87	65 a	181 a	0.92 a
Mean	58	87	55	167	0.71
L.S.D. (.05)	2		5	23	0.14
C.V. (%)	4		12	20	29
Contrasts					
No N vs N	**		**	**	**
No P vs P	**		**	NS	**
N x P	**		**	NS	**

Response to fertilization with 60-25-0:

0.35t x 5000 Tk./t = 1750 Tk.

Fertilizer cost: 85kg x 13Tk./kg = 1105 Tk.

Return to fertilizer = $\frac{1750 \text{ Tk.}}{1105 \text{ Tk.}}$ = 1.58

Bhatirtek Chilli Fertilizer Trial

Chillies (*Capsicum frutescens*) are an important cash crop in the char region. They are grown by many subsistence farmers because they require much labour and demand a high price on the market. Chillies are well adapted to the climate of the region, tolerating moderate leavels of salinity and drought. A trial with N-P-K fertilization was conducted to determine the response of the crop to additional inputs. Fertilizer was broadcast prior to the final land preparation.

The contrast for the effect of nitrogen on plant height and yield was significant (TABLE 35). Growth of nitrogen-fertilized plants averaged 6 cm higher than those which did not receive urea. Chilli plants that were fertilized with urea had a darker green color. Yield response to 60 kg N/ha averaged 350 kg/ha ripe chillies over the whole experiment. Under the present economic conditions, application of nitrogen is not recommended; however, if ripe chilli prices rise to 7500 Tk./t, this rate of nitrogen fertilization is economical. Phosphorus and potassium may be beneficial if nitrogen is also applied but none of the interactions were statistically significant.

TABLE 35: Bhatirtek Chilli Fertilizer Trial

Planting date: 4-11/1/87 | Design: RCBD
Flowering date: 9-18/3/87 | Replications: 3
First harvest date: 23-29/4/87 | Variety: Local
Plot size: $25m^2$

Fertilizer treatment	Plant height	Yield (ripe chilli)
Kg $N-P_2O_5-K_2O$/ha	cm	t/ha
0-0-0	31 c	0.65
60-0-0	37 ab	0.85
0-40-0	31 c	0.61
60-40-0	39 a	0.84
0-0-60	35 abc	0.66
60-0-60	38 a	0.93
0-40-60	32 bc	0.50
60-40-60	38 a	1.20
Mean	35	0.78
L.S.D. (.05)	6	NS
C. V. (%)	9	27
Contrast F values		
No N vs N	**	**
No P vs P	NS	NS
No K vs K	NS	NS

Response to fertilizer:

1) 60-40-60

0.55 t/ha x 5500 Tk./t = 3025 Tk./ha

Fertilizer cost = $100 \times \frac{100}{46} \times 6$ Tk. + $60 \times \frac{100}{60} \times 5$ Tk. = 1804 Tk.

Return to fertilizer:

$$\frac{3025 \text{ Tk.}}{1804 \text{ Tk.}} = 1.68$$

2) 60-0-0

0.20 t/ha x 5500 Tk/t = 1100 Tk./ha

Fertilizer cost = $60 \times \frac{100}{46} \times 6$ Tk. = 783 Tk.

Return to fertilizer:

$$\frac{1100 \text{ Tk.}}{783 \text{ Tk.}} = 1.40$$

Bhatirtek Sweet Potato Fertilizer Trial

Sweet potato (*Ipomoca batatas*) is a popular crop among small farmers in the char region. It employs family labour and has had a good market value the last two years. Although storage is difficult and people consider it a "poverty food", it is an excellent source of vitamins and energy. A trial was conducted in farmers' fields to determine the response of sweet potatoes to fertilization. Urea, TSP, or MP were broadcast as appropriate and incorporated by the final ploughing and laddering. Sweet potato vines were transplanted at a density of 175,000 vines/ha.

The response of sweet potato to fertilization under saline soil conditions was low (TABLE 36). Plant height was not significantly increased by any of the fertilizers. Phosphorus significantly decreased tuber yield. Although the yield response of tubers due to potassium was not significant, it was highly economical with a return of 4.80 Tk. for every taka invested.

TABLE 36: Bhatirtek Sweet Potato Fertilizer Trial

Planting date: 12-30/12/86 Design: RCBD

Harvest date: 28/4-14/5/87 Replication: 5

Plot size - planted: 5m x 5m Variety: Local

harvested: $5m^2$

Fertilizer treatment	Plant ht.	Yield
	cm	t/ha
0-0-0	54	10.6
20-0-0	60	10.6
0-40-0	54	9.3
20-40-0	55	8.7
0-0-60	60	12.2
20-0-60	50	11.3
0-40-60	53	9.4
20-40-60	61	11.1
Mean	56	10.4
L.S.D.	NS	NS
C.V.	24	20
Contrasts		
No N vs N	NS	NS
No P vs P	NS	**
No K vs K	NS	NS

Response to fertilizer:

0-0-60 1.6 t/ha x 1500 Tk./t = 2400 Tk./ha

Fertilizer cost = $60 \times \frac{100}{60} \times 5 = 500$ Tk.

Return to fertilizer:

$$\frac{2400 \text{ Tk.}}{500 \text{ Tk.}} = 4.80$$

Bhatirtek Khesari Phosphate Fertilizer Rate Trial

Work at Char Bata Research Station on a fairly saline soil showed that the broadcast application of 40 kg P_2O_5/ha at the time of relay sowing doubled the yield of khesari (Lathyrus sativus). Eight observations were established in farmers' fields during late October, each with five fertilizer rates ranging from 0 to 40 kg P_2O_5/ha. All of these replications were lost due to heavy rains in early November. Another replication was established when the soil had dried sufficiently to permit broadcasting of seed. Results are shown in Table 37. Fertilizer stimulated vegetative growth and improved plant survival but yield was not affected. 1985 weather data showed that a 14 mm rainfall occurred one week following the sowing of the experiment which had a dramatic yield response. No rainfall occured during the growing season of 1986-87. For effective utilization of broadcast TSP on relay sown crops, a shower may be necessary to wash the phosphorus into the root zone of the crop.

TABLE 37: Bhatirtek Khesari Phosphate Fertilizer Rate Trial

Planting date: 18/11/86
Harvest date: 28/2/87
Plot size - planted: 5m x 5m
harvested: $5m^2$
Planting method: Broadcast

Design: Observation
Replication: 1
Seedrate: 30 kg/ha
Previous crop: Karjasail

Fertilizer Rate	Plant height	Plant Density	Yield
Kg P_2O_5/ha	cm	#/m^2	t/ha
0	54	33	0.76
10	53	32	0.46
20	61	39	0.72
30	63	42	0.78
40	60	40	0.82

Charland Cowpea Phosphorus Rate MLT Trials

Pulses such as khesari (Lathyrus sativus), fieldpea (Pisum sativum), and soybean (Glycine max) have responded well to the application of phosphorus in the char. A trial was conducted in farmers' fields at Bhatirtek and Char Bata Khaserhat to determine the response of cowpea (Vigna unguiculata) to phosphorus fertilization. Phosphorus at five rates was applied as TSP prior to the final plowing. Salinity damage at Bhatirtek prevented the detection of any growth trends (TABLE 38). On the less saline soils in Char Bata a yield decrease of 24 kg/kg P_2O_5 was observed (TABLE 39). The additional phosphorus stimulated vegetative growth and, consequently, delayed the onset of flowering. The early flooding of the fields in April prevented the fertilized cowpeas from maturing fully, and therefore, their yield potential was not realized. Several interpretations are possible. 1) Cowpeas may respond vegetatively to phosphorus at the expense of grain production. 2) If the cowpeas were sown in December, yields could increase with fertilizat[illegible] because of the increased vegetative growth. A longer crop duration would be required, however, for this increased grain production. Further testing is required to determine which of these alternatives is correct.

Bhatirtek Mustard Fertilizer Observation

Relayed mustard (Brassica) has grown very well in the char when fertilized with nitrogen and phosphorus. This year mustard relayed into standing aman was not possible because the fields were flooded when the aman was harvested. Seed and fertilizer were broadcast on moist soil when the excess water had evaporated. Although the mustard germinated well, salinity in the surface layer of soil increased rapidly and soon choked out the young mustard seedlings at most locations (TABLE 40). For satisfactory establishment of mustard in saline soils by relay sowing, a crop canopy is essential during the seedling stage to prevent rapid salinzation of the upper soil layer. Relay mustard in saline fields will only be successful when a crop canopy is maintained for two to three weeks following broadcasting of the seed.

TABLE 38: Bhatirtek Cowpea Phosphorus Rate MLT Trial

Planting date: 9-13/1/87
Flowering date: 21-29/3/87
Plot size - planted: 5m x 5m
harvested: $25m^2$

Design: RCBD
Replications: 3
Variety: Local

Fertilizer treatment	Days to flower	Plant height	Yield
		cm	kg/ha
0-0-0	74	55	300
0-10-0	74	52	250
0-20-0	74	51	290
0-30-0	74	56	300
0-40-0	74	53	340
Mean	74	53	290
L.S.D. (.05)	NS	NS	NS
C. V.		4	22
Contrast F values			
P rate	NS	NS	NS

TABLE 39: Char Bata Cowpea Phosphorus Rate MLT Trial

Planting date: 15-21/1/87
Plot size - planted: 5m x 5m
harvested: $5m^2$

Design: RCBD
Replications: 6
Variety: Local

Fertilizer treatment	Days to flower	Days to last harvest	Plant density	Yield
Kg $N-P_2O_5-K_2O$/ha			#/m^2	t/ha
0-0-0	53 e	98	10	1.72 a
0-10-0	56 d	98	10	1.36 b
0-20-0	59 c	98	9	1.04 c
0-30-0	62 b	98	10	0.93 c
0-40-0	66 a	98	11	0.74 d
Mean	59	98	10	1.16
L.S.D. (.05)	2			0.13
C. V. (%)	3		9	10
Contrast				
P rate	m = 0.317			m = -0.0239

TABLE 40: Bhatirtek Mustard Fertilizer Observation

Planting date: 2/12/86
Plot size - planted: $25m^2$
harvested: $5m^2$
Seedrate: 16 kg/ha

Design: Observation
Replication: 1
Variety: Maghi
Previous Crop: BR11

Fertilizer treatment	Plant height	Plant density	Yield
Kg $N-P_2O_5-K_2O$/ha	cm	#/m^2	kg/ha
0-0-0	19	66	40
0-25-0	18	135	60
0-50-0	16	221	40
60-0-0	23	129	80
60-25-0	24	125	60
60-50-0	26	241	180

Bhatirtek Mungbean Seedrate Trial

A trial was conducted to determine the optimum seedrate for mungbean (*Vigna radiata*) in the char region. Recommended seedrates are 10-12 kg/ha but charland farmers commonly use higher rates. The seed is broadcast-sown and stands are frequently thinned by salinity. Because of the salinity damage, plant density did not reflect seeding rate closely and yield was not affected (TABLE 41).

Bhatirtek Fieldpea Variety Trial

Fieldpea (*Pisum sativum*) was dibble sown into the north side of rice hills using a pointed stick known as a ghati. Fertilizer at 20-40-0 was broadcast on the top of the soil at the time of planting. The plants emerged well but turned yellow and ceased to grow due to the high salinity of the soil (TABLE 42). Fieldpea is not well suited to saline regions and only does well in less saline char regions.

TABLE 41: Bhatirtek Mungbean Seedrate Trial

Seeding date: 24-28/1/87 | Design: RCBD
Plot size: 16m^2 | Replication: 3
Fertilizer: 20-40-0 | Variety: 7715, 2710, 2773

Seedrate	Plant density	Yield
Kg/ha	#/m^2	kg/ha
10	18	250
20	34	230
25	50	300
30	51	430
40	38	250
50	55	340
Mean	41	300
C. V.(%)	34	25
Farmer's rate (12-16)	30	230

TABLE 42: Bhatirtek Fieldpea Variety Trial

Planting date: 14/12/86
Plot size - $25m^2$
Seeding method: Dibbled
Previous crop: Aman (Rajasail)

Design: Observation
Replication: 1
Seed rate: Large White - 90 kg/ha
Large Green - 60 kg/ha
Small Green - 40 kg/ha
Fertilizer: 20-40-0 broadcast at seeding

Variety	Days to flower	Days to maturity	Plant height	Plant density	Yield
			cm	$\#/m^2$	kg/ha
Large Green	54	76	53	1.6	75
Small Green	51	76	22	1.6	30
Large White	59	76	51	0.5	10

Charland Tomato Salinity Screening Trials

Several tomato (Lycopersicon esculentum) lines were tested in the char region for their adaptability to saline soils. Several problems prevented fulfillment of the objectives of the trial. Heavy rains in early November weakened the seedlings and many died in the seedbed from waterlogged soils. At transplanting time, seedlings could not be placed in saline soils as easily as had been hoped. They needed to be transplanted close to homes in the midst of other crops to prevent theft and other forms of damage. Land in the vicinity of homes tends to be less saline, and therefore, was not suitable for salinity screening. Greater care in selection of trial sites needs to be taken next year.

Yields of the tomato lines were fair at both Char Bata (TABLE 43) and Bhatirtek (TABLE 44). The inclusion of a check variety in all trials would assist in their interpretation.

Bhatirtek Bushbean-Gardenpea Observation

An observation was conducted in the charland to determine the acceptability of two new vegetables, gardenpea (*Pisum sativum*) and bushbean (*Phaseolus vulgaris*), as well as these two vegetables intercropped. The first planting in mid-October had excellent emergence but was destroyed by flooding in early November. A second planting had variable stands of both gardenpea and bushbean because of wet soils. Total yield of the intercrop was higher than either sole crop (TABLE 45). Bushbean yields were sharply decreased by intercropping while the gardenpea yield was unaffected. The farmer was pleased with the taste of both vegetables but had difficulty knowing at what stage to pick gardenpeas. They allowed the gardenpea pods to become too mature before they were harvested.

TABLE 43: Char Bata Tomato Salinity Screening Trial

Planting date: 26/10/86
Transplanting date: 3-11/12/86
Plot size - planted: 1.2m x 2.0m
harvested: 1.2m x 2.0m
Spacing - row: 60 cm
plant: 40 cm

Design: RCBD
Replications: 3
Fertilizer: 45/45-90-116 with N at 0 and 30 DAT

Variety	Days to flower	Days to 1st harvest	Days to last harvest	Yield
				t/ha
E-1205	76	135	145	35.1
UF-145B-7879	83	139	149	35.0
Local (Roma VF)	88	139	146	27.6

TABLE 44: Bhatirtek Tomato Salinity Screening Trial

Planting date: 26/10/86
Transplanting date: 30-11/86
Plot size - planted: 0.8m x 1.2m
harvested: 0.8m x 1.2m
Spacing - row: 60 cm
plant: 40 cm

Design: RCBD
Replications: 2
Fertilizer: 45/45-90-116
with N at 0 and 30 DAT
Irrigation: Rep 1 - once
Rep 2 - 3 times

Variety	Days to flower	Days to 1st harvest	Days to last harvest	Plant height	Yield
				cm	t/ha
BADC-86	73	118	147	94	32.0
UC-82	78	120	148	91	30.9
UF-145B-7879	81	125	147	99	27.2

TABLE 45: Bhatirtek Bushbean-Gardenpea Observation

Planting date: 27/11/86

Item	Gardenpea	Bushbean	Intercrop(alternating rows)
Plot size (m):	2.4 x 5.0	2.4 x 5.0	5.0 x 5.0
Row spacing (cm):	30	60	40
Plant spacing (cm):	10	25	GP[a/] - 10 BB - 25
Seed rate (kg/ha)	55	25	GP - 22 BB - 18
Fertilizer (Kg/ha):			
N	40	40	40
P_2O_5	35	40	40
K_2O	28	55	55
Cowdung (t/ha)	10	10	10
Plant ht. (cm)	35	29	GP - 38 BB - 26
First harvest date:	18/2/87	26/1/87	GP - 25/1 BB - 11/1
Last harvest date:	25/2/87	8/2/87	GP - 25/2 BB - 8/2
Yield (kg/ha)			
- picked pods:	530	540	GP - 580; BB - 290
- peas:	290	-	GP - 330

a/ GP - gardenpea
BB - bushbean

NATHER PETUA AND CHITOSI STATION CROPPING SYSTEMS SITE REPORT, 1986-87

INTRODUCTION

This is a summary of the research carried out at Nather Petua and Chitosi Station MCC Cropping Systems Research Sites. Both Nather Petua and Chitosi Station are in Laksam Upazila, District Comilla. Nather Petua is on the Noakhali rail line 10 miles south of Laksham Junction. Chitosi Station is on the Chandpur rail line 8 miles west of Laksam Junction. The research site was moved from Nather Petua to Chitosi station in November, 1986, so the aman results are from Nather Petua and the rabi results are from Chitosi Station. Oscar Rozario is the Site Manager. Rofiqul Hossain and Abu Taher are the data collectors working in the field at the cropping systems research site. The Site Description section of this annual report has more information on these sites.

Multilocation Testing (MLT) was done near Khil Bazar (6 miles south of Laksam Junction on the Noakhali rail line) and near Eroain bazar (3 miles west of Laksam bazar). Khila and Eroain are both in Laksam Upazila, District Comilla. Sheym Gobindo Chakroborty, Bhabaranjan and Mohiuddin were responsible for conducting trials at the MLT sites.

CLIMATE

Temperature, flooding depth and rainfall data for the year are presented at the beginning of this annual report in the CLIMATIC DATA section. The area is a deepwater rice area.

CROPPING PATTERN MANAGEMENT AND PERFORMANCE

The predominant cropping pattern is mixed aus/aman or mono aman - fallow. 60% of the land is fallow in the rabi season. Wheat, fieldpea, khesari, mustard, lentils, flax, and mungbeans are the major rabi season crops. There is also a very limited acreage of boro rice, potatoes, chillis and watermelons grown in the area. More detailed monitering of the cropping pattern is being started this year at the Chitosi Station Site.

note: the terms broadcast aman (b. aman) and deepwater rice in this report refer to photoperiod-sensetive varieties of rice that are usually broadcast seeded in late March-early April and harvested in late November and, to varying degrees, have a great capacity to elongate.

ON-FARM TRIALS

The following trials were conducted on farmers' fields during the 1986/87 cropping year at Nather Petua, Chitosi Station, Khila or Eroain:

- Nather Petua, Eroain and Khila deepwater rice TSP fertilizer trials.
- Eroain soybean/deepwater rice intercropping trial.
- Eroain and Khila *Azospirillam* sp. inoculated wheat trials.
- Khila soybean urea topdressing trial.
- Eroain wheat relaying observation.
- Chitosi station Boro ALART variety observation.

A number of other on-farm wheat trials were planted at the Chitosi Station site but due to severe damage by army worms data from these trials was not analyzed.

Eroain Soybean-Deepwater Rice Intercropping Trial

Some farmers in the Eroain area have started planting soybeans and rice together as a way to include soybeans in their cropping pattern without increasing the risk of their aman rice crop being flooded out due to late planting. A trial was conducted to try and determine what effect intercropping with soybeans had on rice yields and also to compare various soybean seeding methods. Farmers who had intercropped rice and soybean before said their rice produced better where it had been intercropped with soybeans and that the soybeans seemed to deter rice hispa.

Four soybean seeding methods were tried: (1) line-sowing: 18" rows, 25 kg/ha seedrate; (2) line-sowing, 28" rows, 25 kg/ha seedrate; (3) broadcast, 32 kg/ha seedrate; (4) broadcast, 20 kg/ha seedrate. All rice was broadcast at the farmers' usual rate (92 kg/ha). The rice and soybeans were planted together. A treatment of February-planted broadcast aman was included to test how date of planting affected the aman crop. This was planted at the same time as the intercropped rice/soybean.

Many of the soybean plots were damaged by goats. Also, heavy rains in May delayed maturity of the soybeans and caused their seed quality to decline. Line-sowing soybeans didn't appear to have any advantages over broadcast soybeans (TABLE 1). Intercropped rice looked very good in the field and had significantly more heads per m^2 than the control plots. There was, however, no significant difference in yield. The nitrogen fixed by the soybeans may have enhenced tillering after the soybean harvest. But perhaps the benefit of the added nitrogen was masked later on by flood waters. Further work with this intercropping is being conducted. In the future this technology should be tested against relaying rice into soybeans. Also, it should be kept in mind that ufra may be more of a problem in earlier planted fields.

TABLE 1: Eroain Soybean - Deepwater Rice Intercropping Trial

Planting dates - soybean/rice: 2/2/86-6/2/86
normal rice: 10/3/86-21/3/86
Plot size - planted: 5 x 10m
harvested: $5m^2$ crop cut
Rice seedrate: 92 kg/ha
Rice seeding method: broadcast

Design: RCBD
Replications:: 5
Fertilizer: farmers' choice
Varieties - soybean: Pb-1
rice : Local

Treatment	Flowering date		Harvest date		Plant ht.		Panicles/m^2		Yield	
	soy	rice	soy	rice	soy	rice	soy	rice	soy	rice
					cm	cm	#	#	kg/ha	kg/ha
B. aman/soy 18" rows[b/]	30/3	25/10	25/5	29/11	40	223	24	141	790	1690
B. aman/soy 28" rows	30/3	25/10	25/5	29/11	38	235	15	123	670	1820
B. aman/soy broadcast 20 kg/ha	30/3	25/10	24/5	29/11	38	235	23	133	600	1850
B. aman/soy broadcast 32 kg/ha	30/3	25/10	24/5	29/11	41	231	16	119	1020	1720
Feb. sown b. aman		25/10		29/11		229		111		1720
Normal b. aman		29/10		29/11		222		109		1630
Mean	30/3	26/10	24/5	29/11	40	229	19	122	770	1740
L.S.D. (.05)					NS	NS	**	NS[a/]	NS	NS
C.V. (%)					6	4	22	16	34	14

a/ significant at the 10% level (05 p 10)

b/ B. aman is broadcast aman

Orthoganal Comparisons

Treatments and comparisons						F - tests		
Mono-rice Feb. rice	Mono-rice March rice	Inter-cropped rice w/ b. soy 32 kg/ha	Inter-cropped rice w/ b. soy 20 kg/ha	Rice w/ line soy 18" rows	Rice w/ line soy 28" rows	Rice:plant ht.	Rice: panicles per m^2	Rice yield
2	2	-1	-1	-1	-1	NS	*	NS
-1	1					NS	NS	NS
		1	1	1	1	NS	NS	NS
		1	-1			NS	NS	NS
				1	-1	NS	NS	NS
Soybeans						Soy:plant ht.	Soy:plant per m^2	Soy:yield
		1	1	-1	-1	NS	NS	NS
		1	-1			NS	*	*
				1	-1	NS	**	NS

Deepwater Rice Phosphate Fertilizer Trials

A phosphate (Triple Super phosphate = TSP) fertilizer trial was conducted at Khila, Eroain and Nather Petua to try and determine if there is a rice (*Oryza sativa*) yield response to TSP fertilizations in these deepwater rice areas. Many farmers in these areas use some TSP (the farmers' rate is usually around 65 kg TSP/ha) but past research had shown no yield response to TSP application. The fields chosen for this trial had not had TSP applied to them within the last 3 years. The area the trial was conducted in floods from 1-2 meters deep.

Before the flood waters came, there was a definite visible vegetative response to TSP in most of the replications. In Khila, under mixed aus/aman cultivation, contrast comparisons showed a significant linear response to TSP in both aus yields and panicles per m^2; also, a linear response occurred for total aus/aman yield at the 10% level of significance (TABLE 2). In Eroain, there was a significant response in panicles per m^2, but no corresponding significant difference in yield (TABLE 3). In Nather Petua, TSP application didn't have a significant effect on any of the parameters measured (TABLE 4). In Khila, under mono-aman cultivation, there was no significant yield response to TSP. However, TSP application did significantly increase plant height and appeared to be profitable (TABLE 5).

Given the information here, farmers should be encouraged to test their own fields by putting TSP on one part of it to see if there is a response. In Khila, TSP application up to 60 kg/ha appeared to be very profitable. In the other areas, despite a strong pre-flood vegetative response, TSP application did not increase yields and was unprofitable. Therefore farmers will have to be convinced that just because they see a vegetative response in June, they won't necessarily see a yield response in November.

TABLE 2: Khila Mixed Aus/Aman Phosphate Fertilizer Trial

Planting dates: 16/4/86-17/4/86 Plot size - planted: 8 x 8m

Harvest dates: aus: 7/7/86-20/7/86 harvested: $5m^2$ cropcut

aman: 6/12/86-9/12/86 Replications: 2

Design: RCBD

Kg P_2O_5/ha	Flowering date	Harvest date	Plant ht.	Panicle per m^2	Yield	MRR %[a/]
Aus harvest			cm	#	t/ha	
0 Kg P_2O_5/ha	26/6/86	17/7/86	65	95	0.47	
14 "	23/6/86	11/7/86	70	160	0.56	156
28 "	22/6/86	11/7/86	71	224	0.83	667
41 "	20/6/86	11/7/86	73	237	0.81	
55 "	20/6/86	11/7/86	73	273	0.83	
Mean			70	199	0.70	
L.S.D. (.05)				NS	NS	
C.V. (%)				25	22	
Aman harvest						
0 Kg P_2O_5/ha	31/10/86	9/12/86	155	115	1.52	
14 "	31/10/86	9/12/86	158	105	1.56	36
28 "	31/10/86	9/12/86	163	111	1.62	105
41 "	31/10/86	9/12/86	167	113	1.60	
55 "	31/10/86	9/12/86	167	103	1.47	
Mean			162	109	1.55	
L.S.D. (.05)				NS	NS	
C.V. (%)				16	11	
Total yield						
0 Kg P_2O_5/ha					1.99	
14					2.12	292
28					2.45	872
41					2.41	
55					2.30	
Mean					2.25	
L.S.D. (.05)					NS	
C.V. (%)					7	

Contrasts

Aus linear response	*	*
Aman linear response	NS	NS
Total linear response	NS	significant at the 10% level

a/ assumes TSP cost is 6 Tk./kg, the aus value is 190 Tk./md., and the aman value is 230 Tk./md.

TABLE 3: Eroain Deepwater Rice Phosphate Fertilizer Trial

Planting date: 20/3/86-16/4/86
Plot size - planted: 8 x 8m
harvested: 5m^2 cropcut
Seedrate: farmers' seedrate (92-115 kg/ha)

Seeding method: broadcast
Design: RCBD
Replications: 6
Variety: local

Kg P_2O_5/ha	Flowering date	Harvest date	Plant ht.	Heads/m^2	Yield	MRR %[a/]
			cm	#	t/ha	
0	11/10/86	25/11/86	201	119 b	1.58	
14	11/10/86	25/11/86	202	128 ab	1.59	-66
28	11/10/86	25/11/86	200	130 ab	1.50	-237
41	11/10/86	25/11/86	203	138 a	1.74	83
55	11/10/86	25/11/86	204	140 a	1.67	-66
Mean			202	131	1.62	
L.S.D. (.05)			NS	14	NS	
C.V. (%)			4	9	12	

a/ assumes TSP cost is 6 tk/kg; rice value is 230 tk/md; and that all other costs (plowing, weeding, etc.) are the same between treatments

TABLE 4: Nather Petua Deepwater Rice Phosphate Fertilizer Trial

Planting dates: 24/3/86-6/4/86
Plot size - planted: 8 x 8m
harvested: 5m^2 cropcut
Seedrate: farmers'

Seeding method: broadcast
Design: RCBD
Replications: 4
Variety: local

Kg P_2O_5/ha	Flowering date	Harvest date	Plant ht.	Heads/m^2	Yield[a/]
			cm	#	t/ha
0	27/10/86	27/11/86	158	109	1.09
14	27/10/86	27/11/86	167	111	0.94
28	27/10/86	27/11/86	157	106	1.10
41	27/10/86	27/11/86	158	110	1.03
55	27/10/86	27/11/86	159	119	0.95
Mean			160	111	1.02
L.S.D. (.05)			NS	NS	NS
C.V. (%)			6	18	15

a/marginal analysis was conducted; all the fertilizer treatments lost money so the figures are not reported here

TABLE 5: Khila Deepwater Rice Phosphate Fertilizer Trial

Planting dates: 12/4/86-7/5/86 Replications: 2
Harvest dates: 2/12/86-6/12/86 Design: RCBD
Plot size - planted: 8 x 3m
harvested: $5m^2$ cropcut

Kg P_2O_5/ha	Flowering date	Harvest date	Plant ht.	Heads/m^2	Yield	MRR %[b/]
			cm	#	t/ha	
0	27/10/86	4/12/86	186	133	1.99	
14	27/10/86	4/12/86	191	137	2.29	928
28	27/10/86	4/12/86	197	142	2.35	106
41	27/10/86	4/12/86	202	146	2.07	
55	27/10/86	4/12/86	206	142	2.16	
Mean			196	140	2.17	
L.S.D. (.05)			NS[a/]	NS	NS	
C.V. (%)			2	7	12	
Contrasts						
linear response			**	NS	NS	

a/ significant at the 10% level

b/ assumes TSP cost is 6 Tk./kg; rice value is 230 Tk./md. and that all other costs are the same between treatments

Azospirillum-inoculated Wheat MLT Trials

Since Azospirillum Brasilansa inoculation may reduce urea requirements for wheat (Triticum aestivum), and save farmers money MLT trials were conducted to see how much urea nitrogen could be replaced by nitrogen fixed by A. brasilensa. Wheat inoculated with was brasilensa tested against non-inoculated wheat at 0, 20, 40 and 60 Kg N/ha fertilizer rates.

Inoculum obtained from United Mission to Nepal was applied in a water slurry to the seeds. This seed was given to extensionists and, as it was realized that the bacteria may die upon drying, more inoculum was provided to extensionists to apply to the seed immediately prior to planting. This trial was conducted at Khila and Eroain.

There was no visible effect from Azospirillum inoculation. The visible affect of urea was very dramatic. The affect of urea on yield, plant height and heads/m^2 was highly significant (TABLES 6 and 7). The effect of Azospirillum inoculation on heads/m^2 was significant at the 10% level in Khila. There was no significant interaction between urea fertilization and inoculation of wheat.

The data suggested that A. brasilense inoculation had a positive effect on tillering. This seemed to be more pronounced at low soil N levels. Perhaps as the soil nitrogen level increased the A. brasilense fixed less nitrogen or, perhaps the level fixed is independent of how much soil nitrogen is available, but is so small that it is masked by the use of urea at economical levels. Further testing of this type of inoculation of cereals should probably not be undertaken until the developers of inoculant have something they are ready to extend.

TABLE 6: Khila Azospirillum -inoculated Wheat Trial

Planting dates: 13/12/87-22/12/87 Design: RCBD

Harvest dates: 22/3/87-25/3/87 Replications: 4

Plot size - planted: 5 x 5m Fertilizer: P_2O_5- 60, K_2O-10

harvested: $5m^2$ cropcut

Seeding method: asra min. till.

Seed rate: 120 kg/ha

Treatment	Plant ht.	Heads/m^2	Yield
	(cm)	#	t/ha
Ø N - no Azospirillum	57 d	75 b	.72 c
Ø N - plus Azospirillum	55 d	99 b	.73 c
20 N - no Azospirillum	67 c	88 b	.85 c
20 N - plus Azospirillum	70 bc	125 ab	.89 bc
40 N - no Azospirillum	73 abc	135 a	1.06 abc
40 N - plus Azospirillum	74 abc	140 a	1.28 ab
60 N - no Azospirillum	77 ab	138 a	1.33 a
60 N - plus Azospirillum	80 a	142 a	1.38 a
Mean	69	118	1.03
L.S.D. (.05)	9	38	.40
C. V. (%)	9	22	26
Contrast F values:			
Nitrogen rate		**	**
Axospirillum versus no Azospirillum		NS[a/]	NS
Nitrogen x Azospirillum interaction		NS	NS

a/ significant at the 10% level

TABLE 7: Broain Azospirillum - inoculated Wheat Trial

Planting date: 23/12/87
Harvest dates: 30/3/87-31/3/87
Plot size - planted: 5 x 5m
harvested: $5m^2$ cropcut
Seeding method: asra minimum tillage

Seed rate: 120 kg/ha
Design: RCBD
Replications: 2
Fertilizer: P_2O_5-60, K_2O-10

Treatment	Flowering date	Plant ht.	Head/ m^2	Yield
		cm	#	t/ha
0 N w/o Az.[a/]	22/2/87	42 c	148 c	.84 c
0 N w/ Az.	22/2/87	43 c	162 bc	.88 c
20 N w/o Az.	22/2/87	57 b	150 c	1.07 c
20 N w/ Az.	22/2/87	56 b	165 bc	1.01 c
40 N w/o Az.	22/2/87	62 ab	200 ab	1.56 b
40 N w/ Az.	22/2/87	61 ab	209 ab	1.54 b
60 N w/o Az.	22/2/87	70 a	218 a	2.05 a
60 N w/ Az.	22/2/87	63 ab	217 a	1.69 b
Mean		57	184	1.33
L.S.D. (.05)		10	52	.32
C.V. (%)		8	12	10
Contrast F Values			**	**
N rate			NS	NS
AZ us no AZ			NS	NS
N x AZ interaction			NS	NS

a/ w/o Az. is "without Azospirillum"; w/ Az. is "with Azospirillum"

Froain Wheat Relaying Observation

Relaying wheat (Triticum aestivum) into deepwater amon (Oryza sativa) would reduce farmers' input costs for growing wheat and would allow for earlier planting of wheat which may enhance wheat yields. The biggest limitation to this is the thick straw mat from the tall deepwater rice varieties. The wheat in this observation was sown into a relatively shorter (higher yielding, less flood resistant aman variety, Murabazal, to see what kind of yields were possible with wheat relayed into deepwater aman.

The wheat was relayed in at four seedrates: 100, 120, 140, and 160 kg/ha. Relaying was done one week before rice harvest. Initially this trial was designed as a seedrate trial with 5 replications.

The wheat that was relayed at the proper time did quite well. Two replications did very poorly because they were planted when the soil was too wet. Another two replications were lost to cows. The replication that was not damaged looked very good in the field, and produced good yields (TABLE 8). This technology is very promising and needs to be tested further to try and define what soil moisture level is most appropriate for relaying and also to see which varieties of deepwater aman are most appropriate for it.

TABLE 8: Froain Wheat Relaying Observation

Planting date: 28/11/86 Design: Observation

Harvest date: 19/3/87 Fertilizer: 40-31/32/21 (topdress at 30 DAP)

Plot size - planted: 10 x 10m

harvested: $5m^2$ cropcut

Seeding method: relay

Seed rate	Flowering date	Plant ht.	Plants/m^2	Yield
		cm	#	t/ha
100 kg/ha	8/2/87	67	200	1.97
120 kg/ha	8/2/87	74	183	2.22
140 kg/ha	9/2/87	60	235	1.63
760 kg/ha	9/2/87	57	246	1.50
Mean		65	216	1.83

Chitosi Station Boro ALART Variety Observation

A BRRI cooperative ALART (Advanced Lines Adaptive Research Trial) boro (Oryza sativa) observation was conducted at the Chitosi Station Cropping Systems Research Site. The one replication was planted in a farmer's field at Chitosi Station. This field has a fallow-boro rotation.

All the lines had good stands in the field. The farmer who owned the field was impressed with BR-17 and BR-18. He especially liked the tall height of these varieties, their early maturity, and yield (TABLE 9).

TABLE 9: Chitosi Station Boro ALART Variety Observation

Planting date: 6/12/86
Transplanting date: 1/2/87
Spacing - row: 25 cm
plant: 15 cm
Fertilizer: 33/33/33-60-40-10
N at 20-40-52 DAT

Design: Observation
Replications: 1
Insectivide - Dimecron: 21/2/87
Nogos: 30/3/87

Variety	Days to flower	Days to maturity	Plant height	Yield
			cm	kg/ha
BR-18	136	152	75	4790
BR-17	134	152	99	4010
BR-19	141	161	89	2670
BR-3	142	167	64	2600
BR-15	141	161	70	2370
BR-16	141	161	58	1710
Mean	139	159	76	3030

Khila Soybean Urea Topdressing Trial

AVRDC recommends topdressing soybeans (*Glycine max*) at four to six weeks after planting. Also, some soybean farmers topdress their soybeans with urea. Because there is some doubt about how useful this practice is, a trial was run to see if there is any soybean yield response to topdressing with urea.

Urea was topdressed at three rates at 40 days after planting. The rates were 10, 20, and 30 kg N/ha.

The soybeans appeared to respond positively to urea application in two replications and negatively in two replications. The reason for this is unclear. The replications that appeared to respond positively to urea topdressing had higher soil moisture levels than the replications that showed a negative response. One of the replications that appeared to positively respond to urea topdressing was harvested by the farmer before a crop cut could be taken. The results of this trial are inconclusive but the raw data indicates that in every replication there was either a strong positive or negative yield response to urea topdressing (TABLE 10). This trial should be conducted again next rabi season.

TABLE 10: Khila Soybean Urea Topdressing Trial

Planting dates: 14/1/87-23/1/87
Plot size - planted: 5 x 5m
harvested: $5m^2$

Design: RCBD
Replications: 3
Fertilizer: farmers' rate
Variety: Pb-1

Fertilizer	Flowering date	Harvest date	Plant ht.	Plants/m^2	Yield
			cm	#	t/ha
Ø	10/3/87	30/4/87	35 b	43	1.83
10	9/3/87	30/4/87	35 b	43	1.72
20	9/3/87	30/4/87	38 a	45	1.64
30	8/3/87	30/4/87	38 a	46	1.46
Mean			36	44	1.66
L.S.D. (.05)			2	NS	NS
C.V. (%)			2	17	21

1986 Chitosi Station Wheat-Fieldpea Intercropping Trial

Wheat (*Triticum aestivum*) and fieldpea (*Pisum sativum*) were planted together following asra minimum tillage in an on-farm trial at Chitosi Station. Asra minimum tillage involves removing straw, two rakings, broadcasting seed and fertilizer, two more rakings, two ladderings, and reapplication of the straw. The treatments included monocropped wheat; wheat (80 kg/ha seedrate) intercropped with fieldpea (20 kg/ha seedrate); monocropped fieldpea with asra minimum tillage; and monocropped fieldpea without tillage.

The wheat was almost totally destroyed by armyworms. However, the fieldpea was not touched by the armyworms and grew well in each treatment. No fieldpea data is presented here because the wheat was damaged at the seedling stage and never really competed with the fieldpea in the intercrop treatment.

Removal of the straw mulch deterred the armyworms. This was probably because it reduced soil moisture and increased the ability of birds to feed on the armyworms. This highly unusual armyworm attack was probably connected with the unusually high soil moisture levels present at the time these trials were planted. Heavy rains in early October and November delayed drainage of most fields in the Chitosi area until the first week in December.

Chitosi Station Azospirillum-inoculated Wheat Trial

Azospirillum brasilense inoculated wheat (*Triticum aestivum*) was tested under 0, 20, 40, and 60 kg fertilizer N/ha in an on-farm trial at Chitosi Station. This is the same trial that was conducted at the Khila and Eroain MLT sites.

The plots were planted using the asra minimum tillage technique (straw removal "two" rakings- broadcast seed and fertilizer - two rakings- two ladderings- reapplication of straw). The bacteria was applied a water slurry to the seed immediately prior to planting.

All the treatments seemed to germinate well, but five of the six replications were severely damaged by armyworms in the seedling stage. Removal of the straw mulch deterred armyworms, probably because it reduced soil moisture and exposed the armyworms to being eaten by birds. The plots in this trial, however, were severely damaged before the straw mulch was removed and so no data from this trial is presented here. It is thought that part of the reason for this extremely unusual armyworm attack may have been unusually high soil moisture levels that were the result of the heavy rains of early October and early November. These rains caused the floodwaters in the Chitosi area not to recede until early December.

Chitosi Station Wheat Variety Trial

Akbar, Kanchan and Agrani were planted in an on-farm wheat (*Triticum aestivum*) variety trial at Chitosi Station. All the replications were planted with the asra minimum tillage method. This method involves straw removal, two rakings, broadcasting seed and fertilizer, two more rakings, two ladderings, and reapplication of the straw.

Five of six replications were severely damaged by armyworms at the seedling stage. Removal of the straw mulch deterred the armyworms, probably by reducing soil moisture levels and exposing the armyworms to bird attacks. It was thought that the highly unusual armyworm attack may have in part been caused by heavy rains in early October and November. This caused late drainage of the fields and very high soil moisture levels late into December.

TETUAYA AND DHORKORA CROPPING SYSTEMS SITE REPORT, 1986-87

INTRODUCTION

This report is a summary of on-farm crop research and monitoring performed at the medium highland cropping systems sites during the 1986 aus, aman, and 1986-87 rabi seasons. Aus and aman season trials and monitoring were conducted at the Tetuaya site. This site was then closed December 31, 1986. A new site near Dhorkora Bazar with similar agronomic and socio-economic conditions was opened in November, 1986. Rabi season work was conducted at this site. The site change was made in keeping with MCC's philosophy of maximizing interchange between farmers and researchers.

Results of medium highland multilocational testing is also given here. This testing was conducted through two MCC cropping systems extension offices at Bordain and Dhagonbhuiyan. The trials were conducted at three sites located at Bordain, Dhagonbhuiyan, and Mohammed Ali Bazar.

The medium highland cropping systems site is managed by Sukhen Chandra Paul, Delowar Hossain, Md. Abdul Mannan and an expatriate agronomist.

CLIMATE

Information relating to temperature, rainfall and flooding depth at the Tetuaya site during the aus and aman seasons, and at the Dhorkora site during the rabi season is presented in the CLIMATIC DATA section at the beginning of this annual report.

SOCIO-ECONOMIC SURVEYS

A final economic survey was conducted at the Tetuaya site in October, 1986. A short informal "SONDEO" survey and a more formal baseline survey were conducted at the Dhorkora site in early 1987. The results of these surveys are given in the SOCIO-ECONOMIC RESEARCH section of this annual report.

CROPPING PATTERN MANAGEMENT AND PERFORMANCE

TABLES 1 to 6 present summaries of agronomic management practices and economic performances of crops during the aus and aman seasons, as obtained through the monitoring of farmers' fields in the Tetuaya area. Crops monitored were rice (*Oryza sativa*) and black sesame (*Sesamum indicum*). This is a continuation of monitoring that was initiated during the 1983 aus season.

There are two major cropping patterns: direct-seeded aus, transplanted aman, fallow; and direct-seeded aus, transplanted aman, rabi. Aus varieties are usually Chenal (Ikra), a local low yielding variety, and Purbachi, a higher yielding variety. Pajam is the main aman variety but other high yielding varieties (HYV's), particularly BR-11, are also grown.

Aus yields were lower this year than last year probably due to dry weather in May and early June. Rains continued until mid-October, about one month longer than in 1985. This was probably the primary cause of increased aman yields this year as compared with last year.

TABLE 1: Agronomic Management Priactices, Tetuaya, 1986 Aus season, Medium Highland

Crop	Chenal (Ikra)	Purbachi	Badali	IR 532
No. of fields	19	4	4	1
Field size				
Range (ha)	0.05-0.27	0.04-0.0.06	0.07-0.15	
Mean (ha)	0.14	0.05	0.11	0.05
No. of plowings	6	6	6	6
No. of ladderings	4	5	5	4
Weeding (Manhours/ha)	270	398 (3)[a/]	527	556
Planting date				
Range	7/4-6/5	6/4-16/5	7/4-18/4	
Mean	19/4	20/4	15/4	15/4
Harvest date				
Range	5/7-24/7	24/7-30/7	9/7-28/7	
Mean	13/7	28/7	17/7	30/7
Field days[b/]	85	99	93	106
Seed rate (kg/ha)	102	64	98	96
Organic fertilizer (t/ha)	3.6	2.8	3.0	2.3
Commercial fertilizer (kg/ha)				
Basal				
N	0	0	0	0
P_2O_5	0	0	0	0
K_2O	0	0	0	0
Topdress N	35 (1)	39 (4)	30 (3)	34 (1)
Total N	35 (1)	39 (4)	30 (3)	34 (1)
Yield (kg/ha)				
Range	1160-2098	2030-3340	1600-2170	
Mean	1640	2640	1840	3110

a/ number in ( ) refers to the number of fields treated; mean rates are averages only for those fields

b/ number of days from planting to harvest

TABLE 2: Agronomic Management Practices, Tetuaya, 1986 Aus Season, Highland

Crop	Chenal (Ikra)	Black Sesame	Aman Seedbed
No. of fields	2	2	6
Field size			
Range (ha)	0.02-0.05	0.05	0.02-0.05
Mean (ha)	0.04	0.05	0.04
No. of plowings	6	4	7
No. of ladderings	4	4	5
Weeding (Manhours/ha)	439	247 (1)[a/]	
Planting date			
Range	2/4-14/4	11/4-12/4	28/6-5/7
Mean	8/4	12/4	2/7
Harvest date			
Range	25/6-17/7	16/6-18/6	6/8-24/8
Mean	6/7	17/6	13/8
Field days[b/]	89	67	42
Seed rate (kg/ha)	100	14	484
Organic fertilizer (t/ha)	4.6	0	5.2 (2)
Commercial fertilizer (kg/ha)			
Basal			
N	0	0	0
P_2O_5	0	0	0
K_2O	0	0	0
Topdress N	17 (1)	0	28 (2)
Total N	17 (1)	0	28 (2)
Yield (kg/ha)			
Range	1110-1860	500-620	
Mean	1480	560	

a/ number in ( ) refers to the number of fields treated; mean rates are averages only for those fields

b/ number of days from planting to harvest

TABLE 3: Agronomic Management Practices, Tetuaya, 1986 Aman Season

Crop	Pajam	BR 11	BRC 16-127-4-3	Chenal (Ikra)[a/]
No. of Fields	20	10	1	3
Field size				
Range (ha)	0.04-0.27	0.05-0.19		0.02-0.05
Mean (ha)	0.11	0.12	0.06	0.04
No. of plowings	8	8	7	6
No. of ladderings	4	4	3	5
Weeding (Manhours/ha)	152 (9)[b/]	212 (10)	179 (1)	0
Transplanting date				
Range	3/8-29/8	24/7-17/8		12/7-27/8[c/]
Mean	15/8	4/8	22/8	2/8[c/]
Harvest date				
Range	20/11-30/11	20/11-4/12		28/9-8/11
Mean	22/11	28/11	24/11	16/10
Field days[d/]	100	116	95	75[e/]
Seed rate (kg/ha)	45	37	41	
Commercial fertilizer (kg/ha)				
Basal				
N	17 (3)	21 (2)	0	0
P_2O_5	34 (19)	35 (9)	0	0
K_2O	20 (18)	19 (9)	0	0
Topdress N				
TD_1	34 (20)	33 (10)	30	0
TD_2	32 (12)	36 (9)	45	0
TD_3	0	21 (5)	0	0
Total N	56	77	75	0
Yield (kg/ha)				
Range	3500-4700	3900-4820		1200-2240
Mean	4030	4410	4240	1610

a/ grown on highland plots for seed multiplication

b/ number in ( ) refers to the number of fields treated; mean rates are averages only for those fields

c/ planting date

d/ number of days from transplanting to harvest

e/ number of days from planting to harvest

TABLE 4: Economic Performance (Averages), Tetuaya, 1986 Aus Season, Medium Highland

Crop	Chenal (Ikra)	Purbachi	Badali	IR 532
No. of Fields	20	4	4	1
Labor Costs (Tk./ha)				
Land preparation-animal	1708	1456	1572	1372
Organic fert. application	228	115	243	103
Chemical fert. application	2	51	24	26
Seeding	25	380	29	51
Weeding	1412	1577	2476	2779
Pest control	0	0	0	0
Harvesting/threshing/drying and carrying	796	1198	869	1236
Total labor[a/]	4171	4777	5213	5567
Family[a/]	2505	3815	2852	2170
Hired	1666	962	2361	3397
Material Costs (Tk./ha)	1972	1941	2061	2265
Organic fertilizer	925	717	818	618
Commercial fertilizer	40	461	267	412
Seeds	1007	763	976	1235
Pesticides	0	0	0	0
Total Variable Costs[b/]	3638	2903	4422	5662
Product price (Tk./kg)	4.6	5.1	4.29	5
Yield (Kg/ha)	1652	2637	1839	3108
Gross revenue (Yield x Price)	7599	13449	7888	15540
Gross margin (GR-TVC)	3961	10546	3466	9878
Returns to TVC (GM/TVC)	1.09	3.63	0.78	1.75
Returns to hired labor (GM/N_H)	2.38	11.0	1.47	2.91
Returns to comm. fert. (GM/F_C)	99.03	22.9	12.98	23.98
Returns to animal labor (GM/A)	2.32	7.24	2.20	7.20

a/ assuming the family opportunity cost of labor is equal to the market wage rate

b/ hired labor plus material costs

TABLE 5: Economic Performance (Averages), Tetuaya, 1986 Aus Season, Highland

Crop	Chenal (Ikra)	Black Sesame
No. of fields	2	2
Labor costs (Tk/ha)		
Land preparation animal	1842	1115
Organic fert. application	258	0
Chemical fert. application	10	0
Seeding	65	51
Weeding	2471	824
Pest control	0	0
Harvesting/threshing/drying and carrying	1442	1647
Total labor[a/]	6088	3637
Family[a/]	3863	3224
Hired	2226	413
Material Costs (Tk./ha)	2296	174
Organic fertilizer	1112	0
Commercial fertilizer	103	0
Seeds	1081	174
Pesticides	0	0
Total Cariable Costs[b/]	4522	597
Product price (Tk./kg)	4.55	6.40
Yield (kg/ha)	1483	560
Gross revenue (Yield x Price)	6748	3584
Gross margin (GR-TVC)	2225	2987
Returns to TVC (GM/TVC)	0.49	5.00
Returns to hired labor (GM/N_H)	1.00	7.23
Returns to comm. fert. (GM/F_C)	21.61	
Returns to animal labor (GM/A)	1.21	2.68

a/ assuming the family opportunity cost of labor is equal to the market wage rate

b/ hired labor plus material costs

TABLE 6: Economic Performance (Averages), Tetuaya, 1986 Aman Season

Crop	Pajam	BR 11	BRC 16-127-4-3
No. of fields	20	10	1
Labor Costs (Tk./ha)			
Land preparation-animal	3527	3455	2822
Organic fert. application	16	195	309
Commercial fert. application	71	70	44
Transplanting	1052	1004	1500
Weeding	414	1284	882
Pest control	1	14	22
Harvesting/threshing, drying and carrying	1312	1530	1323
Total Labor[a/]	6394	7436	6902
Family[a/]	4070	4384	4058
Hired	2324	3052	2844
Material Costs (Tk./ha)	2017	3007	3140
Organic fertilizer	41	675	1588
Commercial fertilizer	1247	1522	882
Seeds	718	588	538
Pesticides	11	222	132
Total Variable Costs[b/]	4341	6059	5984
Product price (Tk./kg)	5.36	4.83	4.83
Yield (kg/ha)	4030	4410	4240
Gross revenue (Yield x Price)	21601	21300	20479
Gross margin (GR-TVC)	17260	15241	14495
Returns to TVC (GM/TVC)	3.98	2.52	2.42
Returns to hired labor (GM/N_H)	7.43	4.99	5.10
Returns to commercial fert. (GM/F_C)	13.84	10.01	16.43
Returns to animal labor (GM/A)	4.89	4.41	5.14

a/ assuming the family opportunity cost of labor is equal to the market wage rate

b/ hired labor plus material costs

DHORKORA SOIL ANALYSIS

Soil samples were collected from four medium highland fields (paddy land) and from four highland plots in the Dhorkora area. These samples were analyzed by the BARI soil science laboratory. The results (TABLE 7) indicate a low pH and organic matter content. The nutrient levels are also generally low with those of the medium highland fields in most cases lower than those of the highland plots.

TABLE 7: Dhorkora Analytical Data (Averages) of Soil Samples

	pH	Organic matter	Ca	Mg	K
		%	meq/100 ml		
Highland	5.6	1.6	2.6	1.5	0.4
Medium highland	5.5	1.5	1.5	0.7	0.3
Critical level			2.0	0.8	0.2

	NH_4-N	P	S	B	Cu	Fe	Mn	Zn
	Ug/ml							
Highland	Trace	29	27	1.9	3	175	8	1.3
Medium Highland	6.5	13	28	1.2	3	152	3	1.3
Critical level	75	14	14	0.2	1	10	5	2

ON-FARM TRIALS

Trials were conducted with rice (*Oryza sativa*) during the 1986 aus and aman seasons, either at the Tetuaya cropping systems site or at the multi-location testing sites. Trials were conducted with several rabi crops d during the 1986-87 rabi season at the Dhorkora cropping systems site and at the Bordain multi-location testing site. The following trials were conducted.

- Tetuaya aus variety trial
- MLT aus variety trial
- Tetuaya aman BRRI ALART trial
- Tetuaya aman variety trial
- Tetuaya mechanical weeder trial
- Tetuaya number of seedlings per hill trial
- Tetuaya early maturing variety trial
- Tetuaya Nitrogen fertilizer trial
- Dhorkora fertilizer response trials with five rabi crops
- Dhorkora sweet potato x fieldpea intercrop trial
- Dhorkora sweet potato variety trial
- Bordain winter vegetable observation trial

A brief discussion of each trial is presented below.

Tetuaya Aus Variety Trial

Several of the best performing aus (Oryza sativa) varieties of last year's ALART trial were tested at Tetuaya this year in a variety trial. Purbachi was included as a check variety. Observations were also taken of Purbachi in the farmers' fields where the trial was conducted.

BR 1 was included in this trial but the farmers destroyed the plots before maturity so the land could be prepared for Aman planting. BR 21 and IR 9708-51-1-2 performed very well as compared to Purbachi (TABLE 8). Both BR 21 and IR 9708-51-1-2 took significantly less time to mature than Purbachi. The farmers were most impressed by these two varieties commenting on their good yield and quick maturity. They also liked the long straw of BR 20 and BR 21.

MLT Aus Variety Trial

Some of the best performing aus (Oryza sativa) varieties of last year's ALART trial were tested in a multilocation variety trial at three sites. Purbachi in the farmers' fields was used as a check variety. At two sites the rice was transplanted into the trial plots. At one site it was direct-seeded either by broadcasting or by dibble planting.

At Bordain and Md. Ali Bazar the rice was transplanted. Purbachi had the highest yield and shortest time to maturity (TABLE 9 and 10). BR 21 also performed well in these two parameters but was taller at harvest than Purbachi. In a similar trial that was broadcast sown at the Tetuaya Cropping Systems site, BR 21 had a higher yield and shorter time to maturity than Purbachi. This suggests that BR 21 performs better than Purbachi when broadcast sown but not as well when transplanted.

At Dagonbhuiyan data was obtained from one replication that was dibble planted and one that was broadcast. Results for time to maturity and plant height at maturity are similar to the results at the other two sites (TABLE 11). Yield results are quite variable with BR 20, BR 21 and IR 50 generally, yielding the most. Note that dibble planting resulted in higher yields for those three varieties.

Tetuaya Aman BRRI ALART Trial

A BRRI Advanced Lines Adaptive Research Testing (ALART) aman (Oryza sativa) trial was conducted this year with eight advanced lines and two HYV checks, BR 10 and BR 11. The same lines tested last year were tested in this year's trial.

Like last year, yield differences this year were not significant (TABLE 12). BR 316-4-4-1 was again the earliest maturing line. This year it was also one of the highest yielding lines.

Tetuaya Aman Variety Trial

An aman (Oryza sativa) variety trial conducted during the aman season compared several advanced lines with Pajam and BR 11. Three replications were placed in Pajam fields and three in BR 11 fields.

BRC 16-127-4-3 has performed well in past MCC research trials. This year BRC 16-127-4-3 and BR 850-9-1-1 performed favorably as compared with the other varieties tested, being the highest yielding varieties (TABLES 13, 14, and 15). Time to maturity for BRC 16-127-4-3 was about the same as for BR 11. Most of the farmers commented favorably on this variety. Time to maturity for BR 850-9-1-1 was about the same as for Pajam (TABLE 13).

Tetuaya Mechanical Weeder Trial

A trial was conducted at Tetuaya to compare line-planted and mechanically weeded aman (Oryza sativa) with randomly planted aman that was weeded by hand. The mechanical weeder is primarily a labor saving device, but it may also encourage farmers to weed more often and thus increase rice yields by reducing competition with weeds. Use of the weeder requires rice to be transplanted in a line. Mechanical weeding increased the yield slightly but not significantly (TABLE 16).

Tetuaya Number of Aman Seedlings per Hill Trial

National research results have suggested that transplanting two seedlings per hill of aman (Oryza sativa) will give maximum yields. Six or more seedlings per hill are usually planted in the Tetuaya area. A trial was conducted with Pajam rice to determine the yields from different numbers of seedlings per hill.

There was no significant difference in yield between the farmers' treatment (7-10 seelings/hill) and the two seedling per hill treatment (TABLE 17). Economically, the two seedling per hill treatment was more profitable due to less cost for seedlings. The farmers and the research staff both noted that recently transplanted seedlings tended to stand erect better in deep water where there were more seedlings per hill. Rain and wind in November caused considerable lodging of aman rice around Tetuaya. The rice was more resistant to lodging where there were fewer seedlings per hill. This trial should be repeated with a popular HYV rice.

Tetuaya Early Maturing Aman Variety Trial

Rice farmers sometimes do not get their aman (Oryza sativa) planted on time. If it is planted late, the yield can be reduced by lack of moisture late in the season. One possible method of getting a timely yield that is not much reduced when one is forced to plant late is to plant a short duration rice. This idea was tested at Tetuaya by planting IR 50 in late-planted Pajam fields.

The IR 50 matured about 25 days earlier than the pajam. Since the small plots of IR 50 were the only plots that were mature, they suffered from damage by various animals. Estimates of the damage ranged from 20 to 80 percent. Therefore, yields cannot be compared. This trial may be repeated using an early maturing variety that is more nearly the same duration as Pajam.

Tetuaya Aman Nitrogen Fertilizer Trial

National research results suggest that it is better not to apply basal nitrogen fertilizer when transplanting aman (*Oryza sativa*) but to apply nitrogen later when the plants are better able to utilize it. This was tested at Tetuaya with the two most popular aman varieties grown in the area. No significant differences in yield were obtained (TABLE 18). Thus, due to the increased input cost, it is better not to apply basal nitrogen fertilizer.

TABLE 8: Tetuaya Aus Variety Trial

Planting date: 7-16/4/86
Harvest date: 23/7-5/8/86
Plot size-planted: 5m x 5m
harvested: $5m^2$
Seed rate: 78-84 kg/ha
Planting method: broadcast

Design: RCBD
Replications: 6
Fertilizer: farmer's choice
mean-50 kg N/ha
range-34-69 kg N/ha
organic-3.0-6.1 T/ha

Variety	Days to flower	Days to maturity	Plant ht.	Tillers/m^2	Yield
			cm	#	kg/ha
BR 21	86 b	107 cd	89 a	223	2400 a
Purbachi[a/]	87 b	110 ab	61 b	222	2150 ab
IR 9708-51-1-2	77 d	103 e	67 b	219	2070 ab
Purbachi	87 b	110 ab	58 b	210	2070 ab
IR 50	86 b	108 bc	53 b	214	1800 bc
BR 20	96 a	111 a	89 a	202	1660 c
IR 9729-67-3	80 c	106 d	63 b	213	1640 c
IR 9129-209-2-2-3[b/]	85	108	64	214	1670
Mean	86	108	68	215	1970
L.S.D. (0.05)	2.9	1.6	15.1	NS	377
C.V. (%)	3	1	7	6	16

a/ data are from the farmers' fields in which the trial was conducted
b/ data available from only two replications and not included in mean calculation or statistical analysis

TABLE 9: Bordain MLT Aus Variety Trial

Seedbed planting date: 21/4/86
Transplanting date: 9-15/5/86
Harvest date: 2-11/8/86
Plot size - planted: 5m x 5m
harvested: $5m^2$

Design: RCBD
Replications: 5
Fertilizer: farmer's choice

Variety	Days to flower	Days to maturity	Plant ht.	Tillers/m^2	Yield
			cm	#	kg/ha
Purbachi	55 c	79 c	79 c	284 c	3820 a
BR 21	58 b	81 b	96 b	321 bc	3620 a
IR 50	57 b	80 bc	70 d	399 a	3080 b
BR 20	67 a	90 a	111 a	284 c	3000 b
BR 1	68 a	90 a	68 d	350 ab	1780 c
Mean	61	84	85	328	3060
L.S.D. (0.05)	1.43	1.17	7.37	55.2	553
C.V. (%)	2	1	6	13	13

TABLE 10: Md. Ali Bazar MLT Aus Variety Trial

Seedbed planting date: 21/4/86
Transplanting date: 12-13/5/86
Harvest date: 30/7-12/8/86
Plot size - planted: 5m x 5m
harvested: $5m^2$

Design: RCBD
Replications: 3
Fertilizer: 10-10-13
Organic: 8.8-10.9 T/ha

Variety	Days to flower	Days to maturity	Plant ht.	Tillers/m^2	Yield
			cm	#	kg/ha
Purbachi	53 b	77 c	76 b	361 b	3770 a
BR 21	53 b	79 b	84 b	324 c	3170 b
IR 50	53 b	78 bc	62 c	398 a	2900 bc
BR 1	65 a	90 a	77 b	328 c	2870 bc
BR 20	64 a	89 a	96 a	257 d	2610 c
Mean	58	82	79	333	3060
L.S.D. (0.05)	3.49	1.19	10.43	32.9	428
C.V. (%)	3	1	7	5	7

TABLE 11: Dagonbhuiyan MLT Aus Variety Trial

Planting date: 13-15/4/86
Harvest date: 21/7-14/8/86
Planting method: Direct-seeded
Plot size - planted: 5m x 5m
harvested: $5m^2$

Design: RCBD
Replications -dibbled: 1
broadcast: 1
Fertilizer: farmer's choice

Variety	Seeding method	Days to flower	Days to maturity	Plant ht.	Tillers/m^2	Yield
				cm	#	kg/ha
BR 20	dibbled	86	119	109	329	3230
	broadcast	83	104	91	298	810
IR 50	dibbled	81	108	72	510	2420
	broadcast	78	100	69	336	1220
BR 21	dibbled	89	109	92	378	2010
	broadcast	80	101	94	365	1230
Purbachi	dibbled	77	105	71	475	1040
	broadcast	66	95	71	292	1630
BR 1	dibbled	96	119	71	435	1200
	broadcast	98				

TABLE 12: Tetuaya Aman BRRI ALART Trial

Seeding date: 3/7/86
Transplanting date: 11-24/8/86
Plot size - planted: 3 x 5m
harvested: $5m^2$
Spacing - row: 25 cm
plant: 15 cm

Design: RCBD
Replications: 2
Fertilizer: 26/26/26-60-40-17
N given at 0/10/30 DAT
Insecticide: 2.18 kg/ha
diazinon at 23-30 DAT

Genotype	Days to[a/] flower	Days to[a/] maturity	Plant height	Tillers per m^2	Yield
			cm	#	t/ha
BR 11	121	153	97	237	4.68
BR 316-4-4-1	112	133	106	284	4.64
BR 593-676-4-1-2	120	151	97	277	4.63
BRC 16-127-4-3	122	152	102	245	4.45
BR 850-9-1-1	118	149	114	270	4.40
BR 51-46-5-65	115	146	99	265	4.30
BR 57-74-6-1	126	154	104	262	4.28
BR 593-719-1-1-7	121	151	90	289	3.99
BR 539-17-4-3	129	159	112	271	3.50
BR 10	124	151	107	248	3.44
Mean			102	265	4.23
L.S.D. (0.05)					NS
C.V. (%)					9

a/ days after seedbed planting

TABLE 13: Tetuaya Aman Variety Trial with Pajam

Seedbed planting date: 3/7/86
Transplanting dates: 30/7-3/8/86
Plot size -- planted: 3m x 5m
harvested: $5m^2$
Spacing: Farmer's choice

Design: RCBD
Replications: 3
Fertilizer: Farmer's choice
mean: 77-23-15
N at 30-66 DAT

Variety	Days to[a/] flower	Days to[a/] maturity	Plant height	Tillers/m^2	Yield[b/]
			cm	#	kg/ha
BRC 16-127-4-3	84	113	97	204	4530 a
BR 850-9-1-1	80	107	104	214	4320 a
Pajam	76	105	109	222	4010 a
BR 51-46-5-C5	74	104	87	192	3650 ab
BR 14	72	94	86	213	2580 b
Mean	77	105	96	209	3820
L.S.D. (0.05)					1079
C.V. (%)					10

a/ calculated from the time of transplanting

b/ differences are significant at the 5 percent level

Calculations are based on 2 replications due to goat damage at maturity

TABLE 14: Tetuaya Aman Variety Trial with BR-11

Seedbed planting date: 3/7/86
Transplanting dates: 31/7-6/8/86
Plot size - planted: 3m x 5m
harvested: $5m^2$
Spacing: Farmer's choice

Design: RCBD
Replications: 3
Fertilizer: Farmer's choice
mean: 67-26-1[illegible]
N at 0-42 DAT

Variety	Days to[a/] flower	Days to[a/] maturity	Plant height	Tillers/m^2	Yield[b/]
			cm	#	kg/ha
BRC 16-127-4-3	89	120	98	227	4600
BR 850-9-1-1	82	107	109	204	4550
BR 11	87	120	92	248	4490
BR 51-46-5-C5	78	108	92	205	4270
BR 14	71	95	99	210	3540
Mean	82	110	98	219	4290
L.S.D. (0.05)					NS
C.V. (%)					9

a/ calculated from the time of transplanting

b/ differences are significant at the 10 percent level

TABLE 15: Tetuaya Yield of Five Replications of Aman Variety Trial

Variety	Yield
	kg/ha
BRC 16-127-4-3	4570 a
BR 850-9-1-1	4460 a
BR 51-46-5-C5	4020 b
BR 14	3160 c
Mean	4050
L.S.D. (0.05)	516
C.V. (%)	9

TABLE 16: Tetuaya Mechanical Weeder Trial

Transplanting date: 30/7-20/8/86
Plot size - planted: 3m x 12m
harvested: $5m^2$
Spacing - row: 20 cm
plant: 15 cm

Design: RCBD
Replications: 5
Fertilizer: Farmer's choice
Variety: Pajam

Planting Method	Weeding Method	Days to[a/] flower	Days to[a/] maturity	Plant height	Tillers/m^2	Yield
				cm	#	kg/ha
Random	hand	75	100	110	250	3850
Line	mechanical	75	100	107	238	4000
Mean		75	100	109	244	3930
L.S.D. (0.05)						NS
C.V. (%)						4

a/ calculated from the time of transplanting

TABLE 17: Tetuaya Number of Aman Seedlings per Hill Trial

Transplanting date: 28/7-10/8/86
Plot size - planted: 3m x 5m
harvested: $5m^2$
Spacing: Farmer's choice

Design: RCBD
Replications: 5
Fertilizer: Farmer's choice
Variety: Pajam

Seedlings per hill	Days to[a/] flower	Days to[a/] maturity	Plant height	Tillers/m^2	Yield
			cm	#	kg/ha
7-10	79	107	112 a	237 a	3790 a
2	82	107	109 ab	212 b	3750 a
1	83	107	106 b	194 c	3400 b
Mean	81	107	109	214	3650
L.S.D. (0.05)			3.47	16.2	283
C.V. (%)			2	5	5

a/ calculated from the time of transplanting

TABLE 18: Tetuaya Aman Nitrogen Fertilizer Trial

Transplanting dates: 28/7-24/8/86

Plot size - planted: 5m x 5m

harvested: $5m^2$

Spacing: Farmer's choice

Design: RCBD

Replications - BR 11: 5

Pajam: 5

Fertilizer: Farmer's choice except basal N

Variety	Basal nitrogen	Days to[a/] flower	Days to[a/] maturity	Plant height	Panicles/m^2	Yield
	kg/ha			cm	#	kg/ha
BR 11	30	82	115	91	257	4550
BR 11	0	82	115	90	256	4550
Mean		82	115	91	257	4550
Pajam	30	77	107	106	235	4140
Pajam	0	77	107	104	240	4060
Mean		77	107	105	237	4100
L.S.D. (0.05)						NS
C.V. (%)						5

a/ calculated from the time of transplanting

Dhorkora Fertilizer Response Trials with Five Rabi Crops

Fertilizer response trials of five rabi season crops were conducted at Dhorkora to determine which nutrients are most important for these crops. Wheat (*Triticum aestivum*), mustard (*Brassica* sp.), khesari (*Lathyrus sativus*) and lentil (*Lens esculenta*) are grown in the Dhorkora area. Fieldpea (*Pisum sativum*) is relatively unknown at Dhorkora but has been a fairly profitable crop for Tetuaya farmers. Fieldpea, wheat, and mustard were grown in fields share-cropped and managed by MCC. Mustard, khesari, and lentil were grown in farmer-managed fields.

Fieldpea - Yields were low due to warm weather and dry conditions late in the season. Differences in yield were highly significant (TABLE 19). The results indicate that fertilization with all three nutrients is important. Nitrogen is probably the most important followed by phosphorus. Marginal analysis (TABLE 20) shows similar rates of return for the two highest yielding treatments. Farmers expressed some interest in growing fieldpea in the future.

Wheat - Two varieties, Ananda and Sonalika, were grown in a split-block design. The results are given in TABLE 21 and 22. Yields were significantly reduced by the elimination of any one of the three nutrients given. Lack of added phosphorus resulted in the greatest reduction.

Mustard - Two varieties, Sampod and a local variety, were grown in a split-block design. The results are given in TABLE 23 and 24. The local variety was also grown in farmer managed fields and its results are given in TABLE 25 and 26. Past MCC trials have shown a response of mustard to N, P, and K fertilization, especially to N and P. Significant reductions in yield were caused by the elimination of any one of the three nutrients indicating that all are important in a fertilization plan for good mustard yields. The farmers in general seem to be aware of this but do not always have the money needed to buy fertilizer.

Khesari - Reductions in yield were caused by the elimination of any one of the three nutrients (TABLE 27). Phosphorus and potassium appear to be the most important nutrients for increasing yield. An economic analysis (TABLE 28) also indicates these two nutrients as being most important.

Lentil - Results are given in TABLES 29 and 30. Yields were reduced significantly by the elimination of phosphorus or potassium with the most reduction caused by the elimination of phosphorus.

TABLE 19: Dhorkora Fieldpea Fertilizer Response Trial

Planting dates: 4-10/12/86
Harvest dates: 2-4/3/87
Plot size - planted: 61.4 - 95.5m^2
- harvested: 5m^2
Seedrate: 100 kg/ha
Seeding method: broadcast

Design: RCBD
Replications: 6
Fertilizer: variable
Variety: Chomir Munshi-White

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plants/m^2	Yield
			cm	#	kg/ha
20-40-40	52	86	116 a	58	470 a
20-40-0	52	86	90 b	64	357 b
20-0-40	53	87	76 b	52	307 bc
0-40-40	54	87	79 b	55	250 c
Mean	53	86	90	57	355
L.S.D. (0.05)			16.6		84
C.V. (%)			15		19

TABLE 20: Dhorkora Marginal and Dominance Analysis of Fieldpea Fertilizer Response Trial

Fertilizer treatment		20-40-40	20-40-0	20-0-40	0-40-40[a/]
Gross return	(Tk./ha)	7562	5744	4940	4023
Variable costs	(Tk./ha)	1037	715	560	798
Gross margin	(Tk./ha)	6525	5029	4380	3225
Marginal gross margin	(Tk./ha)	1496	649		
Marginal variable costs	(Tk./ha)	322	155		
Marginal rate of return	(%)	465	419		
Average rate of return	(%)	450	419		

a/ this treatment is not included in marginal analysis due to dominance

TABLE 21: Dhorkora Wheat Fertilizer Response Trial

Planting dates: 4-10/12/86
Harvest dates: 9-22/3/87
Plot size - planted: 30.7-47.7m^2
- harvested: 5m^2
Seedrate: 140 kg/ha
Seeding method: broadcast

Design: Split-block
Replications: 6
Fertilizer: variable
N at 0 and 20 DAS

Fertilizer treatment	Variety	Days to flower	Days to maturity	Plant height	Plants/m^2	Yield[a/]
				cm	#	kg/ha
20/40-40-40	Ananda	52	98	80	120	1020
	Sonalika	51	98	78	108	860
	Mean					940 a
20/40-40-0	Ananda	54	98	62	90	540
	Sonalika	51	98	68	96	570
	Mean					550 b
0-40-40	Ananda	57	99	63	103	530
	Sonalika	53	98	71	88	520
	Mean					530 b
20/40-0-40	Ananda	57	99	58	72	410
	Sonalika	54	98	63	89	440
	Mean					430 b
Mean		54	98	68	95	610
L.S.D. (0.05)						183
C.V. (%)						24

a/ fertilizer effects are significant at the 1% level. Wheat variety and interaction effects are not significant.

TABLE 22: Dhorkora Marginal and Dominance Analysis of Wheat Fertilizer Response Trial

Fertilizer treatment		20/40-40-40	0-40-40	20/40-40-0[a/]	20/40-0-40[a/]
Gross return	(Tk./ha)	4531	2555	2651	2073
Variable costs	(Tk./ha)	1514	799	1192	1037
Gross margin	(Tk./ha)	3017	1756	1459	1036
Marginal gross margin	(Tk./ha)	1261			
Marginal variable costs	(Tk./ha)	715			
Marginal rate of return	(%)	176			

a/ these treatments are not included in marginal analysis due to dominance

TABLE 23: Dhorkora Mustard Fertilizer Response Trial

Planting dates: 4-10/12/86
Harvest dates: 8/2-2/3/87
Plot size - planted: 30.7-47.7m^2
- harvested: 5m^2
Seedrate: 12 kg/ha
Seeding method: broadcast

Design: Split-block
Replications: 6
Fertilizer: Variable
N at 0 and 20 DAS

Fertilizer treatment	Variety	Days to flower	Days to maturity	Plant height	Plants/m^2	Yield[a/]
				cm	#	kg/ha
20/40-40-40	Sampod	40	81	97	164	600
	Local	25	68	64	135	560
	Mean					580 a
20/40-40-0	Sampod	42	82	79	132	370
	Local	26	68	53	143	400
	Mean					380 b
0-40-40	Sampod	45	81	66	127	300
	Local	26	69	43	125	370
	Mean					340 b
20/40-0-40	Sampod	49	83	22	39	80
	Local	30	69	18	46	100
	Mean					90 c
Mean		35	75	55	114	350
L.S.D. (0.05)						110
C.V. (%)						25

a/ fertilizer effects are significant at the 1% level. Mustard variety and interaction effects are not significant

TABLE 24: Dhorkora Marginal and Dominance Analysis of Mustard Fertilizer Response Trial

Fertilizer treatment		20/40-40-40	20/40-40-0	0-40-40	20/40-0-40
Gross return	(Tk./ha)	6218	4074	3645	965
Variable costs	(Tk./ha)	1514	1192	799	1037
Gross margin	(Tk./ha)	4704	2882	2846	
Marginal gross margin	(Tk./ha)	1822	36		
Marginal variable costs	(Tk./ha)	322	393		
Marginal rate of return	(%)	566	9		
Average rate of return	(%)	260	9		

TABLE 25: Dhorkora Local Mustard Fertilizer Response Trial

Planting dates: 27/11-8/12/86
Harvest dates: 8-13/2/87
Plot size - planted: 5m x 5m
- harvested: $5m^2$
Seedrate: 11-17 kg/ha
Seeding method: broadcast

Design: RCBD
Replications: 5
Variety: Local
Fertilizer: Variable
N at 0 and 20 DAS

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plants/m^2	Yield
			cm	#	kg/ha
30/30-60-40	23	66	62 a	175	612 a
Farmers' treatment[a/]	25	69	53 ab	189	496 ab
0-60-40	24	68	48 bc	233	408 bc
30/30-60-0	25	69	44 bc	160	356 bc
30/30-0-40	25	69	38 c	176	284 c
Mean	24	68	49	186	431
L.S.D. (0.05)			10.4		182
C.V. (%)			16		31

a/ farmers' treatments were variable with an average of 32-41-7

TABLE 26: Dhorkora Marginal and Dominance Analysis of Local Mustard Fertilizer Response Trial

Fertilizer treatment		30/30-60-40	0-60-40	30/30-60-0[a/]	30/30-0-40[a/]
Gross return	(Tk./ha)	6426	4284	3738	2982
Variable costs	(Tk./ha)	1760	1040	1440	1040
Gross margin	(Tk./ha)	4666	3244	2298	1942
Marginal gross margin	(Tk./ha)	1422			
Marginal variable costs	(Tk./ha)	720			
Marginal rate of return	(%)	198			

a/ these treatments are not included in marginal analysis due to dominance

TABLE 27: Dhorkora Khesari Fertilizer Response Trial

Planting dates: 8-12/12/86
Harvest dates: 21-24/3/87
Plot size - planted: 5m x 5m
harvested: $5m^2$
Seedrate: 57-65 kg/ha
Seeding method: broadcast

Design: RCBD
Replications: 3
Variety: local
Fertilizer: variable

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plants/m^2	Yield
			cm	#	kg/ha
20-40-40	73	103	41 a	59	1660 a
0-40-40	74	103	38 ab	57	1460 a
20-40-0	74	103	35 bc	58	1220 b
20-0-40	74	103	31 c	58	1110 b
Farmers' treatment[a/]	74	103	33 bc	61	1110 b
Mean	74	103	36	59	1310
L.S.D. (0.05)			5.2		203
C.V. (%)			8		8

a/ farmers' treatments were variable with an average of 3-19-0

TABLE 28: Dhorkora Marginal and Dominance Analysis of Khesari Fertilizer Response Trial

Fertilizer treatment		20-40-40	0-40-40	20-40-0	20-0-40
Gross return	(Tk./ha)	13280	11680	9760	8880
Variable costs	(Tk./ha)	1040	800	720	560
Gross margin	(Tk./ha)	12240	10880	9040	8320
Marginal gross margin	(Tk./ha)	1360	1840	720	
Marginal variable costs	(Tk./ha)	240	80	160	
Marginal rate of return	(%)	567	2300	450	
Average rate of return	(%)	817	1067	450	

TABLE 29: Dhorkora Lentil Fertilizer Response Trial

Planting dates: 1-18/12/86
Harvest dates: 25/2-9/3/87
Plot size - planted: 5m x 5m
harvested: $5m^2$
Seedrate: 38-57 kg/ha
Seeding method: broadcast

Design: RCBD
Replications: 6
Variety: local
Fertilizer: variable

Fertilizer treatment	Days to flower	Days to maturity	Plant height	Plants/m^2	Yield
			cm	#	kg/ha
20-40-40	50	86	27	159	757 a
Farmers' treatment[a/]	50	86	25	174	627 ab
0-40-40	50	86	26	161	613 ab
20-40-0	50	86	25	155	563 bc
20-0-40	50	86	24	147	443 c
Mean	50	86	25	159	601
L.S.D. (0.05)			NS		164
C.V. (%)			12		23

a/ farmers' treatments were variable with an average of 5-11-7

TABLE 30: Dhorkora Marginal and Dominance Analysis of Lentil Fertilizer Response Trial

Fertilizer treatment		20-40-40	0-40-40	20-40-0	20-0-40
Gross return	(Tk./ha)	10598	8582	7882	6202
Variable costs	(Tk./ha)	1040	800	720	560
Gross margin	(Tk./ha)	9558	7782	7162	5642
Marginal gross margin	(Tk./ha)	1776	620	1520	
Marginal variable costs	(Tk./ha)	240	240	160	
Marginal rate of return	(%)	740	258	950	
Average rate of return	(%)	812	892	950	

Dhorkora Sweet Potato X Fieldpea Intercrop Trial

Returns from sweet potato (*Ipomoea batatas*) fields could theoretically be increased by growing a short duration crop between the sweet potato rows while the sweet potato vines are small. This was tried last year at Tetuaya with garden pea (*Pisum sativum*). This year the trial was repeated at Dhorkora with fieldpea (*Pisum sativum*).

All parameters measured indicated that the performance of sweet potato was significantly reduced by the intercropped fieldpea (TABLE 31). This is in contrast to last year's results where intercropped garden pea did not significantly reduce the yield of sweet potato. Fieldpea yield was variable with most intercropped plots yielding the same as or more than the non-intercropped plots. This was due to early dying of the non-intercropped plants. A possible cause of this early dying is a more rapid evaporation of moisture from the ground not covered by sweet potato vines. An economic analysis (TABLE 32).indicates that the intercrop should be an attractive alternative to growing only sweet potato. The farmers were divided in their opinion of the intercrop. Some favored only sweet potato and others expressed an interest in the intercrop.

TABLE 31: Dhorkora Sweet Potato X Fieldpea Intercrop Trial

Planting date: 26/11-9/12/86 Design: RCBD

Plot size - planted: $17.5m^2$ - $25m^2$ Replications: 6

harvested: $3.5m^2$ - $5m^2$ Fertilizer: farmers' choice

Spacing - row: 35 cm (pea) 70 to 91 cm (sweet potato and intercropped pea)

plant: 10 cm (pea) 27 to 35 cm (sweet potato)

Crop	Days to flower	Days to maturity	Plant height	Pods per plant	Yield
			cm	#	kg/ha
Fieldpea	53	90	100	9.9	690
Fieldpea (intercropped)	54	91	91	9.8	820
Mean	54	91	95	9.9	760
L.S.D.(0.05)			NS	NS	NS
C.V.(%)			14	14	32

Crop	Days to harvest	Plant height	Tubers per hill	Tuber weight	Yield
		cm	#	kg	kg/ha
Sweet Potato	128	80 a	4.7 a	0.098 a	9610 a
Sweet Potato (intercropped)	128	74 b	3.8 b	0.083 b	7050 b
Mean	128	77	4.2	0.091	8340
L.S.D.(0.05)		1.95	0.55	0.010	1207
C.V. (%)		2	9	7	10

TABLE 32: Dhorkora Marginal and Dominance Analysis of Sweet Potato X Fieldpea Intercrop Trial

Treatment		Intercrop	Sweet potato	Fieldpea[a/]
Gross return	(Tk./ha)	28351	20662	11102
Variable costs	(Tk./ha)	4650	4188	4500
Gross margin	(Tk./ha)	23701	16474	6602
Marginal gross margin	(Tk./ha)	7227		
Marginal variable costs	(Tk./ha)	462		
Marginal rate of return	(%)	1564		

a/ this treatment is not included in marginal analysis due to dominance

Dhorkora Sweet Potato Variety Trial

The sweet potato (*Ipomoea batatas*) varieties, Tinirining and Cinjhi, have often performed better than local varieties in past MCC trials and they have an acceptable flavor. These two varieties were compared with the local variety at Dhorkora in a variety trial.

Tinirining and Cinjhi yielded a little better than the local variety but the differences were not significant (TABLE 33). The farmers at Dhorkora preferred Tinirining over Cinjhi saying that it was more suitable for the market.

TABLE 33: Dhorkora Sweet Potato Variety Trial

Planting dates: 22-27/11/86
Harvest dates: 1-23/4/87
Plot size - planted: 1.5m x 5m
harvested: 0.75m x 5m
Spacing - row: 70-85 cm
plant: 22-36 cm

Design: RCBD
Replications: 4
Fertilizer: farmers' choice with a mean of 5-23-0 plus 7.5 tonnes/ha organic

Variety	Plant height	Tubers per hill	Tuber weight	Yield
	cm	#	kg	kg/ha
Cinjhi	78	3.4	0.14	15100
Tinirining	88	4.3	0.12	14900
Local	86	3.6	0.13	11800
Mean	84	3.8	0.13	13900
L.S.D.(0.05)	NS	NS	NS	NS
C.V. (%)	7	22	12	19

Bordain Winter Vegetable Observation Trial

Plants or seed of three vegetables (tomato, *Lycopersicon esculentum*; green bean, *Phaseolus vulgaris*; garden pea, *Pisum sativum*) were given to farmers to determine performance, acceptability, and economic returns. The tomato variety, K-7, performed very well in last year's tomato variety trial showing bacterial wilt resistance. Another tomato variety, Manik, is a new variety that is also bacterial wilt resistant. Plants of these two varieties were given to four farmers to plant along with the popular variety, Roma VF. Two farmers were given seed of green bean variety, June Green, and garden pea variety, Green Feast.

The tomato varieties, K-7 and Manik, were affected by a disease (probably late blight) which ruined the fruit for market. Roma VF was not affected. For this reason the farmers were not interested in saving seed of K-7 and Manik. The green bean and garden pea generally performed well and the farmers saved some seed. No beans or peas were sold so economic returns could not be determined.

Comparative Socio-Economic Study of Four Mennonite Central Committee Research Sites in Noakhali and Comilla Districts

(a) Introduction

Mennonite Central Committee (MCC) has cropping systems research sites in Noakhali, Comilla, and Feni Districts. In this paper we will compare and contrast different characteristics found at four of these sites. We are primarily interested in looking at socio-economic characteristics at these sites although we shall also look at cropping patterns. Through a better understanding of the socio-economic status of farms in these areas, it is hoped that appropriate technologies can be developed which will benefit MCC's target group; the rural poor. After discussing methodology, in section (c) we will briefly look at the cropping patterns found in each of the areas, then in section (d) we shall discuss socio-economic classification, class distribution, socio-economic characteristics and then finally non-farm employment and land rental arrangements.

(b) Methodology

MCC operates research sites in the following areas;

(i) Dhorkora Bazar, Chouddagram Upazila, Comilla District;
(ii) Chitosi Station, Laksham Upazila, Comilla District;
(iii) Char Bhatirtek, Sudharam Upazila, Noakhali District.

Further, MCC has recently closed a research site in;

(iv) Tetuaya village, Nangolkot Upazila, Comilla District.

Surveys were conducted at all four sites between January 1986 and June 1987 using the cluster sample method. Respondents were asked a series of questions relating to cropping pattern, family size, livestock, and land holdings.

(c) Location of Sites and Cropping Patterns

(i) Medium Highland Sites

Both Tetuaya village and Dhorkora Bazar are located in medium highland land-type areas where maximum flooding is 80 cm. Tetuaya village is located some 2 km from Nangolkot; the closest Bazar, and is located 15 km south-west of Chouddagram. Dhorkora Bazar is approximately 5 km west of the Chittagong - Dhaka highway, and is more accessible than Tetuaya.

The cropping patterns at these two sites is similar. The predominant pattern on the medium-highland fields is; aus - transplanted aman - rabi. The aus varieties grown in both sites include Chenal and Purbaci, while the aman varieties includes BR-11 and Pajam. Rabi season crops include: wheat, sweet potato, field pea, khesari, blackgram, mustard, field pea, lentil, and groundnut. In the aus and aman seasons close to 100 percent of the land is used. In Tetuaya village for the 1985-86 rabi season, 90% of farmers cultivated crops on an average of 50% of their land holdings. In Dhorkora Bazar, up to 70 percent of the land was used for rabi season cultivation in 1986-87.

The highland areas at these two sites follow a cropping pattern of the following; aman seedbed (or aus cultivation) - aus seed multiplication (or transplanted aman) - rabi (sweet potato, tomato, chilli, black sesame, egg plant, mungbean, lentil, radish).

(ii) Medium Lowland Site

Chitosi Station is a bazar on the Chandpur rail line and is located in a medium-lowland area (maximum flooding depth 1.75 m). Chitosi Station is some 14 km west of Laksham. The predominant cropping pattern is; mixed aus/aman - fallow. This cropping pattern is followed on approximately 60 percent of the land area. Up to 100 percent of the land is used for aman cultivation. Only local rice varieties are used. Aus varieties include Fitta and Boilam, while aman varieties include Keora, Gorcha, Kali Gorcha, and Hylgada. Approximately 60 percent of land in the area remains fallow in the rabi season. Rabi season crops include; wheat, mustard, mungbean, khesari, lentil and linseed.

(iii) Char Site

Char Bhatirtek is located just south of Choumahani Bazaar, and approximately 10 km south of Sonapur. It is located in the newly formed Noakhali char, and the soil is characterized by moderate to strong salinity. The predominant cropping pattern in the area is; transplanted aman-fallow. Aus(Boilam and IR8) is grown on approximately 10 percent of the fields. Aman(Rajasail, Karjasail, BR-11) is grown on close to 100 percent

of the land. Rabi season cultivation is restricted to approximately 30 percent of the land area and includes: khesari, chilli, and sweet potato.

Clearly the medium-highland cropping patterns are the most intensive; much of the land is triple cropped. This is contrasted to Chitosi Station and Char Bhatirtek which are principally double and single cropped, respectively. One would then expect that from the same parcel of land, a farm family, for example at Dhorkora Bazar could achieve a higher economic status than one at Char Bhatirtek. This hypothesis will be tested in the proceeding section.

(d) Socio-Economic Characteristics

(i) Economic Status

Traditionally, economic status of farms has been defined by farm size. For this paper we will define economic status based on another variable: Rice Provision Ability (RPA). RPA measures the number of months in one year that the farm's total cultivated land can provide rice for that family. For instance, a rice surplus farm is one where 12 or more months per year of the families rice requirements are provided from their total cultivated land. Rice deficit farms range from 3 to 11 months of the family's rice requirements met by total cultivated land. Landless respondents are defined as those who have no cultivated land, up to and including those that can provide 2 months of their family's rice requirements per year from their cultivated land.

MCC works in several areas where the productivity of the land can vary significantly, so it was decided RPA was a more effective way of defining economic status than farm size. Defining economic status using RPA also takes into account family size: given a parcel of land a family could be either rice deficit or surplus depending on the size of that family. MCC's target group is the poor - the landless and rice deficit rural households.[1]

1 One limitation of RPA is it does not take into account non-farm income. MCC is concerned with rice deficit farmers who are both unskilled (in another area) and lack capital resources.

RPA is an approximation of the true Food Provision Ability (FPA) of a farm. Ideally, we would like to include all sources of farm income: income from non-rice crops, livestock, homesite gardening, etc. Arguably RPA is a good approximation of FPA as rice is a major staple in Bangladeshis' diet. Furthermore, it is interesting to note that, in general, farmers are quite aware of their farm's RPA. Arguably, RPA is a superior way of defining economic status versus farm size, especially when making inter-regional comparisons.

In an attempt to evaluate how well RPA was explained by cultivated land and family size, several regressions were run. Three regressions are listed in TABLE 1 below for Tetuaya village, Dhorkora Bazar and Chitosi Station (this data was not available for the Char site).

TABLE 1: Regressions with RPA

Site	Regression Equation	R^2	$\bar{R}^2$	Standard error	F	Accepted at 99% level	Accepted at 99% level
Tetuaya[a/]	$Y = 7.15 + 11.02X_1 - 0.65X_2$ (1.26)(1.22) (0.21)	0.65	0.64	4.03	54.02	Yes	Yes
Dhorkora	$Y = 2.25 + 0.06X_1$ (0.51) (0.003)	0.84	0.83	3.42	360.3	Yes	Yes
Chitosi	$Y = 0.96 + 0.02X_1$ (0.25) (0.002)	0.67	0.66	1.79	155.2	Yes	Yes

X_1 = Cultivated Land Y = RPA

X_2 = Family Size

a/ Does not include landless data

In all three areas, there is a strong relationship between RPA and landholdings. Holding other variables constant, the larger the farm landholding the more rice that can be provided. In only one equation (for Tetuaya) was the family variable significant. In this case, as family size increases, holding other variables constant, RPA declines. All equations were accepted at the 95

and 99 percent levels. R^2s were quite high, ranging from 65 percent to 84 percent. This means that between 65 and 84 percent of the variation in the dependent variable is explained by the independent variable(s).

(ii) Economic Status by Village

In this section we will briefly look at the economic status of farms at our different sites. We shall also look at economic status of different villages within our research areas. TABLE 2 below lists our different research sites and the associated numbers (and percentages) of landless, rice deficit, and rice surplus farms. Also, within three of the sites, two different villages were sampled.

TABLE 2: Farm Economic Status at Four MCC Cropping Systems Research Sites

Research Site village	n	Landless #	Landless %	Rice Deficit #	Rice Deficit %	Rice Surplus #	Rice Surplus %
Tetuaya Village	61	14	23	26	43	21	34
Dhorkora Bazar	73	24	32	25	35	24	33
- Dhorkora Village	35	4	11	18	51	13	38
- Shaktola Village	38	20	53	7	18	11	29
Chitosi Station	79	48	61	28	35	3	4
- Razapur Village	41	23	56	17	41	1	3
- Jonadonpur Village	38	25	66	11	29	2	5
Char	102	13	13	60	59	29	28
- Char Bhatirtek	51	7	14	30	59	14	27
- Char Dharmapur	51	6	12	30	59	15	29
Total	315	99	32	139	44	77	24

As can be seen in the table above, 23 percent of Tetuaya respondents are landless, 43 percent are rice deficit, and 34 percent are rice surplus. In Dhorkora Bazar the distribution between

classes is equally split: 32 percent landless, 35 percent rice deficit, and 33 percent rice surplus. At Chitosi Station there is a large percentage of landless respondents (61 percent), and very few rice surplus farms (4 percent). At the Char site there is a large percentage of rice deficit farms (59 percent), followed by rice surplus farms (28 percent), and then landless (13 percent). In total there is a relatively even distribution among classes: 32 percent landless, 44 percent rice deficit, 24 percent rice surplus.

Now let us look at economic status of different villages within the different research areas. These villages are either right next to each other or within 5 km of each other, as in the case of Chitosi Station. Looking first at Dhorkora Bazar, two villages were sampled: Dhorkora village, and Shaktola village. In this case each village has a similar proportion of rice surplus farms, but whereas Shaktola village has 53 percent landless, Dhorkora village has 51 percent rice deficit farms.

Looking at Chitosi Station, Jonadanpur village has 10 percent more landless respondents, while Razapur village has 12 percent more rice deficit farms. Both villages had a small proportion of rice surplus farms. In the Char, both Char Bhatirtek village, and Char Dharmapur village have similar proportions of all groups.

Two points come to mind from this information. One, MCC should attempt to locate it's research near villages that contain it's target group. Two, if MCC does want to work with the rural poor, then there is a need to do research with the rural landless (comprising 32 percent of the combined sites' populations).

(iii) Socio-Economic Characteristics

In this section we will look at basic socio-economic characteristics at the four sites. We shall look at family size, land and livestock holdings. For Dhorkora Bazar, and Chitosi Station there is also data related to percentage of income from different sources (TABLE 3). In general there is a positive relationship between RPA and family size (and livestock and landholdings). That is, rice surplus farms tend to be characterized by larger families and more assets than rice deficit farms. This applies also between rice deficit farms and the landless.

Table 5: Socio-Economic Characteristics at Four MCC Cropping Systems Research Sites

	Landless					Rice Deficit					Rice Surplus				
	Tetu-aya	Dhor-kora	Chi-tosi	Char	Ave-rage	Tetu-aya	Dhor-kora	Chi-tosi	Char	Ave-rage	Tetu-aya	Dhor-kora	Chi-tosi	Char	Ave-rage
Total Family	5.6	6.0	6.5	4.7	5.7	6.9	6.6	6.9	7.4	7.0	8.8	6.8	8.3	7.1	7.8
Males	1.5	1.1	1.6	1.4	1.4	1.7	1.8	1.7	2.4	1.9	2.6	2.0	2.3	2.4	2.3
Females	1.2	1.5	1.8	1.1	1.4	1.7	1.6	1.7	1.9	1.7	2.1	1.9	2.0	1.7	1.9
Children	2.9	3.2	3.1	2.2	2.9	3.5	3.2	3.4	3.2	3.3	4.0	2.9	4.0	3.0	3.5
Water Buffalo	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0.2	0.1
Bullock	0	0	0.2	0	0.1	0.04	0.2	0.5	0.6	0.3	1.0	1.0	1.0	1.5	1.1
Cow	0.07	0.08	0.3	0.3	0.2	0.9	0.5	0.6	0.5	0.6	1.6	0.8	1.7	0.9	1.3
Calf	0.1	0.4	0.3	N/A[c]	0.3	0.6	0.5	0.8	N/A[c]	0.6	1.0	0.7	1.7	N/A[c]	1.1
Goat	0.4	0.3	0.5	1.5	0.7	0.7	0.4	0.5	0.8	0.6	1.2	1.2	0	2.4	1.2
Chicken	5.9	3.1	2.9	12.4[a]	6.1	8.5	4.0	4.9	20.5[a]	9.5	1.2	1.2	0	2.4[a]	1.2
Duck	1.7	0.5	2.0	4.2	2.1	3.5	1.0	2.8	6.7	3.5	4.9	2.4	2.3	10.0	4.9
Pigeon	N/A	0.2	1.1	N/A	0.7	N/A	0.3	1.6	N/A	1.0	N/A	1.1	1.3	N/A	1.2
Owned land (decimals)	12.4	3.3	21.6	18.9	14.1	82.5	44.7	149.3	139.4	104.0	333.5	250.4	268.3	344.5	299.2
Rented land	2.4	1.3	0.2	78.2	20.5	31.1	12.7	15.5	179.9	59.8	24.8	19.3	120	297.3	93.3
Total Cultivated	14.8	4.6	21.8	97.1	34.6	113.6	57.4	164.8	319.3	163.8	308.7	231.1	388.3	641.8	392.5
Homestead	9.9	7.5	12.8	16.5	11.7	14.8	11.8	22.4	44.7	23.4	29.6	16.3	14.7	67.2	32.0
Puker	2.5	1.6	3.4	N/A	2.5	2.5	5.3	20.0	N/A	9.3	9.9	13.5	7.7	N/A	10.4
Lungi	N/A	2	2.9	N/A	2.5	N/A	2.7	3.1	N/A	2.9	N/A	2.8	6.3	N/A	4.6
Sari	N/A	2.3	3.3	N/A	2.8	N/A	3.4	3.2	N/A	3.3	N/A	4.5	7.0	N/A	5.8
RPA(x/12)	0.1	0.5	0.6	0-12[b]	0.4	6.6	6.0	5.1	0-12[b]	5.9	15.7	18.8	12.3	12[b]	15.6
% Inc-crop	N/A	4	7	N/A	5.5	N/A	43	39	N/A	41	N/A	66	30	N/A	48
% Inc-Farm	N/A	9	5	N/A	7.0	N/A	11	7	N/A	9	N/A	16	5	N/A	10
% Inc-Non F.	N/A	87	88	N/A	87.8	N/A	46	54	N/A	50	N/A	18	65	N/A	42

a/ this data includes chicks b/ specific data unavailable for char c/ N/A indicates that data was not available

As we can see in TABLE 3, landless and rice deficit farms do hold livestock assets: cows, goats, chickens, ducks, and pigeons. Therefore research into improved livestock and poultry management could prove beneficial for these groups.

Let us now look at landholdings. As can be seen in TABLE 3, there is a positive relationship between RPA and owned land (and total cultivated land). There is also a positive relationship between RPA and rented land for Chitosi Station and the Char, however, both Dhorkora and Tetuaya rice surplus farmers, on average, rent out land. Please note the large average land rental at Char Bhatirtek by all groups.

Now let us look at average RPA associated with each group. We see that on average, the landless are able to obtain 0.4 months/year of their rice requirements from their total cultivated land. The comparable figure for rice deficit and rice surplus farms is 5.9 months/year and 15.6 months/year respectively (this specific data was not available for the Char site).

The hypothesis suggested in section (c) above was that given a certain parcel of land in all four areas, families of the same size will have a higher economic status in Dhorkora and Tetuaya than in Chitosi or the Char site. If we now refer to TABLE 4 below we see that this hypothesis appears to be supported. Dhorkora Bazar consistently has lower levels of cultivated land, but has higher (or as high) levels of RPA. Tetuaya cultivated holdings tend to be somewhat larger and are associated with lower levels of RPA. Chitosi Station cultivated holdings are the highest and tend to be associated with the lowest levels of RPA.

Since MCC's target group, often, will include rice deficit farms it is of interest to find the line between these farms and rice surplus farms. This would be the upper boundary of farms within MCC's target group. At Tetuaya village this line would be somewhere between 1 and 3 acres, at Dhorkora Bazar it would be between 0.5 and 2 acres, while at Chitosi Station it would be between 1.5 and 4 acres. Farms with greater landholdings than these will possibly be self-sufficient and outside of MCC's target group.

TABLE 4: Cultivated Land and Associated Rice Provision Ability (RPA) at Three MCC Cropping Systems Research Sites

Group	Site	Total cultivated land decimals	RPA
Landless	Tetuaya	14.8	0.1
	Dhorkora	4.6	0.5
	Chitosi	21.8	0.6
Rice Deficit	Tetuaya	113.6	6.6
	Dhorkora	57.4	6.0
	Chitosi	164.8	5.1
Rice Surplus	Tetuaya	308.7	15.7
	Dhorkora	231.1	18.8
	Chitosi	388.3	12.3

Turning back to TABLE 3, let us look at the last 3 rows. Respondents at Dhorkora Bazar and Chitosi Station were asked to approximate the proportion of their income which comes from the following; (i) crop sources, (ii) other farm sources (including livestock, fish cultivation, homestead gardening, fruit and spice trees), and (iii) non-farm sources (this includes wage labour). This question was in general difficult for respondents to answer, so the results should be treated tentatively. However we can see similar figures for both landless and rice deficit farms at each site. The landless in both areas indicated that close to 90 percent of their income comes from non-farm sources, while rice deficit farms in general received 40 percent of their income from crop sources, 10 percent from other farm sources, and 50 percent from non-farm sources. Rice surplus farmers at Dhorkora indicated they received approximately two-thirds of their income from crop sources, while Chitosi rice surplus farmers indicated two-thirds of their income was from non-farm sources.

(iv) Land Rental Arrangements and Non-Farm Employment

Finally let us look at both land rental arrangements and non-farm employment in the different areas. In Tetuaya village the predominant rental arrangement is cash rent and and Khaikhalashi,[2] while non-farm occupations include wage labour, petty trading and professionals. In Dhorkora Bazar the rental arrangements included sharecropping, Bondhak[3], and cash rent, while non-farm employment included wage labour, professional, petty trading and working outside of Bangladesh.

The rental arrangements at Chitosi Station included sharecropping, Bondhak and cash rent, while non-farm employment included wage labour, rural works rickshaw pulling and petty trading. At the char site the predominant rental arrangement was sharecropping, although some Bondhak is also followed. Non-farm employment in the char includes wage labour, rural works, fishing and pulling rickshaw. In both the char and Chitosi areas, a significant proprotion of the population goes outside the area during the off-season (after the aman harvest) to find employment.

(e) Conclusion

In this paper we have looked at different characteristics of farms in four areas in an attempt to evaluate their economic status. It has been argued that cropping pattern, cultivated land size, and family size go far in explaining the economic status of farms. RPA has been used to define economic status instead of farm size since, arguably, it is a more inclusive measure.

As expected it was found that as economic status improves (as defined by RPA), so does the ownership of physical assets (land and livestock). It is interesting to note that the economic status between villages, and between areas (land types), varies substantially. The former

2 a form of land rental

3 a form of land mortgage

parity is difficult to explain, but the later disparity is, in t, explained by land productivity. The medium-highland cropping terns are more intensive than those associated with the medium-land or char sites. This means that increasingly larger farm sizes required to make a farm self sufficient in the medium-lowland and r areas versus the medium-highland area.

target group includes the rural landless, and at the different as can include farms up to the following size: Tetuaya village o 3 acres, Dhorkora Bazar 0.5 to 2 acres, and Chitosi Station 1.5 4 acres. Of course if the family with this size land ownership is olved in skilled or professional employment and/or if they have nificant capital assets, then they may not be within our target up.

rmers' Adoption of New Technologies at Tetuaya Cropping Systems Research te, Nangolkot Upazila, Comilla District

) Introduction

This paper evaluates to what extent new agronomic practices tested by MCC were adopted by farmers in Tetuaya village, where one of Mennonite Central Committee's (MCC) Cropping System Research Sites (CSRS) was formerly located. Specifically we are interested in practices that proved profitable to the farmer. We shall also look at the distributional question of who has benefitted from MCC's research.

No initial benchmark survey was conducted in Tetuaya village other than an informal Sondeo. Thus, quantification of changes in farm income were not possible, and only a qualitative survey could be done. The survey contained questions pertaining to the basic socio-economic status of the respondent, such as family size, land and livestock holdings. Respondents were asked to recall cropping patterns and fertilizer methods for the previous three years, and whether changes in cropping patterns and/or fertilizer methods indicated in the survey had changed their economic status. Finally, respondents were asked to reveal the origin of the new practice. The survey was completed by 61 respondents which is the household head population of Tetuaya, less those who live there but work full time elsewhere.

In section b we shall discuss the variable used in this study to measure socio-economic status. In section c we shall discuss socio-economic status in Tetuaya village, and in section d we shall look at MCC's impact in the area.

) Socio-Economic Status and Farm Size

MCC Bangladesh has a commitment to working with the very poor. MCC's Agriculture Research Program has recently reaffirmed it's commitment to working with small farmers. The question we want to look at here is, who are the poor? In this section we will attempt to classify farm size in order to better describe our target group.

Before proceeding one point should be clarified. In this paper, we will not be concerned with peoples' socio-economic status in

absolute terms. We will not try to determine if different group's nutritional, caloric, or income requirements are being met. We will argue that, excluding the rural landless, small farms are the most disadvantaged rural residents relative to medium and large farms. We shall assume in this paper that, in general, small farms are unable to provide for their families' basic needs, and therefore MCC's research on their behalf is justified.

Traditionally, socio-economic status in agriculture has been defined by farm land size. If a farmer owned a large tract of land this indicated he was wealthy, and conversely a small tract of land indicated poverty. However, this classification system has limitations for several reasons; (i) land in different geographic areas can have highly varying productivity, (ii) the number of crops grown per year under rainfed conditions can vary, and (iii) family size influences the ability of a given size of farm to provide for the associated family. Attempting to measure socio-economic status strictly based on farm size is questionable.

MCC's Extension Program has used a different method for determining socio-economic status. Their definition, called Food Provision Ability (FPA), is based on the ability of the farmer's land (owned and rented) to provide food for the associated family for one year. Given the many different sources of farm income we shall use a rough approximation of this measure called Rice Provision Ability (RPA). RPA tells us how many months per year a farm is able to provide rice for the associated family. This variable takes into account varying levels of land productivity, the number of rice crops per year the farmer is able to grow, the inputs used, and the family size. Arguably this is a superior method for determining socio-economic status. (It is interesting to note that RPA is a statistic that farmers in general, are very well aware of).

Regression analysis was conducted to determine how well the variance of RPA was explained by a series of socio-economic variables. The equation below regressed non-cultivated land (X_1) and family size

(X_2) against RPA (Y). The sample included large, medium, and small farmers.

$$Y = 7.15 + 11.02\ X_1 - 0.65\ X_2$$
$$(1.26)\quad (1.22)\qquad (0.21)$$

Y = RPA

X_1 = cultivated land,

X_2 = family size,

standard error of equation = 4.03

$F = 54.02$

Regression analysis resulted in an R^2 = 65% and $\bar{R}^2$ = 64%. Thus 64% of the variance of the dependent variable was explained by the two independent variables. Standard errors are in brackets below each regression coefficients. The equation is significant at the 99 percent level, and each individual independent variable was significant.

Positive and negative slope coefficients associated with cultivated land and family size respectively were found, as expected. From regression analysis we will conclude that RPA can be an effective way of determining socio-economic status.

(c) Socio-Economic Status in Tetuaya

The RPA variable was used to categorize different farms in Tetuaya. We categorize farms that were to some extent homogeneous. We have classified farmers as landless, small, medium and large (TABLE 1). Landless included those who had no land other than their bari, up to those having the ability to produce 2 months/years of their families' rice requirements. The distribution between landless and small farms was placed at a level lower than 3 months/year as almost all the family's income at that point comes from outside employment. Small farms were those that could provide between 3 and 9 months of the associated family's rice requirements. This small farm category falls within MCC's Extension Programs Subsistence Farmer Program. Medium farmers were defined as those able to provide between 10 and

14 months of the family's rice requirements. Finally large farms were defined as those that could provide more than 14 months/year of the family's rice requirements.

TABLE 1: Socio-Economic Characteristics of 61 Families in Tetuaya Village in 1986

Socio-economic characteristic	Farm category			
	landless	small	medium	large
RPA (months/year)	0-2	3-9	10-14	14+
Range of cultivated land (ha)	0-0.12	0.03-0.79	0.29-1.17	0.39-3.01
Average cultivated area (ha)	0.02	0.26	0.96	1.45
Average family size	5.57	6.52	7.50	10.40
Child/Adult ratio	2.06	2.71	2.27	1.98
Male family labor	1.50	1.32	2.11	2.60
Number of bullocks	0	0	0.39	1.50
Number of cows	0	0.58	1.45	1.80
Number of goats	0	0.37	1.00	1.90
Number of chickens	5.93	7.74	10.33	18.40
Number of ducks	1.71	2.89	3.61	7.70
Percentage of family members with non-farm employment	28.2	20.2	19.2	19.2

There is a large variance and overlap with cultivated land area associated with each farm classification (TABLE 1 row 3). However, average cultivated area, and other socio-economic variables appear to exhibit the expected positive relationship with RPA. For instance, as the farmers' RPA increase so does the family size, number of chickens, ducks and cows. Small, medium and large farm families have approximately 20 percent of their family involved in non-farm occupations (such as business, trading, rickshaw), while landless families have 28% devoted to non-farm occupations. In addition, small farmers have the highest child-to-adult ratio, and lowest number of male family labour.

(d) MCC's Research Impact in Tetuaya

As was pointed out in the introduction, since there was no benchmark survey done for Tetuaya village, this study had to rely on a qualitative approach. Farmers were asked to provide 3 types of information: (i) the new types of crops and/or fertilizer methods they have used while MCC has worked there; (ii) the economic impact of these changes; (iii) the origin of these new technologies.

During the last 3 years MCC has worked with different crops in all 3 seasons as well as with different fertilizer methods. The survey was broken into four parts where the respondent was asked what crops he had grown over the last 3 years in the aus, aman, and rabi seasons. For analysis purposes it was decided to evaluate MCC's impact in the area based on 7 factors. These are seven factors which MCC can claim at least partial responsibility for their adoption. These 7 factors include the adoption of BR-11, field pea, vegetables (including tomato, egg plant, cauliflower, and cabbage); the increasing level of rabi cultivation, and the adoption of 3 new fertilizer methods (including using phosphate in a basal application, using potassium in the rabi season, and the general use of nitrogen). In some cases the farmers indicated that the new practices were picked up from MCC, while in other cases it was indicated it originated from a neighbor. In this case it was sometimes assumed that the technology originated indirectly from MCC (this will be noted in the text).

Let us first look at the adoption of BR-11, field pea and vegetables in Tetuaya. BR-11 was grown in Tetuaya before MCC arrived, but to a very limited extent, while field pea and vegetables (those listed above) were not grown in the area. TABLE 2 lists for each crop the percentage of farmers in each category that have adopted the crop since 1983, and the percentage of their cultivated land they devote to it. In all cases farmers claimed that this adoption had led to higher economic returns over what was previously grown.

TABLE 2: New Crop Adoption (%) in Tetuaya since 1983 by 61 Farm Families and Amount of Land they Utilized (%)

Farm Category	BR-11		Fieldpea		Vegetables	
	% of farmers that adopted	% of cultivated area devoted to crop	% of farmers that adopted	% of cultivated area devoted to crop	% of farmers that adopted	% of cultivated area devoted to crop
Small	51	41	11	16	0	0
Medium	67	42	33	12	17	8
Large	90	40	50	8	20	8
Average	65	4	28	13	11	5

By the aman season 1986, BR-11 was widely grown in Tetuaya. Fifty-one percent of small farmers had adopted BR-11 within the 4 years that MCC worked there, devoting an average of 41% of their cultivated land to its' use by the 1986 aman season (TABLE 2). The percentage of medium and large farmers that adopted BR-11 in this period is 67 and 90 percent respectively (TABLE 2). These figures indicate a positive relationship between RPA and the adoption of BR-11. On average, 65 percent of Tetuaya farmers had adopted BR-11 by 1986, and devoted 40 percent of their cultivated land to it's use.

Adoption of field pea also shows a positive relationship with RPA. On average, 28 percent of Tetuaya farmers had adopted field pea by the rabi season 1985. There appears to be a negative relationship between RPA and percentage of cultivated area devoted to field pea. That is, small farmers devoted 16 percent of their cultivated holdings to field pea, while medium and large farmers devoted 12 and 8 percent respectively. This relationship probably indicates a relative and not absolute difference in land area devoted to the crop. Small farmers devoted propotionally more, but not necessarily absolutely more, as their landholdings are smaller.

On average, 28 percent of farmers devoted 13 percent of their holdings to cultivate field pea. New types of vegetables have not been adopted by small farmers in Tetuaya, but have been adopted by medium and large farmers at 17 and 20 percent respectively. On average 11 percent of Tetuaya farmers have devoted 5 percent of their land to cultivate vegetables in the Rabi season.

BR-11 appears to be the most successful crop in terms of the percentage of farmers that have adopted it, and the cultivated area devoted to it. However field pea and vegetables also appear to have been adopted to a significant extent. The problem we see here is that MCC's target group (small farmers) have adopted these new crops to a lesser extent than medium and large farmers. Since this is a qualitative survey, we are unable to say to what extent incomes have changed because of these new technologies. However, we can argue that incomes have been increased based on information provided by the respondents.

Let us now turn to the next factors which we will use to evaluate the Research Program's impact in Tetuaya. These factors involve changes in fertilizer methods. MCC has experimented with different fertilizers and methods in Tetuaya. There are three practices which can most easily be attributed to MCC. These include; (i) using phosphate (TSP) in a basal application, (ii) using potassium in the rabi season, and (iii) general use of nitrogen. These practices were not followed extensively before MCC arrived in Tetuaya (TABLE 3). Respondents were asked what new fertilizer methods they have adopted in the 4 years that MCC has been there.

TABLE 3: Adoption of New Fertilizer Methods (%) in Tetuaya since 1983 by 61 Farm Families

Farm category	Farmers that adopted TSP as basal (%)	Farmers that adopted K in rabi season (%)	Farmers that adopted general N use (%)
Small	26	5	21
Medium	56	22	33
Large	70	40	10
Average	46	19	23

In terms of adopting TSP and K there appears to be a positive relationship between RPA and adoption level (TABLE 3). Percentages listed here are based on farmers that indicated a higher economic return from previous practices, and noted the origin from either MCC or a neighbour. Twenty-six percent of small farmers in Tetuaya adopted TSP as a basal application since MCC started research there. Medium and large farmers adopted to a greater extent at 56 and 70 percent respectively (TABLE 3). Overall, TSP and K have been adopted by 46 and 19 percent of Tetuaya farmers. Medium farmers have adopted N use to the greatest extent (33 percent) followed by small farmers (21 percent) and finally large farmers (10 percent). Twenty-three percent of Tetuaya farmers use TSP (this does not include those who use it and state it's introduction from an outside agency). Without quantitative statistics we are unable to determine how income levels have changed due to fertilizer adoption, however one could argue that they have increased.

The last factor we will examine is increasing levels of rabi cultivation in Tetuaya. The percentage of farmers in each category who cultivated during the rabi season, and the average percentage of their land area they devoted to rabi season cultivation, are given in TABLE 4.

TABLE 4: Percentage of 61 Farmers in Tetuaya Who Cultivated Rabi Crops, and Amount of Land They Utilized (%) During 1983-1985.

Year	Farmers that cultivated in the rabi season (%)				Land devoted to rabi cultivation (%)			
	Small	Medium	Large	Average	Small	Medium	Large	Average
1983	32	89	100	68	37	44	37	39
1984	63	89	100	80	42	54	44	47
1985	79	100	100	91	55	56	40	51
Change 1983-1985	47	11	0	23	18	12	3	12

In 1983 an average of 32 percent of small farmers in Tetuaya cultivated a variety of rabi crops on 37 percent of their land. This increased to 79 percent of small farmers in 1985 devoting 55 percent of their land area to rabi cultivation (TABLE 4). One average, 91 percent of Tetuaya farmers devoted 51 percent of their holdings to rabi cultivation in 1985, versus 68 percent of farmers devoting 39 percent of their holdings in 1983. There has been a significant increase in both the number of farmers who cultivated during the rabi season, and the amount of their holdings they devoted to this practice, especially amongst small farmers.

Increases in the extent and level of rabi cultivation cannot necessarily be directly related to MCC's research work in Tetuaya. Respondents were asked to indicate if they cultivated rabi crops in those years and what amount of their holdings they used. What is being argued here is that MCC has had a role in promoting these increases based on the research done in the rabi season.

Medium and large farmers cultivated rabi crops to a greater extent in Tetuaya. However, in 1983 they were already extensively involved in rabi cultivation. It appears the real increase came in the extent and level with which small farmers cultivate rabi crops. TABLE 5 lists which crops were grown in the 1985 rabi season by category.

It appears from the data below that medium and large farmers have benefited at least as much as small farmers from MCC's research. However, since these groups are not in MCC's target group, arguably we cannot evaluate MCC's effectiveness based on successes with these groups. It does appear from the data below that small farmers have adopted new practices and have found them profitable.

(e) Conclusion

It would be a mistake to claim that because one crop was adopted to a greater extent by medium and large farmers that it cannot benefit our target group. Winter vegetables were not adopted by small farmers in Tetuaya while MCC worked there, and yet they are one of the most effective ways which MCC's Extension Program raises the incomes of small farmers. In this case the necessary inputs, irrigation and seeds were not provided by MCC at the CSRS, but were by the Extension Program.

TABLE 5: Percentage of 61 Farmers in Tetuaya Who Cultivated Selected Rabi Crops, and Amount of Land They Utilized (%) in 1985

Crop	Farmers that cultivated the crop (%)			Amount land devoted to crop cultivation (%)		
	Small	Medium	Large	Small	Medium	Large
Wheat	11	11	0	35	15	0
Vegetables	0	17	20	0	8	8
Sweet Potato	32	83	60	32	11	6
Lentil	21	78	100	28	20	11
Field Pea	11	33	50	16	12	8
Khesari	11	33	20	24	14	8
Blackgram	5	1	50	11	7	6
Shak	5	11	10	11	6	1
Mustard	26	67	20	42	20	13
Soybeans	0	5	0	0	5	0

It may be the case with all crop research (and other farm based research) that in the absence of an active extension program, large and medium farmers will more readily adopt new practices. Only an extension program can combine research with other appropriate services (like credit facilities, motivation, and group formation), that will provide the poor with a means of adopting new practices and technologies which will increase their income. Although the CSRS acts in some ways like an extension unit, it is essentially still a research site. We should not evaluate the success or failure of the CSRS strictly in terms of farmer adoption there. Unfortunately, during the Tetuaya period there was a weak link between Research & Extension Program. Thus the Extension Program, by and large, has not benefited from the research work done in Tetuaya. There is clearly a need for improved linkages between Research and Extension within MCC. If MCC's research work is directed towards the Extension Program, the Homesite Program (HSP), and the Rural Savings Program (RSP), then both landless and small farmer classes could be worked with. If MCC's Research Program is to be effective in helping the poor farmer then research results must be

geared towards and used by the extension program(s). Further, if research is to benefit the landless as well as the small farmer then all three extension programs (the Extension Program, HSP, RSP) needs should be better integrated into the Research Program.

Rabi crop adoption is the exception to what was discussed above. Small farmers were influenced greater in terms of numbers of new farmers cultivating, and area used in the rabi season. These crops are low-input, low-return, and therefore small farmers are able to utilize them without requiring large access to other resources. We cannot conclude that incomes increased significantly from the cultivation of these crops, but we will argue that the wide-scale adoption implies a positive return. Potentially, rabi crops could be extended to small farmers with minimal effort on the part of the extension programs, perhaps in conjunction with winter vegetables. Results from this study suggest that rabi season crop research should continue at the MCC medium highland site, but that promising technologies should be delivered to the extension programs. This should not be done at the expense of researching other technologies whose capital and land requirements are low, but whose labour input is relatively high; the latter taking advantage of our target group's greatest resource - their own labour.

Income and Expenditure Analysis at Char Dharmapur, Sudharam Upazila, Noakhali District

(a) Introduction

In this study an analysis of the income and expenditure patterns of small and marginal farmers in Char Dharmapur, Sudharam Upazila, Noakhali District was undertaken. Data was gathered on income, expenditure, and labour requirements from six farmers starting in the aman season 1982, running through the aus season 1983. This study will be restricted to discussing income and expenditure. Labour standards have been established previously.[1]

Through a better understanding of the income and expenditure patterns of small farmers, it is hoped that technologies can be developed which farmers can more readily adopt. Arguably small farmers face the severest capital constraints. If agricultural research is to benefit these farmers, we must understand these constraints. Income and expenditure analysis is an attempt to provide information regarding small farmers' capital constraints. It is hoped this information will be combined with data on labour constraints in order to design technologies that will increase agricultural incomes of small farmers.

There are at least three limitations to this study. First, the data was drawn from only one year. This means unusual events in that year appear to be the norm. Unfortunately, the data was generated for only one year. A further shortcoming of this study is that inventory data was not effectively combined with income and expenditure data. In this study inventory items that were not sold but used for home consumption were not integrated into the data. This has led to an underestimate of the value of income from crops and livestock. The third problem is that it is not obvious that all six of the respondent's belong to the small/marginal farmer category. For instance, land holdings range from zero to 2.0 hectares. However, it has been argued elsewhere[2] that farm categories can be based on something other than landholdings. This question will be dealt with briefly in section 7.

1 See MCC Research Results #4(1977), #5(1978) and MCC Seasonal Reports 1980-81, and Saha Sunil & Brook Greene Labour Standards for Selected Crops in Noakhali District, Bangladesh 1980-82.

2 See Jerry Buckland, "Farmer's Adoption of New Technologies at Tetuaya CSRS, Nangolkot Upazila, Comilla District".

In section c we shall look at basic socio-economic indicators of the study's respondents. In section d we shall then look at income sources and expenditure allocations. In section e we shall then look at income and expenditure patterns throughout the year.

(b) Methodology

Six farmers were selected from the Mennonite Central Committee (MCC) Dharmapur Cropping System Research Site (CSRS). Dharmapur is located in a char region, in southern Noakhali District and is characterized by saline soil. The predominant cropping pattern is fallow-t.aman-fallow, although some aus and rabi crops are grown. The six respondents were questioned once a week to recall their income, expenditure, and labour patterns for the preceding week.

(c) Basic Socio-Economic Data

As can be seen in TABLE 1 below family size of the six informants ranges from six to eleven persons with an average of nine persons, while the number of male workers ranges from one to five with an average of two. Again, landholdings range from zero to 2.03 hectares. Total cultivated land, which includes sharecropped land, ranges from 1.42 to 4.62 hectares with an average of 2.53 hectares. Yearly income ranges from Tk.8104 to Tk.24044 with an average of Tk.15688. Yearly expenditure ranges from Tk. 9897 to Tk.25008 with an average expenditure of Tk.16005.

Let us now turn to the question of farm category. If we now look at income and expenditure per person for each farm family we see that these figures display less variance than those associated with income per year. Income per person per year ranges from Tk. 1853 to Tk.2737 with an average annual income of Tk. 2210. Monthly income per person ranges from Tk. 154 to Tk. 228 with an average of Tk.184. The coefficients of variation associated with the later two measures at 16 percent and 15 percent respectively are lower than that associated with yearly income per family at 33 percent. Arguably this indicates that this is a more homogeneous group of farmers than what might be expected after looking at landholdings. The per capita income figures show low variance which gives us evidence that this is a reasonably homogeneous group. Arguably then, these respondents are representa-

TABLE 1: Socio-Economic Indicators for Six Farm Families at Char Dharmapur, Noakhali District, 1982-83

Respondent	Total family	Male labour	Children	"Effective[a/]" family	Owned land (ha)	Total cultivated land (ha)
1.	11	3	4	9	0.30	1.82
2.	7	1	3	5.5	1.22	2.84
3.	6	1	4	4	0.49	1.42
4.	9	5	2	8	0	2.47
5.	14	2	5	11.5	1.22	4.62
6.	8	1	5	5.5	2.03	2.03
Mean = X	9	2	3.8	7.25	0.89	2.53
Variance = S	3	1.6	1.2	2.77	0.73	1.13
Coefficient of variation = C.V. (%)	-	-	-	-	-	-

Respondent	Yearly income (Tk.)	Yearly income per capita (Tk.)	Monthly income per capita (Tk.)	Yearly expenditure (Tk.)	Yearly expenditure per capita (Tk.)	Yearly expenditure per capita (Tk.)
1.	18171	2019	168	19841	2205	184
2.	15030	2737	228	16471	2995	250
3.	8104	2026	169	9897	2474	206
4.	14827	1853	154	13566	1696	141
5.	24044	2090	174	25008	2175	181
6.	13954	2537	211	11244	2044	170
Mean = X	15688	2210	184	16005	2264	189
Variance = S	5248	345	28	5690	438	37
Coefficient of variation = C.V. (%)	33	16	15	36	19	20

a/ for analysis purposes effective family means children under 12 equivalent to ½ an adult

tive of small and marginal farmers. When expenditure figures are broken down in this manner they also display similar characteristics. As was mentioned in the introduction, inventory data was not included so these income and variance figures are probably underestimates of the true figures.

(d) Income Sources and Expenditure Items

This section is broken in two parts. In part (i) we will look at the different sources of income for the respondents in Char Dharmapur. In part (ii) we will look at the allocation of expenditure to different items.

(i) Income Sources

TABLE 2 below breaks down total income of the six respondents into two main categories; agricultural income and off-farm income. Agricultural income includes income from crop and livestock sales (livestock sales includes sales of milk and eggs) and loans in kind. Off-farm income includes wage labour, salary and business sources of income as well as land mortgaging and money loans. As can be seen below, an average of 49 percent of the respondents' income comes from agricultural sources, while 51 percent comes from off-farm sources.

Crop and livestock income provide an average of 30 and 19 percent of total income, and 64 and 36 percent of agricultural income, respectively. It appears that when livestock income is a large source of agricultural income, then crop income is low, and vice-versa. There does seem to be a negative relationship between size of landholding and relative income from livestock.

Relating to off-farm income, one of the respondents receives income from a shop, while another two from salaries. Three of the respondents receive an average of 33 percent of their total income from wage labour.

TABLE 2: Sources of Income by Respondent at Char Dharmapur, Noakhali District, 1982-83

Respondent	Total income (Tk.)	Agricultural income as percent of total income	Crop income as percent of total income	Livestock income as per-percent of total income	Crop income as percent of agricultural income	Livestock income as percent of agricultural income	Off-farm income as percent of total income	Wage income as percent of total income
1.	18171	54	39	15	72	28	46	26
2.	13030	45	40	5	88	12	55	-
3.	8104	67	47	20	72	28	33	31
4.	14827	54	11	43	20	80	46	37
5.	24044	17	16	1	85	15	83	-
6.	13954	54	26	28	47	53	46	-
Mean = X	15688	49	30	19	64	36	51	16
Variance=S	5248	17	14	15	26	26	17	18
C.V.(%)	33	35	47	79	41	72	33	113

(ii) Expenditure Items

In TABLE 3, expenditure items are listed for the six respondents. From column 1 we can see that average yearly expenditure is Tk.16005, which is Tk.317 greater than average income. Agricultural expenditure (which includes payments for seeds, fertilizer, hired labour, new implements, agriculture-related loan repayment and field rental) accounts for an average of 32 percent of total expenditure. Crop expenditure (expenditure on seed, fertilizer and hired labour) accounts for an average of 16 percent of total expenditure and 57 percent of agricultural expenditure. Buying livestock is the other major agricultural expenditure and accounts for an average of 21 percent of total expenditure and 50 percent of agricultural expenditure. Again, it is interesting to note the apparent negative relationship between landholding and relative expenditure, on livestock.

Household, or non-agricultural expenditure, accounts for an average of 68 percent of total expenditure. This includes expenditure on food, clothing, education, medicine, transportation, house repair, non-agricultural loan repayment, and personal items. Food is the largest single item and accounts for an average of 41 percent of total expenditure and 63 percent of household expenditure. As was mentioned above, this item is probably underestimated, as inventoried food which was eaten by the family was not included in the data. It is interesting to note the coefficients of variation associated with agricultural expenditure and those associated with non-agricultural expenditure. The later items show significantly lower C.Vs, indicating less variance with this data. This makes intuitive sense, as people cannot easily choose not to consume food, whereas one can be more flexible about the buying and selling of livestock.

TABLE 3: Expenditure Items by Respondent

Respondent	Total expenditure (Tk.)	Agricultural expenditure as percent of total expenditure	Crop expenditure as percent of total expenditure	Livestock expenditure as percent of total expenditure	Crop expenditure as percent of agriculture expenditure	Livestock expenditure as percent of agriculture expenditure	Household expenditure as percent of total expenditure	Food expenditure as percent of of total expenditure	Food expenditure as percent of household expenditure
1.	19841	41	20	21	50	50	59	48	81
2.	16471	17	17	0	100	0	83	38	46
3.	9897	36	17	19	48	52	64	44	69
4.	13566	49	7	42	14	86	51	39	76
5.	25008	30	21	9	72	28	70	37	52
6.	11244	21	11	10	57	43	79	40	51
Mean = X	16005	32	16	16	57	43	68	41	63
Variance=S	5690	12	5	14	28	28	12	4.2	15
C.V.(%)	36	38	31	88	49	67	18	10	23

(e) Income and Expenditure Patterns

In this section we shall look at average income and expenditure patterns throughout the year. Please refer to TABLE 4 for income patterns, and TABLE 5 for expenditure patterns. Note that each table lists the average monthly figure for each category, plus the percentage of yearly income (expenditure) of that category. For instance, in TABLE 4 we see that average total income (12 months) for the respondents in 1982-83 was Tk.15323. Of this, Tk.1533 was earned in December which represented 9 percent of total income that year.

If we now refer to row 2 of TABLES 4 and 5, and to FIGURE 1, we can discuss the pattern of total income and expenditure through the year. Total income shows fluctuations throughout the year, and appears to be at a minimum in the months of January and February. Total expenditure also fluctuates extensively throughout the year, and also appears to be very low in the months of January and February. Net income (total income less total expenditure) is positive in August and September, negative in October, November, and December, and then positive again in January, February, and March.

Let us now look at agriculture income and expenditure. These are found on row 2 of TABLES 4 and 5 and on FIGURE 2. Agricultural income peaks in October, November, and December, while being at a minimum from January to April. On the other hand, agricultural expenditure is at a maximum in August, September and October, before the maximum agricultural income months. Agricultural expenditure is at a minimum in January. Net agricultural income is positive from September to February and is at a maximum in December. The remainder of the year net agricultural income fluctuates around zero.

We shall now look at crop and livestock income and expenditure, in an attempt to explain the preceding observations. Crop income and expenditure is found on row 3 of TABLES 4 and 5, and on FIGURE 3. In October, November and December crop income is high, while in December it is at a maximum. October and November are high income months because people are taking out significant quantities of loans in the form of rice, to be paid back after the aman harvest (these loans in kind are here considered income). December is a

TABLE 4: Average Income Patterns (In Taka) through the Year for Six Farm Families at Char Dharmapur, Noakhali District, 1982-83[a/]

	July	August	September	October	November	December
Total Income	1399(9)	1667(11)	1712(11)	1469(10)	1026(7)	1533(9)
Agricultural Income	353(5)	462(7)	582(9)	941(14)	798(12)	1145(17)
Crop Income	193(5)	434(10)	180(4)	424(10)	725(17)	1098(26)
Livestock and By-Products' Income	160(6)	28(1)	402(15)	517(20)	73(3)	47(2)
Off-Farm Income	1046(12)	1205(14)	1130(13)	528(6)	228(3)	388(4)
Wage Labour Income	297(7)	350(8)	200(5)	143(3)	120(3)	325(8)

	January	February	March	April	May	June	July	Yearly Total
Total Income	1000(7)	999(7)	1954(12)	727(5)	1214(8)	623(4)	973	15323
Agriculture Income	232(3)	381(6)	298(4)	345(5)	782(12)	311(6)	446	6630
Crop Income	160(4)	226(5)	186(4)	155(4)	234(6)	19(5)	380	4034
Livestock and By-Products' Income	72(3)	155(6)	112(4)	190(8)	548(21)	292(11)	66	2596
Off-Farm Income	768(4)	618(19)	1656(19)	382(4)	432(5)	312(4)	527	8693
Wage Labour Income	448(11)	653(15)	712(17)	451(11)	260(6)	210(6)	0	4169

a/ percentages in brackets

TABLE 5: Average Expenditure Patterns (in Taka) through the Year for Six Farm Families at Char Dharmapur, Noakhali District, 1982-83[a/]

	July	August	September	October	November	December
Total Expenditure	1548(10)	1611(10)	1178(7)	1572(10)	1394(10)	1679(10)
Agricultural Expenditure	448(9)	706(14)	408(8)	599(12)	441(9)	246(5)
Crop Expenditure	270(11)	693(27)	258(10)	122(5)	444(17)	246(10)
Livestock Expenditure	178(8)	13(1)	150(6)	477(20)	0	0
Household Expenditure	1100(10)	905(8)	770(7)	973(9)	950(9)	1433(13)
Food Expenditure	784(12)	735(11)	502(8)	688(10)	551(8)	506(8)

	January	February	March	April	May	June	July	Yearly Total
Total Expenditure	920(6)	964(6)	1414(9)	993(6)	1386(9)	1270(8)	-	15929
Agricultural Expenditure	31(1)	239(5)	421(9)	241(5)	501(10)	639(13)	135	4923
Crop Expenditure	31(1)	56(2)	88(3)	241(10)	83(3)	29(1)	135	2561
Livestock Expenditure	0	183(8)	333(14)	0	418(17)	610(26)	-	2362
Household Expenditure	889(8)	725(7)	993(9)	752(7)	885(8)	631(5)	-	11006
Food Expenditure	466(7)	473(7)	494(8)	444(6)	461(7)	481(8)	-	6585

a/ percentages in brackets

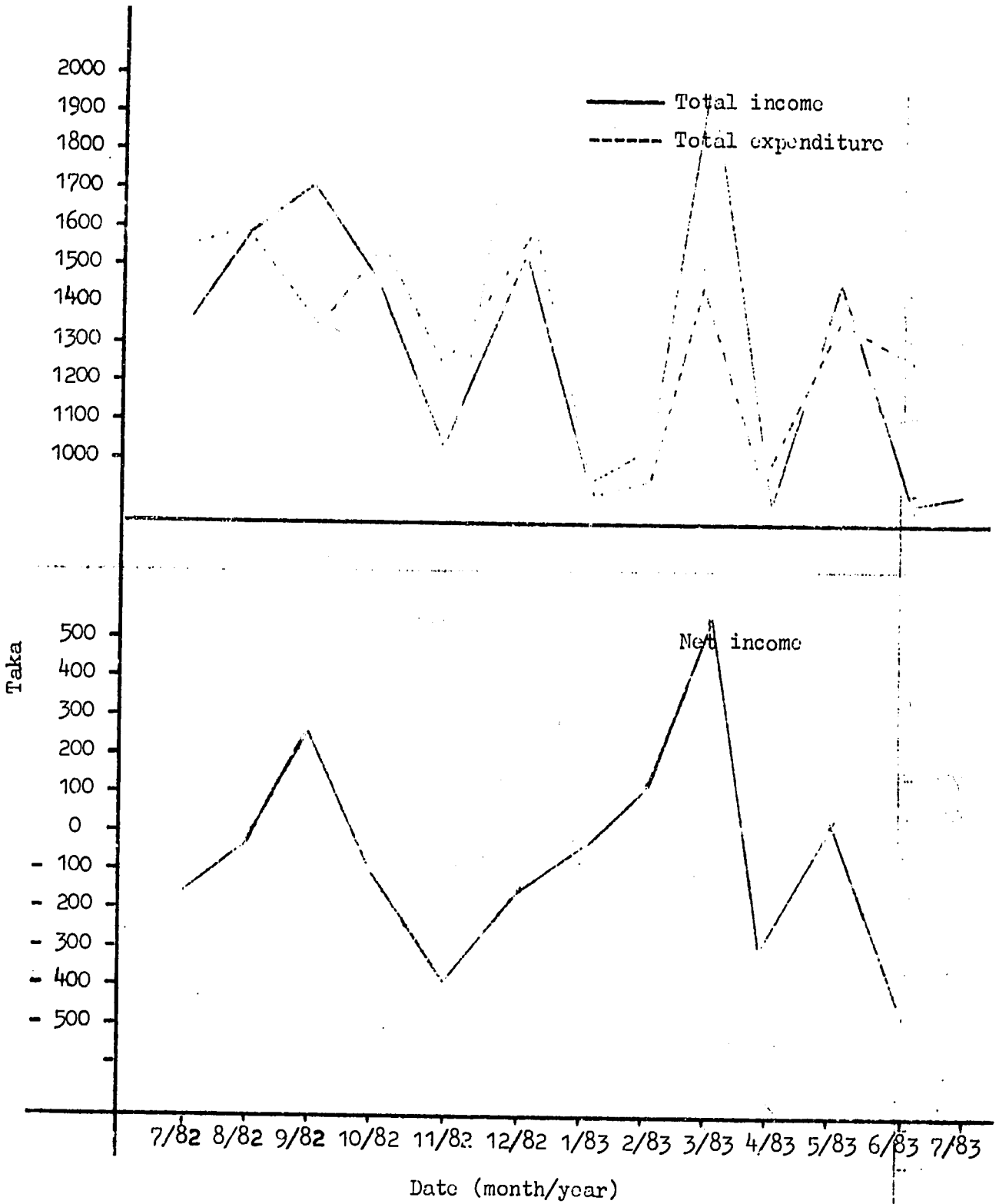


FIGURE 1: Total income and expenditure, and net income of six farm families at Char Dharmapur, Noakhali District, 1982-83.

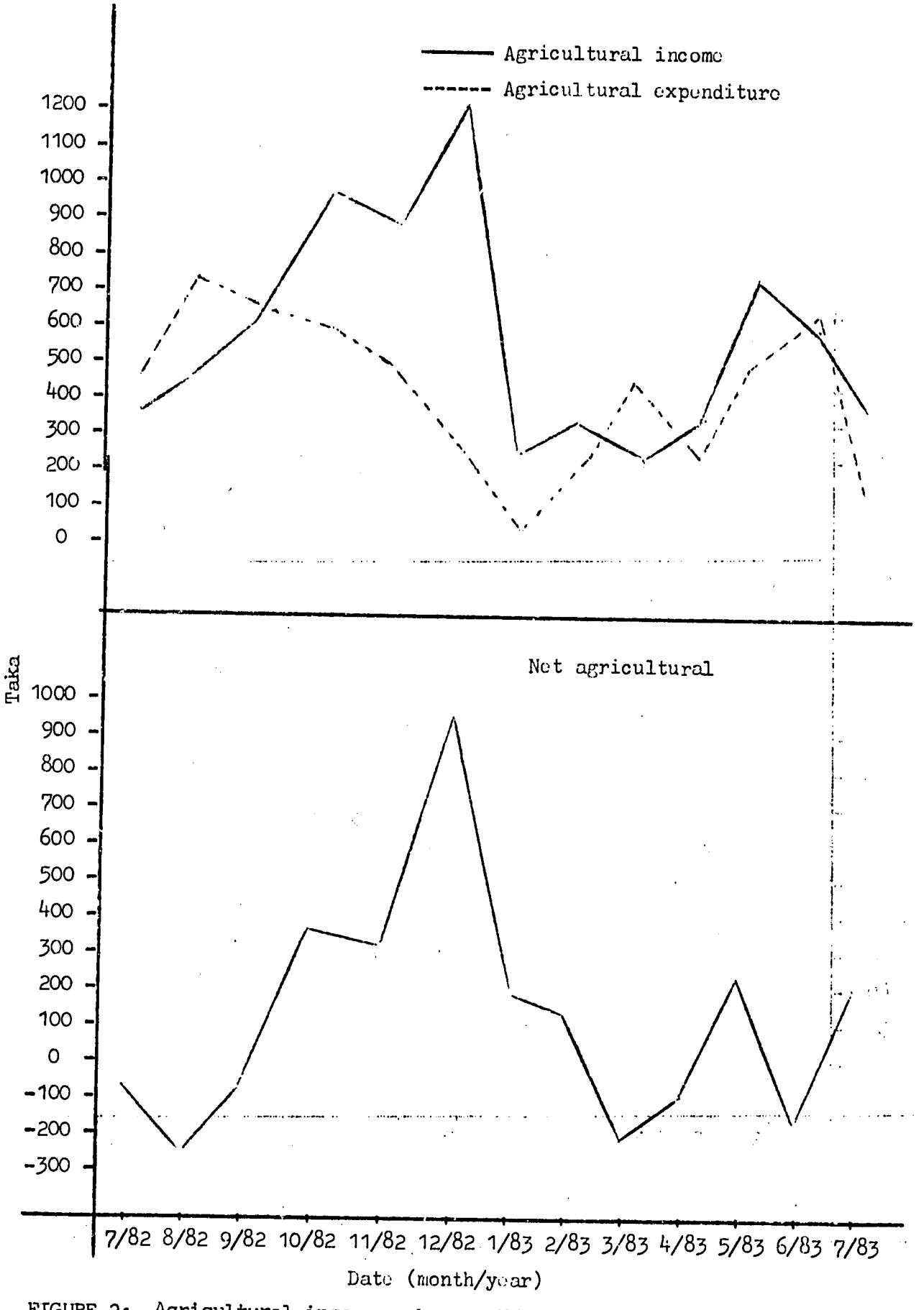


FIGURE 2: Agricultural income and expenditure, and net agricultural income of six farm families at Char Dharmapur, Noakhali District, 1982-83.

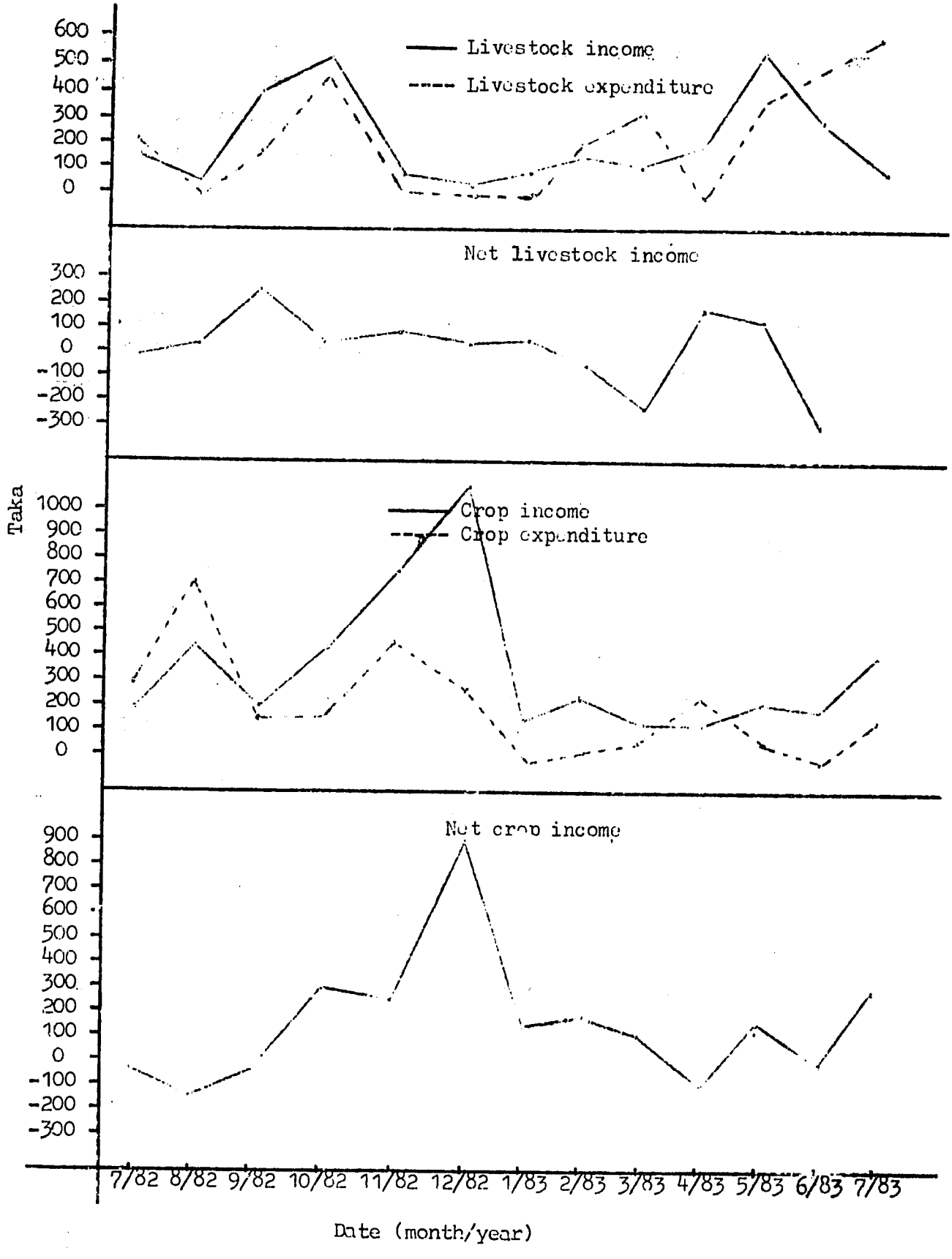


FIGURE 3: Livestock and crop income and expenditure, and net livestock and crop income, of six farm families at Char Dharmapur, Noakhali District, 1982-83.

maximum because this was the period of the aman harvest, clearly the single most significant source of income for farmers in this area. Crop expenditure is at a maximum in August when farmers are purchasing aman seed and fertilizer, and again in October and November when labor is hired to do weeding. Net crop income is positive from October through February, and fluctuates around zero the remainder of the year.

Livestock income and expenditure can be found on row 4 of TABLE 4 and 5 and on FIGURE 3. Both income and expenditure appear to track each other quite closely here. These large levels of income and expenditure are associated with the buying and selling of cows which takes place before the aman harvest in September and October, and then afterwards, from February through June. During the months of November, December and January, this activity discontinues. Net livestock income is constantly slightly above zero from October to January, indicating income from other livestock sources such as sale of goats, chickens, ducks, eggs, and fish.

Total off-farm income is found on row 5 of TABLE 4. It is lowest in November and December and peaks from July to September (recall that off-farm income includes wage labour, salary and business income, land mortgaging, and money loans). It is interesting to see how off-farm income is high when farm income (especially crop income) is low. Wage labor income found on row 6 of TABLE 4 and on FIGURE 4 is at a maximum after the aman harvest from January to April presumably from work outside of the area. Wage labour provides an important source of income during a time when few other agricultural activities are occuring.

Household expenditure found on row 5 of TABLE 5, and FIGURE 4, is at a maximum in December, while showing no other major trend the remainder of the year. The high December household expenditure represents repayment of loans from October and November. This high household expenditure (mainly due to loan repayment) explains why net total income in December is negative, while crop income is at a maximum. Clearly loans before the aman harvest are very significant, as repayment leads to a negative total income figure in December. It is interesting to note how consistent food expenditure is throughout the year.

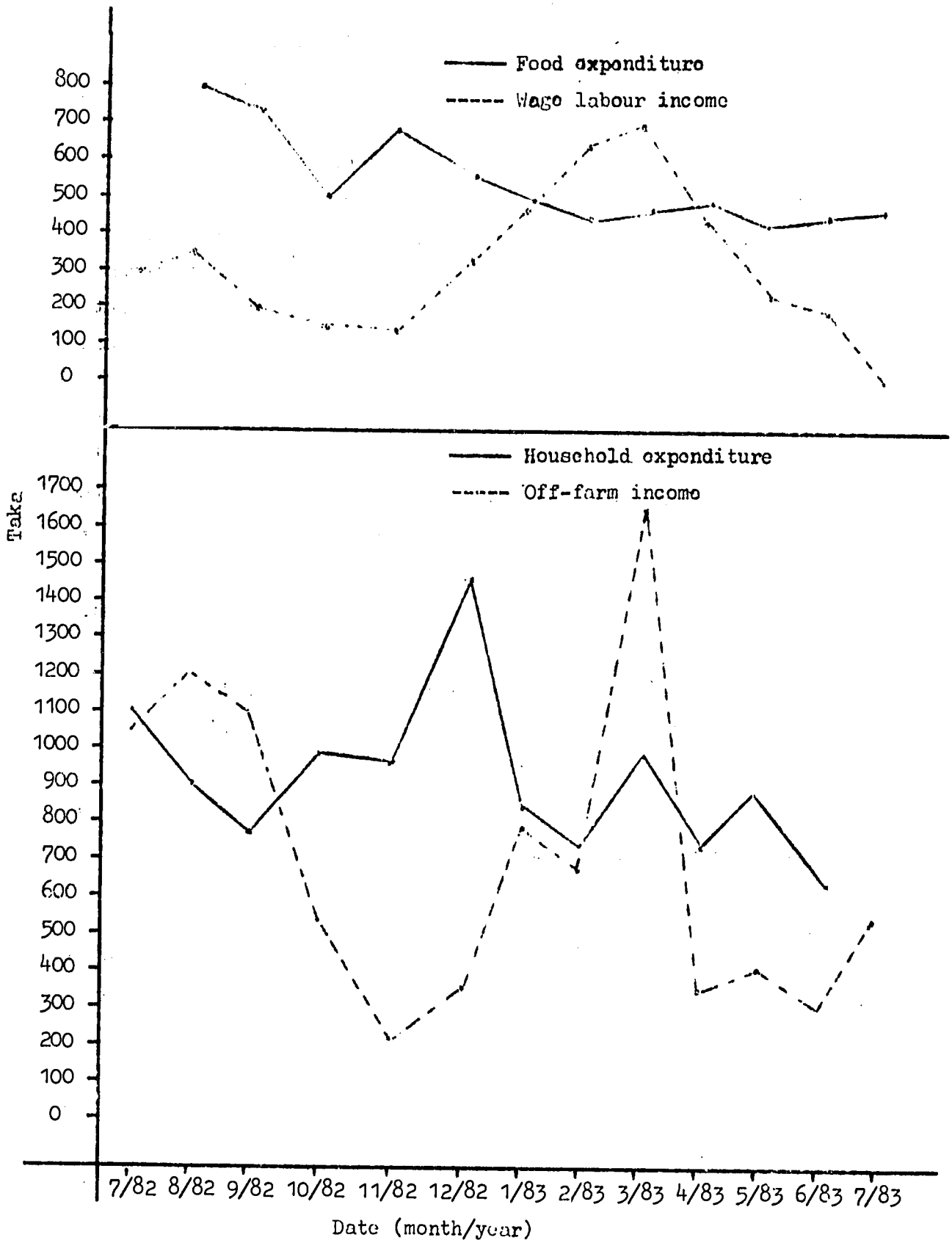


FIGURE 4: Wage labour and off-farm income, and food and household expenditure of six farm families at Char Dharmapur, Noakhali District, 1982-83.

(f) Conclusions

On average the respondents earned 49 percent of their income from agriculture and 51 percent from off-farm sources. Agricultural expenditure, on average represented 32 percent of total, while household expenditure represented 68 percent of the total. Crop and livestock income represented 30 and 19 percent of total income respectively. However expenditure on crop and livestock represented on average 16 percent for both categories. Off-farm income represented 51 percent of total income, while household (on non-agricultural) expenditure represented 68 percent of total expenditure. For those respondents that worked as day laborers, it represented 33 percent of their total income. Food expenditure as was indicated was probably underestimated as representing 41 percent of total expenditure.

The aman harvest represents the largest single income source in December. However, before the aman harvest farmers take out significant loans which are paid back in rice upon harvest. Interest rates for these loans can range from 100 to 200 percent per year. As seen above this can result in a small farm's net agricultural income (income less expenditure) being negative during the aman harvest.

There appears to be a need to research in ways of diversifying farmers' incomes. At present both livestock and non-farm activity occur during the aus and rabi seasons and tend to stabilize farm income throughout the year: presumably reducing the risk the farmer faces by diversifying it's source. Given the difficulties in aus and rabi season crops (i.e., the salinity problem), other income-earning activities should be researched. Livestock, fish cultivation and homesite gardening are three areas that should be considered priorities for this area. This does not mean that crop research should not continue, but that it should be combined with other research that has potential for benefitting the very poor in the area.

Dhorkora Cropping Systems Research Site Sondeo, Chouddogram Upazila, Comilla District

(a) Introduction

A Sondeo, or informal survey, was conducted at our Dhorkora Bazar Cropping Systems Research Site (CSRS) on January 25 and 26, 1987. The Sondeo was undertaken as the initial step in understanding the farming system in the area. The Sondeo will be followed by a formal survey to be done in March, 1987. It is hoped the results from these surveys will provide information to our researchers to better target their work to the rural poor. This Sondeo is a part of an on-going study of the socio-economy in particular regions in Bangladesh by the Mennonite Central Committee (MCC).

(b) Methodology

A total of 9 people were involved in the Sondeo. The people involved were; Sukhen Chandra Paul (Site Manager), Delwar Hossain (Data Collector), Abdul Mannan (Data Collector), Hashnahena Akter (Homesite Coordinator), Caroline Stetter (Homesite Program Leader), Dan Belgum (Research Program Leader), John Friesen (Livestock Specialist), Amos Showalter (Site Agronomist), and Jerry Buckland (Agricultural Economist). 3 groups of 3 people were arranged for the 2 days. Each morning the groups randomly interviewed farm families in both Shaktola and Dhorkora villages.

Interviewers had no prepared questions, and pursued issues based on their own particular interest. There was some effort to direct questions to smaller farmers. In the afternoon the groups were brought together to discuss their findings. Participants were asked to submit a short paper at the end of the Sondeo, discussing issues they felt were important.

(c) Discussion

In general all the participants felt the Sondeo was a useful survey technique. However, it was clear that the Sondeo is only the start of gaining an understanding of farming in the region and that close communication with farmers over the long-run is necessary. There

were a number of general questions discussed in the papers, as well as specific proposals for research. Let us first look at the general issues, and then look at the more specific proposals.

It was pointed out that Dhorkora and Shaktola villages are very diverse communities, with landless, subsistence and solvent families. These families derive their income from a variety of sources including field crops, livestock and poultry, homesite vegetables, fruit trees, and their labor. It appeared that when a family's landholdings were small, then more relative importance was placed on such things as vegetables, livestock, poultry, ducks and pigeons. When peoples' holdings are small, it appears they are forced to use what they have more intensively. This would seem to indicate that MCC should look to directing more research to other aspects of the farm not just crops.

It was clear from the Sondeo that woman play an important role in the farming system. Generally at the CSRS, our male researchers find it difficult to get women's input because of the observance of Purdah in the rural areas. However, with the involvement of some female MCC staff we were able to get some women's input. Women are involved in homestead land cultivation, seed preservation, and the care for domestic animals, to list only some of their work.

There was some question as to who are the poorest in those villages. Initial impressions were that even families with small amounts of land (i.e., less than 0.5 hectares) were better-off than landless people. This question will be dealt with further in the formal survey. To the extent that landless are among the poorest in the region, which seems clear, MCC should direct research towards their resources. This objective could be met by doing livestock research, work on tank fish cultivation, more work on fruit and spice trees, and homesite vegetables. This type of research could also benefit small subsistence farmers.

An interesting point was raised in regards to whether these communities would be more benefited by research, or the extension of exting ideas. There are things that MCC is already extending (in the broad sense) that could benefit these communities. The extension of some winter

vegetables and health education are some examples of this. This pointed out the importance of critically looking at resource allocation between research and extension work. The question here being if existing ideas could be successfully extended in this area, then perhaps resources should be shifted from research to extension.

It was pointed out that agricultural research is one of many requirements if development is to occur. The MCC research program essentially accepts land, labor and capital resources of the family as fixed and tries to develop more profitable technology for the farmer. However when dealing with subsistence and landless families these resources are very minimal. This emphasizes the importance of work on cooperation and group development to allow for pooling of resources. With this in mind, perhaps the research program could work more closely with MCC's Rural Savings Program who are involved in group formation.

Other specific problems were listed by the participants. Problems sighted include; bean insect damage, chicken and duck disease, non-availability of some vegetable seeds, lack of irrigation facilities, inadequate diet, and the high cost of crop inputs (specifically the ploughing input).

Other research suggestions included highland vegetable trials, and medium-highland field crop trials.

Chitosi Station Cropping Systems Research Site Sondeo, Laksham Upazila, Comilla District

(a) Introduction

A Sondeo, or informal survey was conducted at our Chitosi Station Cropping Systems Research Site (CSRS) on May 24th and 25th, 1987. The Sondeo was the first stage in the initial survey process, which was followed by a formal survey in June 1987. The objectives of the Sondeo are two-fold; one, to get a wholistic view of the Bangladeshi farm by involving researchers from different disciplines; and two, to give the MCC Research Program ideas about research possibilities which will benefit our target group.

(b) Methodology

A total of 10 people were involved in the Sondeo. These people included; John Friesen, (Livestock Specialist), Shahanaz Noor (Field Supervisor - HSP), Franck Wiebe (Agriculture Administrator), Abu Taher (Data Collector), Rafiqul Hossain (Data Collector), Shyem Gobindo (Extension Supervisor), Oscar Rozario (Chitosi Station Site Manager), Peter Sexton (Chitosi Station Agronomist), Becky Sanders (Agriculture Advisor - HSP), Jerry Buckland (Agricultural Economist). 3 groups were arranged for each day. The mornings were spent in the field interviewing, while the afternoons were used for group discussion. Formal questions were not prepared in advance, and people were interviewed at random in two villages near the site office (Jonadonpur and Razapur villages).

(c) Discussion

Before looking at specific suggestions for research, let us look at some of the more general issues that were raised. It was clear from the Sondeo that within the Chitosi area there are many people who's basic needs are not being met in terms of health care, nutrition, sanitation, education, and safe water supply. Agricultural research alone cannot solve these problems. From this it was suggested that a more integrated approach to development would be more effective.

Providing a farm family with a more profitable crop technology may not mean improvements in the provision of their basic needs. Motivation and education (plus the provision of necessary inputs) might also be necessary inputs.

Another general issue that was raised dealt with the apparent disparity of economic status between the two villages. A large proportion of the residents of Jonadonpur village were day laborers and rickshaw pullers, while many Razapur residents were semi-skilled or professional. It appeared that the level of sanitation, children's health and house type were all superior in Razapur relative to Jonadonpur. In general it would appear that the economic status in Razapur is higher than that of Jonadonpur.

MCC's target group is the rural poor. In this area this includes, in general, landless and some rice deficit farms. It was suggested that it would be easier to work with the later group as they at least have some land for more intensive crop production. However, there is potential for working with the livestock and homestead resources of the landless in order to improve their economic status.

Let us now look at some specific suggestions for research in the area. Suggestions for crop research included; reducing wheat input costs, introducing soybean, mungbean, mustard, and trying to find a successful HYV paddy for the aman season. Vegetable research could include work on highland and lowland land-types, and intensifying homestead production. Suggestions for livestock research included intensifying the system of "share-animals" used by the landless, and looking at the effectiveness of poultry vaccinations.

STATION RESEARCH SITE DESCRIPTIONS

INTRODUCTION

At the formal research sites most practices were controlled by MCC and trials were put in by hired labor. All land preparation was done using traditional plows and bullocks. At Feni, water was provided by five 5.cm rower pumps.

FENI STATION RESEARCH

Much of the formal research effort is conducted on 0.69 hectares of rented land, situated about 5 km north of Feni near the village of Fatepur. Of this area 0.24 ha are on highland and 0.45 ha are on medium highland. This site is located on the Tippera Soil Series[1], which is a moderately well drained soil, developed in medium texture old Meghna alluvium. It is a friable, silt loam with a top p^H of 5.5 and an alkaline subsoil. On the medium highland plot, seasonal flooding depth does not normally exceed 30 cm. The major cropping pattern, under rainfed conditions is aus-t.aman-fallow. To a much lesser extent some rabi crops are grown.

RAIPUR STATION RESEARCH

Several soybean trials were conducted in Raipur Upazila at a site about one mile west of Raipur town which is in Laksmipur district. The site is located on the Faridganj soil series which includes seasonally flooded, poorly drained soils developed on the lower Meghna River floodplain. They are characterized by a friable silt loam topsoil overlying a friable silt loam subsoil. The area is mostly triple cropped land with aus or jute followed by transplanted aman followed by some rabi crops such as khesari, mungbean, or chillis. Some mixed aus-aman followed by rabi crops is also planted. Flooding up to 1 meter occurs for three to four months a year.

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[1]Reconnaissance Soil Survey Noakhali District and Sadar North, Sadar south and Chandpur subdivision of the Comilla District, 1965-66 (Revised edition 1970) Soil Survey Directorate.

CHAR BATA STATION RESEARCH

Most of the char research this past year was conducted at the station near Char Bata, Kashir Hat. This station contains 10 bunded fields of varying sizes totaling about 1.2 hectares, to which another field of 0.25 hectares is added in the rabi season. Soil salinity is low to moderate, although several fields have patches of high salinity. Flooding depths range from 10 to 50 cm and vary between fields enabling the testing of both Rajashail and Kalamota based cropping patterns. Rajashail and Kalamota are the two predominant aman varieties grown in the char with the former being an early-maturing, somewhat salt tolerant variety grown on higher land and the latter being a later-maturing variety grown on lower land.

CHUADANGA STATION RESEARCH

Research on soybeans has been conducted for the past two years near Chuadanga town, in Chuadanga district. This research is designed to aid MCC's soybean seed multiplication efforts there. Two soil types prevail: one is a sandy loam, on higher land and the other is a clay loam on lower land. Trials are conducted on both soil types.

NATHER PETUA STATION RESEARCH

Approximately 0.3 ha of land was rented to perform some station research trials in conjunction with the Nather Petua C. S. site. The bazar of Nather Petua is located in Uttar Howda South Union, Laksam upazila, Comilla. It is approximately 10 km north of Sonaimuri on the Sonaimuri-Laksam road. It is also on the Noakhali Laksam rail line. The research site area is classified as medium lowland. The soil is a clay silt to clay silt loam of the Barura and Tippera Soil Series. The area is poorly drained and subject to flash flooding with flood water to a depth of 0.75 to 1.75m for five to seven months of the year.

STATION RESEARCH PERSONNEL

At Feni research station, research trial implementation was managed by Abdur Razzaque Shah. At Raipur, Md. Zainal Abedin conducted the soybean trials. At the Char Bata station, Golam Mowla was responsible for managing the research work. Ali Hossain Mia managed the research trials at Chuadanga, under the supervision of the soybean agronomist, George Horlings. Oscar Rozario, the Chitosi Station C. S. site manager, implemented the research trials at the Nather Petua and, later, Chitosi Research Stations. This work would not have been possible without the dedication and effort of these men, and the many other regular staff and daily laborers at these research sites.

CROPPING SYSTEMS SITE DESCRIPTIONS

Medium Lowland Sites

Nather Petua: The bazar of Nather Petua is located in Uttar Howda South Union, Laksam Upazila, Comilla. It is approximately 10 km north of Sonaimuri on the Sonaimuri-Laksam road. It is also on the Noakhali - Laksam rail line. Nather Petua is in a large area of medium lowland. Flooding occurs from June to December, ranging in depth from 0.75m to 1.75m. Small plots near baris have been raised by farmers and could be classified as medium highland. There are also spots of very deep flooding that could be classified as lowland. The area generally has poor drainage and is subject to flash flooding. The soil is a clay silt to clay silt loam.

The main cropping patterns are broadcast aman-fallow and broadcast aus/aman-fallow. Rabi crops are grown to a very limited extent. There are several local varieties of aus and aman grown; the major aus variety is Kalapetia and the main aman variety is Keora. Because of a late aman harvest and the poor drainage, rabi crops cannot be planted very early. Rabi crops grown include wheat, mustard, linseed, lentil, and mungbean.

Fertilizer is used by farmers with investable resources. Little weeding is done during the rice season. Larger farmers who own an asra (rake) use it to weed their fields. Most farms are owner-operated; only a small proportion of land is sharecropped. Only the richer farmers own all of their agricultural implements.

The Nather Petua Cropping Systems Site was closed in December, 1986, and a new medium lowland site was opened at Chitosi Station.

Chitosi Station: Chitosi Station is located on the Chandpur fail line, 13 Km west of Laksam. It is in Mudafarganj #5 Union, Laksam Upazila, Comilla District. The Chitosi Station Cropping Systems Site was opened at the end of 1986.

Chitosi Station is in a medium lowland area (flooding depth of 0.75 - 1.75m). The depth of flooding, duration of flooding and potential for

for flash floods are the major constraints affecting the cropping pattern. Flooding usually starts in June and ends in November. The soil is a silty clay loam.

The main cropping patterns are deepwater aman - fallow and mixed aus/aman - fallow. About 60% of the fields are fallow in the rabi season. There are many local aus and deepwater aman varieties grown; the major aus variety is Fitta; major aman varieties are Keora and Gorcha. The aus and aman crops are usually planted around the end of March and beginning of April, respectively. Aus is harvested mostly in July. Aman is harvested in mid to late November.

The major rabi crops in this area are wheat, fieldpea, mustard, Khesari, lentil, linseed and mungbean. Boro rice, watermelon, chilli and potato are grown to a very limited extent. There is no irrigation scheme in this area.

The average family size, according to our surveys, is 6.7 persons. Based on the surveys, 96% of the families cannot produce enough from their fields to provide all the rice they need. Non-farm occupations include wage labor, rickshaw pulling, and petty trading. A large proportion of the men go outside the area in the off-season (July through October) in search of work.

Medium Highland Sites

Tetuaya: The Tetuaya Cropping Systems Site is located in the eastern part of Nangolkot Upazila in Comilla District. It is in the midst of a medium highland area that covers about 150 square miles. The Tetuaya site was opened in November 1982 and represented MCC's continued commitment to work in medium highland areas. Medium highland cropping systems work was carried out initially at the Gunabuti site in Chouddogram Upazila, but this site was closed in early 1982.

The physical and agronomic characteristics are typical of a traditional medium highland area. Maximum flooding depth is approximately 80 cm, with flooding normally lasting from the end of June until the middle of October. Soil is of the Trippera soil association, a grey silt loam flood plain.

The major cropping pattern is direct seeded aus-transplanted aman-fallow. Some rabi crops are grown (mustard, lentil, fieldpea, khesari and wheat). Aus varieties are usually Chenal, Purbachi or some other local varieties. Pajam is the dominant aman variety. On the highland areas, aman seedbeds are followed with vegetables, pulses, groundnuts or sweet potatoes.

Tetuaya farmers have had little contact with outside agricultural agencies so information on different agricultural practices is scarce. Most of the farmers have very small landholdings, little excess capital, and usually work part of the year as daily agricultural laborers. Therefore, their capacity for risk taking is constrained by their present marginal existence.

The Tetuaya Cropping Systems Site was closed in December, 1986, and a new medium highland site was opened in Dhorkora village in November, 1986.

Dhorkora: The Dhorkora Cropping Systems Site includes the villages of Dhorkora and Shaktola located near Dhorkora Bazar in Cheora Union, Chaudogram Upazila, Comilla District. The site is approximately five kilometers west of the Dhaka-Chittagong highway. It was opened in November, 1986.

The Dhorkora site is in a large area of medium highland. Maximum flooding depth is approximately 60 cm, with flooding normally lasting from the end of June until the middle of October. Soil is of the Tippera Soil Series, a gray silt loam flood plain. The major cropping pattern is direct seeded aus-transplanted aman-fallow. Aus varieties are Purbachi, Chenal, Badali, and Baturi. Pajam is the dominant aman variety, but some BR 11 is also grown. The land is 80 percent fallow during the rabi season. Crops grown on the remaining land generally include mustard, lentil, khesari, wheat, and cowpea.

Highland areas within or near the villages are usually used for aman seedbeds. Other crops grown on these plots include aus, transplanted aman, sweet-potato, lentil, blackgram, ground nut and winter vegetable (radish, chili, eggplant, sweet pumpkin).

The average family size at the site is 6.5. Approximately one third of the families can provide more than 12 months supply of rice each year from their land holdings. The remaining families are classified as rice deficit or as landless. The average landless family owns 3.3 decimals of land (homesite area only) and obtains 81 percent of its income from non-farm sources (wage labor, professional, petty trading, foreign service). The average rice deficit family owns 44.7 decimals of land. About half of its income comes from farm crops, almost half from non-farm sources, a and a small amount from other farms. The average rice surplus family owns 250.4 decimals and obtains two thirds of its income from farm crops. The predominant land rental methods at the site are sharecropping (bondhak) and cash rent.

BHATIRTEK (Charland)

The Bhatirtek Cropping Systems site is located 10 km south of Sonapur at Choumahani Bazar in U. P. No. 6 of Sudharam Upazila, Noakhali District. Nearby bazars include Hajirhat to the north north east, Bangla Bazar to the north, and Uttar Wabba to the west. Bhatirtek is a relatively new area of the Noakhali Char, formed from the tidal floodplain of the lower Meghna River. Most of the land is medium highland. Flooding may occur from May through to October. The soil is a medium-textured, calcareous silt loam typical of the Ramgoti soil series. The soil is moderately to strongly saline. Some pockets of lighter-textured soils are less saline and can be cropped to vegetables and chilli in the rabi season.

The predominant cropping pattern is fallow-transplanted aman-fallow. The main aman varieties are Rajasail (on the higher land) and Karjasail (on the lower land). The area is 70 to 80 percent fallow in the rabi and aus seasons. Where rabi crops are grown, they include khesari, chilli, cow-pea, linseed, and sweet potato. Eggplant, garlic, onions and peanut are common capital-intensive crops.

Absentee landownership is quite prevalent in the region. This, in conjunction with the sharecropping land tenure system, results in a significant proportion of the rice harvest being transported out of the area.

The mud roads make communication difficult, particularly during the rainy season. Essential inputs of seed, fertilizer and insecticides are often not available in adequate quantities. Farmers depend on their family members for labor, or for additional income if a family member holds another job. During the busy times of rice transplanting and harvesting, additional labor is supplied by migrant laborers. Many farmers own their own draft power.

CROPPING SYSTEMS SITE PERSONNEL

The research trials at the medium lowland sites were implemented and managed by Oscar Rozario. At the medium highland sites, Sukhen Ch. Paul conducted the trials. Nitae Ch. Das managed and implemented the trials at the Char Bhatirtek C. S. Site. All of these men, and the many other regular staff and daily laborers, are to be commended for their excellent work. The research conducted the past year could not have been done without them.

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