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MENNONITE CENTRAL COMMITTEE
Agricultural Program

REPORT NO.-19
STATION AND FARMING SYSTEMS RESEARCH RESULTS

covering the period March 1991 through May 1992

APRIL 1993
1/1 Block A, Mohammadpur, Dhaka, Bangladesh

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INTRODUCTION

MCC's Farming Systems Research Program aims to address the constraints being faced by resource-poor subsistence farmers with their crops, fisheries, livestock and poultry. We have conducted research on two land types: medium highland in Comilla district and the coastal saline charland of Noakhali district. Soybean research was done in Chuadanga, and Bhabaniganj areas.

This report contains the research results from March, 1991 through May, 1992. Research was conducted on vegetables, rice, soybeans, fish, livestock and poultry. Our research was conducted in farmers' fields under their management as well as at the MCC research stations under MCC management.

We express our utmost gratitude to many farmers and individuals from various organizations for their cooperative spirit and good relationships. We also are very much grateful to our Extension Program (EP), Rural Savings Program (RSP) and Homesite Program (HSP) for their generous help and cooperation in identifying the problems encountered by our target subsistence farmers.

We believe this report will serve as a reference for present and future work. These research results, and the process of research itself, help in our efforts to better understand the resource-poor farmers in our working areas. We believe our extension programs have been better enabled to work with our target groups using the technologies/techniques, suitable to them, developed by the Farming Systems Research Program. We also hope that those who receive this report may be benefitted from the findings herein.

CONVERSIONS, ABBREVIATIONS, and DEFINITIONS

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 (TSP, 45 to 50% P_2O_5), muriate of potash (MP, 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). Topdressings are shown by quantities separated by slashes, e.g. 30/30-40-40-15 indicating two 30 kg N/ha applications of urea.

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, Fisher'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.), is the standard deviation (square root of the error mean square) expressed as a percent of the mean. It can be used to compare variability in different experiments involving the same character.

MARGINAL ANALYSIS

When appropriate, trials were evaluated economically using marginal analysis. Please use this discussion when referring 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 off 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 off 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 ARR 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 the VC of the experiment's varying factor(s) and all other VCs from GR.

ABBREVIATIONS/EXPLANATIONS

a) Measurements:

mm	millimeter
cm	centimeter
m	meter
ha	hectare
g	gram
kg	kilogram
md	maund
t/ha	metric tonne per hectare
lb/a	pounds per acre
^{o}C	temperature, degrees Celsius
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):

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

c) Institutions:

ARTD	Adaptive Research and Training Division, BRRI
AVRDC	Asian Vegetable Research and Development Centre, Shanhua, Taiwan
BADC	Bangladesh Agriculture Development Corporation
BARI	Bangladesh Agriculture Research Institute, Joydebpur
BAU	Bangladesh Agriculture University, Mymensingh
BRRI	Bangladesh Rice Research Institute, Joydebpur
CIAT	International Center of Tropical Agriculture, Celi, Columbia
CERDI	Central Extension Resource 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
IFDC	International Fertilizer Development Centre
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

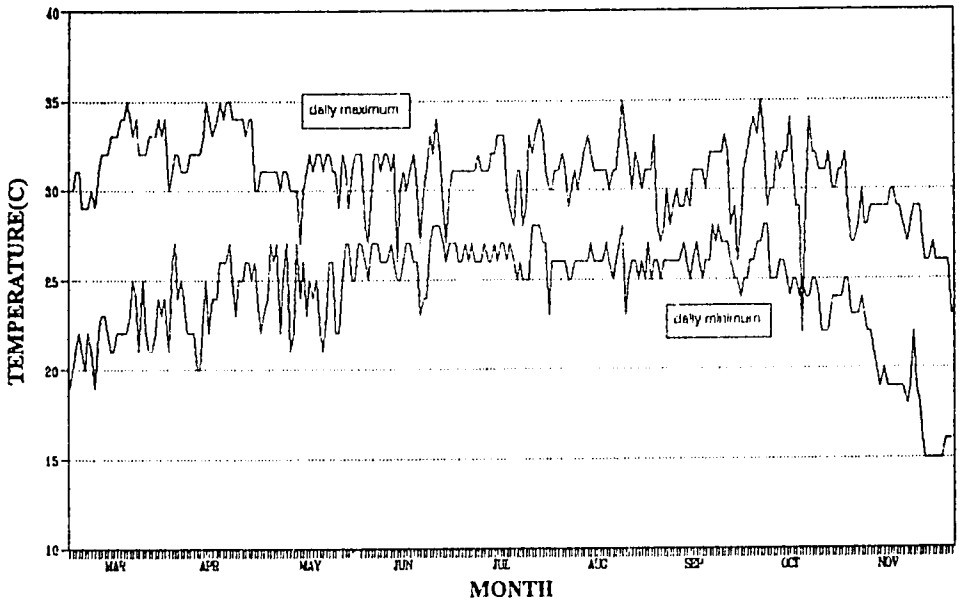
Others:

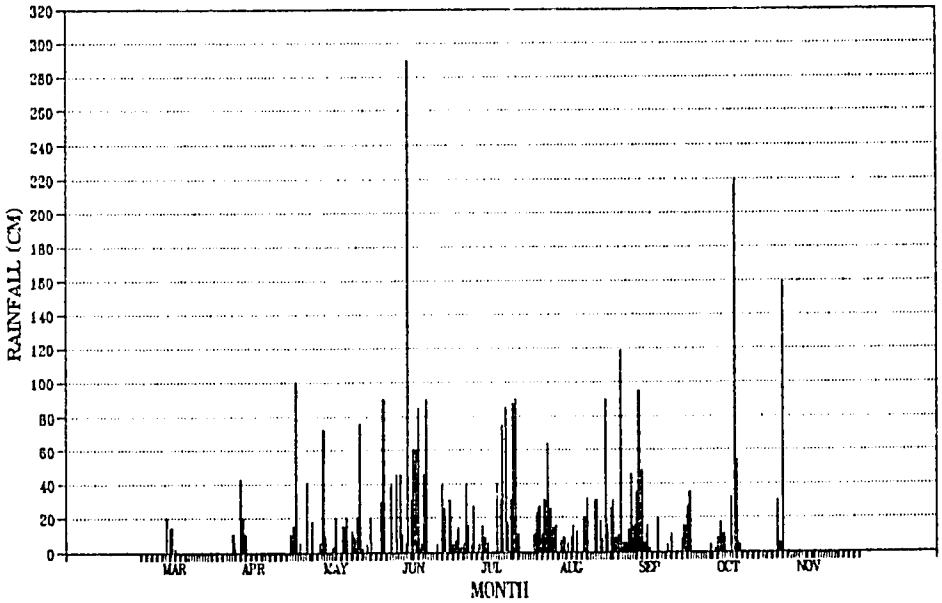
A	Animal labor
ac	acre
achra/asra	Field rake; 1-2 m wide with iron teeth 10-20 cm apart
ALART	Advanced lines adaptive research trial; Cooperative with BRRI
aman	Rainy season rice crop, July-December
aus	Spring rice crop, March-July
bari	a homesite
boro	Winter rice crop, December-May
char	land newly formed by siltation and accretion
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

DWR	Deepwater rice
F_c	Commercial fertilizer
FSRS	Farming System Research Site
G	Granular
GM	Gross margin
GR	Gross revenue
HYV	High yielding variety
K	Potassium
K_2O	Potassium Oxide
kharif	Summer (rainy) season, roughly May-October
M_c	Moisture content
Mh	Man hours
MLT	Multilocation trial
N	Nitrogen
N_H	Hired labor
P	Phosphorus
P_2O_5	Phosphate
Pt	Plant
rabi	Winter (dry) season, roughly November-April
TD	Topdress of fertilizer
Tk	Taka, Bangladesh currency
TSP	Triple super phosphate
TVC	Total variable costs
USG	Urea super granules
VS	Versus
wt	weight

DHORKORA,CHAUDDOGRAM UPAZILA,COMILLA

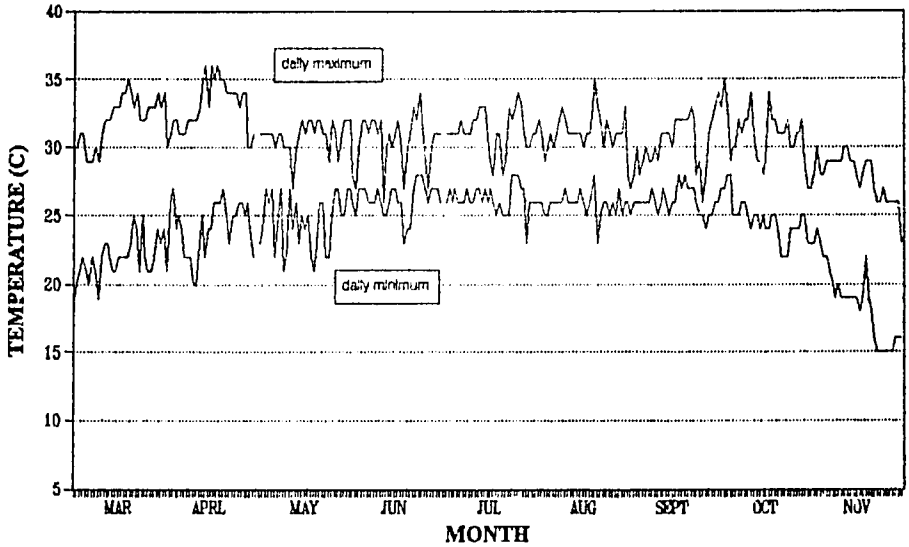
Climatic Data : 1991

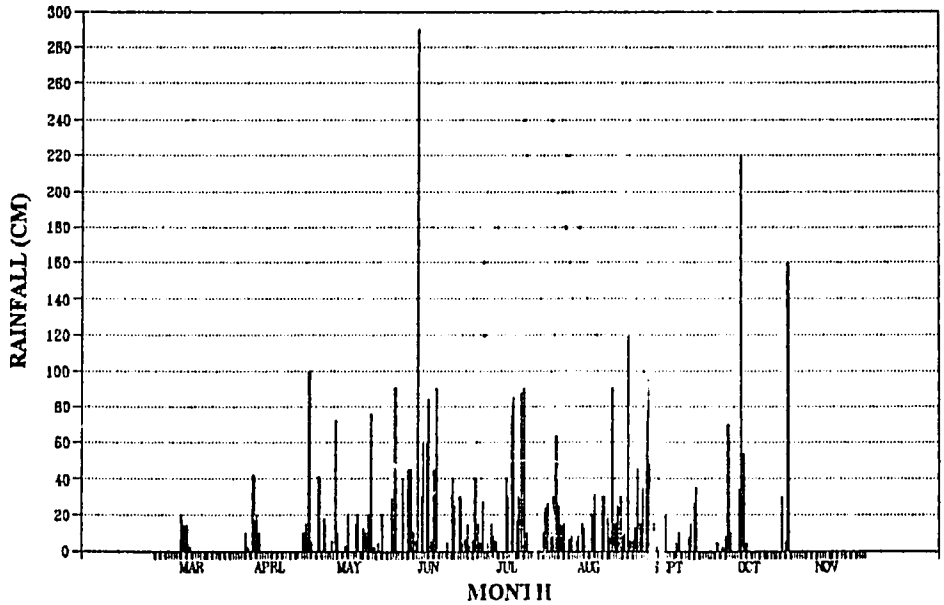




CHAR MATUA,SADAR UPAZILA,NOAKHALI

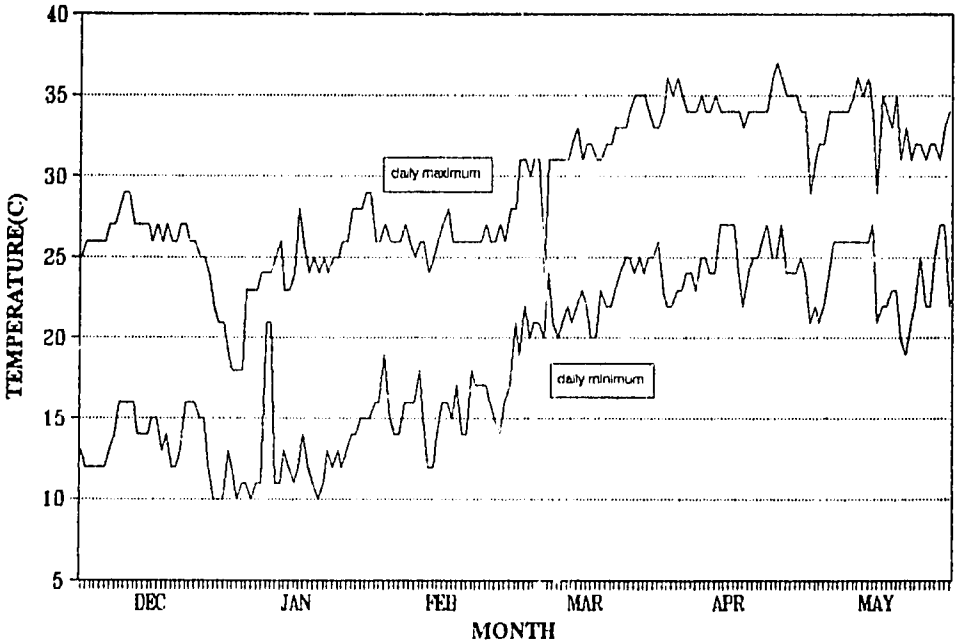
Climatic Data: 1991

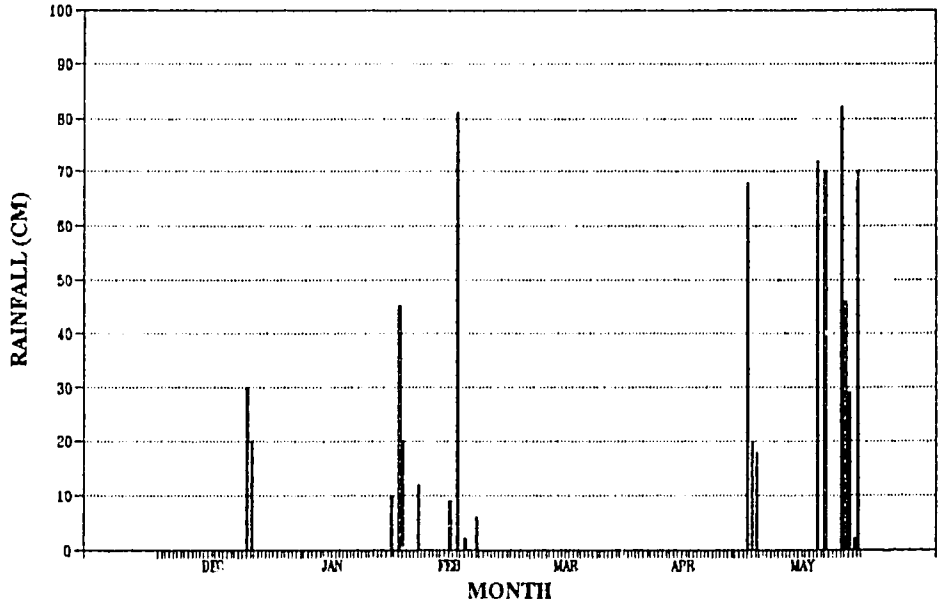




MANNAN NAGAR, SADAR UPAZILA, NOAKHALI

Climatic Data : 1991-92





Crop Research

A

ON-STATION RESEARCH

RICE

DHORKORA ON-STATION UPLAND AUS PVART TRIAL

Introduction

As a part of cooperative research with Bangladesh Rice Research Institute last year seeds of two lines for an upland aus PVART trial were received. This proposed lines adaptive Research trial means these two new lines were already proposed to National Seed Board for their release as new varieties. This proposal for release was made based on their better performance in several previous trials in various agro ecological zones of Bangladesh in the past years. The objective of this trial was to evaluate them finally in this area. The trial was conducted at the MCC Research station at Dhorkora of Chauddagram Upazila, Comilla district.

Results and Discussion

The two proposed lines BR4290-3-1-10 and BR4290-3-3-5 produced statistically similar yields to BR21 and Purbachi. One positive characteristic of the line BR4290-3-1-10 is that it was the earliest maturing line of the four varieties/lines. It was four days earlier than BR-21 and a similar result was obtained in last year's trial. This earliness is undoubtedly a very important characteristic for an aus variety. Another good characteristic of this line was its low seed weight. The shape of the seeds are a little bit narrower and longer than that of the others.

These varieties should be released and recommended for extension.

Table 1 : Dhorkora Upland Aus PVART Trial

Planting date : 15/4/91
Planting method : Direct seeding
Seed rate : 80 Kg/ha
Plot size - planted : 5m X 4m
- harvested: 4m X 3m
Harvesting date: 20/7-5/8/91

Design : RCBD
Replications : 4
Fertilizer : 60-40-40-10
$N-P_2O_5-K_2O-S$ Kg/ha
N at 23, 36 and 50 DAS
Weeding : At 21, 28, 44 and 56 DAS
Insecticides: a/ Ripcord 10EC at 8 and 38 DAS
b/ Basudin 10g at 9 DAS
c/ Diazinon 60EC at 51 & 66 DAS

Variety/Lines	Days to flower	Days to Maturity	Plant height	Plants/ m^2 at 14DAS	Panicles/ m^2 at maturi.	1000 seed wt.	Yield
	#	#	cm	#	#	g	t/ha
BR4290-3-1-10	73	98	96b	174	261	20c	3.2
BR21	73	102	94b	180	255	23b	3.0
BR4290-3-3-5	81	105	105a	180	251	23b	2.9
Purbachi	77	103	85c	161	238	24a	2.9
Mean			95	174	251	22	3.0
LSD (0.05)			6.6	NS	NS	0.59	NS
CV %			4.0	11.5	19	2.00	20.0

a/ Ripcord was applied for cutworm & Stem borer & Rice hispa
b/ Basudin for army worm and cut worm
c/ Diazinon was applied for stem borer

DHORKORA ON-STATION T. AUS PVART TRIAL-91

Introduction

In a continuation of cooperative research with Bangladesh Rice Research Institute (BRRI), two rice lines which are now about to be released were tested at the MCC research station. Seeds were received for both on-station and on-farm trials. This trial was conducted at MCC Research Station along with check variety Chandina (BR-1) to evaluate its specific adaptability in this agro ecological zone.

Results and Discussion

The grain yield of the line IR 44595-70-3-2-2 was found to be significantly higher than that of other line IR 32429-47-3-2-2 and the check variety BR-1. The 1000 grain weight of this variety was also significantly higher than the other line and the variety BR-1. This might be a positive characteristic for this line because in some areas of Noakhali farmers prefer coarse grain over fine grain. The other line IR32429-47-3-2-2 produced a statistically similar yield to BR-1. From this study, the proposed line IR44595-70-3-2-2 seems to be promising.

Table 1 : Dhorkora On-station T. Aus PVART Trial-1991

Planting date : 3/4/91
Transplanting date: 6/5/91
Plot size - planted : 5m X 4m
- harvested: 4m X 3m
Spacing - 20cm X 15cm

Design : RCBD
Replications : 3
Fertilizer : 60-40-40-10
$N-P_2O_5-K_2O-S$ Kg/ha
Weeding : 21 and 34 DAT
Pesticides[a]/ : Maladon 57EC
@ 1.2L/ha at 29 DAT
Dimecron 100EC
@ 1L/ha at 44 DAT

Lines/ Varieties	Days to Flower	Days to matur.	Plant ht.	Plants/ m^2 at 14DAT	Panicles/ m^2 at ma.	1000 seed wt.	Yield
	#	#	cm	#	#	g	t/ha
IR-44595-70-3-2-2	89	111	89a	186b	292	24a	3.31a
BR-1	88	114	74c	211b	266	22b	2.94b
IR-32429-47-3-2-2	87	111	79b	247a	295	20c	2.93b
Mean			81	215	285	22	3.06
LSD (0.05)			4.2	25.1	NS	0.38	0.13
CV %			2.0	5.0	6.0	1.0	2.0

a/ Maladon and Dimecron application were necessary for Rice Hispa and stem borer infestation

CHAR MATUA AUS VARIETY TRIAL

Introduction

In char areas the local rice variety, Boilam is very popular as an aus variety. No improved aus variety is currently cultivated in this area. In Dhorkora areas under Chauddagram Upazila, Comilla district the HYV BR-21 performs well and now it is becoming a popular aus variety in that area. In MCC research trial at Dhorkora a new rice line BR4290-3-1-10 was identified to be a promising variety and BRRI informed that this line was already proposed to NSB for its release as a variety based on its very good performance. In this area Lucky IRRI (source is unknown) is another very popular cultivar and farmers cultivate it widely. The objective of this trial was to compare the performance of the popular cultivar, Boilam in char area with three good performers in Dhorkora areas.

Results and Discussion

The cultivar Lucky IRRI performed the best among all the materials listed. Its yield was significantly higher than the other varieties and it was due to a higher panicle number/m² than that of other varieties. The yields of the line BR4290-3-1-10, BR-21 and local variety Boilam are statistically similar. Though yields are statistically similar the new line had one positive characteristic. It is the earliest maturing line compared to the other three and it matured 14 days earlier than the local popular variety Boilam. This shorter duration is a very important characteristic for an aus variety. In char area as well as in other areas, the line BR4290-3-1-10 seems to be promising.

Table 1 : 1991 Char Matua Aus Variety Trial

Planting date	: 2/4/91	Design	: RCBD
Plot size - planted	: 3m X 3m	Replications	: 4
- harvested	: 2m X 2m	Fertilizer	: 20/20-40-0
Spacing	: 25 X 15cm	Weeding	: 68 DAS
		Pesticide	: None

Variety/Line	Days to[a/] flower	Days to[a/] maturity	Plant height	Panicles/m²	Yield
	#	#	cm	#	t/ha
Lucky IRRI	105	132	95 b	190 a	2.76 a
Boilam	102	129	106 a	148 b	1.92 b
BR4290-3-1-10	86	118	85 c	136 b	1.73 b
BR-21	99	136	74 d	126 b	1.50 b
Mean			90	150	1.98
LSD (0.05)			7.0	33.2	0.69
CV %			4.9	13.8	21.9

a/ days to flowering and maturity calculated from seeding date

DHORKORA T. AMAN (PHOTOINSENSITIVE) ALART TRIAL

Introduction

Seven photoinsensitive advanced T. Aman lines were received from BRRI to test their performance in agro-ecological conditions of Dhorkora areas. These lines were tested along with three check varieties, BR-10, BR-11 and Pajam. The trial was conducted in MCC Research Station at Dhorkora under Chauddagram Upazila, Comilla district.

Results and Discussion

The results indicated that in regard to yield none of the advanced materials is better than BR-10 and BR-11. The variety Pajam produced the lowest yield and it is statistically different from all other tested materials. The line BR534-1-8-2-2-3-1 produced statistically similar yield to BR-10 and BR-11 but its 1000 grain weight is significantly less than that of BR-10 and BR-11. This characteristic of the line indicated its superior fine grain quality and thus will have a higher market price.

Table 1 : Dhorkora T. Aman (Photoinsensitive) ALART Trial

Planting date : 14/7/91
Transplanting date : 13/8/91
Plot size - planted : 5m X 4m
- harvested: 3m X 2m
Spacing : 20 cm X 20 cm

Design : RCBD
Replications : 3
Fertilizer : 60-40-40-10
$N-P_2O_5-K_2O$ Kg/ha
N at 12, 29 and 47 DAT
Weeding : 14 and 22 DAT
Pesticide[b]/ - Maladan 57EC @ 1.1 L/ha
- Sabion 60EC @ 3.5 L/ha
applied at 12, 29 &48 DAT

Lines/Varieties	Days to[a]/ flower	Days to[a]/ maturity	Plant height	Panicles/ m^2	1000 Seed weight	Yield
	#	#	cm	#	g	t/ha
BR534-1-8-2-2-3-1	85	115	112 d	226 a	21 c	4.5 a
BR-11 (Check)	75	104	111 d	217 a	24 a	4.4 a
BR593-676-5-1-1	85	115	113 d	232 a	23 ab	4.3 a
BR-10 (Check)	77	108	110 d	222 a	24 a	4.2 a
BR1244-9-1-2-1-1	77	111	111 d	226 a	24 a	4.0 a
BR2664-3B-5-5-2	75	104	132 c	222 a	24 a	4.0 a
BR2664-3B-5-3-2	90	119	155 a	172 b	24 a	3.8 b
BR425-189-1-6-2-3-1	69	99	137 b	238 a	22 bc	3.5 b
BR4149-13-12-2-1	77	109	135 bc	229 a	23 ab	3.2 b
Pajam	76	103	133 bc	227 a	22 bc	2.3 c
Mean	79	109	125	221	23	3.8
LSD (0.05)			4.98	25.6	1.6	0.61
CV %			2.3	7.0	4.0	9.0

a/ days to flower and maturity were calculated from Transplanting date

b/ maladon and sabion were applied for stem borer and leaf roller control

DHORKORA T. AMAN (PHOTOSENSITIVE) ALART TRIAL

Introduction

Five photoperiod sensitive rice lines for T. Aman cultivation were developed by BRRI. BRRI's objective was to test their performance under different agro-ecological conditions of Bangladesh. MCC's objective was to see their performance in the Dhorkora area. The trial was conducted at the MCC Research Station at Dhorkora under Chuaddagram Upazila, Comilla district. The variety BR-22 was used as the check variety.

Results and Discussion

The numerically highest grain yield was obtained with the line BR1192-2B-35 although it is statistically similar to all other lines/variety excepting the line BR2558-4-2-2-1-3. This line also has the same crop duration to that of the check variety BR-22. Although the yields of the variety BR-22 and the line BR1192-2B-35 are statistically similar, numerically, the yield of the new line was higher so it merits further study to confirm these results.

Table 1 : Dhorkora T. Aman (Photosensitive) ALART Trial

Planting date : 14/7/91
Transplanting date : 12/8/91
Plot size - planted : 5m X 4m
- harvested: 3m X 2m
Spacing : 20 cm X 20 cm

Design: RCBD
Replications: 3
Fertilizer: 60-40-40-10
$N-P_2O_5-K_2O$ Kg/ha
N at 14, 30 and 48 DAT
Weeding: 14, 23 and 30 DAT
Pesticide[b]/-Sabion 60EC @ 1.9 L/ha applied at 28 & 77 DAT

Lines/Varieties	Days to[a]/ flower	Days to[a]/ matur.	Plant ht.	Pani./ m^2	1000 Seed wt.	Yield
	#	#	cm	#	g	t/ha
BR1192-2B-35	85	120	101 d	305 a	24	5.0 a
BR1192-2B-10-1-1-1	86	120	117 a	231 b	23	4.7 a
BR554-156-1-2-1-1-519	87	120	106 cd	244 b	23	4.5 a
BR1870-75-1-2	80	110	113 a	234 b	23	4.1 ab
BR22 (Check)	86	120	110 bc	227 b	24	4.1 ab
BR2558-4-2-2-1-3	78	99	105 cd	190 c	24	3.2 b
Mean			109	239	23	4.3
LSD (0.05)			5.8	24.2	NS	1.11
CV %			10	6.0	4.0	14

a/ days to flower and days to maturity were calculated from Transplanting date
b/ Sabion was applied for stem borer and leaf roller infestation

CAULIFLOWER

MANNAN NAGAR LATE PLANTED CAULIFLOWER VARIETY TRIAL

Introduction

In Noakhali char areas during rainy season, drainage is a big problem, so the lands become ready for winter vegetable cultivation late. Cauliflower cultivation by our subsistence farmers in our working areas is becoming popular. Currently the cauliflower variety that is being extended by our Extension Program is Early Snowball. From its very name it implies that the variety is suitable for early planting and it was also observed that when it was transplanted early in November it performed well. As the lands are not ready for early planting and farmers are still interested to grow cauliflower, a variety suitable for late planting needs to be identified. The trial was conducted with seven cauliflower varieties; six late planted cauliflower varieties plus Early Snowball variety. Seeds of all six other varieties were collected from a seed store in Comilla. The trial was conducted in Mannan Nagar FSRE Research Station, 10 Km south-west of Maijdi in the Sudharam Upazila. The soil of the area is of the Ramgati series, a silt loam soil. The salinity level of the soil is yet to be analyzed.

The primary objective of the trial was to screen out a suitable cauliflower variety for late planting situation in saline char areas.

Results and discussion

The highest yield was obtained from the current MCC extension variety Early Snowball and it differed significantly from all other tested varieties. The second highest yield was associated with the variety N.B. Bigtop and its yield was also significantly different from that of the others.

Although the highest yield producer was the variety Early Snowball some very good desirable characteristics are associated with the variety N.B. Bigtop. It formed curd quicker and first and last harvest were completed earlier than the variety Early Snowball. It initiated curd formation 5 days earlier and this earliness is significant in relation to marketing. As it comes late the market price also goes down. Another important feature of this variety was that it produced virtually no bad curds. The curd size of this variety was nicer and the colour of the curd was whiter than Early Snowball. Farmers around Mannan Nagar Research Station who visited the trial plots preferred the variety N.B. Bigtop over the other varieties. It also had higher market price. The yields of the other varieties were much lower than these two varieties. The variety Patnaiya produced very small curds and bloomed in 21 days and produced seeds. We plan to try these seeds next winter. Considering certain good characteristics of the variety N.B. Bigtop, it merits further testing in the upcoming season both in on-station and on-farm conditions to confirm the present findings.

Table 1: Mannan Nagar Late Planted Cauliflower Variety Trial

Planting date : 17/11/91
Transplanting date : 10/12/91
Plot size - planted : 3m X 4.8m
- harvested: 3m X 4.8m
Spacing - row : 60 cm
- plant : 40 cm

Design : RCBD
Replications: 3
Fertilizer: 120-120-80 N-P_2O_5-K_2O + 2.7t/ha chicken droppings, N at 10, 35 and 50 DAT and chicken droppings at 35 DAT
Irrigation : At 37 and 52 DAT
Insecticide: None

Variety	Days to flower	Days to harvest		Plants/ Plot	Fruits harvested/plot			Yield		
		First	Last		Good	bad	Total	Good	Bad	Total
	#	#	#	#	#	#	#	t/ha	t/ha	t/ha
Early Snowball	55	69	80	55	53	2	55	28.4a	0.8	29.2a
N.B. Bigtop	50	64	71	54	54	0	54	24.2a	-	24.2b
Maghi	50	62	80	55	45	10	55	14.0b	2.9	17.0c
Banarashi	48	57	71	56	50	6	56	13.4b	1.4	14.8cd
Rakkashi	50	62	78	51	47	4	51	13.7b	1.1	14.8cd
Agrahayani	47	57	65	51	49	2	51	11.9b	0.4	12.3d
Patnaiya	21	-	-	-	-	-	-	-	-	-
Mean				41	42.5	3.6	46.1	15.1	0.95	16.0
LSD (0.05)				6.9	9.2	-	6.9	4.4	-	3.7
CV %				8.4	12.1	-	8.4	16.3	-	12.9

MUNGBEAN

MANNAN NAGAR MUNGBEAN LINE TRIAL

Introduction

In 1989, in cooperation with the pulse project of BARI, a mungbean (*Vigna radiata*) line trial on saline soils was conducted at Char Matua (1989 MCC Research). Out of the 30 lines tested, the 9 most promising ones were further tested in 1990 (1990 MCC Research). Due to heavy rains after planting, the yields were all very low. However, the BARI lines still outperformed the local variety. In 1991 these lines were again tested, but early rains ruined all the plots before harvest.

This year we again tested the BM-84 lines that have performed the best and also added several other lines found in the seed stock. Unfortunately some lines could not be planted as the seed had gone bad since the 1990 harvest.

Results and Discussion

Seed was two years old and had not been kept in proper storage. All seed planted had at least 75% germination, yet the vigor was too low on some lines to deal with the field conditions. Therefore plant populations were less than optimum for most of the lines. A heavy rain on 18/2/92 (20 DAS) flooded the field and reduced the plant stand considerably. The damage was greatest in the southern plots (17% survival) and gradually becoming less in the northern plots (57% survival). Only lines BM-84-1-06-3 and BM-84-1-25-2 displayed low survival regardless of location. Unfortunately the replications were laid parallel to this survival gradient so the experimental error in the yield data was increased.

Powdery mildew was measured as the percent of plants infected with the disease. This also showed a north-south gradient. No powdery mildew was recorded in the southern 30% of the plots while 64% of the infected plants were in the northern 20% of the plots. This makes it impossible to compare individual lines, but general comparisons can be made. The BM-84 lines and Kanti were the only lines ever free from powdery mildew in the northern portion of the plot. All 88- lines and the local plots in the northern portion always had some degree of powdery mildew. Population density may have also been a contributing factor, but Kanti and BM-84-22-44 had high populations and still had some plots free from powdery mildew. No yellow mosaic virus was present this year to measure resistance to this virus.

The days to flowering are similar in all of the varieties except for the local which is 4 to 6 days longer. This however is not a great enough difference to consider unless all other factors are equal.

In the 1989 and 1990 trials, the BM-84 series of lines performed much better than the local variety. The 89 trial also showed improved resistance to yellow mosaic virus. This year's trial indicates some improved resistance to powdery mildew, but shows little potential for yield improvements over the local variety. Based on these three years of research, further testing is recommended on the local, 880131, Kanti, and all 5 of the BM-84 lines. The other 3 lines, 880145, 880134, and 880138 should be dropped from future testing as they don't show as much yield potential and are susceptible to powdery mildew.

Table 1: Mannan Nagar Mungbean Line Trial

Planting Date:	29/1/92	Seed Rate	: 39 kg/ha
Harvest Dates:	13/4/92 to 27/4/92	Design	: CRD
Plot Size planted:	2.0m X 4.0m	Replications	: 3 or 4
harvested:	1.0m X 3.0m	Fertilizer	: 20-40-0
Row spacing:	25cm		

Line	Emergence 14 DAS	Days to Flower	Yield/ plant harvested	Yield
	plants/3m^2		g	kg/ha
Local	366 a	55	1.34 bc	775 a
BM-84-22-44	322 ab	49	1.11 c	667 ab
880131	234 c	51	1.65 bc	667 ab
Kanti (7703)	248 c	49	1.56 bc	562 abc
880145	324 ab	50	0.94 c	511 abc
880134	284 bc	50	0.99 c	394 bcd
BM-84-2-07-4	101 d	49	2.15 b	384 bcd
880138	306 b	50	0.75 c	322 cd
BM-84-2-07-3	113 d	50	1.65 bc	300 cd
BM-84-1-06-3	79 de	51	2.38 ab	97 d
BM-84-1-25-2	42 e	52	3.27 a	94 d
Mean	213	51	1.63	430
L.S.D. (.05)	48		0.86	252
C.V.	15.7%		36.3%	40.6%

SOYBEAN

CHUADANGA PRUNED VS. UNPRUNED SOYBEANS TRIAL

Introduction

Planting soybeans in June usually insures that soybean emergence in *kharif* season is not hampered by the beginning of heavy monsoon rains. However, planting soybeans in early June also increases lodging. When soybeans are planted in June, they have a longer vegetative growth stage and plants are 30 to 50 percent taller than soybeans planted in either July or August.

MCC extension staff in the Chuadanga area observed that several farmers were pruning their soybeans (i.e. removing the central growing point at an early stage of development) in response to the problem of increased plant height and lodging. The extentionists observed that the pruned soybeans appeared to have increased branching, higher pod numbers, and greater resistance to lodging. This trial was designed to assess whether pruning of the main growing point of early *kharif* season planted soybeans would reduce overall plant height while maintaining average yield performance.

In order to assess the impact of pruning soybeans, soybeans were pruned at 20, 25 and 30 days after planting. The soybeans were pruned by gathering the growing point or main branch of several soybean plants and then removing that section of the plant by cutting with a knife.

Results and Discussion

Yields of soybeans pruned at both 25 and 30 DAP were significantly higher than those which were not pruned and pruned at 20 DAP. Soybeans pruned at 30 DAP yielded 560 Kg/ha more than the non-pruned soybeans. The treatments pruned 25 and 30 DAP also had more pods/plant. The higher number of pods/plant may have been related to increased branching. In those treatments where soybean plants were pruned, the growth of additional branches from the main stem axils was stimulated. This resulted in a more compact, dense plant.

There was limited difference in the overall resistance to lodging, (Table 1.) However, there were differences in the growth stage at which lodging began. These difference are not reflected in the lodging data, because only one lodging rating was recorded at the end of the season.. However, general observations of the trial indicate that the pruned treatments began to lodge later than the unpruned treatments. Later lodging may account for some of the increase in yield.

Adjacent to the trial plot soybeans were pruned at 40 DAP. These plants appeared to have greater branching and pod number than the trial treatments. Further trials looking at the potential of pruning June planted soybeans should include treatments with pruning dates greater than 30 DAP.

Table 1 : Pruned vs Unpruned Soybeans

Planting date: 21/06/91
Harvest date : 24/10/91
Plot size - planted : 3.6 x 5m
- harvested: 2.7 x 4m
Spacing - row : 45 cm
- plant : 10 cm

Design : RCDB
Replications : 4
Fertilizer : 20-60-20-15
Variety : Pb-1

Treatment	Days to[a/] flow.	Days to[a/] matur.	Plant Height before	Plant Height after	Plant height	Pods/ plant	Plant stand	Lodging [b/]	100 seed weight	Yield
			cm	cm	cm	#	#/m²		g	Kg/ha
No pruning	54	124	-	-	113a	312c	22.3	3.5	10.5	1160c
Pruned 20 DAP	54	124	13.5	11.4	112a	398b	22.5	3.0	11	1232c
Pruned 25 DAP	54	124	16.9	14.6	98b	399b	22.3	3.0	11	1478b
Pruned 30 DAP	54	124	18.6	16.3	92b	469a	22.2	3.0	11	1728a
Mean	54	124	16.3	14.1	104	395	22.3	3.4	10.9	1511
L.S.D. (0.05)					11	54	NS			125
C.V. (%)					6.8	8.6	1.3			5.6

a/ plant height before and after pruning
b/ rating of crop lodging (1=lodging, 5=severe lodging)

CHUADANGA FERTILIZED VS. UNFERTILIZED SOYBEANS

Introduction

The objective of this trial was to assess the effect on soybean yields and profits, by applying fertilizer levels less than those currently recommended by MCC. Many of the farmers involved in MCC's soybean extension programmes use fertilizer levels lower than MCC's recommended fertilizer dose of 20-60-20-15/ha. The decision to apply lower levels of fertilizer are often made because of financial constraints, lack of knowledge about the financial benefit of applying the recommended fertilizer dosage and/or because of confusion about the role of nodules in meeting the nutrient requirements of soybeans. Some farmers believe that proper innoculant application is sufficient.

Results and Discussion

Yields were not significantly different between the treatment receiving the current MCC fertilizer recommendation and the treatment where TSP, MP and S were applied but not Urea (Table 1). The two treatments where fertilizer was applied were both significantly different from the non-fertilized treatment. The benefit of applying additional urea as a basal dose may have been masked by high soil nitrogen levels and/or higher levels of *B. japonicum* bacteria in the soil from previous soybean crops. Previous research has shown that the value of applying urea at the time of planting may become less significant in those fields where soybeans have previously been cultivated (1985 MCC Research Results, Pg. 48-49). As a soil test was not done prior to this trial, it is difficult to make more specific comments.

The treatment that received the recommended MCC fertilizer dosage had the highest gross margin followed by the treatment which received the recommended MCC dosage minus urea. Although the treatment gross margin masks the fact that the two fertilized treatments were not significantly different, which makes the treatment not receiving urea the most economical. The gross margins for both fertilized treatments were substantially higher than the non-fertilized treatment. For *kharif* planted soybeans the current recommended fertilizer dosages should be maintained, especially TSP, MP and S. Future research could reassess the value of applying N (urea).

Although different rates of fertilizer were applied in all three treatments, there were no significant differences in plant heights. There were also no noticeable differences in color ratings at both 28 and 42 days after planting. The only major visual difference was that the treatment receiving no fertilizer had considerably less lodging.

Germination at the time of harvest for all treatments was poor because of late October rains that caused significant damage to the seed.

Table 1 : Chuadanga Fertilized vs Unfertilized Soybeans

Planting date : 27/06/91
Harvest date : 19/10 to 21/10/91
Plot size - planted : 4.5 x 6m
- harvested: 3.6 x 5m
Spacing - row : 45 cm
- plant : 10 cm

Design : RCBD
Replications : 4
Fertilizer : as noted

Treatment[a]	Days to Flow.	Days to Matur.	Plt. ht.	Plant stand b/	Color 28 c/	Color 42	Lodging d/	100 seed wt.	Germination /e	Yield
			cm	#/m²				g	%	t/ha
20-60-20-15	52	117	79	22	3	4	4	11	58	1.55
00-60-20-15	52	117	75	22	3	4	3	11	58	1.41
no fertil.	52	116	66	22	3	4	1	10	70	1.00
Mean	52	117	73	22	3	4	1	10.5	62	1.32
L.S.D (0.05)		NS	NS					0.75	14	0.23
C.V. (%)		16.1	1.3					4.5	NS	11.0

a/ all treatments are with inoculant
b/ number of plants/m² at harvest
c/ colour rating at 28 and 42 DAS (1=yellow; 5=dark green)
d/ rating of crop lodging (1=no lodging, 5=severe lodging)
e/ germination at the time of harvest

Table 2: Comparison of Cost and Returns for Three Different Fertilizer Additions.

Treatment	Yield	Product Price	Gross Revenue	Total Variable Costs	Gross Margins
	t/ha	Tk/kg	Tk/ha	Tk/ha	Tk/ha
1. 20-60-20-15	1.55	10	15500	1640	13,860
2. 00-60-20-15	1.41	10	14100	1400	12,700
3. no fert.	1.00	10	10000	-	10,000

CHUADANGA *KHARIF* SOYBEAN VARIETY DATE OF PLANTING SCREENING TRIAL

Introduction

The objective of this trial was to observe the effect of field weathering on soybean (*Glycine max L. Merr.*) seed quality at harvest. Each of the varieties in MCC's collection which have been obtained since this trial was last conducted (1989 MCC Research Results pp. 37-38) were planted on a wide range of planting dates. Weathering is caused by high temperature and humidity during the period between physiological maturity and harvest. Since soybean is more susceptible to this weathering than other crops, it is important to select a variety which can resist field weathering. Other important agronomic traits were also monitored. The varieties were planted out on each of four dates.

Results and Discussion

Information presented in TABLE 1 was compiled by taking the average of the four planting dates for all data except photosensitivity index and weathering resistance. The range of values was also reported for days to maturity, plant height and yield.

Photosensitivity index was calculated as the negative slope of the regression of days to maturity against date of planting.

Weathering resistance was rated as the number of planting dates from which good quality seed was harvested. Seed germinating above 90 percent was scored 2 points while each harvest producing seed germination over 80 percent was scored one point.

Table 1: Chuadanga Kharif soybean date of planting screening trial

Planting dates: 8/8/91, 21/6/91, 11/7/91, 25/7/91
Plot size: 0.6m x 2m
Replications:1
Fertilizer: 20-60-20-15

Variety	Days to Maturity		Photo-sensitivity index a/	Plant height		Disease rating	
	mean	range		mean	range	YMV	BP
NS-1	86	76- 92	0.27	44	31- 60	1	1
PM-60	109	97-121	0.52	63	38- 95	1	2
SJ-1	105	89-123	0.55	65	32-121	1	2
SJ-2	106	89-128	0.61	63	34- 99	1	2
SJ-4	104	89-121	0.49	58	33- 88	1	2
SJ-5	105	89-128	0.59	61	34-100	1	1
SL-1	101	89-118	0.43	68	32-110	1	1
Chaing Mai	98	81-119	0.62	42	26- 81	1	1
MTD-173	100	85-119	0.70	65	35-103	1	1
MTD-176	101	85-120	0.52	72	28-147	1	1
MTD-451	100	85-119	0.54	61	22-123	1	1
MTD-452	94	89-108	0.27	66	29-120	1	1
MTD-459	93	85- 97	0.28	62	26- 98	1	1
MTD-6	99	84-126	0.69	72	30-121	1	2
MTD-9	108	89-128	0.66	62	30-111	1	1
MTD-10	103	86-128	0.65	70	33-109	1	1
Don Son	99	84-123	0.66	69	33-126	1	3
Tan Uyem-1	98	82-118	0.64	57	30- 78	1	1
Ngoc dong	99	82-128	0.75	69	33-156	1	3
Tan tho 3	107	93-128	0.73	51	43- 74	1	2
Dabo bong tim	99	88-123	0.53	67	31-129	1	3
Ming Hai	91	86- 98	0.21	45	29- 63	1	3
AGS-54	97	93-103	0.22	34	30- 45	1	2
AGS-59	98	93-104	0.25	38	30- 58	1	2
AGS-79	107	96-121	0.50	43	34- 63	1	2
AGS-91	98	93-103	0.23	35	24- 44	1	1
AGS-95	98	93-103	0.23	34	26- 46	1	2
AGS-120	102	89-120	0.45	58	38-121	1	2
AGS-154	96	93-100	0.17	45	30- 60	1	2
AGS-182	83	76- 91	0.22	36	20- 47	1	2
AGS-205	86	80- 88	0.04	37	24- 55	1	2
AGS-227	96	93-104	0.30	54	37- 81	1	3
AGS-283	88	85- 91	0.12	42	29- 55	1	2
AGS-297	89	89- 92	0.06	40	28- 63	1	2
AGS-129	100	94-105	0.32	42	32- 64	1	1
AGS-302	99	94-103	0.26	40	30- 55	1	2

a/ photosensitivity index is a rating of sensitivity of maturity to photoperiod (day length) 0 = photoinsensitive and 1.0 = absolutely photosensitive.

b/ YMV = yellow mosaic virus; BP = bacterial pustule; rated on a scale of 1 to 5; 1 = no disease, 5 = severe symptoms.

Table 1: Chuadanga Kharif Soybean Date of Planting Screening Trial pg 2

Planting dates: 8/8/91, 21/6/91, 11/7/91, 25/7/91
Plot size: 0.6m x 2m
Replications:1
Fertilizer: 20-60-20-15

Variety	Days to Maturity		Photo-sensitivity index a/	Plant height		Disease rating	
	mean	range		mean	range	YMV	BP
AGS-314	87	85- 90	0.10	50	33- 74	1	2
AGS-327	85	82- 93	0.20	46	31- 59	1	1
GC-81027-16-1	100	96-107	0.26	55	38- 80	1	1
GC-82341-7-2	101	94-108	0.28	58	34- 88	1	1
GC-82341-14-2	103	93-120	0.58	64	39-105	1	1
GC-82333-24-11	102	97-108	0.17	46	34- 61	1	1
GC-82345-20-2	97	93-103	0.22	52	34- 80	1	3
GC-84007-9-5-1	102	96-118	0.48	41	35- 46	1	2
Kusl-20004	97	93-102	0.20	46	32- 45	1	1
Pl-25658	94	93- 98	0.14	28	24- 34	1	2
LN-14	101	93-118	0.53	50	36- 78	1	1
Vesoy-4	106	97-119	0.46	36	23- 48	1	1
No 205	94	82-102	0.33	22	10- 29	1	3
No 305	-	-	-	-	-	1	-
Shohag (Pb-1)	99	88-120	0.49	52	31- 92	1	3
G2120(M7)69-1	86	80- 90	0.10	42	23- 72	1	2
Santa Rosa R	106	89-130	0.61	50	29- 78	1	1
MTD-469	97	85-119	0.53	78	53-107	1	1

a/ photosensitivity index is a rating of sensitivity of maturity to photoperiod (day length) 0 = photoinsensitive and 1.0 = absolutely photosensitive.

b/ YMV = yellow mosaic virus; BP = bacterial pustule; rated on a scale of 1 to 5; 1 = no disease, 5 = severe symptoms.

Table 2: Chuadanga Kharif Soybean Date of Planting Screening Trial

Planting dates: 8/8/91, 21/6/91, 11/7/91, 25/7/91
Plot size: 0.6m x 2m
Replications:1
Fertilizer: 20-60-20-15

Variety	100 seed wt. (g)	Weathering Resistance (0 to 8) /c	Yield (t/ha) mean	Yield (t/ha) range
NS-1	18	7	1.6	1.2-3.0
CM-60	14	4	1.2	0.6-1.6
SJ-1	12	4	1.2	1.2-1.9
SJ-2	11	5	1.0	0.9-1.4
SJ-4	12	4	0.9	0.8-1.4
SJ-5	12	6	1.1	0.9-1.5
SK-1	13	2	0.9	0.4-1.3
Chaing Mai	12	4	0.8	0.8-1.1
MTD-173	11	2	0.8	0.4-1.4
MTD-176	15	5	1.5	1.1-2.6
MTD-451	13	3	0.7	0.6-1.2
MTD-452	15	6	1.2	1.1-2.1
MTD-459	16	4	0.9	1.0-1.4
MTD-6	13	5	1.4	1.3-2.1
MTD-9	15	6	0.7	0.5-0.9
MTD-10	10	5	1.2	1.0-2.1
Lan Son	13	4	1.2	1.1-2.1
Lan Uyem-1	14	3	0.8	0.8-0.9
Moc dong	14	6	0.6	0.6-0.8
Can tho 3	13	6	0.6	0.2-0.9
Dabo bong tim	10	6	1.1	0.9-1.8
Ning Hai	8	5	0.8	0.6-1.5
AGS-54	10	5	0.6	0.1-1.4
AGS-59	10	4	0.9	0.3-1.9
AGS-79	10	4	1.0	0.6-1.3
AGS-91	9	3	0.6	0.2-1.4
AGS-95	10	4	0.6	0.2-1.2
AGS-120	9	7	1.1	0.5-2.4
AGS-154	10	3	0.7	0.4-1.1
AGS-182	12	1	0.8	0.3-1.6
AGS-205	10	2	0.7	0.2-1.4
AGS-227	11	2	0.8	0.4-1.2
AGS-283	8	0	0.8	0.3-1.4
AGS-297	9	7	0.7	0.3-1.4
AGS-129	12	3	0.2	0.1-0.3
AGS-302	17	0	0.1	0.1-0.2
AGS-314	5	6	0.7	0.2-1.0
AGS-327	16	7	1.5	0.7-2.9

/c weathering resistance rated by number of planting dates with greater than 80 percent germination. Dates with greater than 80% germination = 1 point scored; dates with greater than 90% germination = 2 points scored.

Table 2: Chuadanga Kharif Soybean Date of Planting Screening Trial pg 2

Planting dates: 8/8/91, 21/6/91, 11/7/91, 25/7/91
Plot size: 0.6m x 2m
Replications:1
Fertilizer: 20-60-20-15

Variety	100 seed wt. (g)	Weathering Resistance (0 to 8) /c	Yield (t/ha) mean	Yield (t/ha) range
GC-81027-16-1	11	8	1.0	0.6-1.4
GC-82341-7-2	14	4	1.1	0.8-1.4
GC-82341-14-2	10	3	1.3	0.8-1.9
GC-82333-24-11	10	5	0.4	0.2-0.5
GC-82345-20-2	14	4	0.9	0.4-1.8
GC-84007-9-5-1	9	3	0.7	0.5-0.9
Kusl-20004	11	3	0.9	0.3-1.6
Pl-25658	19	3	0.4	0.8-0.3
LN-14	11	5	0.7	0.4-1.0
Vesoy-4	21	1	0.9	0.1-1.3
No 205	17	0	0.1	0.1-0.2
No 305	-	-	-	-
Shohag (Pb-1)	9	1	1.1	0.8-2.1
G2120(M7)69-1	5	5	0.8	0.4-1.5
Santa Rosa R	10	7	1.3	1.1-2.1
MTD-469	13	4	1.3	0.9-2.2

/c weathering resistance rated by number of planting dates with greater than 80 percent germination: dates with greater than 80% germination = 1 point scored; dates with greater than 90% germination = 2 points scored.

CHUADANGA SOYBEAN ROW VS BROADCAST METHOD OF SEEDING

Introduction

In the past, MCC recommended that soybeans (*Glycine max L. Merr.*) be line sown in both *rabi* and *kharif* seasons. Due to the higher labour cost of line seeding and the ease of broadcasting, almost all farmers broadcast rather than line seed. This trial was designed to contrast the difference between row and broadcast methods of seeding soybeans in *kharif* season.

Results and Discussion

The data did not indicate any significant difference in yield between line and broadcast seeding. In addition, there are other important reasons why farmers choose to broadcast soybeans in *kharif* season. Firstly, line seeding is much more expensive than broadcast seeding. For broadcast seeding soybeans, the total variable cost for the Chuadanga area was approximately 15 TK/ha (one laborer for four hours). This is in contrast to line seeding which has a variable cost of approximately TK. 750/ha (25 laborers for one day). Although line seeding has an advantage for weeding because of the regular inter-row spaces, the convenience does not warrant the additional expenditure for seeding.

Secondly, in *kharif* season broadcast seeded fields generally have higher emergence than line seeded fields. When soybeans are line seeded, the seed is planted deeper in the soil than when broadcast. A heavy rain after planting can inhibit the emergence of deeply planted seed, particularly in soils prone to crusting. On the other hand, seed planted close to the soil surface, as it is in broadcast fields , seldom has emergence problems. For example, this trial had to be planted 3 times because of heavy rains which decreased emergence in the line sown treatments to virtually nothing. This is in contrast to the broadcast treatments which had adequate emergence each time that the trial was planted.

Reduced planting time is a third advantage of broadcasting soybeans in *kharif* season. In the case of line seeding approximately 25 laborers are required to plant one hectare of land in one day. For broadcast soybeans one person can seed one hectare of land in three to four hours followed by the time needed for a light harrowing. Shorter planting times allow the farmer to complete more sowing in the times between heavy rains.

Table 1 : Chuadanga Soybean Row vs Broadcast Method of Seeding

Planting date : 11/07/91
Harvest date : 23/10/91
Plot size - planted : 9 x 11 m
- harvested : 2.7 x 4 m
Spacing - row : 45 cm
- plant : 10 cm

Design : CRD
Replications : 3
Fertilizer : 20-60-20-15
Variety :Pb-1

Treatment	Days to Flower	Days to Matur.	Plant Stand	Plant Height	Lodg.	100 Seed Wt.	Germination a/	Yield
			#/m²	cm		g	%	t/ha
Broadcast	46	103	22	62	1	9	93	1.43
Line	46	103	21	57	1	9	93	1.26
Mean	46	103	21	60	1	9	93	1.33
C.V.(%)			1.1	4.8				15.0
L.S.D. (0.05)			NS	NS				NS

a/ Germination at the time of harvest

KHARIF SOYBEAN OBSERVATION TRIALS

Introduction

In both *kharif* season (Chuadanga) and *rabi* season (Bhabaniganj) a varietal observation trial was conducted to maintain a germplasm of soybean (*Glycine max L. Merr.*) varieties and to provide an opportunity for data to be collected on important agronomic characteristics. In the 1991 *kharif* and *rabi* seasons there were a total of 102 varieties in the observation trials.

The data collected is presented in the same format as presented in the 1991 MCC research results with the exception of varietal identity genetic markers (color of flowers, pubescence, hilum, pod and seed), which will only be listed for those varieties that have been added since the last reporting period.

Table 1: Chuadanga Kharif Soybean Variety Observation Trial

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Days to flower	Days to maturity	Plant height	Seed germ-ination	Plant stand	Yield /a
			cm	%	#/m²	t/ha
G10102	47	105	63	67	37	1.52
G10180	37	112	45	98	36	0.68
AGS-313	40	90	55	90	39	1.22
Shohag (Pb1)	47	101	63	80	35	1.45
Bragg	37	111	43	36	27	1.86
PK-262	43	111	35	70	15	1.39
PK-327	40	103	39	77	35	1.56
PK-416	38	109	47	73	36	1.62
Guarav	45	114	53	90	37	2.06
Durga	45	107	53	93	39	1.72
AGS-160	44	160	43	64	36	1.03
G2120(M7)69-1	39	86	43	83	40	0.76
MTD-65	46	104	61	93	39	2.02
MTD-13	44	108	50	83	39	1.52
IAC-12	44	108	46	82	40	1.32
TGX814-26D	47	108	49	95	39	1.14
PR-13(114)	53	115	53	92	29	1.65
TGX814-23D	57	111	60	92	39	2.14
Leflore	47	108	65	78	39	1.35
ISRA/IRAT26/77	54	118	69	94	39	1.40
KHSB-2	47	111	53	57	39	1.68

a/ yields taken from unbordered plots

Table 1: Chuadanga Kharif Soybean Variety Observation Trial page 2

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Days to flower	Days to maturity	Plant height	Seed germ-ination	Plant stand	Yield /a
			cm	%	#/m²	t/ha
TGX849-294D	48	107	59	92	18	1.69
MACS-57	47	103	55	75	39	1.49
SaoLuiz	44	118	46	93	39	2.03
PR-141	57	118	51	90	28	1.44
TGX573-208D	44	108	79	80	39	1.75
Santa Rosa R	44	114	70	93	39	2.59
CO-1	47	103	74	94	36	1.07
IAC-11	44	108	69	70	38	1.62
IAC-8	45	111	66	72	39	2.10
PB1-OT	46	103	62	67	35	1.17
TGX-539-5E	60	125	59	45	33	2.16
AGS-272	37	114	43	70	36	1.68
AGS-234	44	105	39	74	12	0.46
Davis	37	105	41	60	30	1.64
PR164-20	49	109	67	90	30	1.52
PR-142	58	118	61	90	40	1.23
Shilajeet	38	104	41	44	38	1.59
JS-2	40	106	39	50	39	1.55
Ankur	50	122	61	95	34	1.91
Tari 92533	48	108	88	90	38	1.54
D-75-9207	59	125	62	94	40	1.39
BBF	62	125	69	49	32	2.08
NS-1	35	90	45	68	39	1.86
CM60	39	108	60	43	33	0.94
SJ-1	41	108	58	72	38	1.46
SJ-2	45	107	68	88	37	0.86
SJ-4	44	106	62	65	38	1.09
SJ-5	45	108	64	80	38	1.18
SK1	40	104	58	87	36	1.50
Chaing Mai	45	107	51	89	38	1.59
MTD-173	40	101	62	37	38	0.88
MTD-176	49	108	85	90	38	1.73
MTD-451	46	102	67	55	38	1.14
MTD-452	46	101	63	72	39	1.67
MTD-459	37	102	65	84	38	0.96
MTD-464	43	111	51	82	36	0.94
MTD-469	41	100	83	59	40	1.30
MTD-6	49	100	69	78	32	1.59

a/ yields taken from unbordered plots

Table 1: Chuadanga Kharif Soybean Variety Observation Trial page 3

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Days to flower	Days to maturity	Plant height	Seed germ-ination	Plant stand	Yield /a
			cm	%	#/m²	t/ha
MTD-9	43	102	67	61	39	1.05
MTD-10	47	107	76	88	38	1.40
Con son	48	102	65	18	36	1.53
Tan Uyem-1	43	108	81	73	40	0.91
Ngoc dong	45	101	75	12	17	0.86
Can tho-3	50	107	67	94	37	1.01
Dabo bong tim	48	102	68	84	39	0.91
Ninh Hai	39	98	49	40	39	0.84
AGS-54	43	102	35	85	13	1.01
AGS-59	42	103	51	37	19	1.07
AGS-79	44	109	62	88	17	1.16
AGS-91	41	106	42	48	7	0.67
AGS-95	41	106	56	50	17	1.01
AGS-120	48	107	72	94	30	1.48
AGS-154	37	99	50	40	20	0.74
AGS-182	34	81	44	20	34	1.08
AGS-205	26	83	37	32	26	0.64
AGS-227	26	88	23	18	2	0.07
AGS-283	37	86	40	75	32	0.82
AGS-297	37	86	31	79	30	0.45
AGS-129	40	100	38	60	5	0.20
AGS-302	26	102	37	20	20	0.16
AGS-314	37	83	48	70	39	1.06
AGS-327	35	90	56	80	39	1.81
GC 81027-16-1	39	102	53	79	33	1.16
GC 82341-7-2	43	103	66	52	37	1.54
GC 82341-14-2	44	103	65	70	37	1.32
GC 82333-24-11	35	102	42	28	25	0.82
GC 82345-20-2	34	99	51	8	40	1.05
GC 84007-9-5-1	44	101	51	67	31	1.15
Kusl-20004	35	98	48	22	16	0.91
PI-25658	35	90	27	9	29	0.79
UN-14	40	103	49	67	16	0.99
Vesoy-4	41	108	35	88	10	1.12
No 205	34	98	29	4	9	1.92
No 305	34	90	21	-	2	0.04
KairyoushiRome	28	105	28	92	22	0.56
Orihime	37	109	32	77	15	0.45

a/ yields taken from unbordered plots

Table 1: Chuadanga Kharif Soybean Variety Observation Trial part 1

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Days to flower	Days to maturity	Plant height	Seed germination	Plant stand	Yield /a/
			cm	%	#/m²	t/ha
Kogane diazu	37	90	24	80	6	0.17
Asomu Sume	39	106	42	67	33	1.1[illegible]
Akisene taku	41	108	36	64	29	0.81
Fukuyu taku	37	108	44	34	31	0.90
Shih-Shih	37	89	41	72	17	0.52

a/ yields taken from unbordered plots

Table 2: Chuadanga Kharif Soybean Variety Observation Trial

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Disease rating/b/ YMV	Disease rating/b/ BP	Insect rating/b/c HC	Insect rating/b/c LF	Lodging/d rating
G10102	1	3			1
G10180	1	4			1
AGS-313	1	2			1
Shohag (Pb1)	1	3			3
Bragg	1	1			1
PK-262	1	1			1
PK-327	1	1			1
PK-416	1	1			1
Guarav	1	1			1
Durga	1	1			1
AGS-160	1	3			1

b/ disease and insect damage symptoms rated on a scale of 1 to 5; 1 = no symptoms; 5 = severe symptoms
YMV - yellow mosaic virus
BP - bacterial pustule
HC - hairy caterpillar
LF - leaf folder

c/ no insects were observed
d/ 1 = no lodging; 5 = severe lodging

Table 2: Chuadanga Kharif Soybean Variety Observation Trial pg 2

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Disease rating/b		Insect rating/b/c		Lodging/d rating
	YMV	BP	HC	LF	
G2120(M7)69-1	1	2			1
MTD-65	2	1			2
MTD-13	1	1			1
LAC-12	1	1			1
TGX814-26D	1	1			1
PR-13(114)	1	1			1
TGX814-23D	1	1			1
Leflore	1	3			1
ISRA/IFAT26/77	1	1			1
KHSB-2	1	1			1
TGX849-294D	2	1			1
MACS-57	1	3			1
SaoLuiz	1	1			1
PR-141	1	3			-
TGX573-208D	1	1			1
Santa Rosa R	1	1			1
CO-1	1	4			2
LAC-11	1	3			2
LAC-8	1	2			1
PB1-OT	1	3			1
TGX-539-5E	1	1			1
AGS-272	1	3			1
AGS-234	1	3			1
Davis	1	1			1
PR164-20	1	1			1
PR-142	1	4			1
Shilajeet	1	1			1
JS-2	1	1			1
Ankur	2	1			1
Tari 92533	2	3			2
D-75-9207	3	2			1
BBF	1	1			1

b/ disease and insect damage symptoms rated on a scale of 1 to 5; 1 = no symptoms; 5 = severe symptoms
YMV - yellow mosaic virus
BP - bacterial pustule
HC - hairy caterpillar
LF - leaf folder

c/ no insects were observed
d/ 1 = no lodging; 5 = severe lodging

Table 2: Chuadanga Kharif Soybean Variety Observation Trial pg 3

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Disease rating/b		Insect rating/b/c		Lodging/d rating
	YMV	BP	HC	LF	
NS-1	2	1			1
CM60	1	3			1
SJ-1	1	3			1
SJ-2	1	3			1
SJ-4	1	3			1
SJ-5	1	3			1
SK1	1	1			1
Chaing Mai	1	2			1
MTD-173	1	3			1
MTD-176	1	1			3
MTD-451	1	1			3
MTD-452	2	1			2
MTD-459	1	1			3
MTD-464	1	1			1
MTD-469	1	1			3
MTD-6	1	3			3
MTD-9	1	1			1
MTD-10	1	1			1
Con son	1	3			3
Tan Uyem-1	1	1			4
Ngoc dong	1	3			2
Can tho-3	1	4			1
Dabo bong tim	1	4			3
Minh Hai	1	4			3
AGS-54	1	3			1
AGS-59	1	2			1
AGS-79	1	3			[illegible]
AGS-91	1	2			1
AGS-95	1	2			1
AGS-120	2	3			1
AGS-154	2	3			3
AGS-182	1	5			2
AGS-205	1	3			2

b/ disease and insect damage symptoms rated on a scale of 1 to 5; 1 = no symptoms; 5 = severe symptoms
YMV - yellow mosaic virus
BP - bacterial pustule
HC - hairy caterpillar
LF - leaf folder

c/ no insects were observed
d/ 1 = no lodging; 5 = severe lodging

Table 2: Chuadanga Kharif Soybean Variety Observation Trial pg 4

Planting date: 11/7/92 Fertilizer: 20-60-20-15
Harvest date: 30/9 to 12/11/92 Pesticide: none
Plot size - planted: 1m x 5m
harvested: 1m x 5m
Spacing - row: 50 cm
plant: 5 cm

Variety	Disease rating/b		Insect rating/b/c		Lodging/d rating
	YMV	BP	HC	LF	
AGS-227	1	4			1
AGS-283	1	2			1
AGS-297	1	4			1
AGS-129	1	2			1
AGS-302	1	3			1
AGS-314	1	3			1
AGS-327	1	1			2
GC 81027-16-1	1	1			1
GC 82341-7-2	1	1			1
GC 82341-14-2	2	1			2
GC 82333-24-11	1	1			1
GC 82345-20-2	1	3			2
GC 84007-9-5-1	1	2			1
Kusl-20004	2	1			1
PI-25658	2	2			1
LN-14	2	2			1
Vesoy-4	2	1			1
No 205	1	4			1
No 305	1	2			1
KairyoushiRome	1	3			1
Crihime	1	3			1
Kogane diazu	1	3			1
Asomu Sume	1	3			1
Akisene taku	1	3			1
Fukuyu taku	1	4			1
Shih-Shih	1	3			2

b/ disease and insect damage symptoms rated on a scale of 1 to 5; 1 = no symptoms; 5 = severe symptoms YMV - yellow mosaic virus
BP - bacterial pustule
HC - hairy caterpillar
LF - leaf folder

c/ no insects were observed
d/ 1 = no lodging; 5 = severe lodging

Table 3 : Chuadanga Kharif Soybean Variety Observation Trial

Planting date : 11/7/92 Fertilizer : 20-60-20-15
Harvest date : 30/9 to 12/11/92 Pesticide : none
Plot size - planted : 1m x 5m
- harvested : 1m x 5m
Spacing - row : 50 cm
- plant : 5 cm

Variety	100 seed wgt	Flower color	Pubescence color	Hilum color	Pod color	Seed color
	g					
AGS-54	11	Purple	Tawny	Brown	Tawny	White
AGS-59	12	Purple	Tawny	Black	Tawny	White
AGS-79	10	Purple	Tawny	Buff	Tawny	White
AGS-91	12	Purple	Tawny	Brown	Tawny	White
AGS-95	12	Purple	Tawny	Im Black	Tawny	White
AGS-120	9	Purple	Tawny	Brown	Tawny	White
AGS-154	11	Purple	Green	Brown	Brown	Wh/Green
AGS-182	13	Purple	Tawny	Brown	Tawny	White
AGS-205	9	Purple	Green	Buff	Tawny	White
AGS-227	11	Purple	Green	Brown	Brown	White
AGS-283	7	Purple	Tawny	Buff	Tawny	White
AGS-297	8	Purple	Tawny	Brown	Tawny	White
AGS-129	12	Purple	Green	Buff	Tawny	White
AGS-302	18	Purple	Tawny	Brown	Tawny	White
AGS-314	5	Purple	Tawny	Brown	Tawny	Wh/Green
AGS-327	19	Purple	Tawny	Brown	Tawny	White
GC 81027-16-1	12	Purple	Green	Brown	Brown	White
GC 82333-7-2	15	Purple	Green	Buff	Brown	White
GC 82341-14-2	10	Purple	Tawny	Buff	Tawny	White
GC 82333-24-11	11	Purple	Tawny	Buff	Tawny	White
GC 82345-20-2	14	Purple	Tawny	Im Black	Tawny	White
GC 84007-9-5-1	9	Purple	Tawny	Brown	Tawny	White
Kusi-20004	13	Purple	Tawny	Brown	Tawny	White
PI-25658	19	Purple	Green	Buff	Tawny	White
LN-14	12	Segregating	Tawny	Brown	Tawny	White
Vesoy-4	24	Purple	Green	Brown	Tawny	White
No 205	17	Purple	Green	Buff	Brown	White
No 305	15	White	Green	Buff	Brown	White
Kairyoushi rome	9	Purple	Green	Buff	Tawny	White
Orihime	8	Purple	Green	Buff	Tawny	White
Kogane doizu	10	Purple	Tawny	Brown	Tawny	White
Asomu sume	13	Purple	Tawny	Brown	Brown	White
Akisene taku	11	White	Green	Buff	Brown	White
Fukuyu taku	19	Purple	Green	Im Black	Brown	White

BHABANIGANJ LATE *RABI* SEASON PLANTED SOYBEAN TRIAL

Introduction

The objective of this trial was to assess the adaptability of selected soybean varieties when planted in late *rabi* season. MCC currently recommends that Shohag (Pb-1) be planted between December 15 and January 15. However, farmers often plant after January 15 because of inclement weather and labour constraints. Although Shohag will produce well in late *rabi* season, delayed plantings can cause harvests to coincide with the start of the rains. If harvesting occurs during the rains the yield and quality of the harvest may decrease. Delayed soybean plantings may also cause delays in planting subsequent crops. An earlier maturing variety would circumvent these difficulties.

The varieties that were selected for this trial showed comparable yield performances and were similar to or earlier maturing than Shohag when compared in previous observation trials. A total of 9 varieties were included in this trial with the varieties MTD-469 and Tom Uyem-1 being included only as observation varieties because of the lack of seed to complete 3 replications.

Results and Discussion

Yields of all seven varieties in this trial were statistically similar with the exception of JS-2. JS-2 yielded significantly lower than all other varieties. From this trial it appears that any of the varieties other than JS-2 could be used in late season plantings and have a yield comparable to Shohag on the basis of yield. In the past JS-2 yields have been similar to Pb-1.

AGS-314, NS-1 and AGS-327 may have an advantage for late season *rabi* season planting because they matured six to seven days before Shohag. Although yield performances of NS-1 and AGS-327 are comparable with Shohag, their large seed sizes may limit any possible extension efforts. Larger seeds require a higher seeding rate. In this trial NS-1 was planted at the rate of 123 kg/ha which is approximately double the rate for Shohag (62 kg/ha). AGS-314, with it's small seed size (100 seed weight - 6 grams), may hold more promise than either NS-1 and AGS-327. Further trials are necessary to evaluate the potential of these and other varieties in late *rabi* season plantings.

By delaying planting until the end of January, days to maturity were decreased by 13 to 20 days when compared with a similar variety trial planted one month earlier. Therefore harvesting was only delayed 1.5 to 2 weeks even though planting was delayed by one month (see Bhabaniganj Variety Trial - 1992 Research Results). Yields were comparable for all varieties with the exception of JS-2 which had significant yield decrease when planted at the end of January. From this trial it appears that for the varieties

included, with the exception of JS-2, planting can be delayed with limited impact on the date of harvest and yield. Decisions to delay planting must continue to take into account the increased possibility of rain at the time of harvest and problems for subsequent crop rotations.

Table 1: Bhabaniganj Late Rabi Season Soybean Trial

Planting date : 30/01/92 Design : RCBD
Harvest date : 26/04 to 04/05/92 Replications : 3
Plot size - planted : 2.5 x 5.0m Fertilizer : 20-60-20-15
- harvested: 2.0 x 4.0m
Spacing - row : 25 cm
- plant : 8 cm (5 cm for JS-2 and NS1-1)

Variety	Days to Flow.	Days to Matur.	Plant hgt.	Plant stand	Lodging a/	100 Seed Wgt.	Germination b/	Yield
			cm	#/m²		g	%	t/ha
1. GC8234-14-2*	40	93	55	50	1	11	99	2.51
2. MTD-6	44	94	85	51	2	11	97	2.47
3. Shohag	43	94	53	54	1	11	99	2.41
4. NS-1	40	88	48	39	1	19	99	2.39
5. AGS-327	39	97	52	56	2	19	100	2.35
6. AGS-314	44	88	73	56	1	6	100	2.22
7. JS-2	39	86	26	40	1	15	99	1.88
Mean	41	90	56	50	1.4	13	99	2.32
C.V. (%)			7.5	6.1		4.1		8.1
L.S.D. (0.05)			7.5	6.1		0.9		0.34
Observation Varieties								
1. MTD-469	41	91	74	74	5	13	100	2.08
2. Ton Uyem -1	47	91	59	59	5	14	98	1.96

a/ Rating of crop lodging (1=no lodging; 5= severe lodging)
b/ Germination at the time of harvest

BHABANIGANJ SOYBEAN DATE OF HARVEST VS SEED VIABILITY

Introduction

A 1985 trial on the variety Bragg showed that there may be some potential for increasing seed quality by harvesting before visual maturity (MCC 1985 Research Results, Page 31-33). This finding has also been supported by research done in Japan where it was observed that for some varieties seed quality is maximized by harvesting prior to visual maturity (reference unavailable). This trial was designed to assess whether harvesting of the varieties Shohag (Pb-1), Santa Rosa R and PK-416 at stages prior to visual maturity could improve seed viability while at the same time decreasing the overall duration of these varieties. Santa Rosa R and PK-416 have shown good production potential but have been limited because of poor seed quality. Production of Santa Rosa R is also limited by it's long duration.

Harvesting of each variety was conducted on the following days:

1. Shohag - 95, 100, 105, 110 and 115 days after planting.
2. Santa Rosa R - 105, 110, 115, 120 and 125 days after planting.
3. PK-416 - 95, 110, 105, 110 and 115 days after planting.

Results and Discussion

From graph 1, which shows % germination over time when stored in ambient conditions, it appears that the majority of Pb-1 seed reaches physiological maturity approximately 5 days before visual maturity (105 DAP). Harvesting at this stage also provided seed that maintained the highest average germination rates over the course of 4 test dates. By harvesting prior to visual maturity it may be possible to slightly decrease the duration required for growing Shohag, while at the same time insuring that seed quality is maximized.

Seed harvested at or before visual maturity also showed a slight dormancy affect, with germination rates increasing over the period between the first and second germination test dates.

Seed harvested after visual maturity initially had very high germination rates but over the test period germination decreased more rapidly than seed harvested earlier. The accelerated decline in germination, may be related to the seed being in the field for a longer period of time during which the seed was more susceptible to microbial attack. The seed may also have sustained damage to the seed coat from increased exposure to the environment which resulted in seed quality declining faster.

Yield of Shohag were highest when harvesting was completed at 100, 105, 110 and 115 days after planting. Although it is not known why the yield of the treatments harvest at 95 DAP were significantly lower than the subsequent harvest dates it may have been related to light weight seed that had not reached maturity being lost in cleaning.

As shown in graph 2, Santa Rosa R shows approximately the same seed germination trends observed for Shohag. Treatments harvested at 115 DAP (5 days before visual maturity) had germination rates that were similar to treatments harvested at 120 and 125 DAP. For Santa Rosa R it appears that plants can be harvested prior to visual maturity but without any improvement in seed quality.

The Santa Rosa R treatment harvested at 120 DAP yielded significantly higher than all other treatments. It is unclear whether this is related to the date of harvest or some other factor outside of the trial variables.

For PK-416 the 2 harvest dates prior to visual maturity produced seed that maintained average germination levels higher than those for the treatment harvested at 110 DAP. For PK-416 it may be possible to harvest by as much as 10 days earlier than visual maturity and at the same time insure that seed quality is maximized.

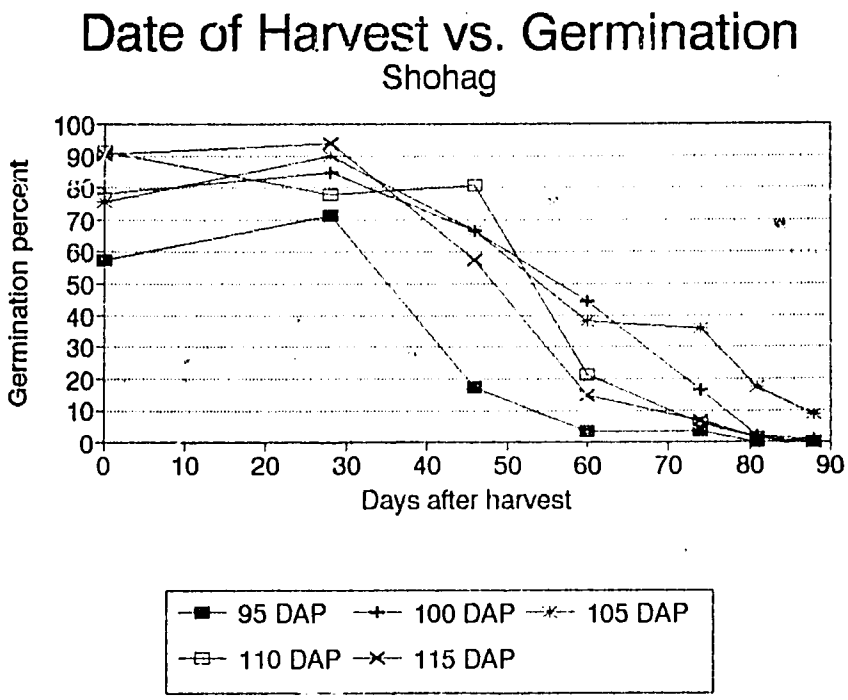
From this trial it appears that there may be some potential for maximizing seed quality by harvesting of Shohag, Santa Rosa R and PK-416 prior to visual maturity. Further research with these varieties will be required to clarify the relationship between date of harvest and seed quality. It is also important to find easily identifiable indicators of physiological maturity.

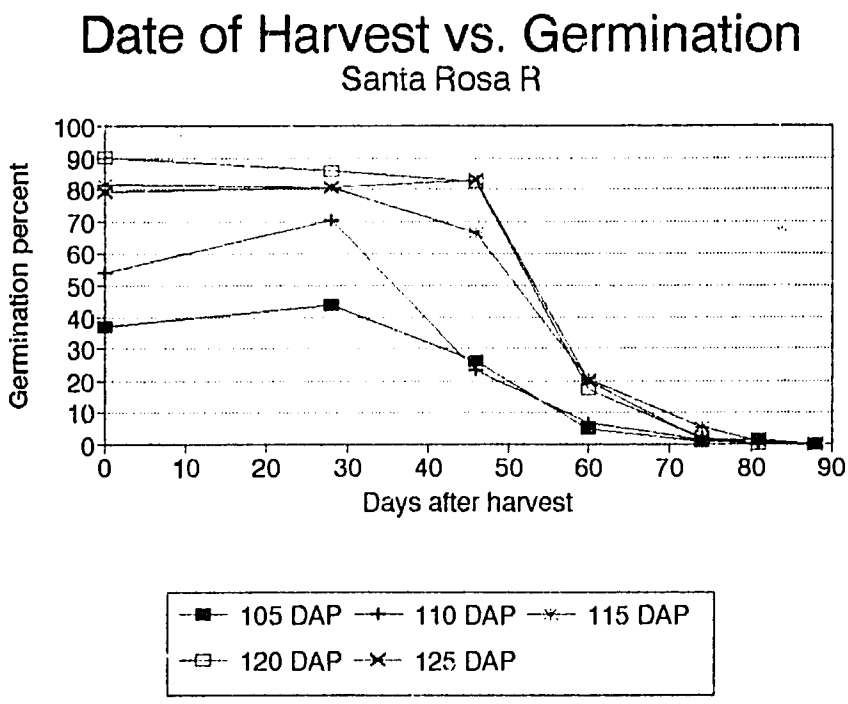
Table 1 : Bhabaniganj Soybean Date of Harvest vs Seed Viability

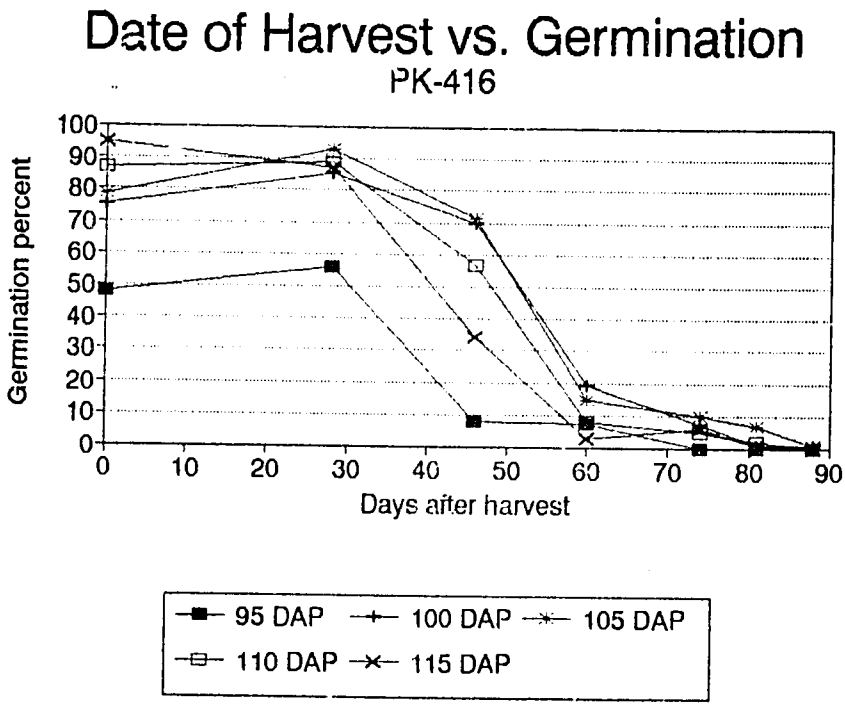
Planting date : 6/1/92 Design : RCBD
Harvest date : as noted Replications : 3
Plot size - planted : 3.25 x 5.2 Fertilizer : 20-60-20-15
(total replication size)
Harvested : 0.75 x 1.6
Spacing - row : 25 cm
plant: 8 cm

Variety	Harvested # DAP	Days to Flower	Plant Height	Plant Stand	100 seed Weight	Yield
			cm	#/m²	g	t/ha
Shohag	95	58	58	44	12.2	1.96
	100	58	58	48	12.0	2.54
	105/a	58	58	52	12.2	2.83
	110	58	58	48	12.3	2.74
	115	58	59	44	12.0	2.46
Mean		58	58	47	12.0	2.51
C.V. (0.05)				18.7	2.86	11.7
L.S.D. (0.05)				NS	NS	0.55
Santa Rosa R	100	54	52	61	11.8	2.44
	110		52	63	12.0	2.14
	115		54	68	12.3	2.83
	120/a		52	67	12.3	2.34
	125		52	63	12.0	2.53
Mean		54	52	64	12.1	2.66
C.V. (0.05)				7.88	3.81	5.8
L.S.D. (0.05)				NS	NS	0.30
PK-416	95	54	54	62	12.0	1.93
	100		52	66	12.2	2.64
	105		52	64	12.2	3.17
	110/a		56	62	12.8	2.81
	115		56	61	12.5	2.64
Mean		54	54	63	12.3	2.64
C.V. %				6.97	3.47	9.65
L.S.D. (0.05)				NS	NS	0.48

a/ visual maturity


Date of Harvest vs. Germination
Shohag
Germination percent
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
Days after harvest
95 DAP
100 DAP
105 DAP
110 DAP
115 DAP


Date of Harvest vs. Germination
Santa Rosa R
Germination percent
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
Days after harvest
105 DAP
110 DAP
115 DAP
120 DAP
125 DAP


Date of Harvest vs. Germination
PK-416
Germination percent
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
Days after harvest
95 DAP
100 DAP
105 DAP
110 DAP
115 DAP

BHABANIGANJ PRUNED VS UN-PRUNED SOYBEAN OBSERVATION

Introduction

In the 1991 *kharif* season a trial was conducted to assess whether pruning of the main growing point of the soybean plant would result in a decrease in lodging without decreasing yield. Although only limited differences were observed in final lodging ratings, it was observed that yields were significantly increased by pruning at 30 days after seeding (see Chuadanga Pruned vs Unpruned Soybean Trial - 1991 Research Results).

To assess whether comparable yield increases could be expected in *rabi* season, a pruning observation trial was conducted. In this observation Shohag was pruned at 40 days after seeding.

Results and Discussion

Yields of the soybeans that were pruned in this trial were 0.44 t/ha lower than the Unpruned soybeans. When Shohag is grown in *rabi* season lodging is not a problem and therefore it appears that there is no benefit in forcing the plan to further limit vegetative growth by pruning. In this observation trial plant height decreased 14 cm in the plots that were pruned. Pruning of varieties that are prone to lodging during rabi season could be tested.

Table 1 : Bhabaniganj Pruned vs Unpruned Soybean Observation Trial

Planting date	: 31/12/91	Design	: RCDB
Harvest date	: 18/4/92	Replications	: 3
Plot size - planted	: 2.0 x 4.0 m	Fertilizer	: 20-60-20-15
- Harvested	: 1.5 x 3.0 m	Variety	:Shohag
Spacing - row	: 25 cm		
- plant	: 8 cm		

Treatment	Days to Flower	Days to Maturity	Plant stand	Plant height	100 Seed wt.	Germination a/	Yield
			#/m²	cm	g	%	t/ha
1. Pruned	63	107	52	46	13	97	1.86
2. Unpruned	63	107	55	60	11	99	2.30

a/ germination at the time of harvest

GABANIGANJ PB-1 LINE VS BROADCAST TRIAL

Introduction

In order to minimize the costs and decrease labor, most farmers are broadcasting rather than line sowing soybean seed. This is in contrast to MCC's recommendations which are based on results from line seeding. This trial was conducted to contrast the difference between broadcast and line sown Shohag (Pb-1) in *rabi* season.

Results and Discussion

Yields were not significantly different between the broadcast and line seeded treatments, even though plant stands were significantly different. Lower plant stands for broadcast treatments is a common observation. When soybeans are line seeded the placement of the seed can be controlled better and therefore emergence rates are generally high. Although plant stands are higher for line seeded fields, yields were not affected. Soybeans are able to compensate for lower plant stand by increasing branching. Because there was no yield benefit from line seeding, (Table 2), the additional cost of line seeding (TK 690/ha) would not be recovered. The results from this trial are similar to the *kharif* season line vs broadcast trial (Chuadanga Line vs Broadcast Method of Seeding Soybeans - 1992 Research Results).

Table 1 : Bhabaniganj Shohag Line vs Broadcast Trial

Planting date	: 06/01/92	Design	: CRD
Harvesting date	: 20/04/92	Replications	: 3
Plot size - planted	: 2.75 x 4.0 m	Fertilizer	: 20-60-20-15
- harvested	: 2.75 x 4.0 m	Seed rate	: 62 kg/ha
Seeding method	: broadcast		

Seeding Method	Days to Flower	Days to Maturity	Plant Height	Plant Stand	100 Seed Wt.	Germination a/	Yield
			cm	#/m²	g	%	t/ha
1. Broadcast	58	104	50	24	12	99	2.43
2. Line	58	104	52	33	12	100	2.46
Mean	58	104	51	29	12	99.5	2.44
C.V. (%)			7.6	5.8	2.4		2.9
L.S.D. (0.05)			NS	3.8	NS		NS

a/ Germination at the time of harvest

Table 2 : Comparison of costs and returns for broadcast vs line soybeans

Seeding Method	Yield	Product Price	Gross Revenue	Total Variable Costs	Gross Margin
	t/ha	Tk/Kg	Tk/ha	Tk/ha	Tk/ha
1. Broadcast	2.43	8	19440	25	19415
2. Line	2.45	8	19600	750	18850

OPTIMUM SEEDING RATE FOR G2120(M7)69-1 SOYBEAN WHEN BROADCAST

Introduction

During the last two *rabi* seasons (90/91 and 91/92) MCC has extended the variety G2120(M7)69-1 on limited basis in the Faridpur-Gopalganj, Laksham and Noakhali areas. G2120(M7)69-1 is cold tolerant and suitable for early rabi season plantings. The possibility of planting G2120(M7)69-1 in early rabi season allows farmers to plant this variety following the harvest of aman in late October or early November.

Because of the small size of G2120(M7)69-1 seed (100 seed weight equals 6 to 7 grams) MCC originally proposed a seed rate of 30 kg/ha (MCC Rabi Soybean Variety Recommendations for Noakhali - October, 1989). During the 1990/91 production year an average seed rate of 37 kg/ha was recommended when broadcast. However, this recommendation was not based on a replicated trial. The plant stand in the fields which were seeded at the rate of 37 Kg/ha appeared less than optimum.

The objective of this trial was to determine the optimum seeding rate for G2120(M7)69-1 when broadcast seeded. For this trial G2120(M7)69-1 was broadcast at five different rates ranging from 32 to 54 kg/ha.

Results and Discussion

Within a certain range, soybeans are able to compensate for lower plant stands by increasing vegetative growth. As noted in Soybeans: Improvement, Production and Uses, "Soybean plants can produce similar yields across a wide range of seeding rates." However, at some minimum plant density, the soybean plant cannot fully compensate and yields decrease.

The ability of soybeans to compensate for lower seed rates is reflected in the yield differences between the treatments seeded at 37 kg/ha and 44 kg/ha. Although plant stands were significantly different for the two treatments, yields were not.

Additionally, in initial observations of this trial the plant stands for 32 kg/ha and 37 kg/ha appeared too low. However, in the final observations, the 37 kg/ha treatment appeared to have compensated for the lower seeding rate with additional vegetative growth.

For this trial, yields were highest when plant stands were approximately 50 to 60 plants/m^2. Although there were no treatments with plant stands above 60 plants/m^2, this range may be the optimum for G2120(M7) 69-1. Yields remained relatively constant for the highest three seeding rates.

Although seed rates varied by five kg/ha for the three highest seed rates there were no significant differences in plant stands. Based on the increase in seed rates it would have been expected the

difference in plant stands would have been significant between all treatments. Further study of this phenomena is required.

Analysis of this trial was further complicated by the fact that the day after seeding a heavy rain was recorded at the research site. This may have resulted in a decrease in emergence. Decreased emergence would have made all experimental seed rates equivalent to lower seed rates when seeded under optimum conditions.

Because of the anomalies and difficulties with the trial, it should not be used for recommending a particular seeding rate for G2120(M7)69-1. Further study may indicate that seed rates less than the current recommended rate of 44 to 49 kg/ha may be adequate under optimum conditions. However, this seeding rate insures an adequate margin for seeding methods like relaying, when conditions are less than optimum for seed emergence.

Table 1: Optimum Seeding Rate for G2120(M7)69-1 Soybeans when Broadcast

Planting date : 23/12/91
Harvest date : 18/04/92
Plot size - planted : 3.0 x 4.5 m
harvested: 2.0 x 3.5 m
Seeding method : broadcast

Design : RCBD
Replications: 3
Fertilizer : 20-60-20-15

Treatment	Days to Flower	Days to Maturity	Plant Stand	Plant Height	100 Seed Weight	Germination a/	Yield
			#/m²	cm	g	%	t/ha
1. 32 kg/ha	71	115	34	79	6.5	99	2.13
2. 37 Kg/ha	71	115	38	76	6.5	99	2.42
3. 44 kg/ha	71	115	55	80	6.2	99	2.50
4. 49 Kg/ha	71	115	60	81	6.3	99	2.79
5. 54 kg/ha	71	115	60	83	6.3	98	2.68
Mean	71	115	49.4	80	6.4	98.6	2.53
C.V. (%)			7.4	5.0	5.5	1.6	6.2
L.S.D. (0.05)			6.9	9.0	NS	NS	0.29

a/ Germination at the time of harvest

LINE VS BROADCAST AND SEEDING RATE TRIAL FOR JS-2 SOYBEAN

Introduction

JS-2 is a variety which has been considered for the last few years for production in Bangladesh. In previous variety trials yields of JS-2 have been comparable with Shohag (Pb-1) while maturing 4 to 7 days earlier. Although this variety has shown some promise, questions have remained about seed viability and emergence. In previous trials it has been difficult to establish good plant stands for JS-2. This trial was designed to determine the optimum seed rate for JS-2 when broadcast and line sown.

Because of the large seed size, short plant height and emergence problems the following seed rates were chosen: 74, 86 and 99 Kg/ha.

Results and Discussion

There were significant differences in plant stands between the treatments; both seed rate and seeding method. However, there was no significant interactions between the main plot and subplots.

Yields for the main plots and main plots x sub-plots (interactions) were not significantly different. There was a significant difference in yield, related to seeding rate. Although this trial indicates that JS-2 yields can be improved with higher seeding rates, the seeding rates required are much higher than the currently used varieties, Shohag and G2120(M7)69-1.

The results from this trial also supports past observations that JS-2 has emergence problems. At the seeding rates used in this trial it would be expected that plant stands would be higher than that observed.

In that JS-2 has only limited advantage when compared with Shohag (earlier maturity) and significant disadvantages, it is recommended that this variety be dropped from further testing.

Table 1 : Line vs Broadcast and Seeding Rate Trial for JS-2 Soybean

Planting date : 06/01/92
Harvesting date : 11/4 to 12/4/92
Plot size - planted : 2.75 x 4.0 m
harvested: 2.75 x 4.0 m
Spacing - row : 25 cm
plant : 5 cm

Design : Factorial
Replications : 3
Fertilizer : 20-60-20-15

Main plots : 1. Broadcast
2. Line sowing

Subplots : S1 - 74 kg/ha
S2 - 86 kg/ha
S3 - 99 kg/ha

Treatment	Plant Stand 20 DAS	Plant Stand harvest	Plant hgt.	Days to flower	Days to maturity	100 seed wgt.	Yield
	#/m²	#/m²	cm			g	t/ha
Main plots							
1. Broadcast	22	21	28	52	96	18.5	1.75
2. Line	32	32	31	52	95	18.6	1.95
L.S.D. (0.05)	0.5	4	NS				NS
C.V.	0.8	9.4	10.0				15.0
Subplots							
S1	23	23	26				1.67
S2	28	26	29				1.78
S3	29	29	33				2.08
L.S.D. (0.05)	4	2	NS				.30
C.V.	10.6	8.5	7.3				12.3
Main plots x subplots							
1 x S1	19	17	26				1.43
2 x S1	28	30*	27				1.91
1 x S2	23	22	28				1.68
2 x S2	32	31	29				1.89
1 x S3	24	23	29				2.12
2 x S3	35	35	36				2.05
L.S.D.	NS	NS	NS				NS

* mistake in data - plant stand should not have increased over the number registered at 20 DAS

RABI SOYBEAN OBSERVATION TRIAL

Introduction

In both *kharif* season (Chuadanga) and *rabi* season (Bhabaniganj) a variety observation trial was conducted to maintain a soybean germplasm collection and to provide agronomic data on these varieties. In the 1991 *kharif* season there were 102 varieties in the observation trial, and in the 1991/2 *rabi* season trial there were 102 varieties tested.

The data collected will be presented in the same format as presented in the 1991 MCC research results. Varietal identity traits, (color of flowers, pubescence, hilum, pod, and seed,) will only be listed for those varieties that have been added since the last reporting period.

Table 1: Bhabaniganj Rabi Soybean Variety Observation Trial

Planting date: 6/1/92 Fertilizer: 20-60-20-15
Harvest date: 9/4/92 to 16/5/92 Plot size:1.6 m²
Spacing - row: 50 cm
- plant: 5 cm

Variety	Days to flower	Days to maturity	Plant height	Seed germination	Plant stand	Yield /a
			cm	%	#/m²	t/ha
G10102	66	125	75	99	26	4.55
G10180	62	105	83	99	26	3.25
AGS-313	62	105	76	97	26	3.08
Pb-1	60	104	61	98	26	2.52
Bragg	49	109	32	99	20	1.60
Pk-262	56	113	50	98	25	2.71
PK-327	51	106	33	94	26	1.66
PK-416	56	110	47	97	25	2.25
Guarav	56	116	57	97	25	3.32
Durga	59	119	59	99	26	3.02
AGS-160	62	119	55	95	22	2.40
G2120(M7)69-1	62	106	86	98	26	2.52
MTD-65	60	110	69	87	23	2.83
MTD-13	57	118	58	94	25	2.52
TAC-12	62	120	59	99	26	2.55
TGX-814-26D	76	132	91	97	26	3.08
[illegible]-132(114)	71	125	94	99	25	2.95
TGX-814-23D	77	132	101	98	25	2.40
[illegible]Flore	64	122	70	97	26	2.65
[illegible]RA/IRAT26/72	65	125	58	99	26	2.22
[illegible]SB-2	65	121	68	99	23	2.22
[illegible]X-849-294-D	67	120	90	99	25	3.51
[illegible]GS-57	60	106	58	99	25	2.46
[illegible]oluiz	57	120	31	98	26	1.91
[illegible]-141	69	130	78	99	26	4.19

[illegible] yields were determined from unbordered plots

Table 1: Bhabaniganj Rabi Soybean Variety Observation Trial page 2

Planting date: 6/1/92
Harvest date: 9/4/92 to 16/5/92
Spacing - row: 50 cm
- plant: 5 cm

Fertilizer: 20-60-20-15
Plot size: 1.6m²

Variety	Days to flower	Days to maturity	Plant height	Seed germ-ination	Plant stand	Yield /a
			cm	%	#/m²	t/ha
TGX-573-208D	59	117	107	88	25	3.32
Santa Rosa R	57	120	46	97	26	1.9[illegible]
Co-i	62	117	99	98	25	2.59
IAC-11	61	117	72	95	25	2.28
IAC-8	67	126	78	96	26	3.63
Pb1-O.T.	68	106	64	100	26	2.59
TGX-539-5E	67	132	72	92	25	3.39
AGS-272	52	111	47	87	26	1.42
AGS-234	60	117	68	97	26	4.74
Davis	55	120	30	91	13	1.29
PR-164-20	57	120	56	100	26	4.00
PR-142	63	132	47	99	25	2.52
Shilajeet	52	98	29	100	25	1.69
JS-2	52	98	29	99	26	1.97
Ankur	64	130	62	98	25	2.89
Tari-92533	64	113	104	97	22	3.39
D-75-9207	56	118	46	94	26	2.09
BBF	68	132	72	99	26	3.26
NS-1	53	102	62	99	25	1.72
CM-60	60	118	78	82	25	2.95
SJ-1	63	120	107	97	26	3.45
SJ-2	61	127	96	99	25	2.71
SJ-4	60	120	83	99	26	2.89
SJ-5	60	120	87	98	26	3.82
SK-1	56	117	52	95	25	2.74
ChiangMai-60	62	113	79	98	26	2.77
MTD-173	60	113	103	-	25	-
MTD-176	62	113	94	96	26	2.83
MTD-451	65	113	112	96	25	2.22
MTD-452	62	113	91	97	25	2.80
MTD-459	60	113	74	97	26	2.15
MTD-464	60	118	43	96	25	1.11
MTD-469	56	105	39	99	26	2.71
MTD-6	60	110	92	100	27	3.32
MTD-9	66	117	64	91	25	2.80
MTD-10	62	117	79	99	26	3.02
CanSon	60	110	78	97	25	3.32
Tan Uyen-1	60	106	77	98	25	1.60
Ngoc dong	61	106	83	98	25	2.95
Cantho-5	62	106	91	97	25	2.09

a/yields were determined from unbordered plots

Table 1: Bhabaniganj Rabi Soybean Variety Observation Trial page 3

Planting date: 6/1/92 Fertilizer: 20-60-20-15
Harvest date: 9/4/92 to 16/5/92 Plot size: 1.6 m²
Spacing - row: 50 cm
- plant: 5 cm

Variety	Days to flower	Days to maturity	Plant height	Seed germ-ination	Plant stand	Yield /a
			cm	%	#/m²	t/ha
Dabo Bong tim	60	110	96	97	25	2.80
Minh Hai	60	110	84	99	25	1.53
AGS-54	62	117	84	96	25	4.19
AGS-59	65	117	84	100	25	3.75
AGS-79	60	125	56	97	25	2.59
AGS-91	63	117	85	99	26	2.71
AGS-95	63	117	90	98	26	2.89
AGS-120	63	117	75	96	26	2.57
AGS-154	55	110	92	89	25	2.95
AGS-182	51	103	47	94	26	2.12
AGS-205	50	104	42	89	23	1.42
AGS-227	50	98	44	99	23	1.60
AGS-283	61	110	79	99	25	3.88
AGS-297	62	103	54	98	28	1.51
AGS-129	56	117	72	98	25	3.20
AGS-302	55	110	52	92	12	2.37
AGS-314	62	96	84	99	23	2.65
AGS-327	53	102	54	99	25	2.15
GC 81027-16-1	60	113	85	91	25	3.94
GC 82341-7-2	60	113	83	99	20	2.68
GC 82341-14-2	56	110	65	97	23	1.97
GC 82333-24-11	55	112	77	97	23	4.00
GC 84007-9-5-1	62	120	67	98	26	4.25
Kusl-20004	59	111	69	91	25	2.77
P125658	57	110	44	99	26	1.91
Ln-14	60	120	80	99	25	4.31
Vesoy-4	58	120	84	91	22	2.65
No 205	53	102	52	-	1	0.15
No 305	50	110	55	-	1	.18
KairyouShiRome	49	95	31	99	26	1.60
Orihime	55	96	37	99	26	2.34
Kogane diazu	50	96	37	99	26	2.34
Asomu sume	61	110	59	99	24	4.25
Akisene taku	53	110	19	88	14	0.92
Fukuyu taku	57	110	29	91	18	1.85
Shih-Shih	56	103	44	99	18	2.46

/yields were determined from unbordered plots

BHABANIGANJ SOYBEAN VARIETY TRIAL

Introduction

The purpose of this trial was to test 19 varieties, selected on the basis of general performance in previous observation and variety trials. As part of MCC's soybean research programme soybean varieties are routinely collected from other countries and then tested for their adaptability to Bangladesh growing conditions. Those varieties that show promise in observation trials over several years are selected for testing with varieties that MCC is currently extending. Specific emphasis is placed on selecting varieties with good seed quality and yield and duration similar to or better than that of Shohag.

Results and Discussion

Santa Rosa R yielded significantly more than all other varieties included in this trial. Although yields of this variety have been consistently high, there are two main limiting factors for the production of Santa Rosa. It has poor seed quality and long duration. On average Santa Rosa R matures 7-15 days after Shohag, when grown in *rabi* season.

The varieties Dabo Bong tim and SK-1 also yielded well when compared with all other varieties. The main production problem for these varieties, is their tall plant height. Lodging was severe for both of these varieties. These varieties also had longer plant durations than Shohag.

On the basis of visual observations and production data the varieties AGS-314 and GC-82341-14-2 also showed promised when compared with Shohag. Both of these varieties are similar in duration to Shohag, have small to medium size seed and have comparable yields. GC-82341-14-2 also has limited plant height, and no problem with lodging.

Other varieties that showed adequate performance were Chiang Mai-60, SJ-5 and Can Son. The remaining varieties have less potential because of large seed size, long duration and/or tall plant heights.

Table 1 : Bhabanigani Soybean Variety Trial

Planting date	:31/12/92	Design	: RCBD
Harvest date	:11/04 to 04/05/92	Replications	: 3
Plot size - planted	:2.0 x 4.0m	Fertilizer	: 20-60-20-15
- harvested	:1.5 x 3.0m		
Spacing - row	:25 cm		
- plant	:8 cm (5 cm for JS-2 and NS1-1)		

Variety	Days to Flow.	Days to Matur.	Plant height	Plant stand	Lodg	100 seed weight	Germination	Yield
			cm	#/m²		g	%	t/ha
Santa Rosa R	64	123	54	84	1	11	99	2.88
SK-1	62	116	51	94	5	12	97	2.76
Pabo Bong tim	66	111	57	97	5	12	99	2.74
SJ-5	66	124	50	91	1	13	98	2.48
Can son	65	110	54	100	4	12	98	2.44
GC-82341-14-2	55	107	54	62	1	10	99	2.44
Chaing mia-60	66	115	55	69	4	12	98	2.43
MTD-10	66	117	55	88	5	12	97	2.42
JS-2	53	102	59	29	1	17	96	2.35
Shohag (Pb-1)	63	107	55	60	1	11	99	2.30
Can tha	67	105	51	84	4	13	99	2.31
MTD-6	66	103	51	100	5	11	99	2.26
AGS-314	65	106	53	93	4	6	99	2.24
MTD-469	58	108	50	92	4	17	99	2.08
SJ-1	69	125	41	116	5	12	99	2.12
NS-1	55	105	46	49	1	22	99	2.05
AGS-327	56	105	43	49	1	22	99	1.95
Tan Uyem-1	69	110	51	87	5	18	99	1.87
Mean	41	90	56	50	1.4	13	99	2.32
C.V. (%)			7.5	6.1		4.1		8.1
L.S.D. (0.05)			7.5	6.1		0.9		0.34

SOYBEAN SEED QUALITY TESTING SUMMARY

Introduction

One of the most important varietal characteristics for soybeans is good seed quality. Many of the varieties that MCC has tested in Bangladesh have produced well, but because of poor seed viability, they have been dropped from further testing. Determining whether a particular variety has good quality seed is an important aspect of early varietal screening.

Ambient seed storage trials provide an early indication of seed quality for newly obtained varieties. Ambient storage trials were conducted by placing seed from each variety produced in *rabi* season in cotton cloth bags and then placing these bags in a well ventilated room. Seed was taken from these bags every two weeks starting in June and tested for germination. The rate at which germination declines over time for new varieties was then compared with the rate at which germination declines for Shohag (Pb-1), MCC's current extension variety, to give general indication of seed quality (Table 1).

In addition to ambient storage tests, weathering resistance ratings also give an indication of seed quality. Weathering resistance is evaluated by comparing the at harvest germination over a number of different harvest dates with at harvest germination rates for Shohag. Final results are expressed as a percentage of Shohag's germination rates (Table 1).

Of the 51 varieties that have been newly obtained in MCC's ongoing variety observation, the varieties NS-1, MTD-469, MTD-6, MTD-9, Tom Uyem-1, Dabo bong tim, AGS-327, and GC-82341-14-2 appear to have seed of similar or better quality than Shohag. Further testing of these varieties is required.

Table 1 : Soybean Seed Quality Summary

Variety	Ambient storage rating a/	Weathering Resistance b/	Average c/
NS-1	118	94	106
CM-60	16	70	43
SJ-1	80	95	87
SJ-2	75	105	90
SJ-4	83	92	88
SJ-5	83	100	91
SK-1	88	102	95
Chiang Mai	25	105	65
MTD-173	28	42	70
MTD-176	25	110	68
MTD-452	5	95	50
MTD-459	26	102	30
MTD-464	85	100	92
MTD-469	118	89	104
MTD-6	100	100	100
MTD-9	73	85	76

Table 1 : Soybean Seed Quality Summary page 2

Variety	Ambient storage rating a/	Weathering Resistance b/	Average c/
MTD-10	100	105	102
Can Son	93	65	79
Tom Uyem-1	108	102	105
Con tho	55	107	81
Dabo bong tin	108	102	105
Minh Hai	50	78	64
AGS-54	10	102	66
AGS-59	23	77	50
AGS-79	20	104	62
AGS-91	9	83	46
AGS-95	24	83	53
AGS-120	65	107	86
AGS-154	48	72	60
AGS-205	80	68	79
AGS-227	-	83	42
AGS-283	60	98	79
AGS-297	83	99	91
AGS-129	12	89	50
AGS-302	19	63	41
AGS-314	113	95	104
AGS-327	118	101	110
GC-81027-16-1	70	96	83
GC-82341-7-2	63	85	74
GC-82341-14-2	103	94	98
GC-82333-24-11	28	70	49
GC-82345-20-2	75	60	68
GC-84007-9-5-1	35	93	64
Kusl-20004	13	63	38
PI 25658	58	61	79
LN-14	13	93	53
Vesoy-4	12	101	57
No. 205	14	4	9
No. 305	3	-	9
Pb-1	100	100	100
PK-416	83	96	89

a/ average seed germination after prolonged storage in ambient conditions, expressed as a percentage of that of Shohag

b/ average seed germination at harvest expressed as a percentage of that of Shohag. Germination rates from *kharif and rabi* season observations were used

c/ mean of ambient storage and weathering resistance results

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Table 3: Chuadanga Kharif Soybean Variety Observation Trial page 3

Planting date: 19/07/90
Harvest date: 5/10 to 12/11/91
Plot size - planted: 1m x 5m

Fertilizer: 20-60-20-15
Pesticide: Ekalux (25 EC) 8/8/90 and 20/8/90

Variety	100 seed weight	Flower color	Pubescence color	Hilum color	Pod color	Seed color
NS-1	19	Purple	Tawny	Brown	Tawny	White
CM-60	15	White	Tawny	Brown	Tawny	White
SJ-1	11	Purple	Tawny	Black	Tawny	White
SJ-2	11	Purple	Tawny	Brown	Tawny	White
SJ-4	11	Purple	Tawny	Brwon	Tawny	White
SJ-5	12	Purple	Tawny	Brown	Tawny	White
SK-1	13	Purple	Green	Buff	Brwon	White
Chiang Mai	13	Purple	Tawny	Brown	Tawny	White
MTD-173	12	Purple	Tawny	Black	Tawny	White
MTD-176	17	Purple	Tawny	Brown	Tawny	White
MTD-451	13	Purple	Tawny	Brown	Tawny	White
MTD-452	18	Purple	Tawny	Brown	Tawny	White
MTD-459	14	Purple	Tawny	Brown	Tawny	White
MTD-464	14	Purple		Black	Tawny	White
MTD-469	15	Purple	Tawny	Brown	Tawny	White
MTD-6	12	Purple	Green	Brown	Tawny	White
MTD-9	12	White	Tawny	Brown	Tawny	White
MTD-10	11	White	Tawny	Brown	Tawny	White
Can Son	13	Purple	Green	Brown	Brown	White
Tan Uyen-1	16	Purple	Tawny	Buff	Tawny	White
Ngoc Dong	18	Purple	Tawny	Brown	Tawny	White
Can tho	12	Purple	Tawny	Brown	Tawny	White
Dabobongtim	10	Purple	Green	Brown	Brown	White
Ming-Hai	10	Purple	Tawny	Brown	Tawny	White

RICE

DHORKORA ON-FARM AUS UPLAND PVART TRIAL

Introduction

The same proposed variety adaptive research trial with two new rice lines was conducted both in MCC Research station (other report) and in on-farm conditions. This on-farm trial was set with two farmers of two villages in Dhorkora areas. It was a cooperative trial with BRRI. The objective of the trial was to evaluate these two lines' adaptability in this specific Agro-ecological zone.

Results and Discussion

The results of this trial are similar to that of the trial conducted at MCC Research station. The yields of the two new lines did not vary significantly from the varieties BR-21 and Purbachi. The numerically highest grain yield was obtained with the variety BR-21, thus BR-21 is still a good variety. The Line BR-4290-3-1-10 produced statistically the lowest seed weight, an indication of its smaller grain size. From this trial it was also observed that this line matured only 2 days earlier than BR-21.

Table 1 : Dhorkora On-farm Aus Upland PVART Trial

Planting date : 18/4/91
Harvesting date : 27/7-4/8/91
Plot size - planted : 6m X 6m
- harvested: 3m X 2.5m
Seed rate : 80 Kg/ha

Design : RCBD
Replications: 2
Fertilizer : 60-40-40-10

Lines/ Varieties	Days to Flower	Days to maturity	Plant ht	Panicles/ m²	1000 seed wt	Yield
	#	#	cm	#	g	t/ha
BR-21	77	99	81 a	246	22b	2.66a
BR-4290-3-1-10	76	97	81 a	219	20c	2.35ab
BR-4290-3-3-5	85	103	83 a	240	23b	2.08ab
Purbachi	81	103	54 b	230	26a	1.20b
Mean	80	100	75	234	23	2.07
LSD (0.05)			8.1	NS	1.12	1.19
CV %			3.4	12	2.0	18

DHORKORA ON-FARM T. AUS PVART TRIAL:

Introduction

Like previous years, this past year two rice lines from BRRI which are already proposed for release to the NSB were tested by MCC. As a part of our cooperative research with BRRI these two lines were tried in Dhorkora on-farm site along with check variety BR-1. The objective of this trial was to determine specific adaptability of these two lines under agro-ecological conditions of Chauddagram area in comparison to BR-1. The trial was conducted on medium highland of Dhorkora area with three farmers of two villages.

Results and Discussion

From the results it was seen that none of the two proposed lines produced significantly higher yield than the check variety BR-1, although numerically the line IR-44595-70-3-2-2 recorded the highest yield. However, the farmers in the Dhorkora area who visited this rice trial gave their preference to the line IR-44595-70-3-2-2 over BR-1.

Table 1 : Dhorkora On-farm T. Aus PVART Trial

Planting date : 3/4/91
Transplanting date: 2/5-9/5/91
Seedling age : 29-36 days
Plot size - planted : 6m X 6m
- harvested: 3m X 2.5m
Spacing : 20m X 15m

Design : RCBD
Replications : 3
Fertilizer : 60-40-40-10
Pesticides[a/] : Mastal @ 1.6L/ha
Dimecron @ 1L/ha

Lines/ Varieties	Days to Flower	Days to maturity	Plant ht	Panicles/ m^2	1000 seed wt	Yield
	#	#	cm	#	g	t/ha
IR-44595-70-3-2-2	94	118	90 a	295	26a	3.65
IR-32429-47-3-2-2	95	117	69 b	307	22b	3.18
BR-1	95	118	73 b	299	25ab	3.11
Mean	95	118	77	300	24	3.31
LSD (0.05)			9.5	NS	3.4	NS
CV %			5.4	9.6	6.2	10.2

a/ Mastal and Dimecron application were necessary for Rice Hispa and stemborer infestation

DHORKORA ON-FARM BR21 FERTILIZER RATE AND SEEDLING DENSITY TRIAL

Introduction

BR-21 rice variety is becoming a popular variety in DHORKORA areas in aus season. It is cultivated both as a broadcast and transplanted crop depending on weather situation.

In broadcasting and transplanting farmers use various seed rates and seedling densities respectively. During the year before last a trial was conducted to find an optimum seed rate and fertilizer rate in broadcast conditions, but no specific recommended seedling density and fertilizer rate for transplanted condition is available. Therefore the objective of this trial was to find out an optimum seedling density and fertilizer dose for transplanted BR-21 aus cultivation. This trial was conducted with seven farmers in six villages of DHORKORA areas under Chauddagram Upazila. The soil of the area is of the Tippera soil series, a gray silt loam flood plain soil.

Results and Discussion

From the results it was revealed that neither the three different fertilizer doses nor the three different seedling densities had any significant effects on yields or other characters. Thus it indicated that the fertilizer dose of only 30 kg/ha N produced as much grain as the 60-40-20-10 N-P_2O_5-K_2O-S kg/ha dose, and the yield with 2-3 seedlings/hill is similar to that with 8-9 seedlings/hill. The positive interaction effects of the fertilizer and seedlings density were noticed with the grain yields. The highest grain yield was obtained with the highest fertilizer dose (60-40-20-10) and 5 to 6 seedlings/hill. However it did not vary from the other combinations excepting the treatment which received fertilizer dose 40-20-10 and a seedling density 2-3/hill. So from the trial it may be concluded that for this area only 40 Kg Nitrogen at 40 days after transplanting is required for BR-21 t. aus cultivation and 2-3 seedlings/hill is the optimum seedling density.

Table 1. Dhorkora On-farm BR21 Fertilizer Rate and Seedling Density Trial

Planting date : 10/4/91
Transplanting date : 2/5/-16/5/91
Seedling age : 22-36 days
Plot size - planted : 4m X 3m
- harvested : 3m X 2m
Spacing : 20cm X 15cm
Harvesting date : 22/7-08/8/91

Design : Factorial RCBD
Replications : 7
Fertilizer: Variable

Factor A : Fertilizer

F_1-30-0-0-0 N-P_2O_5-K_2O-S Kg/ha[a/]
F_2-40-20-10-0 N-P_2O_5-K_2O-S Kg/ha[b/]
F_3-60-40-20-10 N-P_2O_5-K_2O-S Kg/ha[c/]

Factor B : Seedling density

S_1-2-3 seedlings/hill
S_2-5-6 seedlings/hill
S_3-8-9 seedlings/hill

Treatment	Days to flower	Days to maturity	Plant height	Panicles/ m^2	1000 seed weight	Yield
	#	#	cm	#	g	t/ha
Fertilizer						
F_1	88	112	70.9	237	21	2.28
F_2	89	112	80.2	249	22	2.29
F_3	88	112	82.5	252	22	2.41
LSD (0.05)			NS	NS	NS	NS
Seedling density						
S_1	89	112	80.6	227	21	2.22
S_2	88	112	80.8	249	22	2.36
S_3	88	112	81.2	262	22	2.40
LSD (0.05)			NS	NS	NS	NS
Fertilizer X Seedling density						
F_1 X S_1	89	112	79.0	218c	22	2.22ab
F_1 X S_2	87	112	79.9	239abc	22	2.30ab
F_1 X S_3	88	112	80.9	253ab	22	2.31ab
F_2 X S_1	89	112	79.3	226bc	22	2.14b
F_2 X S_2	89	112	80.6	256ab	22	2.26ab
F_2 X S_3	88	111	80.7	264a	22	2.47ab
F_3 X S_1	89	112	83.4	237abc	22	2.30ab
F_3 X S_2	88	112	81.9	250abc	22	2.51a
F_3 X S_3	88	112	82.1	269a	22	2.41ab
Mean	88	112	80.9	246.0	22	2.33
LSD (0.05)	-	-	NS	33.74	NS	0.372
CV (%)	1.27	0.45	4.5	9.3	3.10	11.0

a/ N at 40 DAT
b/ N at 20 and 40 DAT
c/ N at transplanting, 20 & 40 DAT

CHAR MATUA ON-FARM BR-23 AMAN SEEDLING DENSITY TRIAL

Introduction

BR-23 is a photoperiod sensitive variety developed by BRRI for cultivation during aman season. The variety is becoming popular in char areas. In previous trials during the past years its tillering capacity was found to be limited. Last year a trial was conducted to determine if its yield could be increased by using higher seedling density. From the previous trial it was revealed that using higher seedlings numbers than 2-3 seedlings/hill did not lead to increased yield. During the past aman season this trial was repeated to confirm the previous finding. The trial was conducted with three farmers of three villages under union #1 of Sudharam Upazila. Each farmer received two replications. Two seedling densities viz 2-4 seedlings/hill and 6-8 seedlings/hill were compared with farmers' practices. The seedling density of farmers' treatment was counted.

Results and Discussion

From the study it was found that the number of seedlings farmers used per hill was ranging from 5-11 and the average was 9. Thus it was higher from both the other treatments.

The hills per unit area with farmers' treatment was significantly higher than the other two treatments and panicles/m^2 was statistically higher than the treatment which had 2-3 seedling density/hill. But it was not reflected in yield. The yields with all three treatments were statistically similar. With farmers treatment despite higher panicles number/m^2, yield was not increased, that might be because the number of grain per panicle was less. The result of this trial is in agreement with that of the past year. Therefore it might be recommended that farmers should not use seedlings density more than 2-3/hill; higher than this would simply be a waste of seedlings and thus a wastage of money.

Table 1 : Char Matua On-farm BR-23 Aman Seedling Density Trial

Planting date : 16-30/7/91
Transplanting date : 26/8-8/9/91
Plot size - planted : 5m X 4m
- harvested: 3m X 3m
Spacing : 25 X 15cm

Kg/ha

Design : RCBD
Replications : 6 (2 with each farmer)
Fertilizer :
Farmer 1 : 19-47-0 N,P,K, Kg/ha
Farmer 2 : 15/21-38-0 N,P,K

Farmer 3 : 34-68-0 N,P,K Kg/ha

Treatment	Days to flow.	Days to matu.	Ave. Seed den./ Hill	Hills/ m^2	Plant ht.	Panicl./ m^2	Yield
	#	#	#	#	cm	#	t/ha
3-4 seedlings/hill	111	150	4	30 b	105	231 b	4.2[illegible]
6-8 seedlings/hill	111	150	7	30 b	105	257 a	4.9[illegible]
Farmers' Choice (5-11 seedlings/hill)	111	152	9	35 a	03	303 a	3.5[illegible]
Mean				31	104.6	263.4	3.9[illegible]
L.S.D (0.05)				2.1	NS	54.6	NS
CV (%)				5.0	1.9	16.1	14.[illegible]

SNAKEGOURD-AROID

DHORKORA SNAKEGOURD AND AROID (LATIRAJ) INTERCROP TRIAL

Introduction

Snakegourd is cultivated widely in Dhorkora areas and it is a profitable vegetable. Farmers generally grow this as a sole crop. The aroid variety Latiraj also grows well on highlands and it is cultivated primarily for it's stolons. The snakegourd normally is cultivated on trellis and underneath the trellis room is available for growing other crops, though it is partially or fully shady depending on the growth of the snakegourd plants. The aroids generally are little bit shade tolerant. So the main objective of this trial was to examine whether the space beneath the snakegourd trellis could successfully and profitably be utilized with aroid cultivation instead of growing only sole snakegourd. In addition another intercrop treatment, aroid + puishak, was tried to compare with sole aroid. The experiment was conducted with nine farmers in three villages of Dhorkora area under Chauddagram Upazila, Comilla district. The soil of the area is of the Tippera soil series, a gray silt loam flood plain.

Results and Discussion

From the results it was observed that the snakegourd equivalent yields of the treatments - Aroid + Puishak; sole aroid and Aroid + Snakegourd were significantly higher than that of sole snakegourd. The highest snakegourd equivalent yield was obtained from the treatment Aroid + Puishak. However these three treatments did not differ statistically among themselves in regard to yield. The yields of snakegourd in both sole and intercrop treatments were very poor; and this happened because the snakegourd plots were affected very badly by the April 29, 1991 cyclone. As the snakegourd was grown on trellis - the damage was much higher than the aroid and puishak which grew on soil without any support. In the Aroid + snakegourd intercrop treatment the gross return from aroid was much higher (more than twice) than that of snake gourd, so that is another added advantage of growing snakegourd and aroid together. If one is damaged the other still can support the farmer. The gross margin was highest from the Aroid + Puishak intercrop treatment and it was much higher than that of sole snakegourd. As the snakegourd was affected very much by cyclone, the gross margin from the treatments aroid + Puishak and Aroid + Snakegourd should not be compared and it merits further study. However, from the study it might be concluded that growing snakegourd + aroid together is more profitable than growing only sole snakegourd and the performance of aroid + Puishak is better than that of sole aroid. Therefore it may be recommended that farmers who wish to grow snakegourd should also grow aroid underneath the trellis and those interested in growing aroid should intercrop it with Puishak.

This trial was further conducted during the past summer season in our Companiganj Extension area. The results are yet to be analyzed.

Table 1 : Dhorkora Snakegourd, Aroid and Puishak Intercrop Trial

Planting date : 26/2-12/3/91
Harvesting date-aroid : 20/5-29/9/91
-S. gourd: 25/4-30/5/91
-Puishak : 14/4-23/5/91
Plot size - planted : 3.5m X 5m
- harvested: 3.5m X 5m
Spacing - Sole Aroid : 60 X 30 cm
- Sole Snakegourd: 1.5 X 1.5m
- S. gourd + Aroid intercrop : S. gourd : 1.5 X 1.5m
: Aroid : 50 X 50 cm
- Aroid + Puishak intercrop : Aroid : 80 X 30 cm
: Puishak : 80 X 30 cm

Design : RCBD
Replications : 9
Fertilizer: Farmers' choice (variable)
Irrigation : 1-2 times
Insecticide: None

Treatment	Days to flower	Days to 1st harvest	Days to last harvest	Fruits or Stolon/ plot	Stolon length	Yield	Snakegourd equivalent yield	Gross return	Input Cost	Gross margin
	#	#	#	#	cm	t/ha	t/ha	Tk/ha	Tk/ha	Tk/ha
Intercrop		77a	178a	957a/	36	5.30	6.74a	31782		
Aroid +		57	76			5.02		18058	12626	37214
Puishak								49840		
Sole aroid		76a/	178a/	1275a/	37	7.43	6.02a	44586	12659	31927
Intercrop										
Aroid +		80a	178a	853a/	35	4.70	5.53a	26206		
Snakegourd	49	73	82	15		1.71		12684	23610	17280
								40890		
Sole Snakegourd	49	68	83	27	-	3.13	3.13b	23184	19324	3860
Mean						5.35				
LSD (0.05)						1.34				
CV %						25.1				

a/ Stolen harvested

MUNGBEAN

CHAR ON-FARM MUNGBEAN VARIETY TRIAL

Introduction

Kanti (7703) variety of mungbean (*vigna radiata*) has performed well in station research in 1989 and 1990. Before extending this variety, it was decided to test it on farmers' fields as on-farm research. Twelve farmers were selected in the Mannan Nagar and Bhabaniganj extension areas.

Results and Discussion

Of the twelve farmers selected, yield data was collected from only eight of them. The other four plots were damaged by salinity or heavy rains and were not harvested. Even those plots that were harvested had reduced yields due to the heavy rains in early February.

The most striking difference in the data is the improved yield from line sowing. However this is not a fair comparison as the broadcast plots were not on the same farms as the line sown plots. Fair comparisons can only be made between varieties with the same planting method.

Kanti did slightly better on line sowing but the difference was not statistically significant. However the local variety did better under broadcast conditions and this difference was statistically significant. All earlier station research was done by line sowing but the traditional method is broadcast seeding.

The large difference between line sowing and broadcast seeding is likely a result of weed pressure. All of the line sown plots were weeded, but only one of the broadcast plots was weeded. In the one weeded broadcast plot, yields of both Kanti and local were similar to the line sown plots. However, in all three replications with severe weed pressure, both varieties had low yields, but the local gave two to three times more yield than kanti. Because weeding is more difficult under broadcast conditions, it is less likely to get done. Kanti does not seem to be able to compete as well as the local variety under this additional stress.

Both varieties are photoperiod sensitive, resulting in fewer days to flowering with later plantings, but the local variety is consistently two to four days later to flower than Kanti.

Kanti shows slightly better resistance to powdery mildew, although both varieties become infected to some degree.

Before extending or dropping Kanti, one more year of research should be done to compare line sowing to broadcast seeding or weeding to no weeding. These changes have a slight labor cost but no cash cost, and seem to have large yield increase potentials.

Table 1 : Char Mungbean On-Farm Variety Trial

Planting date : 27/1/92 to 3/3/92
Harvest dates : 9/4/92 to 22/4/92
Plot Size planted : 10.0m X 5.0m
harvested: 10.0m X 5.0M
Row spacing : 25 cm where line sown

Seed rate : 39 Kgh/ha
Design : RCBD
Replications: 8
Fertilizer : none

Variety	Days to Flower Range	Days to Flower Mean	Yield
			Kg/ha
LINE SOWN (4 reps)			
Kanti	32-57	47	384
Local	36-60	50	299
Mean		49	341
L.S.D. (0.05)			NS
C.V. (%)			26%
BROADCAST (4 reps)			
Kanti	49-63	56	116
Local	49-65	58	166
Mean		57	141
L.S.D. (0.05)			48
C.V. (%)			15%
OVERALL (4 reps)			
Kanti	32-63	50	250
Local	36-65	53	232
Mean		52	241
L.S.D. (0.05)			NS
C.V. (%)			30%

BUSHBEAN

BUSHBEAN / PULSE COMPARISON TRIAL

Introduction

Bushbean (*Phaseolus vulgaris*) has been grown successfully on medium highland in previous MCC trials. However, in the only trial done in the char, it performed poorly (MCC Research Results 1984). Previous trials have looked at bushbean as an intensively cultivated vegetable crop, and farmer acceptance has been moderate. The objective of this trial was to look at bushbean (June Green variety) as a pulse crop, and see how it compares with the commonly grown rabi season pulses of the char.

Results and Discussion

Replications of this trial were placed in the Companiganj, Bhabaniganj, and Mannan Nagar areas. Planting dates varied in the different areas from late November to early February. Dibbling was the selected mode of seeding bushbean and cowpea except in Mannan Nagar where the bushbean was line sown. Lentils were broadcast and fieldpea had one replication dibbled and one replication broadcast. In addition to the farm trials, a small plot of bushbean was planted at the Mannan Nagar demonstration garden under intensive cultivation and good fertility management.

Poor bushbean seed hurt the emergence in this trial. Populations of bushbean were 1/4 or less of the desired populations. This was the cause of some of the Bhabaniganj plots not being harvested.

As can be seen in Table 1, growing pulses is risky in the char. Only half of the plots were harvested. However, all the pulses seem to be equally susceptible to failure. Bushbean survived better in the early rabi season while cowpea survived better in the late rabi season. An advantage of bushbean in the early rabi is its short duration. Bushbean was harvested more than 30 days earlier than cowpea from November and December plantings. Cowpea is photoperiod sensitive, flowering in mid-March regardless of planting date, while bushbean takes thirty eight to fifty four days to flower regardless of planting date. This short duration of bushbean in the early rabi allows farmers to plant aus after bushbean or relay summer vegetables into bushbean.

Table 2 is based on selling the bushbean as a green vegetable crop and other pulses as dry. Extensionists find the bushbean in its green state very tasty. They prefer it over the yardlong bean. No one has tried to consume the bean as a pulse here, so the market demand for the dry bean is impossible to measure. Two adjacent lines of bushbean in the demonstration garden gave 741 kg/ha as dry bean and 7370 kg/ha as a green bean. For this reason, dry yields are multiplied by 10 to calculate the green yield.

Table 2 compares the Companiganj data on an economic basis. This table is needed to compare the four different crops, but because of the low number of replications, especially of fieldpea and lentil, the yields could be inaccurate. Fieldpea, while giving the highest yield seems to be about the poorest investment by all measures. The best choice among the other three depends on the individual farmer. Lentil has the lowest investment cost and the quickest harvest, so this would seem the best for the farmer with low cash. However, bushbean gives substantially more actual income from the same piece of land, so if land is the restraint, then bushbean is the better investment. Cowpea is the good compromise crop with a low investment and high returns, but its long duration when planted in early rabi season prevents growing aus or any late rabi crops.

This trial shows that bushbean has potential to be grown as a pulse crop in the early rabi season. The yield will be much lower than when grown as a vegetable crop, but if harvested as a green bean, it is competitive with other pulses. Because of its short duration, it allows for another crop after harvest while cowpea does not. Multilocation testing of bushbean should be done in fields that dry early in the season. This will allow the crop to enter the marketplace and test consumer response. Only monitoring of farmers' results is needed at this time. Further research is only merited if farmers show interest in this crop.

Table 1: Bushbean / Pulse Comparison Trial

Plot Size planted	5.0m x 5.0m	Seed Rate:	Bushbean 100 kg/ha
harvested:	variable		Cowpea 60 kg/ha
Row spacing:	25cm where line sown		Fieldpea 100 kg/ha
Replications:	16		Lentil 24 kg/ha
Fertilizer:	none		

	Reps harvest/ Reps planted	Planting Dates*	Days to* Flower	1st har.	last har.	Crop Yield*
COMPANIGANJ						Kg/ha
Bushbean	4/4	21/11 - 25/11	51	91	100	194
Cowpea	2/4	25/11	102	122	133	371
Fieldpea	1/2	29/11	52	95	95	417
Lentil	1/2	8/12	53	88	88	283
BHABANIGANJ						
Bushbean	2/6	4/12 - 5/12	38	90	104	13
Cowpea	2/6	4/12 - 5/12	94	126	131	130
MANNAN NAGAR						
Bushbean	1/6	21/1	41	61	61	20
Cowpea	4/6	14/1 - 10/2	49	65	76	487
OVERALL						
Bushbean	7/16	21/11 - 22/1	46	87	96	117
Cowpea	8/16	25/11 - 10/2	74	95	104	369

* Data is from harvested plots only.

Table 2: Companiganj Pulse Economic Comparison

Crop	Seed Cost	Total Cash Cost/[a]	Sale Price	Total Income	Net/[c] Return	Net/[d] Return Per day	%/[e] Return	%/[f] Return Per day
	Tk/Kg	Tk/ha	Tk/Kg	Tk/ha	Tk/ha	Tk/Kg		
Bushbean	30	3000	4/[b]	7760	4760	47.60	159	1.59
Cowpea	30	1800	16	5936	4136	31.10	230	1.73
Fieldpea	22	2200	10	4170	1970	20.74	90	0.95
Lentil	30	1480	12	3396	1916	21.77	129	1.46

/[a] Includes seed cost and initial tillage. Only lentil was tilled before planting. The others were all dibbled into aman stubble.

/[b] Green bean price based on a low Yardlong bean sale price.

/[c] Total Income - Total Cash Cost

/[d] Net Return / Days to last Harvest

/[e] (Net Income / Total Cash Cost) x 100

/[f] % Return / Days to last Harvest

COMPANIGANJ FRUIT FLY CONTROL OBSERVATION TRIAL

Introduction

MCC has recommended a bait trap for the last several years to control fruit flies (Dacus cucurbitae) on cucurbits. This bait trap calls for the insecticide Dipterex changed every 3 days. However Dipterex is not always locally available. This year BARI has recommended Nogos as a replacement to Dipterex but has also recommended changing the bait daily. Nogos is available but changing the bait trap every day is a lot of cost and work. This trial looked at alternatives to fruit fly control in comparison to Nogos changed daily.

This was an observation trial done in snakegourd and bittergourd at the Companiganj demonstration garden. Four different traps each approximately four meters apart were compared. Only dead flies were counted as the traps were too close together to be able to compare fruit damage.

Results and Discussion

The BARI recommended bait trap caught the most flies but was also the most expensive. Nogos definitely loses its effectiveness in 3 days as Nogos-3-days only caught 2/3 as many flies as Nogos daily.

The bottle trap was nearly as effective as Nogos-3-days after the trap hole was enlarged to 25 mm. The bottle trap involves no poisons so the cost is lower and there is no danger to people or poultry.

The urine trap caught no flies. It may have been due to the cucumber peel/ sweet pumpkin peel bait. However the potential social problems of using urine mean that no further research with urine is recommended.

Further research should be done on bottle traps. Fruit flies can be physically trapped. Research should focus on different baits and trap designs that will catch more fruit flies with locally available materials.

Table 1: Fruit FLY Control Observation trial

Planting Date : March 1992 Crops: Snakegourd, Bittergourd

Nogos Daily: 5 ml Nogos + 100 gm mashed sweet pumpkin + 10 ml water placed in a coconut shell. Changed daily except weekends.

Nogos-3-days: Same as treatment 1 except changed every 3 days.

Urine: 50 ml human urine + 100 gm sweet pumpkin peel or cucumber peel soaked overnight. Dilute with 1.5 liter water and placed in a coconut shell. Changed weekly.

Bottle Trap: 100 gm mashed sweet pumpkin + 10 ml water changed every 3 days. Trap was a plastic bottle with the top cut off and inverted into the bottom. The hole in the bottle was 9 mm until 2/6 and then enlarged to 25 mm diameter.

Treatment	Flies caught			Cost/ week/trap
	28/5 - 2/6	3/6 - 18/6	Overall	
	#	#	#	Tk
Nogos daily	10	19	29	4.53
Nogos-3-days	7	13	20	2.27
Urine	0	0	0	0
Bottle trap	0	11	11	1.67

FISHERIES RESEARCH

DHORKORA AQUATIC VEGETATION FISH FEED TRIAL

Introduction

Polyculture of Indian major carps has been traditionally practiced in freshwater ponds by farmers. But most of the subsistence farmers are not able to use semi-intensive or intensive fish culture due to high input costs (about 35 to 50 percent of the total production cost) for supplementary feeding (Cho *et al.*, 1985). The use of terrestrial vegetation and aquatic macrophytes by herbivorous and detritivorous fish that feed low down on the food chain, may provide a low-cost, low-energy feeding approach (Edwards, 1987). It has long been appreciated that fish production is highest for ponds with a "short food chain" (i.e. those with herbivores, omnivores and plankton and detritus feeding fish) (Huet, 1972). In many natural ecosystems, up to 90% of the primary plant production is not directly consumed by herbivores and enters the "detrital food web" (Pomeroy, 1980). Because most detritus originates from plant biomass in natural ecosystems, vegetation and the detrital food web hold promise as inputs for low cost, low energy aquaculture systems (i.e. those appropriate for the small scale farmer). It has been reported that faecal matter of grass carp could replace either manuring or supplementary feeding of other carps along with grass carp, without any adverse effect on the growth of cultured fishes (Manissery and Verghese, 1988).

On the other hand, some innovative farmers showed interest in freshwater prawn culture due to the high market price, but monoculture of prawns possesses a number of problems. The most significant being over-fertile water in the pond, where plankton or algal blooms might occur and eventually lead to a total ecological collapse (Cohen *et al.* 1983). Sastradiwirja (1986) reported that polyculture of freshwater prawn and fish is more profitable and less risky than monoculture. He also added that there is less chance of total ecological collapse due to extreme fluctuations of water quality parameters.

In this trial, six species of carps - Grass carp (*Ctenopharyngodon idella*), Silver carp (*Hypophthalmichthys molitrix*), Bighead (*Aristicthys nobilis*), Rohu (*Labeo rohita*), Mrigel (*Cirrhinus mrigala*), and Mirror carp (*Cyprinus carpio var. communis*) were stocked in the ponds. Two aquatic macrophytes - azolla (*Azolla pinnata*) and pistia (*Pistia stratiotes*) were used as a supplementary feed (TABLE 1).

The first objective of this trial was to reduce the input cost for supplementary feeding, using some aquatic macrophytes instead of conventional supplementary feed (rice bran : mustard oil cake = 50:50) in a polyculture system. The second objective was to compare the costs and returns with farmers' traditional practice (wild fish culture).

Results and Discussion

In overall analysis of the average growth rate of each species, the highest growth rate was found in the bighead carp (TABLE 2). Lowest growth rate was found in the rohu and grass carp.

In growth rate analysis of each species within the treatments, it was found that the silver carp, bighead carp and rohu grew best in the second treatment with pistia feed (TABLE 1 and 2). But the grass carp, mrigel and mirror carp grew best in the first treatment (with azolla feed). Grass carp performed very bad in this year (only 60-122 gm within six months) with the same type of feed (MCS Res. Rep. No. 18, pp. 77-84). One of the main points was that all supplemental feeds were used on the basis of the weight of grass carp only.

From the growth rate analysis, it could be concluded that azolla was the best supplementary feed for grass carp (TABLE 2). Food conversion ratio (FCR) was lowest in the second treatment.

The highest yield was found in the first treatment (TABLE 3). Percentage of survival of each species and overall percentage of harvest was also highest in the first treatment. Poor growth rate and percentage of harvest of grass carp in both the first and second treatments ultimately severely affected the yield. Because only grass carp comprised 25% of the total stocked fish and at the same percentage survival was found only 40-67% (TABLE 2) and the supplementary feed had always been given on the basis of only grass carp body weight. For that reason, other fishes did not get sufficient amount of food, which also was found by the gut analysis during each month sampling.

In economic analysis, highest amount of gross return was found in the first treatment (with azolla feed), which amounted two and half times higher than that of the farmers' practice (trapping and holding method) (TABLE 4). The margin to variable cost was 98% and the cost for fish production was 2.99tk/kg in the first treatment.

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Table 1: Dhorkora Aquatic Fish Feed Trial

Trial period : 6 months
Pond size : 8.2 dec.
Stocking rate: 1 fingerlings per sq. m.
Replications: 2
Fish composition ratio:
Grass carp:Silver carp:Bighead:Rohu:Mrigel:Mirror carp = 25:20:20:10:15:10

Treat. no.	Supplementary feed[a/]	Feed cost Tk/kg	Feed nutritional value(%)			
			Protein	Fat	Fibre	Moist
#1	Azolla[b/c/]	-	2.19	0.69	0.48	94.95
#2	Pistia[d/e/]	-	1.20	0.40	1.25	91.84
#3[f/]	Wild fish culture (Trapping & holding method)					

a/ chopped pistia were supplied on a bamboo raft in the pond but azolla was supplied directly in the pond
b/ 100 percent per body weight of total grass carp
c/ cited from "Aquatic weeds and Algae, the Neglected Natural Resources of Bangladesh"
d/ 200 percent per body weight of total grass carp
e/ cited from "Integrated fish farming in China", p. 67
f/ control for the semi-intensive polyculture with conventional feed

Table 2 : Weight Gain of the Different Species for Each Treatment

Treatment No.		Grass carp		Silver carp		Bighead		Rohu		Mrigel		Mirror carp	
		#1	#2	#1	#2	#1	#2	#1	#2	#1	#2	#1	#2
Initial wt. (gm)	Average	1.9	1.9	1.3	1.3 0	1.5	1.5	3.5	3.5	3.1	3.1	4.2	4.2
Final wt. (gm)	Average	121.5	60.5	268.0	243.5	273.0	346.5	86.0	101.5	122.5	102.5	163.5	139.0
	Std.	16.5	21.5	26.0	42.5	14.0	78.5	10.0	13.5	27.5	1.5	69.5	56.0
Wt. gain ratio[a/]	Average	63	31	221	146	185	226	24	28	33	32	38	32
Wt. incr. (gm/mo)	Average	19.9	9.8	47.8	40.4	46.3	56.5	13.8	16.3	19.9	16.7	26.6	22.5
% of survival	Average	66.64	40.06	86.94	88.09	89.80	86.47	78.53	60.78	85.20	35.78	87.51	84.03
	Std.	16.31	0.77	5.72	7.38	2.66	0.83	5.31	1.82	8.93	4.35	5.15	8.22

a/ ratio of weight increment and initial weight

Table 3 : Yield Parameters of The Different Treatment

Treatment No.	Yield (t/ha/6 months)	Harvesta/ %	FCRb/c/
#1	1.57	81.39	25.1
#2	1.31	64.93	18.3
#3	1.03		
Mean	1.31	73.16	21.7
CV (%)	16.94	11.25	16

a/ computed by comparing the total fish stocked and the total fish harvested

b/ feed conversion ratio (FCR) = $\frac{\text{Total weight of feed used (wet basis)}}{\text{Total fish body weight gain (wet basis)}}$

c/ based on the partial harvest

Table 4 : Economic Analysis[a/] of Dhorkora Aquatic Fish Feed Trial

Particulars	Treatment Number #1	#2	#3[b/c/]
Total gross return (Tk/ha/6 months)[b/]	51,600	41,500	20,500
Total variable costs (Tk/ha/6 months)			
a. Fingerlings[e/]	4,200	4,100	0
b. Feed	0	0	0
c. Fertilizer[f/]	600	600	0
Total	4,700	4,700	0
Gross margin (Tk/ha/6 months	46,900	36,800	20,500
Margin to variable costs (%)	998	783	0
Cost for fish production (Tk/kg)	2.99	3.59	

a/ figures were rounded up to nearest 100 Tk for Tk/ha/6 months
b/ estimated total gross return was computed by an average market price of 20 Tk/kg for all species
c/ due to zero variable cost, it was not included in the economic analysis
d/ estimated average market price of all varieties of fish: Grass carp - 45 Tk/kg, Silver carp - 30 Tk/kg, Bighead carp - 30 Tk/kg, Mirror carp - 35 Tk/kg, and Rohu and Mrigel - 40 Tk/kg
e/ estimated fish fingerlings cost: Grass carp - 500 Tk/1000, Silver carp - 250 Tk/1000, Bighead carp - 550 Tk/1000, Mirror carp - 525 Tk/kg, and Rohu and Mrigel - 300 Tk/1000
f/ fertilizer cost: Urea - 5 Tk/kg, Triple Super Phosphate (TSP) - 5 Tk/kg and Muriate of potash (MP) - 4.5 Tk/kg

DHORKORA PADDY-CUM-FISH-CUM-AZOLLA CULTURE TRIAL

Introduction

Bazal (*Oryza sativa*) is a broadcast local *aman* of long duration (about 8-9 months) that needs less fertilizer (about 44 kg of urea per hectare) than the HYV rice. It produces about 32 to 40 t/ha green fodder and about 1.8 to 2 t/ha grain. *Bazal* rice is popular in the medium highland area due to continuing scarcity of cattle feed. Also, other local varieties of long duration rice are grown in medium lowland. In both cases, there is scope for paddy-cum-fish culture, where standing water exists at least four to five months.

Azolla is an aquatic macrophyte, which can fix nitrogen from the air and contains about 23 percent protein (dry matter basis). Azolla can provide good supplemental food for fish, increase the crop yield, and reduce the fertilizer application needed for present and future crops. Plant nutrients are provided through the decomposition of azolla lobes or roots and fish excreta.

In this trial, five species of carps - Thai Sharputi (*Puntius gonionotus*), common carp (*Cyprinus carpio var. communis*), Silver carp (*Hypothalmicthys molitrix*), Bighead carp (*Aristichthys nobilis*) and grass carp (*Ctenopharyngodon idella*) were used in the paddy fields (TABLE 1). The farmers' practices, including seed rate and fertilizer dose were followed in the trial. The farmers broadcast azolla over the fields and also collected azolla from neighboring fields to use as fish feed. No refuge tank or trench was dug out in the paddy field.

The first objective of this trial was to observe the yield potential with those five species of carps in different composition ratios using azolla as a supplemental feed. The second objective of this trial was to compare the yields of fodder, grain and fish of different treatments.

Results and Discussion

Growth rates of the different species of fish were compared within each treatment and between different treatments (TABLE 2). On average, among all the species, the highest growth rate was found in the grass carp, followed by the Thai Sharputi, Bighead carp, Silver carp and Mirror carp respectively. Grass carp showed the highest weight gain in the third treatment. Thai Sharputi also showed the highest weight gain in the third treatment. Where there was no grass carp and Thai sharputi, both bighead carp and mirror carp and even silver carp grew better (TABLE 1). But there is no direct correlation of the weight gain of bighead, Silver carp and Mirror carp with lowering the composition ratios of either grass carp or Thai Sharputi in the total fish stock. So, even a small number of grass carp and Thai Sharputi in the stock can hamper the weight gain of bighead carp and silver carp.

Fish yields in the different treatments were significantly different. The highest fish yield was in the fourth treatment followed by the first, third and second treatments (TABLE 3). Fish harvesting percentage was ranged from 52-70 percent among the different treatments, but that did not differ significantly.

The fodder yields in different treatments were not significantly different (TABLE 3). Grain yield was highest in the first treatment among all the treatments, but they were not significantly different. Average water level in the paddy field in the different treatments (along with fish) was fluctuated from 21-28cm throughout the trial period.

In the economic analysis, the highest gross margin was found in the first treatment, even it was the second highest in the fish yield (TABLE 3 and 4). Among the treatments (#1, #2, #3 and #4), where fish stocked, highest margin to variable cost (591%) was found also in the first treatment.

Table 1: Dhonkora Paddy-cum-Fish-cum-Azolla Culture Trial: Treatments and Particulars

Trial period: 3 months (Aug.-Oct., 1991)
Stocking rate: 1.8 fingerlings per sq. m.
Rice seed rate: 30 kg/ha
Fertilizer: 0/20/0-0-0

Plot size: 6.7±0.8 dec.
Replications: 2
Insecticide: Nil

Treatment no.	Fish composition ratio (%)					B. Aman (*Bazal*)
	Grass carp	Silver carp	Bighead	Mirror carp	Thai Sharputi	
#1	15	10	10	35	30	Yes
#2	10	10	20	40	20	Yes
#3	5	10	30	45	10	Yes
#4 (ctrl)[a/]	0	10	40	50	0	Yes
#5 (ctl)[b/]	0	0	0	0	0	Yes

[a/] last year best treatment
[b/] normal farmers' practice

Table 2: Weight Gain of the Three Fish Species for each Treatment

Treatment No.		Grass carp				Silver carp				Bighead			
		#1	#2	#3	#4	#1	#2	#3	#4	#1	#2	#3	#4
Initial wt. (gm)	Average	1.9	1.9	1.9	x	1.3	1.3	1.3	1.3	1.5	1.5	1.5	1.5
Final wt. (gm)	Average	181.5	122.0	204.0	x	21.0	44.5	30.5	39.0	58.0	74.5	30.0	78.5
		11.5	2.0	8.0		1.0	3.5	5.5	0.5	2.0	27.5	3.0	15.5
Wt. gain ratioa/	Average	95	63	105	x	15	33	22	29	38	49	19	51
Wt. incr. (gm/mo)	Average	59.9	40.0	67.4	x	6.6	14.4	9.7	12.7	18.6	24.3	9.5	25.7
% of survival	Average	45.76	53.81	69.89	x	65.21	56.15	71.55	64.77	66.92	45.67	70.51	59.53
	Std.	25.17	14.83	19.97	x	30.89	7.00	25.79	26.75	29.17	9.24	22.67	24.16

Treatment No.		Thai Sharputi				Mirror carp			
		#1	#2	#3	#4	#1	#2	#3	#4
Initial wt. (gm)	Average	1.3	1.3	1.3	x	3.1	3.1	3.1	3.1
Final wt. (gm)	Average	59.5	49.5	72.5	x	63.0	56.0	44.0	75.0
		1.5	10.5	2.5		0.0	5.0	25.5	15.5
Wt. gain ratioa/	Average	45	37	55	x	19	17	13	23
Wt. incr. (gm/mo)	Average	19.4	16.1	23.7	x	20.0	17.6	13.0	24.1
% of survival	Average	64.63	64.65	76.7 5	x	57.6 9	47.9 5	67.21	62.28
	Std.	32.60	16.35	20.5 9		32.5 2	25.4 9	20.98	36.94

a/ ratio of weight increment and initial weight

Table 3: Yield Parameters of the Different Treatments

Treat. no.	Yield (t/ha)			Fish harvested[c/] (%)	Water level (cm)
	Fodder[a/]	Grain[b/]	Fish		
#1	33.40[d/]	2.14	0.76	59.66	21.0
#2	34.05[e/]	1.80	0.59	52.24	27.5
#3	35.01	1.89	0.62	69.72	25.0
#4	35.80	1.80	0.81	61.43	27.5
#5	35.30	1.77	0.06	-	34.5
Mean CV(%)	34.71 2.79	1.88 7.98	0.57 52.63	60.76 16.83	27.1 59.8

a/ green fodder
b/ unhusked rice at 14% moisture
c/ computed by comparing the total fish stocked and total fish harvested
d/ about 12% of rice plant damaged due to grass carp grazing
e/ about 7% of rice plant damaged due to grass carp grazing

Table 4: Marginal Analysis[a/] of Paddy-cum-Fish-cum-Azolla Trial

Particulars	Treatment no.				
	#1	#2	#3	#4	#5
Total gross return					
a. Fish[b/]	29,300	21,700	22,900	26,300	1,100
b. Fodder[c/]	14,400	14,700	13,700	14,000	14,500
c. Grain[d/]	12,300	11,700	13,900	11,700	11,500
Total	56,000	48,100	50,500	52,000	27,100
Total variable cost					
a. Fish fingerlings[e/]	7,200	7,800	8,500	9,100	0
b. Seed[f/]	700	700	700	700	700
c. Fertilizer[g/]	200	200	200	200	200
Total	8,100	8,700	9,400	10,000	900
Gross margin	47,900	39,400	41,100	42,000	26,200
Margin to variable cost (%)	591	453	437	420	2911

a/ figures were rounded up to nearest 100 Tk for Tk/ha/3 months
b/ estimated average market price of all varieties of fish: Thai Sharputi - 45 Tk/kg, Common carp - 35 Tk/kg, Silver carp - 30 Tk/kg,
Bighead carp - 30 Tk/kg and Grass carp - 45 Tk/kg
c/ estimated average market price of fodder: 50 Tk/100 sq.m. or 0.41 Tk/kg
d/ estimated average market price of grain: 6.50 Tk/kg
e/ estimated fish fingerlings cost: Thai Sharputi - 200 Tk/1000, Common carp - 350 Tk/1000, Silver carp - 250 Tk/1000,
Bighead carp - 550 Tk/1000 and Grass carp - 500 Tk/1000
f/ estimated average market price of rice seed: 7.50 Tk/kg
g/ fertilizer (Urea) cost: 5 Tk/kg

DHORKORA TERRESTRIAL VEGETATION FISH FEED TRIAL

Introduction

Polyculture of Indian major carps has been traditionally practiced in freshwater ponds by farmers. But most of the subsistence farmers are unable to use semi-intensive or intensive fish culture due to high input costs (about 35 to 50 percent of the total production cost) for supplementary feeding (Cho *et al.*, 1985). The use of terrestrial vegetation and aquatic macrophytes by herbivorous and detritivorous fish that feed low down on the food chain, may provide a low-cost, low-energy feeding approach (Edwards, 1987). It has long been appreciated that fish production is highest for ponds with a "short food chain" (i.e. those with herbivores, omnivores and plankton and detritus feeding fish) (Huet, 1972). In many natural ecosystems, up to 90% of the primary plant production is not directly consumed by herbivores and enters the "detrital food web" (Pomeroy, 1980). Because most detritus originates from plant biomass in natural ecosystems, vegetation and the detrital food web hold promise as inputs for low cost, low energy aquaculture systems (i.e. those appropriate for the small scale farmer). It has been reported that faecal matter of grass carp could replace either manuring or supplementary feeding for other carps along with grass carp, without any adverse effect on the growth of cultured fishes (Manissery and Verghese, 1988).

On the other hand, some innovative farmers showed interest in freshwater prawn culture due to the high market price, but monoculture of prawns possesses a number of problems. The most significant being over-fertile water in the pond, where plankton or algal blooms might occur and eventually lead to a total ecological collapse (Cohen *et al.* 1983). Sastradiwirja (1986) reported that polyculture of freshwater prawn and fish is more profitable and less risky than monoculture. He also added that there is less chance of total ecological collapse due to extreme fluctuations of water quality parameters.

In this trial, seven species of carps - Grass carp (*Ctenopharyngodon idella*), Silver carp (*Hypophthalmichthys molitrix*), Bighead (*Aristicthys molitrix*), Rohu (*Labeo rohita*), Mrigel (*Cirrhinus mrigala*), Mirror carp (*Cyprinus carpio* var. *communis*) and Freshwater prawn (*Macrobrachium rosenbergii*) were stocked in the ponds. Terrestrial vegetation - sweet potato (*Ipomoea batatas*) vines, *Bazal* (*Oryza sativa*) and dhaincha (*Sesbania* sp.) were used as a supplementary feed (TABLE 1).

The first objective of this trial was to reduce the input cost for supplementary feeding, using terrestrial vegetation and aquatic macrophytes instead of conventional supplementary feed (rice bran mustard oil cake = 50:50) in a polyculture system. The second objective was to compare the costs and returns with farmers' normal practice (wild fish culture).

Results and Discussion

All species excepting grass carp, mrigel, and rohu grew the best in the first treatment. And the species grass carp, mrigel and rohu showed the best performance in the second treatment. However they were not significantly different (TABLE 2).

Higher yield was found in the first treatment. There was no significant difference among the percentages of harvest in different treatments. The food conversion ratio was also the lowest in the first treatment.

In economic analysis, the highest gross return was found in the first treatment (with bazal feed). Margin to variable cost and cost for fish production of the first treatment were 639% and 5.46 Tk/kg respectively.

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Table 1: Dhorkora Terrestrial Vegetation Fish Feed Trial

Trial period : 6 months
Pond size: 11.7 ± 0.7 dec.
Stocking rate: 1 fingerling per sq. m.
Replications: 2
Fish composition ratio:
Grass carp:Silver carp:Bighead:Rohu:Mrigel:Mirror carp = 25:20:20:10:15:10

Treat. no.	Supplementary feed[a/]	Feed cost Tk/kg	Feed nutrit.value(%)[b/]		
			Protein	Fat	Moisture
#1	Bazal green rice plant	0.29[c/]	-	-	- -
#2	Dhaincha stem with leaf[e/]	0.08[d/]	8.7	-	90.00
#3	Sweet Potato	-	3.20	0.40	91.84 -
#5[f/]	Wild fish culture (Trapping & holding method)				

a/ supplied as the chopped form at the rate of about 100% per body weight of total grass carp on a bamboo raft.-
c/ cited from "Tropical Leaf Vegetables in Human Nutrition", pp 36-37
d/ estimated average market price as 35 Tk/100 sq.m.
e/ production cost only (on the basis of 42.6 t/ha/crop with - leaf : stem = 1:1); "MCC Research Results", Rep. no. 17:27-29.
f/ control for the semi-intensive polyculture with conventional feed

Table 2 : Weight Gain of the Different Species for Each Treatment

Treatment No.		Grass carp			Silver carp			Bighead			Rohu		
		#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
Initial wt. (gm)	Average	1.9	1.9	1.9	1.3	1.3	1.3	1.5	1.5	1.5	3.5	3.5	3.5
Final wt. (gm)	Average	69.5 19.5	71.5 5.5	64.0 1.0	231.0 79.0	214.0 30.0	99.0 10.0	370.0 141.0	326.5 100.5	175.5 19.5	106.0 20.0	110.5 20.5	93.5 24.5
Wt. gain ratio*	Average	36	37	33	177	164	75	246	217	116	29	31	26
Wt. incr. (mg/hd)	Average	11.3	11.6	10.4	38.3	35.5	16.3	61.4	54.2	29.0	17.1	17.8	15.0
% of survival	Average Std.	37.33 5.81	29.09 3.20	26.77 4.39	77.52 1.90	73.22 2.62	70.90 11.46	77.61 0.14	53.03 12.66	72.44 5.65	68.15 6.37	59.75 1.04	52.46 3.49

Treatment No.		Mrigel			Mirror carp			Freshwater prawn		
		#1	#2	#3	#1	#2	#3	#1	#2	#3
Initial wt. (gm)	Average	3.1	3.1	3.1	4.2	4.2	4.2	1.9	1.9	1.9
Final wt. (gm)	Average	105.0 8.0	115.5 0.5	90.5 17.5	188.0 96.0	66.0 17.0	86.0 3.0	105.7 18.6	102.9 19.1	99.3 12.2
Wt. gain ratio*	Average	33	36	28	44	15	19	55	53	53
Wt. incr. (mg/hd)	Average	17.0	18.7	14.6	30.6	10.3	13.6	34.6	33.7	32.7
% survival	Average Std.	54.12 8.36	45.55 5.02	42.57 2.50	38.87 1.61	48.00 0.93	41.92 9.28	58.33 5.21	60.09 6.37	60.67 4.62

* Ratio of weight increment and initial weight

Table 3 : Yield Parameters of The Different Treatment

Treatment No.	Yield (t/ha/6 months)	Harvest[a/] %	FCR[b/c/]
#1	1.41	58.76	14.1
#2	1.08	55.11	14.4
#3	0.76	55.93	14.4
#4	1.03	-	-
Mean	1.67	56.60	14.3
CV (%)	24.93	3.38	1.2

a/ computed by comparing the total fish stocked and the total fish harvested

b/ feed conversion ratio (FCR) = $\frac{\text{Total weight of feed used (wet basis)}}{\text{Total fish body weight gain (wet basis)}}$

c/ based on the partial harvest

Table 4 : Economic Analysis[a/] of Dhorkora Terrestrial Fish Feed Trial

Particulars	Treatment Number #1	#2	#3	#4[b/c/]
Total gross return (Tk/ha/6 months)[b/]	56,900	47,200	36,700	20,500
Total variable costs (Tk/ha/6 months)				
a. Fingerlings[e/]	7,100	7,100	7,100	0
b. Feed[d/]	0	0	0	0
c. Fertilizer[f/]	600	600	600	0
Total	7,700	7,700	7,700	0
Gross margin (Tk/ha/6 months	49,200	39,500	29,000	20,500
Margin to variable costs (%)	639	513	377	0
Cost of fish production (Tk/kg)	5.46	7.13	10.13	

a/ figures were rounded up to nearest 100 Tk for Tk/ha/6 months

b/ estimated total gross return was computed by an average market price of 20 Tk/kg for all species

c/ due to zero variable cost, it was not included in the economic analysis

d/ estimated average market price of all varieties of fish: Grass carp - 45 Tk/kg, Silver carp - 30 Tk/kg, Bighead carp - 30 Tk/kg, Mirror carp - 35 Tk/kg, and Rohu and Mrigel - 40 Tk/kg

e/ estimated fish fingerlings cost: Grass carp - 500 Tk/1000, Silver carp - 250 Tk/1000, Bighead carp - 550 Tk/1000, Mirror carp - 525 Tk/kg, Freshwater prawn (PL_{20}) - 1000 TK/1000, and Rohu and Mrigel - 300 Tk/1000

f/ fertilizer cost: Urea - 5 Tk/kg, Triple Super Phosphate (TSP) - 5 Tk/kg and Muriate of potash (MP) - 4.5 Tk/kg

LIVESTOCK RESEARCH

ON-FARM SHEEP AND GOAT COMPARISON TRIAL

Summary

This trial compared local female goats and sheep in terms of physical and economic performance, raised under a tethered management system on subsistence level farms. The trial ran for two years from May 1990. Considerable differences between sheep and goats were observed regarding reproductive activity, growth rates, mortality rates and economic performance. The most important difference appeared to be in reproductive activity. Beginning with ten ewes and eight does, the ewes produced a total of six lambs, whereas the does produced ten kids and two abortions. However, the mortality rate to weaning for the kids was 70 percent compared to zero for the lambs. As a result the does were subject to a much greater reproductive stress, but the number of weaned offspring was less than for the ewes. It appears that the traditional feeding management for goats on subsistence level farms is inadequate to support the multiple births frequently observed. This problem could be addressed in future supplemental feeding trials for does in late pregnancy and early lactation. The main constraints for the ewes was the difficulty in identifying heat (i.e. the specific time when the ewe should be bred). Therefore the ewes needed to be accompanied by a ram for extended periods of time. Also for sheep there was a high mortality rate for the brood stock. The average economic performance of the sheep was better than for the goats. The farmers commented that sheep are generally easier to feed, do not need expensive housing, and in some cases are more profitable than goats. They clearly identified the main constraint for raising sheep in the future as the need for both a ewe and ram, and therefore the high initial capital requirement. This constraint could be addressed by attempting to extend sheep to groups of neighbouring farmers willing to share one ram.

Introduction

Past research with sheep and goats has established that farmers are interested in keeping sheep. (MCC Research Results #17 pp 121-22.) The main reasons cited are:

1) Sheep are easier to feed, and less selective eaters.
2) Sheep require less shelter and protection from rains.

The objective of this trial was to compare local female goats and sheep raised under a tethered management system on subsistence level farms. The trial included an economic comparison.

Methodology

The trial ran for two years from May 1990. The original plan was for ten replications each consisting of one ewe and one doe. All replications were managed on-farm by the farmers. The ewe and doe in each replication were kept under similar management conditions on the same farm. The ewes and does were supplied

to the farmers on a share cropping arrangement whereby MCC paid the initial purchase cost and the profits were divided between the farmer and MCC. Breeding rams were supplied by MCC due to the lack of available rams in the area

Results

Data were analyzed for mortality, disease, reproductive performance, weight changes and economic return on investment. Initially ten ewes and eight does were purchased, and managed under a sharecrop system. There were plans to have ten does, however two ewes died before their partner does were purchased.

1. **Mortality**

During the first four months of the trial three sheep were attacked by dogs; two were killed and one was sold shortly afterwards. Also during the first four months one sheep died suddenly due to an unknown illness and one goat died due to diarrhoea. Another ewe died of an unknown illness after 17 months. The only other loss from the initial brood stock came after 12 months, when one doe was stolen. (See Table 1)

Table 1: Mortality - brood stock

	Initial # of animals	No. of mortalities			
		Attacked by dogs	Diarrhoea	Unknown illness	Total (%)
Ewes	10	2	0	2	40%
Does	8	0	1	0	12.5%

With regards to the mortality of offspring; ten kids were born, but only six were born alive. In addition, two does aborted, two kids died within their first months due to lack of milk, and one kid died at seven months old for an unknown reason. All except one of the kid mortalities were from multiple births. Six lambs were born; all were born alive and survived. Mortalities occurred during the months of January, May and November 1991. May and November are typically periods of fodder scarcity. (See Table 2)

Table 2: Mortality - offspring

	# Abortions	# births (exc abortions)	# live births	# off-spring weaned	# off spring matured	% mortality of offspring (# offspring matured/ births)
Ewes	0	6	6	6	6	0
Does	2	10	6	4	3	70

2. **Disease**

All surviving ewes and does were given recommended doses of Nemafex for roundworms and Fasinex for liver fluke in the period May to July each year. All broodstock suffered from at least one disease, with the exceptions of one doe and ewe on the same farm in Char Matua, plus brood stock that were attacked by dogs. The ailments recorded were diarrhoea, pneumonia, ticks, mange, lice and 'unidentified diseases'. The sheep did not contract mange or pneumonia. The number of 'disease months' reported was the same for both sheep and goats. Whilst the incidence of diarrhcea was similar in frequency for both sheep and goats, diarrhea was more serious for goats and caused one adult death. The other fatal diseases were unidentified. (See Table 3)

Table 3: Disease

	Disease	Total # months reported	# animals affected	# deaths	Treatment used
Ewes	Diarrhoea	3	3	0	ORS
Does	"	2	2	1	ORS
Ewes	Ticks	6	3	0	Gama BHC
Does	"	7	3	0	Gama BHC
Ewes	Mange	0	0	0	
Does	"	2	2	0	cowdung ash
Ewes	Lice	3	2	0	tobacco soln + ata leaf
Does	"	3	2	0	"
Ewes	Pneumonia	0	0	0	
Does	"	1	1	0	Tetracycline
Ewes	Unknown	3	3	2	
Does	"	0	0	0	
Ewes	All	15	7	2	
Does	All	15	7	1	

3. Reproductive Performance

The does produced a total of ten kids, compared to six lambs produced by the ewes. Four kids were dead at birth, and two died before weaning. In terms of the number of weaned offspring; the reproductive performance of the ewes was superior to that of the does during the trial period. This was despite the fact that for three ewes, breeding was postponed for three to five months due to the lack of a ram. The conception rate of the ewes was superior to that of the does. (See Table 4)

Table 4: Reproductive performance

	# breedings	# pregnancies	# abortions	# still births	# live births	# Weaned	Conception rate	weaned offspring per breeding
Does	12	8	2	4	6	4	0.67	0.33
Ewes	8	6	0	0	6	6	0.75	0.75

The gestation period was recorded in order to indicate whether or not the possible number of pregnancies per year is different between sheep and goats. Of the gestation periods recorded, the average for does was six days less than for ewes. However, the range of gestation periods recorded was much wider for ewes than for does. There does not appear to be a clear difference between the gestation period for sheep and goats. (See Table 5)

Table 5: Average gestation period

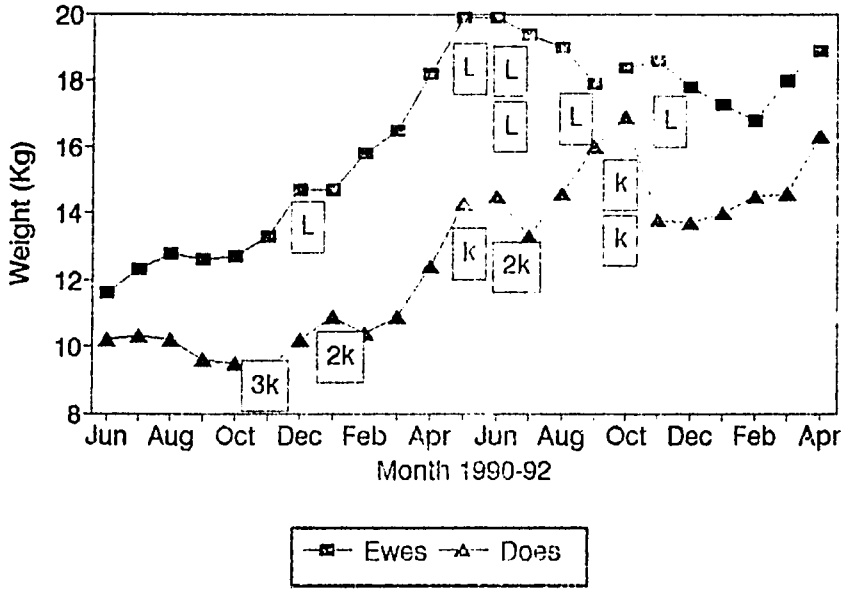
	No. of pregnancies with complete records	Av. gestation period (days)	Range (days)
Does	5	142	139 to 144
Ewes	5	148	126 to 165

4. **Weight Changes for brood stock and offspring**

The body weights of the brood stock and growth rates of the offspring are presented in Graphs No.1 and 2 respectively. The body weights of the brood stock represent the average of six ewes to September 1991 and seven does to May 1991. In Graph No.1 the boxed L and Ks indicate when individual brood stock gave birth to lambs or kids. The notation 2K and 3K represents a single doe giving birth to twins or triplets respectively. The average weight loss for a ewe after lambing was 3.9kg (or 0.65 kg average over the total sample). For a doe after kidding the average weight loss was 2.8kg (or 0.4 kg averaged over the total sample). The initial average body weight of the does (10.2Kg) was less than for the ewes (11.6Kg). The major factor affecting the weight changes during the trial period appears to have been reproductive activity. The two abortions and ten kids produced by the does were a much greater strain on the does than were the six lambs on the ewes. Graph No 2 represents the growth rates of four lambs and four kids, up to five months of age. Two out of the four kids in Graph No.2 were from multiple births whereas all lambs were from single births. During the four month period recorded the lamb weights increased to an average of 345% and the kids to 296% of initial weight. The average daily liveweight gain for lambs was approximately 82 grams and for kids approximately 39 grams. Graphs No. 1 and 2 are extended beyond the dates mentioned above, to indicate the performance of the remaining animals. It should be noted that the average weights before and after these dates are from differing sample sizes.

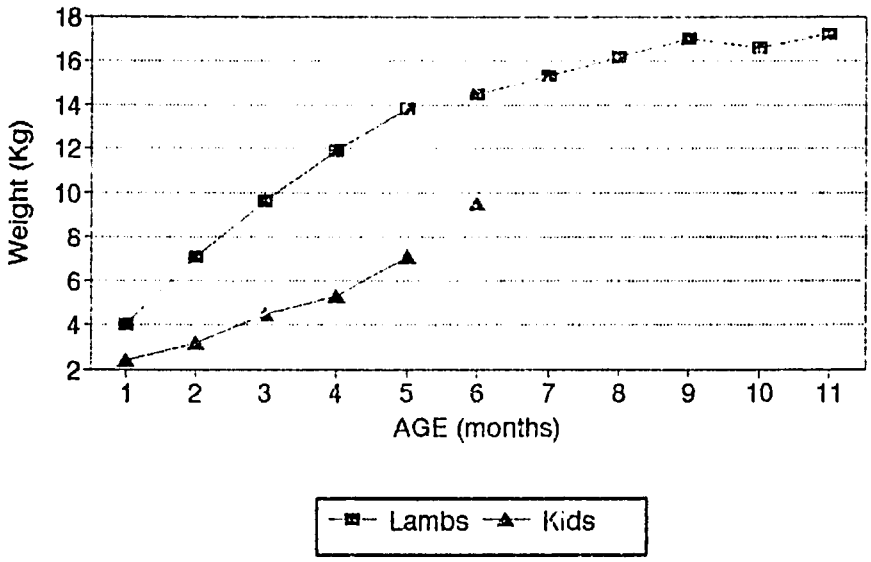
GRAPH No. 1

BODY WEIGHT CHANGES OF EWES AND DOES



GRAPH No. 2

GROWTH RATES OF LAMBS AND KIDS



5. **Survey Results (7 respondents)**

i. Which was easiest to feed: sheep or goats? Why?

Sheep 6 sheep eat more cut grass than goats and eat in the rain

Goats 1 goats are easier for women and children to manage

ii. Are sheep suited to a tethered management system?

Yes 2

No 5 sheep do not eat enough or get enough exercise when tethered

iii. Other comments about advantages/disadvantages of sheep/goats

Goats are easier to breed. For sheep, both a ewe and a ram is needed. If it is only possible to buy one animal, goats are more profitable. Sheep are easier to feed and house.

iv. Do you plan to keep sheep in the future?

Yes 2 Sheep are more profitable than goats and can be sold in the local market. When the number of sheep in my flock reaches seven or eight I plan to sell two or three and buy a calf.

No 3 Lack of capital

2 would prefer to buy calf

The farmers involved in this trial confirmed the previous findings that sheep are easier to feed, and require less shelter and protection from rains than do goats. However, one farmer commented on the difficulty of his wife and children to care for the ram due to its aggressive behavior. In this case the ram was encouraged to be aggressive; this should be discouraged in future work. Of the seven farmers interviewed, five said that sheep do not eat enough, or get enough exercise under a tethered management system. This observation is not clearly reflected in the growth rates of the ewes, and is probably based on the traditional practice of raising sheep in large flocks. Two of the farmers plan to keep sheep in the future. The remaining five do not consider the profitability of sheep enough to justify the high initial capital required to purchase a ewe and a ram.

6. Economic returns

The economic performance was analyzed in terms of percent average annual return on investment. This figure represents the return on the initial investment, plus labour and management. (See Tables 6 & 7)

The average annual return on investment is 10.7 percent and -12.5 percent for sheep and goats respectively. When these figures are adjusted to exclude sheep attacked by dogs and the stolen doe, the return is 28.1 percent and -8.8 percent per year for sheep and goats respectively.

The reasons for poor average economic performances for goats are

- high purchase prices
- poor sale prices
- abortions
- neonatal mortalities
- poor growth rates

As can be seen in Tables 5 and 6, the purchase and sale prices for similar types of animals were very variable. This was particularly so for the goats for which the purchase prices for similar aged does varied from TK 250 to TK 600. This variation had a large effect on the average annual return on investment for both the sheep and goats.

Table 6: Return on investment - sheep

Extensionist or farmers name	Initial price (Tk)	Input/ medical costs (Tk)	Comments	Gross return (Tk)	Net Return (Tk)	Net Return per year (Tk)	Total investment (Tk)	Ewe and lamb sales
Tapon	500	16		1600 (est.May'92)	1086	543	515	ewe + 10 mth old lamb
Bolanath	500	24		1600 (est.May'92)	1076	538	524	" + 13 " " "
Chowdhury	500	20		2595 (act. May'92)	2075	1037.5	520	" + 15+6" " "
Amin Ullah	500	14		825 (act. Nov'91)	311	196.4	514	" + 2 mth " "
Montaz Miah	500	12		500 (act. Nov'91)	-12	- 7.6	512	" only
Bukbul	500	16	ewe died. Oct.'91 - disease	275 (act. Nov'91)	-241	-152.2	516	4 month old lamb only
Dr. Sayed	500	0	ewe died - Aug.'91 - dog bite	0	-500	-250	500 ‡	-
Abul Kashem	500	0	ewe died - May'91 - dog bite	0	-500	-250	500 ‡	-
Abdullah	400	0	ewe bitten by dog then sold June'90	200 (act June'90)	-200	-100	400 ‡	ewe only
Ruhul Amin	500	14	ewe died May'91 - disease	0	-514	-257	514	-
Ram(circulated)	600	12	died - disease	0	-612	-306	612	-
Ram(circulated)	600	24		700	+ 76	+ 38	624	-
					Average	55.8	520.9	
					Average excluding ‡	151.4	539	

Table 7: Return on investment - goats

Extensionists name	Initial Price (TK)	Input Costs (TK) medical breedi.	Comments	Gross Return (TK)	Net Return (TK)	Net Return (TK) per year	Total investment (TK)	# does and kids sold
Tapon	287	52		580 (act.May'92)	241	120.5	333	doe (15)
Bolanath	300(est)	24	Stolen June'91	0	-324	-162	324 *	stolen -
Chowdhury	250	37		1150 (act.May'92)	863	431.5	287	does + 6 mth old kid
Amin Ullah	530	24		470 (act.June'91)	-84	-77.5	554	does + " " "
Montaz Miah	500	22		250 (act.June'91)	-272	-251.1	522	doe only
Mukbul	400	46		300 (act.April'91)	-146	-133.8	446	" "
Dr. Sayed	600	42		500 (act.June'91)	-142	-131.1	642	does + 5 mth old kid
Abul Kashem	-	-		-		-	-	-
Abdullah	500	10	died Aug.'90 -disease	0	-500	-250	510	-
Ruhul Amin	-	-		-	-	-	-	-
					Average	-56.7	453	
					Average excluding *	-41.6	471.4	

NB. est. = estimated value
act. = actual sale price
In cases with zero gross return the losses are calculated over a two year period.

For goats:

Average annual return on investment (%) $= \frac{\text{Av. net return per year}}{\text{Av. total investment}} \times \frac{100}{1}$

$= \frac{-56.7}{453} \times \frac{100}{1} = -12.5\%$

or excluding * $= \frac{-41.6}{471.4} \times \frac{100}{1} = -8.8\%$

highest average annual return on investment = 150.3% (See Chowdhury)

lowest average annual return on investment = 50% (See Bolanath)

For sheep:

Average annual return on investment (%) $= \frac{\text{Av. net return per year}}{\text{Av. Total investment}} \times \frac{100}{1}$

$= \frac{55.8}{520.9} \times \frac{100}{1} = 10.7\%$

or excluding * $= \frac{151.1}{539} \times \frac{100}{1} = 28.1\%$

highest average annual return on investment = 119.5% (See Chowdhury)

lowest average annual return on investment = 50% (See Ruhul Amin)

In order to make a comparison between the economic performance of the does and ewes without the affect of variable prices, the physical performances were converted to more standard economic performances using estimated stable prices (See table 8). All of the physical performance statistics in Table 8 are the actual, average performances of the ewes and does observed during the trial period.

Table 8: Average performance statistics for sheep and goats

	Does	Ewes
Average age at first kidding/lambing (months) a/	15.6	16.6 (14)
Average kidding or lambing % b/	167	100
Average interval from kidding or lambing to next breeding (months) c/	3.3	6.5 (4)
Conception rate (%) - from table 4	67	75
Average interval from kidding or lambing to next conception (months) d/	3.6	6.7
Average kidding or lambing interval (months) e/	8.3	11.6
Doe/ewe mortality rate (% per year) from Table 1 f/	6.25	20
Kid/lamb mortality rate (% to weaning)- from Table 2	70	0
Production life expectancy of doe or ewe (years)	5	5
Average Input costs for does, ewes or rams (TK. per head per year) g/	20	10
Average Input cost for kids/lambs (TK. per head) h/	10	10
Estimated value of 4 month old doe or ewe (TK)	400	500
Estimated value of mature goat or sheep (both male and female) (TK)	600	700

a/ The average age of the ewes at their first lambing in this trial was 16.6 months. It is estimated that this could be reduced to 14 months if the ewes are always accompanied by a ram.

b/ Average kidding or lambing % is calculated as

$$\frac{\text{Total \# of births (alive and dead)}}{\text{Total \# of full term pregnancies}} \times \frac{100}{1}$$

c/ The average interval from lambing to the next breeding in this trial was 6.5 months. It is estimated that this could be reduced to 4.0 months if the ewes are always accompanied by a ram.

d/ Average 'interval from kidding or lambing to next conception' is calculated as 'average interval from kidding or lambing to next breeding', plus an adjustment for the conception rate, if less than 100%.

e/ Average kidding or lambing interval = d/ + average gestation period (from table 5)

f/ The mortality rates in Table 1 are for a two year period, hence the annual mortality rates are taken to be half the figures in Table 1.

g/ Average input costs for does = TK 20 per year for breeding charges, plus TK 10 per year for medical expenses. Average input cost for ewes = TK 10 per year, for medical expenses.

h/ The only input costs for the kids and lambs during the trial period was an average of TK 10 per head for medical expenses.

Using the information summarized in Table 8, we can hypothesize that :-

i) **For a two year project starting with one four month old doe;** The initial investment would be TK.400. An average of 3.4 kids would be born within 4 months from the end of the project, but only 30% or approximately 1 kid would survive to be weaned. As the doe needs to be replaced after 5 years due to old age, over the two year period the equivalent of two fifths or approximately 0.4 lambs need to be kept to replace the doe. Therefore, the equivalent of 0.6, four month old kids @ TK. 400 each plus 1 doe @ TK 600 will be sold at the end of the two year project for a total of TK 840. During the project period the input costs will be TK 60 for the doe and TK 20 (estimated) for the kids, giving a total cost of TK 80.

$$\text{Average annual return on investment (\%)} = \frac{\text{Average net return per year}}{\text{Average total investment}} \times \frac{100}{1}$$

$$= \frac{\text{TK. 180}}{\text{TK. 480}} \times \frac{100}{1} = 37.5\%$$

ii) **For a two year project starting with one four month old ewe and one four month old ram;** the initial investment would be TK 1000. An average of 2.1 lambs would be born within 4 months from the end of the project, all of which would survive to be weaned. In the case of sheep the brood stock are as likely to die from disease or attacks by dogs, as to be replaced for old age. Over the two year period the equivalent of 0.8 lambs will need to be kept to replace the brood stock lost to disease or old age. Therefore the equivalent of 1.3 four month old lambs @ TK 500 each, plus 1 ewe and 1 ram @ TK 700 each will be sold for a total of TK 2050. During the project period the input costs will be TK 40 for the brood stock and TK 21 for the lambs, giving a total cost of TK 61.

$$\text{Average annual return an investment \%} = \frac{\text{Average net return per year}}{\text{Average total investment}} \times \frac{100}{1}$$

$$= \frac{\text{TK.494.50}}{\text{TK.1061.00}} \times \frac{100}{1} = 46.6\%$$

When considering ways to improve the return on investment for goats and sheep under subsistence farmer conditions, options would include reducing the kid mortality rate and increasing the number of ewes per ram. In the following scenarios the return on investment increases greatly for both goats and sheep, but the advantage remains with sheep. It should be noted however that the risk factor is greater for sheep than goats due to the greater initial cost, and higher mortality rates of the brood stock.

iii) If the kid mortality rate could be reduced from 70% to 50%, For a two year project starting with one four month old doe; The initial investment would be TK 400, 1.7 kids would survive to be weaned. Total sales would be 1.3 kids at Tk 400 each plus 1 doe at Tk 600 giving Tk 1120. The costs would be Tk 80 (estimated).

$$\text{Average annual return on investment (\%)} = \frac{\text{Average net return per year}}{\text{Average total investment}} \times \frac{100}{1}$$

$$= \frac{\text{TK.320}}{\text{TK. 480}} \times \frac{100}{1} = 66.7\%$$

iv) For a two year project starting with five ewes and one ram; the initial investment would be TK 3000, 10.5 lambs would be weaned. Total sales would be 8.1 lambs at Tk 500 each, plus 1 ram and 5 ewes at Tk 700 each, giving Tk 8250. The costs would be TK. 225.

$$\text{Average annual return on investment (\%)} = \frac{\text{Average net return per year}}{\text{Average total investment}} \times \frac{100}{1}$$

$$= \frac{\text{TK. 2512.5}}{\text{TK. 3225.0}} \times \frac{100}{1} = 77.9\%$$

The above figures indicate the comparative return on investment for sheep and goats, given the average physical performance observed in this trial and fixed prices. The returns should not be used as budgeting guides for future projects as the above scenarios include fractions of animals and assume that all animals are sold in good, healthy condition. Also, the scenarios assume that no deaths occur in the broodstock until the last four months, and therefore do not indicate the degree of risk.

Conclusion

The superior prolificacy of Black Bengal goats compared to local sheep is not realized on subsistences level farms with traditional feeding practices. The reproductive performance of goats in terms of the number of weaned offspring produced shows great potential for improvement if the kid mortality rate can be reduced. The economic performance of sheep was better than for goats. The main constraint for extending sheep is the need to purchase both a ewe and a ram in order to start a project. Suggestions for future work with goats are supplemental feeding trials for does in late pregnancy and early lactation, and extending the use of colostrum for newborns. For sheep efforts to design a suitable method of extending sheep to groups of farmers sharing one ram, whilst closely monitoring economic performance is suggested. Factors of major importance will be the willingness of farmers to work together, and the mortality rate of the ewes and rams.

Glossary

abortion	- birth before the offspring is fully developed.
breeding	- to reproduce sexually
brood stock	- animals used for breeding
castration	- removal of the sex glands (testes)
colostrum	- the first milk produced by the mother
conception rate	- the number of breedings needed to become pregnant
doe	- adult female goat
ewe	- adult female sheep
gestation period	- the time between becoming pregnant and giving birth
kid	- young goat
kidding	- a doe giving birth to a kid or kids
lamb	- young sheep
lambing	- a ewe giving birth to a lamb or lambs
live births	- the birth of a living offspring
mortality	- death
multiple births	- a birth when more than one offspring is born
neonatal mortality	- death of young offspring
ram	- adult male sheep
single births	- a birth when only one offspring is born
still births	- the birth of a dead offspring
weaning	- the time when offspring learn to take food other than milk

SITE DESCRIPTIONS

STATION RESEARCH SITE DESCRIPTIONS

Introduction

At the station research sites most cultivation practices were controlled by MCC and trials were put in by hired labor. Most land preparation in Char Matua, Mannan Nagar, Dhorkora and Chuadanga was done using traditional plows and bullocks.

DHORKORA STATION RESEARCH

The station research was conducted on 0.65 hectares of rented land located near Dhorkora Bazar in Cheora Union, Chuaddogram Upazila, Comilla District. The site is about five kilometers west of the Dhaka-Chittagong highway. About 0.32 hectares of this is on highland (no flooding) and 0.33 hectares is on medium highland (flooding to a maximum of about 30 cm in the monsoon). This is a gray silt loam flood plain soil of the Tippera soil series. The major cropping pattern is direct seeded aus-transplanted aman-fallow. To a lesser extent, rabi crops are grown. For more information on this area, refer to Dhorkora, in the FARMING SYSTEM. This site was closed in December, 1991.

CHAR MATUA STATION RESEARCH

Charland station research was conducted near Odar Hat, Char Matua Union (no. 1) of Sudharam Upazila, Noakhali. The station consisted of approximately one hectare of rented land and a site office. The soil in this area is predominantly a silty clay loam of the Hatiya soil series although some better drained areas are classified Ramgoti series silt loam. Soil salinity ranges from low to high and generally is lowest for the better-drained soils.

The major cropping pattern is single crop t. aman. Rajasail *Kartiksail* and *Kajalsail* are the predominant local aman varieties. *Rajasail* is an early maturing salt tolerant variety and *kartiksail* matures about one or two weeks later, while Kajalsail matures a full month later than Rajasail.

Flooding depths range from 10 cm to 80 cm and varies between fields. The MCC Char Matua Station Office was opened January 1, 1989 and closed in January, 1992.

MANNAN NAGAR STATION RESEARCH

This Research Station was opened in January, 1992 after closing the previous two research stations at Char Matua and Dhorkora. The site is ten kilometers south-west of Maijdee, under Char Matua Union (no. 1) of Sudharam thana, Noakhali. The area of the station is about 0.50 hectare. The half of the area is on highland (no flooding) and the rest half is on medium highland (flooding to a maximum of about 20 cm in the monsoon). A small part of the station is being used as a demonstration garden and the rest is devoted to implementing trials. The soil in this area is predominantly a silty clay loam of the Hatiya soil series although some better drained areas are classified as Ramgati series silt loam. Soil salinity ranges from low to high and generally is lower for the better-drained soils.

The major cropping pattern is single crop t. aman. Rajasail, kartiksail and kajalsail are the predominant local aman varieties.

CHUADANGA STATION RESEARCH

Research on soybeans has been conducted for the past few years near Chuadanga town, in Chuadanga District. This research was 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.

STATION RESEARCH PERSONNEL

At the Dhorkora and Mannan Nagar research stations, research trial implementation was managed by Oscar Rozario. Golam Mowla was responsible for managing the research work at the Char Matua station. Ali Hossain managed the research trials at Chuadanga. 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.

FARMING SYSTEMS SITE DESCRIPTIONS

Medium Highland Site

Dhorkora

The Dhorkora Farming Systems Site includes the villages of Dhorkora and Shaktola located near Dhorkora Bazaar in Cheora Union, Chauddogram Upazila, Comilla District. The site is approximately five kilometers west of the Dhaka-Chittagong highway. It was opened in November, 1986 and closed in January, 1992.

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. The predominant aus varieties are Purbachi, Chenal, Badali, and Batuir. Pajam is the dominant aman variety, but some BR11 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 homesteads are usually used f[illegible] aman seedbeds. Other crops grown on these plots include a[illegible] transplanted aman, sweet potato, lentil blackgram, groundnut and winter vegetables (radish, chilli, eggplant, sweet pumpkin, cabbage, tomato, cauliflower). Some summer vegetables are also grown.

The average family size at Dhorkora is 6.5. About 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.[illegible] decimals of land (homestead 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, and a small amount other farms. The average rice surplus family owns 250 decimals and obtains two-thirds of its income from farm crops. The predominant land rental methods at the site are sharecropping and cash rent.

Charland Site

Char Matua

The Char Matua Farming Systems research site is located 13 kilometers west of Maijdi and 2 km south of Odarhat in union No. 1 of Sudharam Upazila, Noakhali District. Char Matua is an older area of the Noakhali char, but still faces fairly severe soil salinity constraints.

Soils are medium-textured, calcareous and of two types. The higher land cultivated with early-maturing *aman* is a silt loam of the Ramgoti soil series, and the lower land cropped to late-maturing aman is a silty clay loam of the Hatiya soil series.

The predominant cropping pattern is fallow-transplanted *aman*-fallow. However, there is some *aus* cultivation. Popular local aman varieties include Rajasail and Kartiksail (early-maturing) and Rajalsail (late-maturing). Rabi crops include chilli, mungbean, cowpea, sweet potato, foxtail millet, blackgram and soybeans. Cattail ("*hoogla*") is cultivated as a year-round crop and contributes an important component to the local economy. The reeds are woven into mats and sold in the local bazaars, generating income for the area's many subsistence families.

Communications are difficult during the rainy season due to the absence of surfaced roads. Finished rice is brought into the area by country boat during the rainy season. During the rabi season, many of the local marginal farmers leave the area for employment elsewhere, often to work as laborers in brick factories.

FARMING SYSTEMS SITE PERSONNEL

The research trials were implemented and managed by Sukhen Ch. Paul at the medium highland site; and by Nitai Ch. Das at the Char Matua site. All of these men, and the other regular staff and daily laborers, are commended for their excellent work. The research conducted the past year could not have been done without them.

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